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Faculty of Fine and Applied Arts

Doctoral Dissertation

Assessing the potential of using Virtual Reality based approaches for enhancing the professional development of teachers

Kalliopi-Evangelia Stavroulia

Limassol, April 2020

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DEPARTMENT OF MULTIMEDIA AND GRAPHIC ARTS

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Approval Form

Doctoral Dissertation

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Presented by

Kalliopi-Evangelia Stavroulia

Supervisor: Andreas Lanitis, Professor, Cyprus University of Technology

Signature _____

Member of the committee: Theopisti Stylianou-Lambert, Associate Professor, Cyprus University of Technology

Signature _____

Member of the committee: Paloma Díaz, Professor, Universidad Carlos III de Madrid

Signature _____

Cyprus University of Technology

Limassol, April 2020

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ABSTRACT

This research proposes the use of an innovative Virtual Reality (VR) based framework in teacher practical training methodology, offering a new paradigm in teacher education. This research addresses modern needs for the use of technology-based approaches in teaching and learning, aiming to promote the professional development of teachers. The development of the VR tool followed a multiphase research design consisting of five phases. Additionally, the target audience was actively involved during the entire research process providing significant feedback to the researcher that resulted in the development of a high-quality VR training tool that meets real teachers' needs and challenges and has a strong added value. Multiple instruments were used to measure the effectiveness of the VR training tool including the use of Electroencephalography (EEG) devices, wristband hand monitors, questionnaires, interviews, and focus groups. The research outcomes indicated the potential of using VR in teacher training. The outcomes revealed a strong impact of the VR intervention on participants' emotions and the potential on the cultivation of empathy skills. Moreover, the results are statistically significant related to other parameters under investigation, including the sense of presence and perspective-taking.

Keywords: Virtual reality, teacher education, teacher training, empathy, emotions

PUBLICATIONS

As a result of the research work described in this thesis the following chapter book was published:

- Stavroulia KE., Christofi M., Zarraonandia T., Michael-Grigoriou D., Lanitis A. (2019) Virtual Reality Environments (VREs) for Training and Learning. In Learning in a Digital World. Smart Computing and Intelligence. Springer, Singapore.

As a result of the research work described in this thesis the following papers were published in scientific journals:

[J1] Demitriadou, E., Stavroulia, K.E., and Lanitis, A. (2019). Comparative evaluation of virtual and augmented reality for teaching mathematics in primary education. Education and Information Technologies, 1-21. https://doi.org/10.1007/s10639-019-09973-5

[J2] Stavroulia, K. E., Christofi, M., Baka, E., Michael-Grigoriou, D., Magnenat-Thalmann, N., and Lanitis, A. (2019). Assessing the emotional impact of virtual reality-based teacher training. The International Journal of Information and Learning Technology, 36(3), 192-217.

[J3] Stavroulia, K., and Lanitis, A. (2019). Enhancing Reflection and Empathy Skills via Using a Virtual Reality-Based Learning Framework. International Journal of Emerging Technologies in Learning (iJET), 14(7), 18-36.

As a result of the research work described in this thesis the following papers were published in scientific conferences:

[C1] Stavroulia, K. E. (2019). Designing immersive virtual training environments for experiential learning. In Proceedings Companion of the 2019 ACM SIGPLAN International Conference on Systems, Programming, Languages, and Applications: Software for Humanity (pp. 44-46). *Finalist paper* at SPLASH 2019 Student Research Competition: https://2019.splashcon.org/track/splash-2019-SRC

[C2] Christofi, M., Baka, E., Stavroulia, K. E., Michael-Grigoriou, D., Lanitis, A., and Magnenat-Thalmann, N. (2018). Studying Levels of Presence in a Virtual

Environment Simulating Drug Use in Schools: Effect on Different Character Perspectives. In ICAT-EGVE (pp. 163-170).

[C3] Stavroulia, K. E., and Lanitis, A. (2018, September). Addressing the cultivation of teachers' reflection skills via virtual reality-based methodology. In International Conference on Interactive Collaborative Learning (pp. 285-296). Springer, Cham.

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[C5] Stavroulia, K.E., Baka, E., Christofi, M., Michael-Grigoriou, D., Magnenat-Thalmann, N., and Lanitis A. (2018). A virtual reality environment simulations drug use in schools: effect on emotions and mood states. In The International Conference on Information Communication Technologies in Education (ICICTE 2018) Proceedings (pp. 225- 234). Available at: http://www.icicte.org/assets/6.2_stavroulia_-baka_-christofi_michael-grigoriou_-magnenat-thalmann_lanitis.pdf

[C6] Baka, E., Stavroulia, K. E., Magnenat-Thalmann, N., and Lanitis, A. (2018). An EEG-based evaluation for comparing the sense of presence between virtual and physical environments. In Proceedings of Computer Graphics International 2018 (pp. 107-116).

[C7] Stavroulia, K. E., Baka, E., Lanitis, A., and Magnenat-Thalmann, N. (2018). Designing a virtual environment for teacher training: Enhancing presence and empathy. In Proceedings of Computer Graphics International 2018 (pp. 273-282).

[C8] Stavroulia, K.E., Baka, E., Lanitis, A., and Magnenat Thalmann, N. (2017). Virtual reality-based learning environments in teacher training: new opportunities and challenges. In the proceedings of the 10th International Conference of Education, Research and Innovation, ICERI2017 Conference (pp. 3562-3571), 16th-18th November 2017, Seville, Spain. ISBN: 978-84-697-6957-7

[C9] Stavroulia, K. E., and Lanitis, A. (2017). On the Potential of Using Virtual Reality for Teacher Education. In International Conference on Learning and Collaboration Technologies (pp. 173-186). Springer, Cham.

[C10] Manouchou, E., Stavroulia, K.E., Ruiz-Harisiou, A., Georgiou, K., Sella Francesca, and Lanitis, A. (2016). A Feasibility Study on Using Virtual Reality for Understanding Deficiencies of High-School Students. To be presented at the 18th IEEE Mediterranean Electrotechnical Conference, MELECON 2016, 18-20 Apr 2016, Limassol, Cyprus.

[C11] Stavroulia, K.E., Ruiz-Harisiou, A., Manouchou, E., Georgiou, K., Sella Francesca, and Lanitis, A. (2016). A 3D Virtual Environment for Training Teachers to Identify Bullying. To be presented at the 18th IEEE Mediterranean Electrotechnical Conference, MELECON 2016, 18-20 Apr 2016, Limassol, Cyprus.

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LIST OF ABBREVIATIONS

1P:	First-Person Perspective
2D:	Two dimensional
3D:	Three dimensional
AcSS:	Academy of Social Sciences
ADHD:	Attention-Deficit/Hyperactivity Disorder
ASD:	Autism Spectrum Disorder
AR:	Augmented Reality
BERA:	British Educational Research Association
CAVE:	Cave automatic virtual environment
CPD:	Continuing Professional Development
EU:	European Union
HCI:	Human Computer Interaction
HMD:	Head Mounted Display
ICT:	Information and Communication Technologies
IPQ:	Igroup Presence Questionnaire
ITE:	Initial Teacher Education
MD:	Multiphase Design
NIE:	National Institute of Education
MD:	Multiphase design
SBO:	School Building Organization
SoE:	Sense of Embodiment
TE^{21}:	Model of Teacher Education for the 21st century
VE:	Virtual Environment
VPL:	Visual Programming Lab

VR:	Virtual Reality
VRE:	Virtual Reality Environment
UX:	User Experience

1 Introduction

This chapter presents the problem under investigation along with the conceptual framework and the key elements of the phenomenon under investigation. Additionally, the purpose of the study and its significance are described explicitly stating the contribution and added value of the research. The research design framework and the research questions to be investigated are also posed followed by a description of the structure of the dissertation and a summary of the next chapters.

1.1 Rethinking education

Today's societies are plagued by constant changes brought about by the rapid technological evolution of recent years. The economic and social changes over these years have created new data on a global scale. A new era has already taken shape, characterized by socio-economic rearrangements, drastic changes in the access and acquisition of knowledge, innovations, and change of conditions of our personal, social, and professional life.

In the face of those challenges posed by the rapid development of technology, education could not remain static but became another application domain for Information and Communication Technologies (ICT). The integration of technology in the educational context gave new perspectives on teaching and learning aiming to equip the students with the skills and competences that are considered essential for student's sustainable and prosperous future in a modern and globalized world. In today's dynamically evolving environment, there is a necessity for educational systems to adjust to radical changes to respond to the challenges of the 21st century and meet the new needs arising.

The current educational systems were not designed to teach today's generation of students, the so-called 'Digital Natives' (Prensky, 2001), who have access to technology since their birth. Hence, new challenges were posed to teachers, the so-called 'Digital Immigrants', who were not born into the digital world and are struggling to keep up with technological advancements, adapt to the new circumstances and teach a generation that speaks the language of the digital world (Prensky, 2001). Unfortunately, several teachers face learners as in the past using traditional teaching methods that cannot meet effectively today's needs. However, today's learners speak a different

language and the traditional teaching and learning approaches can no longer provoke student's interest and motivation.

Therefore, teachers must redefine their role, find new ways of establishing strong communication channels with their students and implement new teaching and technology-based strategies to attract their student's interest and guide them in the acquisition of knowledge and competences. Undoubtedly, teachers not only play a vital role in students' learning experiences, but they are also the key components in the way education evolves. Investing in teachers is essential to enhance their professionalism and provide a high-quality education that will empower human, social and economic development.

1.2 Background of the problem

Teachers are the heart and the soul of every educational system around the world. Therefore, the quality of their training and their new role associated with education reshaping and modernization has received significant attention within the European agenda, as high quality and well-trained teachers can help learners develop the competences and skills needed for a sustainable future in a global society and labour market. Lately, Europe's Strategy 'Education and Training 2020' in the field of education and training, puts a strong emphasis on the role of teachers, starting from initial teacher education to career-long professional development, since teachers play a major role in '*advancing human potential and shaping future generations*' (European Commission, 2005, p. 1).

Nowadays, teachers face unprecedented challenges including the diversity of the student population that is characterized by different cultural and language backgrounds, different levels of knowledge different learning needs, and increased levels of antisocial behavior. Classrooms apart from becoming digital have become more complex and dynamic environments and thus teachers need to constantly update their skills and competences, innovate and adapt their teaching practices to the needs of individual learners as well as groups. Teachers have much broader roles and responsibilities than in the past and their role is becoming more and more complex requiring the use of new and innovative teaching strategies. Additionally, they need to understand student's

needs and promote the development of each student individually within a multi-cultural classroom setting and with students with special learning needs.

Over the last decades, Cyprus, Greece, and other European countries have experienced large flows of immigrants leading to the creation of a more diverse student body. Teachers were not prepared for the student population they face today, and thus, they cannot cope with the increasing diversity of the student population. Therefore, the process of restructuring the education framework highlighted the importance of high-quality and well-trained teachers. This need is in line with this research that aims to improve the quality of teacher education by helping teachers develop the skills and competences needed for a sustainable and prosperous future.

Despite the attention that teacher training has received, research results indicate several significant problems in teacher education that undermine the quality of teachers and thus of education itself. The problem begins with Initial Teacher Education (ITE) that is considered the first phase of a long journey in teacher training and development. ITE is a fundamental area for every educational system as it is the first crucial stage of the path in teacher training that lays the foundations of a professional mindset leading to high-quality teaching and professional development (Caena, 2014). Nevertheless, research reveals that ITE programs do not prepare pre-service teachers towards the needs of the later teacher position. Moreover, ITE programs provide mostly theoretical training having a weak or no connection with the school environment (Darling-Hammond et al., 2005; Hagger & McIntyre, 2006; Katsarou & Dedouli, 2008; Woolfolk, 2005). The lack of communication and collaboration between universities and schools also results in insufficient teachers' knowledge and skills (Darling-Hammond, 2006). As a result, beginning teachers' knowledge does not meet the school curriculum requirements (Kennedy, 1991). Teachers' initial training but also their professional development throughout their lives must be in close connection to the school agenda (European Commission, 2015). Moreover, the lack of university-school connection derives beginning teachers from learning through mentoring from experienced colleagues (Caena, 2011; Darling-Hammond, 2006; Darling-Hammond et al., 2005; Katsarou & Dedouli, 2008). Furthermore, although teacher education programs have courses relative to multiculturalism and diversity, they provide theoretical information that does not help teachers manage students with different cultural backgrounds when the time

comes to enter their own classroom. Consequently, teachers instead of understanding that they must treat all students equally and individualize learning, have the impression that certain children cannot learn certain content (Kennedy, 1991).

ITE is the first step of an on-going lifelong learning process. Without a doubt, ITE cannot provide teachers all the necessary skills that they will need throughout their entire careers (Lagoudakos & Karageorgos, 2014). The teaching profession is based on career-long learning and continuous professional development. However, it seems that the concept of lifelong learning is missing from the teaching profession (European Commission, 2015). Additionally, teacher training programs aiming at teachers' continuous professional development do not meet today's challenges and teachers' real needs (Efthimiou, 2017; Karagianni, 2012; Lagoudakos & Karageorgos, 2014). This is a significant program as high-quality training programs can only be achieved once they are designed to meet the established needs and formulated demands of teachers (Katsarou & Dedouli, 2008; Lagoudakos & Karageorgos, 2014). Additionally, teachers feel underestimated as they are not actively involved in the design of the training programs for their professional development, while when they state their problems and needs, they feel that they are not taken into consideration.

Taking all the above into consideration, the most important component in teacher education programs is whether they provide on the job experiences or practicum to teachers, either for future teachers in the limits of ITE or for teachers during their professional development, called 'field experiences' or 'practicum' (Chiero & Beare, 2010; Darling-Hammond, 2006; Schwille & Dembélé, 2007). Practical training field experiences can provide teachers the opportunity to learn on the job through experiential learning, instead of using trial and error techniques alone in the classroom, maximizing the risk of harming the students (Katsarou & Dedouli, 2008; Kessels, 2010). Thus, priority should be given to the '*classroom teaching expertise'* (Hagger & McIntyre, 2006, p. 20), allowing teachers to learn and reflect on their practice becoming 'practically wise' and make the choices that best fit to their classroom needs (Caena, 2014).

Another significant challenge for teacher education is the lack of mentoring from experienced colleagues. Mentoring is the key to achieve the development of highly qualified teachers and the transfer of knowledge from one generation of teachers to the

next. Moreover, mentoring can promote the development of a bond between a beginning and an experienced teacher and the establishment of such a channel of communication provides opportunities for professional learning and enhancement of skills and competences (Pollard, 2005).

Hence, considering all the above there is a theory-practice gap that needs to be addressed that will lead to high-quality and well-trained teachers leading to high-quality education (National Institute of Education-NIE, 2009). In line with European Union objectives and to address the lack of practice in teacher education, this research aims to strengthen the profile of the teaching profession through the enhancement of teachers' professional development that spans from Initial Teacher Education (ITE) and induction to continuing professional development, using a contemporary Virtual Reality-based framework.

Virtual reality (VR) based learning can be the way to develop teachers' professional knowledge, skills, and competences, whilst protecting students from unnecessary risks. By taking advantage of the VR technology, this research aims to provide teachers both in-service and pre-service, a safe environment within which they will be able to be trained, experiment, and make mistakes but without the risk of harming real students. The proposed VR framework aims to deliver a VR application an instrument that can be used to support teachers' continuous professional development through systematic individualized training.

1.3 The purpose of the study

Investment in teacher education is considered as a top priority within the European Agenda. This research will concentrate on improving the quality of higher education with a vision to strengthen the profile of the teaching profession. Additionally, this research gives priority to the promotion of high-quality teacher education and training via using an innovative VR-based approach. The purpose of using a VR framework is to promote the acquisition of the necessary skills and competences that will allow teachers to understand the nature of teaching and learning, understand their students and be able to implement well-designed and effective strategies into the classroom, but also confront classroom situations, problems and challenges.

The gap between theory and practice can be bridged by experiential learning and VR could offer an effective way for experiential learning via engaging and immersive experiences, that could allow teachers to experience real-life based classroom situations. Moreover, the development of "extreme" scenarios could allow teachers to be trained via simulated stressful conditions that would be difficult to simulate in a real classroom setting. For example, teachers who work at locations that accept a huge number of refugees face extreme and unique classroom conditions that were not prepared for, and thus training to deal with multi-cultural classes is essential. Hence, a VR tool could address the need for training in such a condition, providing to in-service but also to potential teachers appointed to such an area, the ability to be trained in such a condition that is not possible to simulate to a real classroom in all locations. Moreover, in this case of multiculturalism, refugee students, for instance, could not be used in a simulated training condition, so as for a trainee teacher to experience such as situation due to potential risk of harming the students.

The work presented aims to investigate the potential and applicability of a novel VR based experiential learning framework as a means for improving the quality of teacher training. The use of new and innovative VR based technology can work as a driver of improvements in teacher education, maximizing teacher expertise, and professional mastery. In the long-term, enhancing the quality of the teaching profession will make the profession more attractive and will motivate teachers to desire and engage themselves in continuing professional development.

The proposed VR tool was developed with the ambition to provide strong support and training to teachers fostering their professional development. This was achieved through the development and use of high-quality scenarios aligned with identified real needs of teachers. For this reason, the target group was actively involved during the design and development of the VR application, but also during all the phases of the current project. The purpose of the research is the development of a VR tool that is designed based on teachers' requirements to achieve an added value for them, maximizing the impact of the tool. Additionally, in the long-term, this VR app could become a part of teacher training starting from supporting ITE to becoming a lifelong learning tool, linking the different phases of teacher training from ITE to continuing professional development,

providing teachers high-quality knowledge, skills and competences throughout their teaching career.

In the last few years, the use of VR environments in education has attracted the interest of the scientific community due to its ability to provide users the opportunity to live and experiment situations that cannot be accessed physically (Freina & Ott, 2015). VR mimics real-world situations allowing the users to experience realistic learning experiences that are transferrable to the real world. Moreover, VR environments can increase learners' involvement and motivation while supporting many different learning styles (Freina & Ott, 2015).

The use of VR environments has considerable potential for teacher education and training. Previous research results revealed the positive impact of VR training in teachers' ability to understand and detect students' possible disorders such as vision disorders or identify and deal with bullying-related issues (Manouchou et al., 2016; Stavroulia et al., 2016). Constant training within the virtual environment will better prepare teachers and will ensure their survival in today's digital and diverse classrooms. Moreover, using a safe virtual training environment that minimizes potential harm of the students is a more ethical approach to teacher training (Dieker et al., 2008). The ambition of the current research project is to provide an innovative VR teacher training tool that can be used for constant professional development and update of teachers' skills so that teachers can remain productive. Furthermore, the use of virtual environments will allow teachers to take control of their own learning, monitor their progress, and learn more via experiential learning. Equally important, is that the VR tool will provide immediate feedback, fostering teachers' reflection and learning that in an actual classroom would be difficult to accomplish.

1.4 Contribution, Innovation, Impact of the proposed work

This thesis aims to give an innovative VR-based approach to teacher education and the related training methodology. Moreover, this project responds to a real need from the European Union for improving the development of teaching practices and attracting more high-quality candidates to the teaching profession. Higher education institutions are trying to reform and modernize ITE programs by introducing new and innovative technology-based methods of teaching, which aim to offer high quality-rich teaching

and learning environments with dynamic programme design dedicated to achieving quality teaching. However, given the financial constraints due to the economic crisis, most European higher education institutions are unable to support significant breakthroughs. Thus, there is a need for newer, cheaper, reliable, and flexible methods to train future teachers.

The objective of this thesis is to present new opportunities for improving teacher training via using virtual reality environments as part of our teacher training methodology that will allow teachers (both in-service and pre-service) to experience an entirely new side of training. Additionally, this thesis aims to offer a new paradigm for teacher training, an alternative safe and low-cost environment that allow users to learn from their mistakes without consequence for the students. The virtual reality scenarios will reflect real-life situations, allowing teachers to test their knowledge and decide which is the appropriate course of action in a life-like situation without real risk of harming students. The project approach is innovative as to the best of our knowledge in the field of teacher education the use of VR is extremely limited.

Taking all the above into consideration, the proposed thesis project is innovative because:

- This is the first time that the problem of inadequate practical training in teacher education has been addressed via a VR based methodology;
- The implementation of the VR application followed a full designed cycle, a five-phase process with the active involvement of the target group;
- The development of the application is linked to both strong theoretical foundations in education derived from the documented literature and real teachers' problems based on extensive literature analysis and survey;
- The VR tool addresses specific teachers' competences as an outcome, after extensive documentation of existing Teachers' Competence Models and significant guidance by experts who pointed specific competences of primary importance to teachers;
- The VR tool aims to contribute to the reinforcement of the quality and efficiency of teacher education programs through the effective use of Information and Communication Technologies (ICTs) and more specifically using VR;

- The VR tool incorporates novel concepts in VR that aim to maximize user engagement and impact;
- Experimental evaluations carried out, follow a unique mixed-research design framework with multiple instruments, to ensure the validity of the results.

Besides the project innovation, this project aims to have a practical impact on the teaching profession through the development of a novel and promising training method for teacher education. Moreover, the prototype VR tool provides increased opportunities for the professional development of teachers through more attractive and innovative teacher training systems that are in line with their real needs and expectations. To ensure the added value of the VR prototype application, the implications of teachers in all research stages were crucial ensuring the results will benefit their personal and professional development.

VR-based training will increase the acquired key competences that will support the professional development of teachers and the promotion of high-quality teaching practices. Another ambitious goal of the proposed research is the promotion of a greater understanding and responsiveness to social, ethnic, linguistic, and cultural diversity in schools and classrooms via innovative VR integrated approaches. In the long-term, the current research aims to lay the foundations of a VR application that could be implemented in the university curriculum giving a new direction to teacher education via the use of VR environments.

1.5 The research question and methodological framework

The main research question that constitutes the fundamental core of this thesis research project are the following:

> *RQ. Can a virtual reality-based learning paradigm be used for the professional development of teachers?*

Multiphase design (MD) was selected as the most appropriate approach for the current research consisting of five phases. MD approach was the most suitable design for the current research and allowed addressing a specific set of questions during the five phases that aimed to provide feedback to the general objective of the research. Using MD and a combination of quantitative and qualitative techniques provided the necessary flexibility to investigate the five interconnected phases.

The five-phase model that was used in the research is presented in figure 1-1. Each phase is explicitly explained in chapter 3 that presents in detail the methodological framework.

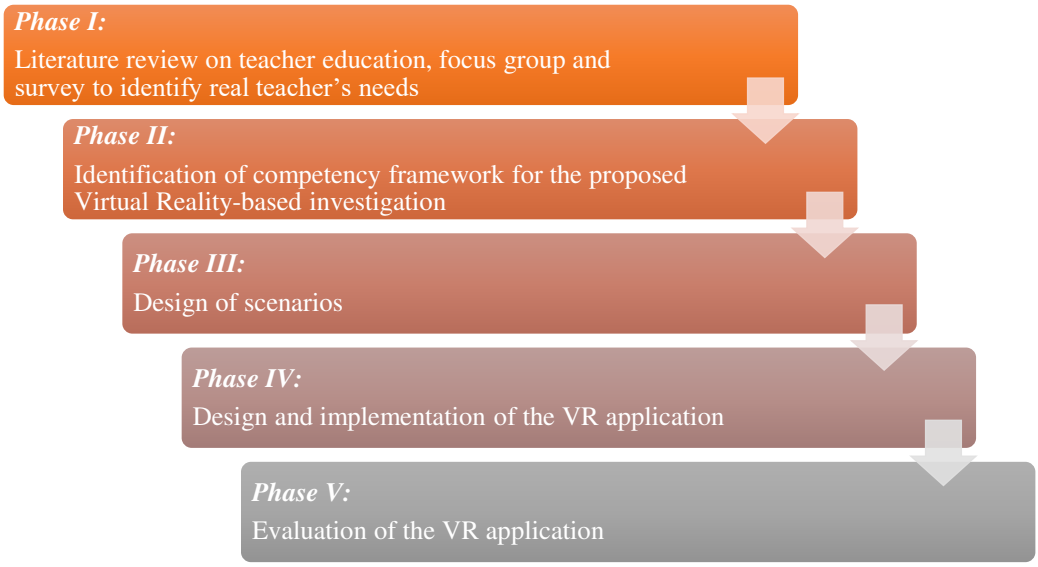

Figure 1-1: Five phase model used in the current research

Phase I includes a state-of-the-art analysis of the topic under investigation and explores in-depth teachers' beliefs, practices, and attitudes about the problems and challenges that they face in their daily classroom life. This initial phase defined the pedagogical framework of the current research that formed the basis for the design of effective training scenarios within the virtual environment that meet teachers' real and daily classroom needs. Equally important is that the identification and classification of teachers' needs as indicated by teachers themselves, not only formed the core of the designed training scenarios but also maximized the added value of the proposed VR tool as part of their professional development.

Phase II deals with the development of the competence framework based on well-identified models regarding teachers' competences. The current competence framework was developed to provide a structure within which the professional standards that the proposed virtual application aims to address are defined.

Phase III deals with the design of the training scenarios for the VR application. The main objective of this phase was the design of scenarios that represent real-life situations as identified by experienced teachers, providing the users challenging,

motivating, and engaging situations that require the proper course of action to be made. This phase aims to design engaging interactive scenarios that feel "real" to the learners.

Following the various scenarios, the VR application is developed under *phase IV* providing teachers an alternative new and innovative way to practice their skills.

Finally, *phase V* assessed the impact of the VR application. The main objective of this research project is to provide an innovative VR tool that will enhance teachers' competences and will maximize their professional development that has been highlighted of paramount importance within the European agenda. Hence, evaluating the impact of the VR tool provided the necessary guidelines for effective teacher training programs that aim to invest in teachers via using new approaches based on VR learning.

1.6 The structure of the thesis

The current dissertation is structured into eight chapters, in addition to this introduction:

- *Chapter 2: Literature Review*. This chapter provides an overview of previous research on the topic under investigation. The chapter reviews the history of virtual reality presents its terminology and its use and impact in general but more particularly in the field of education. Moreover, the topic presents the theoretical framework of teacher education and identifies the problems, the challenges, and the gap that the current research aims to fill.
- *Chapter 3: Methodological Framework*. This chapter provides grounding related to the multiphase research design and describes the five-phase model that the current research follows. Ethical considerations are also presented in this chapter along with the limitations encountered.
- *Chapter 4: Investigating teachers' training needs*. This chapter presents the actions under phase one that aim to investigate and identify teachers' real training needs. The chapter presents a focus group and a survey that aimed to shed light on teachers' training needs along with the research outputs.
- *Chapter 5: User-Inspired Design of Optimum VR Environments*. This chapter presents aspects concerning the design of the virtual reality environment and application. The chapters present at first the methodological framework that was followed for the design of the elements of the virtual world and then the process

for the design of the 3D models is described, along with the presentation of the models that were used within the virtual world.

- *Chapter 6: Investigating the impact and appearance of virtual environments on users*. This chapter presents the initial evaluation of the VR prototype and explores the use of VR versus traditional training approaches. Moreover, appearance issues of the virtual world are explored through the presentation of a survey that aimed to investigate the user's preferences regarding the design of the virtual environment.
- *Chapter 7: Investigating presence, empathy, emotions, and perspective-taking in a VR environment simulating drug use in the school context*. This chapter presents the second evaluation of the VR application aiming to investigate the levels of presence and embodiment in the VR environment, changes in empathy and emotions, and the impact of perspective-taking.
- *Chapter 8: Investigating the impact of a VR intervention on end-users' empathy and emotional state*. This chapter presents the final experiment that investigates the impact of the final version of the VR application on participants' emotions and empathy skills. Emphasis is given to perspective-taking and also levels of presence and embodiment are explored.
- *Chapter 9: Conclusions*. In this chapter, the main findings concerning the research questions are summarized, the contribution of the research is presented along with the limitations encountered. The chapter concludes with future work plans and conclusion remarks.

2 Literature review

This chapter aims to discuss the current state of knowledge in the field of virtual reality and the use of virtual reality in education with a focus on teacher education. The literature review is divided into two parts. The first part aims to offer insights into the topic of virtual reality and virtual reality applications, including education applications. The second part aims to provide an in-depth understanding of teacher education and the necessary skills, teachers' needs, and problems that could potentially be addressed using VR-based approaches. This chapter addresses the current knowledge of the discipline and emphasizes the key components, providing a clear statement of the topic under investigation.

2.1 Virtual Reality

This section presents the terminology of Virtual Reality (VR), its significance, and uses both in the general context as well as for educational purposes. The issues that are discussed in the following sections include the following thematic areas (figure 2-1):

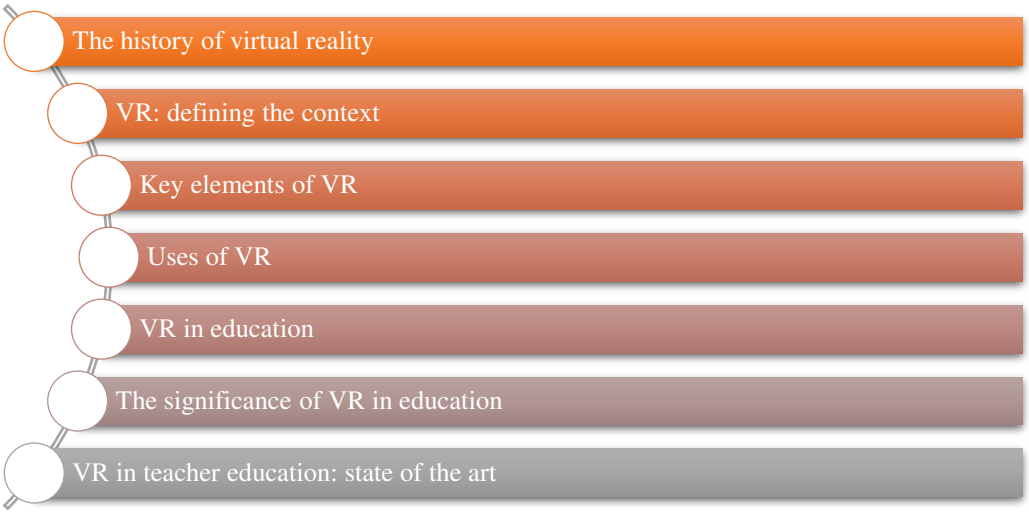

Figure 2-1: VR thematology

2.1.1 The history of virtual reality

The concept of virtual reality (VR) became popular and drew much attention in the early 1990s. However, the roots of VR date back to ancient times, as according to Plato's historical references attention was given on the use of perspective in the scenery

of Aeschylus's and Sofoklis's tragedies. There are also indications that in some paintings by ancient Greek and Roman painters there were high levels of three-dimensional realism. However, no work has been saved from this period to confirm this indication (Giannaka, 2006).

The evolution of VR comes in the 18th Century when 360-degree panoramic paintings began to appear (Freina & Ott, 2015). In 1778, painter Robert Barker painted a 360-degree view of the city of Edinburgh (Giannaka, 2006; Wright et al., 1999). During the 19th century, in 1839 View-Master stereoscope was developed and used for virtual training, offering users a sense of depth and immersion (figure 2-2). Later, in 1929, there was the first attempt for the development of the first flight simulator by Edward Link (Virtual Reality Site, 2017).

Figure 2-2: View master

More recently, in 1956 Morton Heilig developed Sensorama (figure 2-3 Left), a device like a theater cabinet, in which the user was seated in front of the display scene that was equipped with sensory stimulators that would stimulate all the senses to create an immersive virtual reality (Mazuryk & Gervautz, 1996; Virtual Reality Site, 2017). Sensorama is considered the first attempt at creating a multi-sensory VR system (Freina & Ott, 2015; Mandal, 2013; Sherman & Craig, 2003; Craig et al., 2009). Morton Heilig also developed the Telesphere Mask (figure 2-3 Right) which was the first attempt for head-mounted display (HMD) (Sherman & Craig, 2003).

Figure 2-3: Left: Sensorama and Right: Telesphere Mask (Image source: Virtual Reality Society (2016). History of virtual reality. Retrieved from http://www.vrs.org.uk/virtual-reality/history.html)

In 1965, Ivan Sutherland created a virtual world named 'Ultimate Display', describing a room where everything was controlled by the computer, and users' actions had the same impact within the virtual environment like this in the real world (Giannaka, 2006; Mandal, 2013). Moreover, this artificial world included interactive graphics, sound, smell, and taste. Later, in 1968, Ivan and his student Bob Sproull created the first VR head-mounted display (HMD) with head tracking, called 'Sword of Damocles' (figure 2-4) that was connected to a computer and not a camera (Giannaka, 2006; Virtual Reality Site, 2017).

Figure 2-4: The first HMD (Image source: Virtual Reality Society (2016). History of virtual reality. Retrieved from http://www.vrs.org.uk/virtual-reality/history.html)

An artificial reality system called 'Videoplace' (figure 2-5) was developed in 1975 by Krueger that was '*a conceptual environment*' (Mandal, 2013, p. 305) able to '*coordinate the movement of the graphic object with the actions of the participant*' (Mandal, 2013, p. 305). It used projectors, video cameras, hardware and was able to catch users' silhouettes by cameras and projected them on a large screen in real-time as shadows, while the participants in different rooms were able to interact with one another (Mandal, 2013; Mazuryk & Gervautz, 1996).

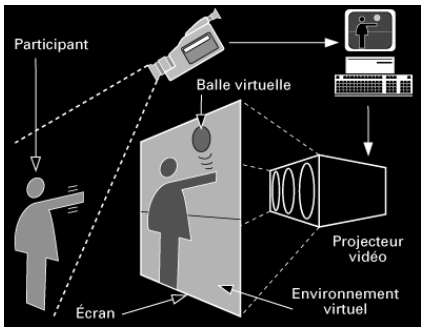

Figure 2-5: Videoplace (Image source: Krüger (2004). Videoplace, Interactive installation. Retrieved from http://netzspannung.org/)

Until 1980 there was no term to describe the field of VR. In 1987, Jaron Lavier, founder of the Visual Programming Lab (VPL) used for the first time the term VR and

developed many of the first VR systems during the 80s (Giannaka, 2006; Kotsifakos, 2008; Virtual Reality Site, 2017). In 1982, Thomas Furness at the US Air Force's Armstrong Medical Research Laboratories developed 'VCLASS', an advanced flight simulator, with the use of HMD (Mandal, 2013). During the 80s VR hardware and software have been developed and in 1989 VPL announces the development of a complete VR system. VPL also manufactured DataGlove (1985) and the Eyephone HMD (1988). In 1989, the BOOM - Binocular Omni-Orientational Monitor device, was presented by the Fake Space Labs (figure 2-6). BOOM was a head-coupled stereoscopic display device, where the screens are housed in a box that is attached to a multi-link arm. The user looks through two holes in the virtual world and can guide the box to any position within the operational volume of the device. Head tracking is accomplished via sensors in the links of the arm that holds the box (Beier, 2008).

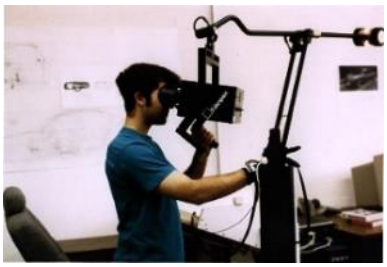

Figure 2-6: The BOOM device (Image source: Beier (2008). Virtual reality: a short introduction. Retrieved from http://www.umich.edu/~vrl/intro/)

In 1990, the first commercially available VR system was developed by W-industries, while research and development continue during the 90s (Craig et al., 2009; Sherman & Craig, 2003). In 1992, Cave Automatic Virtual Environment-CAVE was developed at the Electronic Visualization Laboratory (EVL) at the University of Illinois at Chicago, an immersive virtual reality environment that takes the form of a cube-like space in which images are displayed by a series of projectors (figure 2-7). The user wears VR glasses or an HMD that displays a three-dimensional image via a technique known as stereoscopy. The stereoscopic method presents to someone two images – separately to the left and the right eye – that are combined into the brain as one image creating to the user the illusion of three-dimensional depth given from two images. CAVE allows the users to become fully immersed within the virtual environment.

Figure 2-7: CAVE virtual reality system (Image source: Virtual Reality Society (2016). CAVE fully immersive virtual reality. Retrieved from http://www.vrs.org.uk/virtual-reality-environments/cave.html)

During the '90s, virtual reality seemed to evolve dynamically conquering the market, however, things did not work out so well because the technology was at a very early stage and it was also too expensive and unaffordable for consumers. Efforts from SEGA and NINTENDO to develop VR systems did not pay off and many ideas were abandoned before going into circulation. Undoubtedly, until recently VR technology was costly and mostly used in universities for research purposes. However, this is presently changing as the technological evolution allowed the development of low-cost devices that are affordable for consumers (e.g. Oculus Rift, Oculus Go, VIVE), while access to cheap and free software, such as Unity 3D and Unreal Engine, for the development of virtual worlds, is becoming easier (Górski et al., 2017). The future of VR is still in progress, yet the lower cost of VR equipment, affordable VR hardware and space requirements brought this unique experience within the homes of consumers and gave a boost to the development of new applications that are used in many fields from medicine and education to tourism and shopping.

2.1.2 VR: defining the context

There is no consensus on the definition of the term virtual reality as it is a multidimensional concept with a variety of characteristics. The term 'virtual' means computer-generated, while the term 'reality' refers to the similarity of objects or of the environment to the physical world (Cheng, 2014). Many researchers argue that VR is not a new tool but a completely new concept and paradigm in human-computer interaction (Schwienhorst, 2002).

Virtual Reality (VR) is defined as a '*computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or*

physical way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors' (Freina & Ott, 2015, p. 1). VR '*is a computer-generated 3D representation of real-life environments. A user can autonomously navigate around a VR (in the form of avatars) and interact with simulated objects and other avatars in real-time at the same pace one would experience events in the real world*' (Ke et al., 2016, p. 212). For Lawson et al. (2016) VR '*is a system which permits users to interact, move, look at, and be immersed in a 3D environment*' (p. 323). Lee and Wai Wong (2014), state that VR is '*a way of replicating an environment that can be explored and interacted with by a person*' (p. 50), while for Pan et al. (2006) VR '*is the use of computer graphics systems in combination with various display and interface devices to provide the effect of immersion in the interactive 3D computer-generated environment*' (p. 20).

VR is '*an absorbing, interactive, computer-mediated experience in which a person perceives a synthetic (simulated) environment by means of special human-computer interface equipment. It interacts with simulated objects in that environment as if they were real*' (Mandal, 2013, p. 305). VR aims at making '*the user located in the three-dimensional data environment expressed by the computer, and travel in this environment by eyes, hands, ears or special three-dimensional device, to create a sense of being on the scene*' (Cheng, 2014, p. 428). Górski et al. (2017) state that '*the main concept of VR is the creation of a digital world (or environment), in which a human user is placed and can interact with it in real-time*' (p. 396). The virtual world appears to our senses in the same way we perceive the physical real world, hence, the users feel physically engaged in a simulated virtual environment that is different from the real environment that they are surrounded (Craig et al., 2009).

It should be noted that Steuer (1992) highlighted that VR definitions focus mostly on technological factors and more specifically on a set of minimum hardware requirements that must be met, including computers, head-mounted displays, headphones, gloves, etc., rather than on the experiential side of VR. As a result, the definitions do not provide useful insights regarding the true nature of VR and most importantly regarding user's experiences (Steuer, 1992). Hence, according to the author either the term of VR should not be used by researchers or it should be approximately explained '*in terms of human experience rather than technological hardware*' (Steuer, 1992, p. 75).

The term virtual reality is often considered to be synonymous with the term virtual environment. However, although the terms are related, they are not synonyms and virtual environments are defined as '*virtual worlds or as worlds presented in a particular virtual reality hardware configuration*' (Sherman & Craig, 2003, p. 16). Virtual reality is also closely related to augmented reality (AR). However, AR is a type of virtual reality that combines computer-generated virtual representations along with representations from the physical world (Sherman & Craig, 2003).

Even though there are several definitions of VR, there are specific elements that those definitions have in common, indicating that VR is an interactive, immersive (sense of presence) and autonomous environment (Mazuryk & Gervautz, 1996). There are three key elements of VR known as the '3I' - Immersion, Interaction, and Imagination (Cheng, 2014; Li et al., 2009) (figure 2-8). Apart from the 3Is, there are also some elements of paramount importance for VR systems. The sense of presence plays a key role in a VR system as it deals with users' sense of being in the virtual world (Schuemie et al., 2001). Emotional experiences are also a significant parameter concerning the user's virtual experiences and cannot be dismissed when investigating the impact of VR. Moreover, there are indications that emotions are highly related to the sense of presence (Felnhofer et al., 2015). Highly important for a VR experience is also the component of embodiment, that deals with user's sense of having a body that moves according to users' intentions and interacts with the environment (Matamala-Gomez et al. 2019).

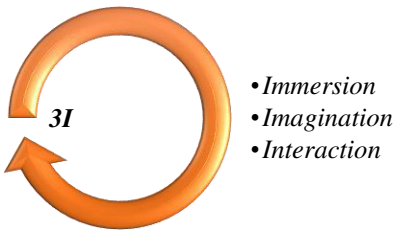

Figure 2-8: '3I' - Immersion, Interaction, and Imagination

2.1.3 Key Concepts of VR

In this section brief descriptions of the key concepts of VR, outlined in the previous paragraph, are presented.

2.1.3.1 Immersion

Immersion is one of the key elements of a virtual environment emphasizing how real the experience feels (Zhan, 2011). Immersion is the '*sensation of being in an environment*' (Sherman & Craig, 2003, p. 9), the '*feeling of being present inside an artificial environment, despite physical presence in the real world*' (Górski et al., 2017, p. 396). It is '*the involvement in the play, which causes lack of awareness of time and of the real world, as well as a sense of 'being' in the task environment*' (Freina & Ott, 2015, p. 1). According to Freina and Ott (2015), immersion in virtual reality environments refers to '*spatial immersion*' that is the '*perception of being physically present in a non-physical world. The perception is created by surrounding the user of the VR system with images, sound or other stimuli that provide a very absorbing environment. Spatial immersion occurs when a player feels the simulated world is perceptually convincing, it looks 'authentic' and 'real' and the player feels that he or she actually is 'there'* (Freina & Ott, 2015, p. 1). For Cheng (2014), immersion, or else called '*the sense on the scene,' refers to the degree of reality that the user feels when he exists as hero in the virtual environment*' (p. 428). An immersive virtual environment '*surrounds the user, increasing his or her sense of presence or actually being within it*' (Bailenson et al., 2008). Immersion can be mental and physical. More specifically, mental immersion refers to the '*sense of presence*' and to the '*state of being deeply engaged*', while physical refers to the ability of a virtual reality environment to '*replace or augment the stimulus to the participants' senses*' (Sherman & Craig, 2003, p. 9).

Although immersion is a significant advantage of VREs, Robertson et al. (1993) and Lee and Wai Wong (2014) state that VREs can also be non-immersive. Non-immersive VREs use more familiar tools for the users (mouse, keyboard, joystick, headphones, etc.) and thus the cost for creating such an environment is lower than a fully immersive system that requires the appropriate equipment such as head-mounted displays. Another advantage of non-immersive environments lies in the fact that it overcomes the technical limitations of VR technology. Finally, non-immersive environments do not require the use of special equipment as in immersive environments. Desktop VREs such as games, simulations, or virtual worlds like Second Life, are less immersive.

Immersion along with involvement are essential components of a VR system for the user to experience presence (Schuemie et al., 2001). For De la Rubia and Diaz-Estrella

(2013), the sense of presence plays a key role in the success of a VRE, as it helps the users to evaluate their experience within the virtual environment. Moreover, for a VR system to be successful, it must make sure that the user is fully immersed in the three-dimensional environment and unable to discern between the true and the virtual (Cheng, 2014).

2.1.3.2 Interaction

The ability of a VR system to respond in real-time to the users' actions is a key issue for providing an authentic real-life experience to the user (Sherman & Craig, 2003; Zhan, 2011). Interactivity takes place when the user provides input to the computer and the computer provides feedback to users' input (Burdea & Coiffet, 2003). Interaction is largely determined by the user interface, and thus considerable attention must be given for the design of the user interface as it is the means of communication between the user and the virtual environment (Mihelj et al., 2014).

Mihelj et al. (2014), argue that interaction is divided into three elements: manipulation, navigation, and communication. Manipulation provides users the ability '*to modify the virtual environment and to manipulate objects within it*' (Mihelj et al., 2014, p. 2015). Manipulation[1] allows the users to experiment within the virtual environment gaining knowledge on the way the environment works. Navigation allows users to move around the virtual environment and communication allows communication between the different users and intermediaries.

2.1.3.3 Imagination

The element of imagination stresses '*that the virtual reality technology possesses a wide imaginable space, which can widen the knowing scope of human beings, not only represent a truly existing environment but also mentally construct a non-existing environment, even an impossible environment*' (Cheng, 2014, p. 429). Imagination

[1] There are four types of manipulation: a) direct user control, where users' gesture recognition allows the manipulation of objects within the virtual environment, b) physical control, where manipulation of objects takes place with devices similar to those of a real environment (e.g. buttons, switches etc.), c) virtual control, that allows manipulation of objects through computer-simulated devices and d) manipulation via intelligent virtual agents (for further information see Mihelj et al., 2014).

refers to the ability of the mind to recognize nonexistent things as real (Burdea & Coiffet, 2003). VR applications are dynamic and not static systems representing various fields and for this reason, imagination is an essential component (Zhan, 2011).

2.1.3.4 Sense of presence

Presence is a characteristic of paramount importance the differentiates VR from other media (Biocca, 1997). It should be noted that in some cases there is confusion around the presence and immersion of the term, and they are often used synonymously, while they should be considered as different. According to Slater (2003), immersion refers to the objective point of view that the VR system delivers to the users. Presence, on the other hand, is the reaction of the users to immersion (Slater, 2003), referring to users' subjective psychological response to a VR system (Donga et al., 2019; Slater, 1999).

There is no consensus on the definition of the sense of presence. The term sense of presence can be defined as 'being there' in the virtual world rather than in the real physical space where the body of the users is located (Piccione et al., 2019; Sanchez-Vives & Slater, 2005; Schwienhorst, 2002; Valmaggia et al., 2016; Västfjäll, 2003). According to Bailenson et al. (2008), the term refers to '*the degree to which the user actually feels as if he or she is present in the VE as opposed to present in the physical world*' (p. 109). Slater (2003) states that presence is about *'the extent to which the unification of simulated sensory data and perceptual processing produces a coherent 'place' that you are 'in' and in which there may be the potential for you to act*'*… When you are present your perceptual, vestibular, proprioceptive, and autonomic nervous systems are activated in a way similar to that of real-life in similar situations*' (Slater, 2003). The feeling of presence gives users the illusion that the virtual space within which they are located really exists (Bouchard, 2010). Users know that the space that they are in and the events that happen are not real in the everyday meaning of the word but mediated but technology, however, they have the illusion of non-mediation and they think, feel and behave as if they were in the real world (Felnhofer et al., 2015; Sanchez-Vives & Slater, 2005; Schuemie et al., 2001). Virtual reality systems are designed to '*give the user a type of mediated experience that…seems truly natural, immediate, direct, and real…that creates for the user a strong sense of presence'* (Lombard & Ditton, 1997). Examining the sense of presence in a VR system is essential for the design of the system and its usefulness (Lombard & Ditton, 1997). Moreover,

understanding how the sense of presence works in a VR system could help understanding how the phycological processes of the users are generated, while using the system (Lombard & Ditton, 1997).

Lombard and Ditton (1997) argue that a strong sense of presence can be achieved if human senses are activated. The more senses are activated the stronger the sense of presence is. For instance, audio and visual stimuli can produce a greater sense of presence than audio-only media (Lombard & Ditton, 1997). Therefore, senses of smell, body movement, and touch in a VR system is more likely to contribute to a stronger sense of presence. Sound is also considered to have an impact on the level of presence, yet the is a lack of research concerning this issue (Sanchez-Vives & Slater, 2005). Visual displays, like the quality of the image or the viewing distance, the color or the movement of images, the third dimension of depth, the camera's point of view can also affect participants feeling of being a part of the environment and thus can affect the levels of sense of presence (Lombard & Ditton, 1997). However, research results indicate that the level of graphical realism does not seem decisive to achieve presence (Sanchez-Vives & Slater, 2005).

Equally important is the interaction of the user in the VRE and the response of the system in the users' input can also affect presence (Lombard & Ditton, 1997). Heeter (1992), suggests that presence might be correlated to the degree that gives the user a sense of déjà vu, that is the feeling of having already lived something. Moreover, Heeter (1992) argues that the reaction of other beings that exist in the world might also affect the users' sense of presence because '*if the environment knows you are there, that may contribute to you believing you are there'* (p. 264).

VR is becoming a significant tool in many disciplines including medicine, psychology, neuroscience but also education. One reason for that is related to the sense of presence that causes users the belief that they are in the virtual environment, reacting as if they were in the real world. Sense of presence allows users to actively and personally experience the training scenario affecting positively skill enhancement (Mantovani & Castelnuovo, 2003), which is a significant advantage of VR systems and the reason they are used for training purposes even in fields such as military, surgery and pilot training, as they are more beneficial than low presence media such as textbooks. Thus, the sense of presence plays a key role in a VR system and for this reason, the investigation of the

levels of presence to the proposed VR application is of paramount importance for the current research. Several studies have been conducted on the topic of presence; however, further research is required to investigate presence concerning the proposed application that addresses teacher education and training.

2.1.3.5 Virtual emotional experiences

The significant role of emotions has been neglected by psychology until the decade of the 80s. As Izard (1991, p. 1) argues, psychology at the beginning was '*a paradox, a science that neglected its most important subject matter*'. However, over the years, emotions have caught the interest of the scientific community. Emotions are defined as '*short-term, intense and caused by a specific cue*' (Felnhofer et al., 2015, p. 48). There is a wide range of scientific opinions regarding the role of emotions. Some scientists argue that people are always experiencing some emotions, others claim that emotions do not play a significant role in the behavior of humans, others claim that emotions are the primary motivational system of humans and others that emotions play a key role in motivation (Izard, 1991).

There is a need to investigate emotional experiences in VREs as there is a lack of research regarding the emotional experiences of users (Felnhofer et al., 2015). The question that arises is why to investigate emotional experiences in VREs. This derives from the fact that emotions '*are implicated in our phenomenological understanding of the physical world*' (Morie et al., 2005). Media such as books or television can provoke emotions (Reiners et al., 2014). Thus, as VREs can represent real-life situations, emotions have an integral part to play during the experience of the users. Moreover, Morie et al. (2005) argue that emotions should not be neglected when the goals are pedagogical. Hence, as the goal of the proposed VR system is to train teachers, their emotional state within the VRE during their training cannot be ignored.

The investigation of emotions is also essential as users' emotional experiences are highly related to the sense of presence, as presence is '*a precondition for an emotion to occur at all in a VE*' (Felnhofer et al., 2015, p. 48). However, it is essential to have in mind that the emotional experiences of the users have to do with '*the content of the experience*', while presence is the '*response*', the '*form*' (Slater, 2003). The relationship between presence and emotions is unclear and more research is needed to deeply

understand their relationship and investigate the possibility that the levels of presence are responsible for the different emotional states or vice versa (Felnhofer et al., 2015; Robillard et al., 2003). A deeper investigation of the relationship between emotions and presence will clarify whether the users feel present because they are having an emotion or because the emotions caused are in line with what one would expect to feel in the virtual environment (Bouchard & Labonté-Chartrand, 2010).

Despite the fact the VREs '*provide the unique possibility of creating rich and interactive true-to-life replications of emotionally charged scenarios and stimuli*', the manipulation of the data regarding emotions from researchers is problematic (Felnhofer et al., 2015, p. 48). Felnhofer et al. (2015) argue that limited emotional experiences have been investigated in VR use including relaxation, joy, sadness, anxiety, anger, and boredom. Anxiety is one emotion that has been addressed in many kinds of research in the context of using VR for mental health problems and psychological treatment (Bouchard & Labonté-Chartrand, 2010).

Investigating users' emotional experiences and their relationship to presence is of paramount importance as this relationship might affect the way a VR system is designed to provoke a specific emotion (Felnhofer et al., 2015). Felnhofer et al. (2015), investigated five different virtual park scenarios each related to a different emotional state: joy, anger, boredom, anxiety, and sadness. In each park scenario, there were differences in the design elements (e.g. lights and sound) to provoke the desired emotional state. The results of their research indicated that although each scenario was linked to a specific emotional state, to some level in all cases other emotional states were also provoked. However, for the three out of five virtual parks, they managed to provoke the desired emotional state. Thus, there are significant indications that the design of the VRE is correlated to the different emotional states. Moreover, their research revealed no differences in the levels of presence and the different emotional states. According to their results, it seems that presence is not affected by the different emotional states. However, previous research by Baños et al. (2004) and Riva et al. (2007) indicated the exact opposite. Nevertheless, it should be noted that despite the research results the authors state that further research is needed to identify the relationship between presence and emotions in VREs.

Up to now, a small number of studies have investigated the emotional reactions of the users in VRE, however, in some cases, the results are unclear (Felnhofer et al., 2015). Bouchard and Labonté-Chartrand (2010) argue that to understand the exact role of emotions during the experience of the users within the VRE, it is essential to try to provoke emotions that do not match the virtual environment because '*if a user feels an emotion that is not supposed to be felt during the immersion, we can determine whether it is the emotional arousal itself that foster presence or if the meaning of the emotional arousal is important as well*' (p. 24). Their objective was to investigate whether users experiencing an emotion that matched the VRE had higher levels of presence that those experiencing an emotion that did not match the VRE. For this reason, during the experiments, the authors tried to manipulate the emotions and induce participants to an emotional state (positive and negative) before the use of VR. The research results indicated that the manipulation of emotions was successful before the use of VR, however, this manipulation did not have the expected impact on presence. Thus, the mishmash of emotions did not have the expected outcome regarding the levels of presence.

2.1.3.6 Embodiment in virtual environments

An important aspect concerning VR deals with the virtual representation of the user, called avatar (Argelaguet et al., 2016). The question lies on whether the users conceive the virtual body representation as to their own body within the virtual world (Kilteni et al., 2012). Embodiment includes the sense of self-location, the sense of agency, and the sense of body ownership (Argelaguet et al., 2016; Kilteni et al., 2012). Self-location refers to '*the space in which we perceive the self to be located*' (Argelaguet et al., 2016, p. 2). The sense of agency refers to the '*feeling of being in control of the avatar*', and the sense of ownership refers to '*the feeling that the avatar is the source of experienced sensations*' (Argelaguet et al., 2016, p. 1). According to Kilteni et al. (2012), one experiences Sense of Embodiment (SoE) '*toward a body B if one feels self-located inside B… if one feels to be an agent of B… if one feels B as one's own body… if and only if one experiences at least one of the three senses at least in a minimal intensity*' (p. 378). Moreover, the user experiences full SoE towards a body B if he/she experiences all of the three senses (self-location, self of agency and self of body ownership) at the maximum intensity (Kilteni et al., 2012).

The SoE was not the primary parameter of the current research. However, it is an important element of a VR system and of the current research, associated with the fact that participant's virtual bodies were seen from a first-person perspective (1PP), hence, it was significant how the participant's conceived their virtual body to maximize their experience in the virtual world (Spanlang et al., 2014). Moreover, for some of the scenarios participants' illusory perception that the virtual body is their own, could have a significant impact on their experience and training, as some of the avatars face disorders including prosthetic parts. Thus, it was of paramount importance for the participants to change perspectives (perspective-taking) and try to enter in another person's shoes and imagine the person's perspective, enhancing their empathic skills and perception of certain disorders and problems faced by the students (Bertrand et al., 2018).

2.1.4 Uses of VR

VR provides unlimited possibilities regarding the development of virtual worlds, making it a valuable tool for any domain. Lately, the enormous technological advancements allowed the development of professional VR applications that can be applied in many fields and for many purposes, for instance for advanced training in the medical or engineering sector (Górski et al., 2016).

Notably, VR has been used as a tool for the treatment of phobias as a more effective method than common therapies. Valmaggia et al. (2016) conducted a literature review research in the use of VR in psychological treatment. The results of their study identified that before 2012 most of the research focused on anxiety disorders, phobias, and stress disorders. According to the authors, the results also revealed that the use of VR had limited positive effects on the participants compared to traditional therapy. According to the results, after 2012 several researchers work on VR- based therapy for cases involving agoraphobia with and without panic disorder, public speaking anxiety, social anxiety disorder, fear of flying, spider phobia, eating disorders, psychological stress, schizophrenia, and autism. Valmaggia et al.'s (2016) research findings indicate the potential of using VREs in the treatment of such psychological disorders. The implementation of VR seems promising in the reduction of all the above-mentioned disorders. Nevertheless, the results cannot be generalized as in most cases the sample

was relatively small while there were high drop-out percentages due to cyber-sickness side effects from the VR headsets. Thus, further research is needed to confirm the above research findings. Furthermore, Valmaggia et al.'s (2016) literature review research also confirmed previous research findings by Freina and Ott (2015), related to the lack of research on the use of VR by younger students and older adults.

VR offers the users the opportunity to live the life of someone else getting an idea of what someone else's life might be like (Axelrod, 2014). Axelrod (2014) argues that in the past we could read a book and try to enter the position of the character, but nowadays, VR technology allows as to live another person's life and experience different viewpoints. Researchers from BeAnotherLab developed an interactive virtual environment called 'The Machine to be Another' to address the relationship between identity and empathy (Bertrand et al., 2014). 'The Machine to be Another' aimed to help the users understand the *Self* through understanding the *Other's* point of view (Bertrand et al., 2014). Several experiments on embodiment with different scenarios based on real stories from different people were conducted. The VR system made it possible for genders to swap bodies, so a woman could feel as being inside of the body of a man and vice versa (figure 2-9) (Bertrand et al., 2014; Kuchera, 2014). Within this context, another experiment allowed a mother to see through the eyes of her daughter strengthening the mother-daughter relationship. Moreover, the users could see through the eyes of an immigrant from Senegal lining in Spain and see themselves in the body of a woman in a wheelchair. The experiments revealed that the participants experienced a high sense of presence increasing the levels of their engagement and embodiment experience (Bertrand et al., 2014). Kuchera (2014) argues that the virtual reality system creates the users an effective illusion so that they do not feel as if they are in a virtual environment, but they feel as being in the body of someone of the opposite gender. Moreover, the participants argued that their experience raised their awareness of other people's problems.

Figure 2-9: VR system for gender swap bodies (Image Source: Rutherford-Morrison, L. (2015). Gender swap virtual reality headsets let you experience what the other gender experiences. Retrieved from: http://www.bustle.com/articles/131482-gender-swap-virtual-reality-headsets-let-you-experience-what-the-other-gender-experiences)

Lately, VR is also widely used in domains such as the automotive industry for the design and development of new products, within interactive virtual environments that allow visualization (Górski et al., 2016). The use of VR allows manufacturing companies to detect possible mistakes that can be eliminated before production starts. Thus, VR can support product development, providing clients with new and high-quality products. Moreover, according to Lawson et al. (2016) car design is an expensive and time-consuming process that requires several modifications and reviews before the product goes to production. The authors claim that VR can be used in the design phase to reduce the time and cost required while maximizing the quality of the product. VR can also be used during the development phase of the product reducing the cost and risks of manufacturing. For this reason industries like Jaguar Land Rover (JLR) have already used VREs. Undoubtedly, industries need to be aware of all the newest technological advances and be constantly updated to remain competitive in a global and dynamic labour market. Moreover, in the last few years, the economic crisis affected severely automotive industries, with declines in the demand for cars globally and millions of jobs lost. Thus, automotive industries cannot afford expensive and time-consuming processes and must implement new and more effective ones but without affecting the quality of the product.

The implementation of VR in automotive industries seems to be able to '*increase the quality of the final outcomes, reduce the costs of the entire process, shorten time to market and improve the efficacy and well-being of users*' (Lawson et al., 2016, p. 328). Nevertheless, despite the new opportunities that VR can provide in automotive industries several disadvantages and limitations must be taken into consideration. Although the use of VR technology may in time reduce the cost of the design of a

product, VR equipment is still unaffordable for many companies (Lawson et al., 2016). Valmaggia et al. (2016), also report the high cost of VR technology and hardware problems as limitations. Moreover, VR technology has many side effects for the users influencing their well-being (Lawson et al., 2016).

2.1.5 VR: the new step for education

Recently, there has been a major shift in the field of education towards the implementation of more immersive and innovative computer-based training educational tools that can contribute to knowledge and skills acquisition. Lately, virtual reality environments (VREs) have attracted the interest of the scientific community, that seeks new ways to enhance teaching and learning via using technology-based approaches (Bailenson et al., 2008).

VR technology has risen as new and innovative teaching and learning techniques providing interactive and immersive activities that turn the experience into learning and learning into an exciting experience (Hanson & Shelton, 2008; Marks et al., 2017). VR can provide users with realistic environments that allow real-time active learning and the transfer of knowledge and skills from the virtual to the real context (Ke et al., 2016). Additionally, VR is an ideal learning and teaching tool due to its ability to stimulate motivation, which is one of the most significant challenges that teachers face in today's dynamic and digitalized classrooms (Freina & Ott, 2015). This ability of VR to arouse interactivity and motivation makes it a valuable tool to be widely used in the field of education and training (Freina & Ott, 2015). Furthermore, apart from a positive impact on motivation, research results indicated that VR can be used for cognitive training increasing learner's attention (Cho et al., 2002).

Another significant advantage of using VR-based approaches it that they promote more learner-centered pedagogies ensuring greater engagement and active participation of learners than in the traditional classroom setting (Schwienhorst, 2002). Hence, learners not only participate actively in the learning process, but they are in control of their own learning enhancing their self-awareness. Moreover, VREs offer space for experimentation where users can experiment with a variety of objects, enhancing their attention and awareness (Biocca, 1997; Valmaggia et al., 2016).

Equally important is that virtual reality offers users the opportunity to be trained in dangerous situations but within a safe environment allowing users to experiment while avoiding real dangers (Bailenson et al., 2008; Freina & Ott, 2015). Sometimes training in real physical space can be expensive or even dangerous. For this reason, VR can be used to provide practical experiences to people of areas in which real-life training is not an option due to lack of access or because the danger is high (Freina & Ott, 2015). For instance, it is not possible to train in real-time firefighters or bioterrorist response units as those dangerous situations cannot be created in reality. However, within a simulated virtual environment that represents a real-life dangerous crisis, learners '*can experience the chaos and affective stressors that are typically accompanied with actual crises*' (Bailenson et al., 2008, p. 110).

Despite the significant advantages of VR-based approaches, there are also many challenges to be addressed. Until recently a major concern of virtual reality was the high cost of the equipment and hardware limitations (Valmaggia et al., 2016). However, the latest technological advances made VR equipment more accessible for the users as the cost has been reduced and, in many cases, a typical desktop computer or even a smartphone are required.

Research regarding the use of VR in the education sector is still at its infancy and there is a limited yet growing body of research indicating the potential of using such an approach. Moreover, the development and implementation within the classroom of educational VR applications are limited enough (Crosier et al., 2002). Freina and Ott (2015) conducted literature research related to the use of virtual reality in education for the years 2013 and 2014. Their research focused on three areas that were: Immersive Virtual Reality Education, Oculus Rift Education and Head Mounted Display (HMD) in Education. What is interesting is that the results indicate a decrease in published papers from 2013 to 2015. Most of the research papers have been written in the United States and the United Kingdom and most of the papers are related to computer science, engineering, social sciences, and medicine. Another interesting result is that literature is extremely limited regarding the use of Oculus Rift in education as only three papers were found during the years 2013 and 2014 coming from the engineering and computer science field. Regarding the use of HMD, the results revealed their use mainly in the USA and Germany, focusing mainly on computer science, engineering, mathematics,

and medicine, while there is a small number of papers referring to social sciences. The results of their study also revealed that most VR research papers have to do with university or pre-university learning focusing particularly on science lessons such as physics or chemistry. Moreover, VR appears to be used in adult training in areas in which practice in the real setting is impossible due to lack of access or danger. Experimentation in situations that 'cannot be accessed physically' seems to be the most important motive for VR use according to the two authors. Undoubtedly, VR technology allows the development of simulated dangerous and risky settings that otherwise would be impossible to realize due to cost and safety reasons. This makes virtual reality a significant means for adult training and provides the trainer a controllable and at the same time safe environment.

Freina and Ott (2015), state that there is a lack of research related to elementary education. The two authors indicate that they found only two papers that have to do with research to children between the ages of 10 to 12. Similar to Freina and Ott (2015), Valmaggia et al. (2016) also conducted literature research on virtual reality and identified that there is a lack of research in the use of VREs with children and younger adults. One possible explanation for the limited use of virtual reality in younger children has to do with the fact that their vision is still under development, while the VR technology is not yet appropriate for younger users (Freina & Ott, 2015). Oculus Rift, for instance, has several recommendations related to the use of the 3D glasses by children and recommends that they should not be used under the age of 13. Additionally, there is a lack of research related to secondary education. Students' age is probably a significant subversive factor. Apart from that, parental permission is required for research involving children and, in many cases, this is a long-lasting process discouraging researchers to conduct experiments with children. Moreover, researching in a school setting demands apart from parents' permission, permission from the school administrator to conduct that research. In many countries, permission by the Ministry of Education must also be obtained and thus, researchers face many bureaucratic and time-consuming obstacles that discourage them. Freina and Ott (2015) also identified a lack of research related to people with disabilities. Furthermore, according to the research conducted by Freina and Ott (2015), there is a growing body of research in the use of virtual reality in medicine, including medical and nurse training, training for dental

students and surgeons, and training for rehabilitation purposes. Overall, the results by Freina and Ott (2015) indicate the use of VR in the field of education for training purposes. However, for the years 2013-2014, this use seems to focus on adult and university education.

Systematic implementation of technology in the classroom such as VR could revolutionize education by offering learners safe environments for practice and acquisition of new skills that are highly interactive. Nevertheless, those speculations have not yet confirmed as except for the medical science where VR is used for educational and training purposes the use of VR in the rest of education remains limited (Jensen & Konradsen, 2018). VR technology can provide powerful and innovative teaching and learning experiences, through virtual environments that are real enough to engage the users and at the same time not real enough allowing experimentation and mistakes (Mantovani & Castelnuovo, 2003).

2.1.6 The significant of VR-based approaches in education

VR can offer an entirely new learning space for pedagogical activities (Akhmetov et al., 2015). From an educational perspective, VR can be used to support constructivist learning theory, offering users engaging learning activities allowing them to conquer knowledge on their own and connect it to their previous knowledge (Aiello et al., 2012; Eschenbrenner et al., 2008). In the last few years, research outcomes regarding the use of VR-based approaches in the field of education indicate significant advantages and positive effects on teaching and learning.

The most significant advantage of VR technology is that it allows the development of virtual worlds that mimic real-life situations and events, not otherwise possible to simulate due to the cost or possible danger, offering users a safe space with room for experimentation and error to be trained and learn (Eschenbrenner et al., 2008). For instance, it is not possible to train in real-time firefighters or terrorism response units as simulating dangerous situations in physical space, such as fire situations, earthquakes or terroristic attacks is impossible due to the high danger and cost (Bailenson et al., 2008; Freina & Ott, 2015; Shu et al., 2018). However, VR technology makes it is possible to develop virtual worlds that represent real-life dangerous situations and events, allowing firefighters or terrorism response units, for example, to '*live and experiment those*

situations that cannot be accessed physically' (Freina & Ott, 2015, p. 6) and '*experience the chaos and affective stressors that are typically accompanied with actual crises*' (Bailenson et al., 2008, p. 110) but within a safe yet stressful environment (Bailenson et al., 2008; Freina & Ott, 2015). Hence, the users can experiment in a free-risk environment and learn "*by doing*" trials within the VE (Freina & Ott, 2015; Rizzo et al., 2009). For this reason, VR is often used in vocational training providing practical experiences to workers of areas in which real-life training is not an option due to lack of access or because the danger is very high (Freina & Ott, 2015).

An important aspect of using VR-based training systems is the fact that knowledge acquired within a VE can be applied to the real context but also the opposite (Eschenbrenner et al., 2008; Huang et al., 2013; Parsons, 2016; Ragan et al., 2010). Simulating real-based phenomena and situations, provide the users with a space that suits their needs for training and learning through experimentation on new ideas (Eschenbrenner et al., 2008). VREs can '*implement contexts and relationships not possible to achieve in a traditional learning setting*' (Cheney & Nelsen, 2011, p. 1384). Thus, VREs provide users the ability to experience authentic and realistic scenarios and situations, closely connected to real-life incidents, allowing them to behave and respond as they would do in the real world (Parsons, 2016).

Of great value is the fact that VEs offer the possibility of visualizing events and situations, allowing the users to step inside the event or situation and examine it from multiple different perspectives, maximizing in-depth understanding of the conceptual framework (Bailenson et al., 2008; Marks et al., 2017). In previous years, people used to read books and enter the position of the character, but today, VR systems make it possible to swap bodies, so a woman can enter inside the body of a man and vice versa (Bertrand et al., 2014; Kuchera, 2014; Rutherford-Morrison, 2015).

VR technology not only allows to make the unseen visible (Marks et al., 2017) but also makes it possible to overcome the restrictions of time and physics and be transferred for instance to the past experiencing historical eras such as the world wars (Eschenbrenner et al., 2008). Additionally, VR situations are easily controllable, while the performance of the users during the virtual experience can be monitored providing feedback that allows reflection and maximization of learning (McComas et al., 1998; Rizzo et al., 2009). Furthermore, VR can promote creativity, communication, collaboration, and

social skills of the users, while research outcomes indicate that learners feel more psychologically present in virtual environments compared to the traditional learning methods (Bailenson et al., 2008; Eschenbrenner et al., 2008; McComas et al., 1998).

Another important aspect is that VREs can support knowledge acquisition by supporting many different learning styles such as visual, auditory, or kinesthetic (Ai-Lim Lee & Wai Wong, 2014; Freina & Ott, 2015). In this way, the virtual worlds match the needs of the trainees leading to knowledge mastering (Rizzo et al., 2009). The visualization of the educational content allows users to better understand concepts that are difficult to present dynamically in the traditional classroom (Eschenbrenner et al., 2008). Hence, the users gain deeper understating and sense of caring for the topic leading to increased enthusiasm for learning (Freina & Ott, 2015). Apart from visual capabilities, VR can offer the users haptic and auditory capabilities, maximizing their experience in the virtual world and more importantly their learning. Those capabilities provide the user's senses an immersive journey maximizing the level of realism of the VE and of the experience resulting in higher levels of engagement, which is essential in many fields such as medicine (Bailenson et al., 2008). Moreover, the users are offered instant feedback allowing reflection and maximization of learning and performance (McComas et al., 1998). The fact that VR can increase learner's involvement, motivation and engagement of the users in the simulated activities (Freina & Ott, 2015; Huang et al., 2013) can lead to its use supplementary to traditional teaching methods allowing teachers to spend the classroom time in more effective activities for the students such as discussions and group work (Eschenbrenner et al., 2008).

Through this technology, users can experience different historical eras overcoming restrictions of time or travel to places that they could not access physically, for instance, visit the moon or a different planet (Eschenbrenner et al., 2008; Freina & Ott, 2015). Hence, the instructors can design activities that include visiting places that no longer exist in real life something that would not be possible with traditional teaching methods. Moreover, instructors can develop cooperative activities with VEs promoting communication, collaboration, and social skills of the users (Bailenson et al., 2008; Eschenbrenner et al., 2008; McComas et al., 1998).

Using VREs is an innovative approach that can promote creativity skills allowing users to develop their VE, which results in idea generation while offering new educational

opportunities (Eschenbrenner et al., 2008). Furthermore, research revealed several advantages of using VR technology in education including better performance in business knowledge application, improved anatomy learning, higher levels of efficiency in matching diagrams and models, improved calligraphic writing skills, improved spatial thinking and abilities, the ability to assist learners with different learning styles and affective outcomes (Ai-Lim Lee & Wai Wong, 2014).

To conclude, VR in a computer-based training approach that has many positive impacts on the learning process and for this reason, many disciplines have adopted its use taking advantage of the benefits it has to offer. In the last decades, there is a growing interest in using VR for educational purposes in different disciplines and the results seem promising. VR has been widely used in the medical sector for training purposes (Marks et al., 2017) and as part of chemical engineering education (Bell & Fogler, 1995). Additionally, VR has been used for pedestrian safety training (Schwebel et al., 2016), for job interview training (Kwon et al., 2013; Smith et al., 2015), for training adults with intellectual disabilities to improve Spatial Perspective Taking skills (Freina et al., 2016), for supporting children with attention-deficit/hyperactivity disorder (ADHD) (Parsons et al., 2007; Rizzo et al., 2009), Autism Spectrum Disorders (ASDs) (Parsons, 2016; Penuel et al., 2007) and in cases of children facing severe disabilities (McComas et al., 1998). However, although a rising body of work related to the use of VR for educational purposes has grown, research regarding the use of VR in teacher education is extremely limited (Freina & Ott, 2015).

2.1.7 VR in teacher education: state of the art

Lately, many efforts have been made to enrich teacher education programs with technology-based approaches to better prepare candidate teachers to deal with the complexities of today's classroom. VREs can provide an alternative effective strategy leading to high-level training and qualified teachers in every classroom.

An extensive literature review research revealed as one of the most common and significant problems in teacher education the lack of practice in the school setting. Most universities but also lifelong learning programs for teachers provide only theoretical training focusing primarily on pedagogical issues and only in some cases include in-field practical experiences (Andreasen & Haciomeroglu, 2009; Dieker et al., 2008;

Katsarou & Dedouli, 2008; Ting, 2013). This results in the question of whether there should be an alternative training method that could provide teachers on-the-job training that is necessary as beginning teachers are expected to be of high professional quality and practice. Teaching practice in schools with real students is becoming more difficult to accomplish nowadays. Additionally, there is a lack of strong communication and collaboration channels between teacher education programs and the school environment (Caena, 2011; Darling-Hammond, 2006; Hagger & McIntyre, 2006). Thus, those programs do not provide practical experiences that would allow teachers to learn on the job through the experience of their colleagues, instead of using trial and error techniques in their classroom that may affect negatively the cognitive, social and psychological development of the students (Chiero & Beare, 2010; Darling-Hammond, 2006). Hence, there is a theory-practice gap that needs to be addressed that will lead to high-quality and well-trained teachers leading to high-quality education.

VR might answer the request for a highly immersive and interactive training tool in teacher education, that would maximize the quality of teachers and education itself. This gap between theory and practice can be bridged by experiential learning and VR could offer an effective way for this type of training by providing engaging and immersive experiences that reflect real-world classroom situations (Caena, 2014). The significance of using VR in teacher education lies in the fact that VR mimics real-world situations allowing the users to experience realistic learning experiences that are transferable to the real world. Another key advantage of VR-based teacher training is the ability for experimentation within a safe environment, where teachers can make mistakes and learn from them but without influencing real students (Lugrin et al. 2016). Dieker et al. (2007) state that one of the most significant aspects regarding the use of VREs has to do with students' protection from being victims of teachers' inexperience due to the lack of previous practice. This fact makes the VR learning environment a suitable tool that can be used for the professional development of teachers. Furthermore, the development of 'extreme' scenarios can allow teachers to be trained via simulated stressful conditions that would be impossible to simulate using traditional teacher training methodologies in a real classroom setting.

Equally important is the fact that the constant technological advancements make VR technology more a more immersive, providing a new level of experience to the users

making the simulated world seem like reality and removing the distractions of the physical environment. Hence, nowadays virtual environments do not look-like real but are more real-like environments (Park et al., 2011).

The significance of using immersive VREs in teacher training lies in the fact that the diversity in the classroom is growing and teachers must attend multicultural classrooms and bilingual students with different cultural and ethnic backgrounds but without intercultural experiences (Dieker et al., 2008). Dieker et al. (2008), also suggest that the purpose of using a virtual training environment is to '*positively impact teacher recruitment, preparation, and retention in education*', and provide teachers a safe environment where they can be trained with virtual students that is a '*more ethical approach to learning the art of teaching*' (p. 4). Another key point is that within the virtual environment teachers can make mistakes but without influencing the learning of real students and they can repeat the experience to work on their mistakes and no matter how many times teachers may experiment, the virtual students have no memory of the process (Dieker et al., 2008). Dieker et al. (2008, p. 7) mention '*imagine that you walk into a room where everything looks like a middle-school classroom…but it is a virtual setting and the students…are virtual avatars. You can talk to with the virtual students; they can show you their homework; and they can act like typical or not-so-typical students. A teacher can manage the classroom, teach students any subject, and monitor their progress in learning…teachers can learn their skills…if novice teachers make mistakes or if experienced teachers want to experiment with a new teaching idea, it poses no danger to the learning of any real student. If a novice makes an error…can reenter…try again...without impeding the learning of any real child*'.

By the same token, virtual classroom environments aim to provide an innovative training tool that can be used for constant professional development and update of teachers' skills so that teachers can remain productive (Dieker et al., 2007). Furthermore, the use of virtual environments will allow teachers to take control of their learning, monitor their progress, and thus learn more. Equally important is that the virtual environment will provide immediate feedback and data that in an actual classroom would be difficult to identify (Dieker et al., 2008).

Recently, some attempts have been made in the preparation of teachers via virtual training environments. However, it should be noted that many of those attempts do not

include the use of VR equipment such as HMD glasses but provide the user with a virtual classroom for experimentation though large screen displays.

A prototype virtual environment named STAR Simulator was developed by the Haberman Education Foundation in partnership with Simiosys and aimed aims to identify and recruit the best teachers and train them (Dieker et al., 2007; Dieker et al., 2008). The virtual environment aimed to assist beginning teachers during their first years in the field by providing them rich experiences to practice through interactions with the virtual students. The goal of the realistic virtual environment is to provide physical, emotional, and social interaction like the one encountered by teachers face in real schools. When the trainee student addresses the entire class, the behaviors of the digital characters are software controlled. Whenever the trainee students address an individual student, a live person in another room controls the specific digital character, while the others were controlled by software, and their behavior was changing based on the management of the classroom by the trainee. Overall, the results of the research revealed that it is possible to develop a virtual environment that can provide teachers with realistic and compelling experiences as if they were in a real classroom with real students (Dieker et al., 2007). Nevertheless, further research and evaluation are required for safer results.

Another attempt is a mixed-reality environment called TeachMe (Andreasen & Haciomeroglu, 2009). This prototype focused on behavior and classroom management aspects and the goal was to train beginning teachers in mathematics, science, and special education before entering the classroom for the first time. The virtual students are controlled by a real human, called interactor, who can change the virtual students' behavior based on teachers' reactions. Moreover, the interactor can cause behavioral problems during the simulation and the students can be for example disrespectful, unmotivated, or unenthusiastic. During the simulation, the teacher faces a large screen that displays all the students and the teacher can interact either individually with each student or with all the virtual classrooms. One of the most important factors is that the virtual environment can be reset and thus teachers can experiment again but without harming the real students. The results of the experiment with TechMe virtual environment indicate the potential in training teachers in behavior management issues. Andreasen and Haciomeroglu (2009), state that such a simulated environment can help

teachers gain in-depth knowledge of their domain and assist the development of behavior management strategies.

Another study suggested the use of a mixed-reality learning environment using OpenSimulator and implementation of Kinect to train teaching assistants regarding gesturing for lecturing (Ke et al., 2016). Teaching assistants' service is critical within the University, yet they usually receive minimal training regarding their role, while they also constitute the future generation of teachers. The results indicated the possibility to create a mixed-reality learning space that enabled the embodied presence and gesturing during the virtual teaching practice.

Furthermore, TLE TeachLivE™ is another mixed-reality classroom aiming to enhance the development of teacher's pedagogical practice and skills (Dieker et al., 2015). TLE TeachLivE™ has been used in different studies and the results indicate the effectiveness of the tool in the development of the teaching skill that can be transferred and applied in a real classroom (Dawson & Lignugaris; Kraft, 2017) or its potential to be used for the confrontation of teacher's anxiety (Eisenreich & Harshman, 2014) and gesture movements improvement (Barmaki & Hughes, 2015).

It is interesting to note that virtual training environments such as STAR Simulator or TeachMe are screen-based training tools and do not include the use of the VR equipment such as HMD headsets, belonging to the category of desktop VR and are not highly immersive applications. In some of the abovementioned cases, monitors are used so as for the trainee teachers to see the virtual classroom, while there are virtual students who are controlled by actors. In other cases, 3D virtual worlds such as Second Life are used as a tool to enhance classroom management practice and skills (Mahon et al., 2010). The development of HMDs after 2013 (including Oculus Rift, Vive, etc.) gave a new perspective in the implementation of VR technology in the field of education as this new technology was more accessible to the public and affordable to buy and use for research and also education purposes (Jensen & Konradsen, 2018). Moreover, HMDs offer a unique experience to the users, while their quality is constantly updated.

The present study proposes the use of a virtual school environment within which the trainees are immersed using HMD equipment such as Oculus Rift and 3D controllers, while there is no need to embody the virtual students with actors. The use of VR special electronic equipment, such as VR headsets (e.g. Oculus Rift, HTC Vive) will allow the

users to interact with the virtual environment, experience a first-person view and take a 360-degree look inside the virtual space and thus look at any direction as in the physical world (Desai et al., 2014) so that the overall experience is highly realistic.

Some first attempts using VR technology and equipment seem promising and indicate the usability of such a tool in the field of teacher education. Homework assignments can provide practice for teachers, but VR can provide the ability to step inside the virtual space experiencing different events and situations and multiple different perspectives of a particular event. As an illustration, a prototype VR classroom training environment offered teachers the opportunity to experience students' vision disorders and specifically myopia, to raise their awareness and maximize their skills in identifying similar vision problems by placing them to the position of a visually impaired student (Manouchou et al. 2016). The results identified the potential of training teachers in student's vision disorders, while it is highly important the fact that many of the participants after the end of the experiment stated that they might have confused possible student's vision problems when looking at the blackboard that they were unaware of with indifference during the lesson. Hence, apart from teachers' problematization towards the specific disorder, there was also a change of attitude regarding identifying students having this disorder in their classroom.

Another attempt aimed to train teachers in bullying-related issues and help them identify bullying issues and distinguish them from simple teasing between the students (Stavroulia et al., 2016). The results indicated that in-service teachers who participated felt extremely comfortable regarding their skills to identify bullying due to their experience and proposed the use of VR only for pre-service teachers, yet what is interesting is the fact that they failed to distinguish bullying from simple teasing incidents.

One more immersive VR system developed is 'Breaking Bad Behaviors' that aims to train teachers to manage disruptive behavior in the classroom enhancing their classroom management skills (Lugrin et al. 2016). The system was implemented as part of a seminar for primary and secondary teachers, with the trainee teachers entering the virtual world and the instructor controlling the tasks and monitor teacher's performance providing feedback. The results indicate that the VR system was beneficial and could potentially be used as part of teacher training, while the virtual environment and student

avatar behaviors elicited stressing situations for the trainees. Moreover, this VR system was used as part of an experiment regarding potential differences between training via using a VR system and via using videos and the results revealed that the performance of the VR group was higher than the group that used the video (Luqrirr et al., 2018).

Bailenson et al. (2008) conducted several experiments using VR and HMD equipment to investigate whether social behaviors including head movements, spatial proximity, and the presence of virtual others have an impact on learning. The authors investigated participants' visual field of view while teaching in a room of virtual students and the results indicated that the participants tended to ignore the students in the periphery than in the center. Moreover, when the participants did not look at the virtual students there was a notification that helped them distribute their gaze more equally among the students. The investigation also revealed that students learn better when sitting in specific privileged seats for instance in front of the teacher than when sitting in the periphery. Finally, the virtual co-learners also affected the learning performance.

Taking all the above attempts of using VR as part of teacher training the results seem to be promising. However, there is a need for new and more practical training activities in teacher education in conjunction with VREs that have the unique ability to place the trainees inside the virtual environment can enhance teacher training. Nevertheless, further research is required to determine the value of VR in teacher training.

2.2 Teacher education

This section addresses teacher education and training, its significance, and today's challenges and problems that can be addressed via using a VR-based approach. An overview of the topics that are covered is presented in figure 2-10.

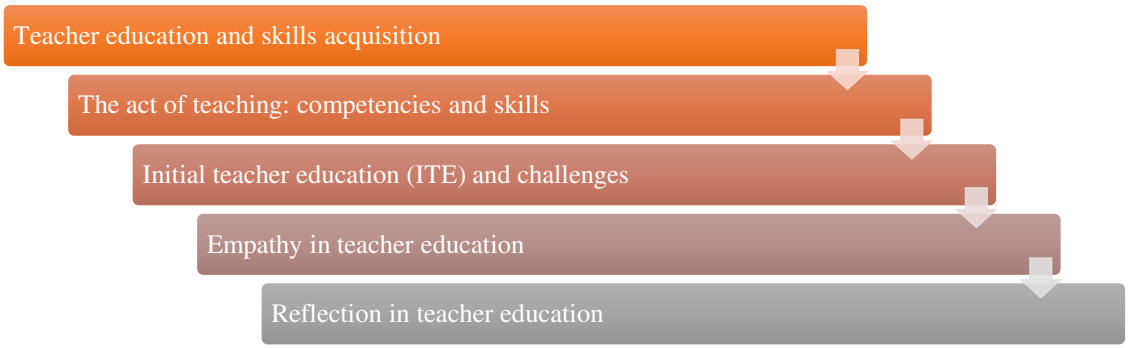

Figure 2-10: Thematic areas to be covered in the following subsections

2.2.1 Teacher education and skills acquisition

"*Teachers play a crucial role in the lives of pupils. They guide them towards their goals and shape their perceptions.*"

Tibor Navracsics, Commissioner for Education, Culture, Youth, and Sport

The role of teachers has received significant attention within the European agenda, as high quality and well-trained teachers can support learners develop the competences that they need in a global labour market. Recently Europe's Strategy 'Education and Training 2020', puts a strong emphasis on the role of teachers, starting from initial teacher education to career-long professional development, as it has become clear that investment in the teaching profession will raise its quality and will make the profession more attractive to young people (European Commission (2015[b]).

In the last few years, greater attention has also been given by researchers to the role that teacher quality plays in student achievement. Darling-Hammond (2000) after research conducted in 50 states reports that the quality of the teacher a significant factor determining student achievement. As a result, ineffective teachers can affect negatively the students leading to low levels of achievement and vice versa. Teachers do not always realize their influence and impact on the life of their students, even after the end of school. Teachers remain an integral part of our lives, their voice is a part of our voice, their thoughts and values represent our thoughts and values, and their teaching and methods used to continue to influence our work (Robert Coles, cited in Woolfolk, 2005).

Modern science and technology extended the classroom beyond the four walls of the school into a globalized knowledge society that gave new perspectives to teaching and learning. In the context of today's digital environment where students use computers and the internet as the source of knowledge, teachers must redefine their role and teaching practice to improve the performance of the students and the quality of education. At the same time another challenge that teachers face in today's classrooms, is the diversity of the student population that is characterized by different cultural backgrounds and language, different levels of knowledge, and different learning needs (Koutsothanasi, 2010). Within this diverse classroom setting teachers might need to

provide their help to students experiencing emotional or interpersonal problems (Woolfolk, 2000).

In the past, the teacher was the unique source of knowledge and what was taught within the classroom setting would last for a lifetime. Nowadays, however, teaching has gone beyond the four walls of the classroom, while the internet is established as a major source of information for students. As the classroom changed, the traditional role of teachers inevitably changed and they became students' partners, co-researchers, co-travelers, and mentors between students and a rapidly changing world (Christodoulou-Gkliarou, 2007). According to O'Shea and Scanlon (1997), as students have free access to a diversity of knowledge sources teachers should undertake two significant and demanding roles: the role of learning guide and the role of curriculum designer. Teachers must act as facilitators of knowledge for the students, using electronic means and share good practices and experiences. Equally significant is the fact that teachers must become more technologically aware and competent to be able to use technology within their classrooms (O'Shea & Scalon, 1997).

These days, teachers are ready to try new ideas and practices, while they sometimes gain knowledge from their students and become students themselves (Karaminas, 2001). So, teachers and students alternate in the role of knowledge transmitter-receiver, and through this effective two-way communication, they both maximize their benefits. It is essential that teachers leave the idea that the school is the unique repository of knowledge and equip their students with the skills that will allow them to expand their knowledge, become familiar with the new technologies, be able for lifelong learning, adjust and adapt to a constantly changing environment (Christodoulou-Gkliarou, 2007).

Teachers are working in a more challenging and digitalized classroom environment that is characterized by uncertainty due to the integration of technology within education. Classrooms have become more complex and dynamic environments and thus, the teachers' role is vital for the development and guidance of students towards the acquisition of the skills and knowledge that will ensure them a sustainable future in a constantly changing labor market. Teachers have much broader roles and responsibilities than in the past, as they must promote the development of each student individually but also promote the development of the entire school as a learning community that is connected to the wider world (OESD, 2005).

In this new global era, teachers must promote the development of the learning needs of individual learners within a multi-cultural classroom setting and with students with special learning needs. Furthermore, teachers must include in their teaching information and communication technologies and must help their students go beyond the basic skills and develop skills including creativity, critical thinking, problem-solving, decision-making, and communication and collaboration skills (European Commission, 2013).

Teachers must be able to adapt their teaching practice to a constantly changing educational setting and the needs of each student individually as well as to the needs of the students (ETUCE, 2008). Additionally, teachers, today must have a deep knowledge of their domain, must be equipped with '*critical, evidence-based attitudes*' and reflective skills (European Commission, 2013). Improving the quality of teacher education has become a number one priority within rethinking education framework as high-quality and well-trained teachers that will help learners develop the skills and competences needed for a sustainable and prosperous future in a global workplace that requires self-directed and life-long learners (European Commission, 2012; Ting, 2013).

2.2.2 The act of teaching: competences and skills

Nowadays, teaching standards are higher than in the past and the teacher's role involves more than simply preparing the lesson, standing in front of a classroom, and lecturing. Teachers should be based on established classroom routines to manage a particular set of problems, but they should also be prepared to adapt their teaching practice to specific circumstances every time that are unpredictable (Williamson & Clevenger-Bright, 2008). As the pupils change, the dynamic of the classroom changes, and the circumstances are different. Thus, teachers should be able to adapt to the context in which they work every time. Teachers take up a wide range of roles nowadays to support the school and their students including those of '*reflective agents*', '*knowledgeable experts*', '*skillful experts*', '*classroom actors*', '*social agents*' and '*lifelong learners*' (European Commission, 2013, p. 13). Hence, teacher competences need to be set in a wider context.

Competences are '*the requirements of a competency-based teacher education and include the knowledge, skills, and values a teacher-trainee must demonstrate for successful completion of a teacher education programme*' (Nessipbayeva, 2012, p. 48).

The term teacher competences refer to '*teacher professionalism*', to '*the multi-faceted roles of the teacher on multiple levels of the individual, of the school, of the local community, of professional network*s' (Caena, 2011, p. 8). Teaching competences, on the contrary, refer to teaching and to 'the *role of the teacher in action in the classroom*' (Caena, 2011, p. 7; European Commission, 2011, p. 7). Undoubtedly, teachers' professional competences cannot be characterized as '*simple or straightforward, neutral or universal, fixed or certain, but historically and culturally bound, subject to change and contestation*' (Caena, 2011, p. 12).

There is no single universally accepted teacher competence model or framework, but many international studies and projects have been carried out categorizing key competences for teachers. According to Nussbaum-Beach et al. (2016), the 21st-century teacher must be equipped with the eight characteristics depicted in figure 2-11:

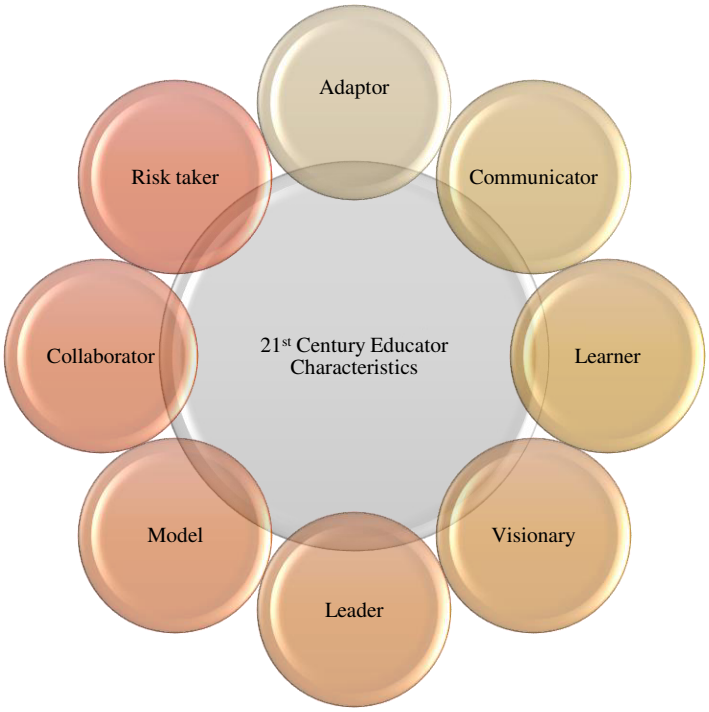

Figure 2-11: 21st-century teacher characteristics

Darling-Hammond & Bransford (2005) developed a framework consisting of three key areas of knowledge that are important for the professional development of teachers: 1) knowledge of learners; 2) understanding of curriculum and 3) understanding of teaching in the light of the contents and diverse learners.

The European Commission (2005, p. 3), recognizing that teachers are key players of the education systems adopted three principles for teacher competences (figure 2-12).

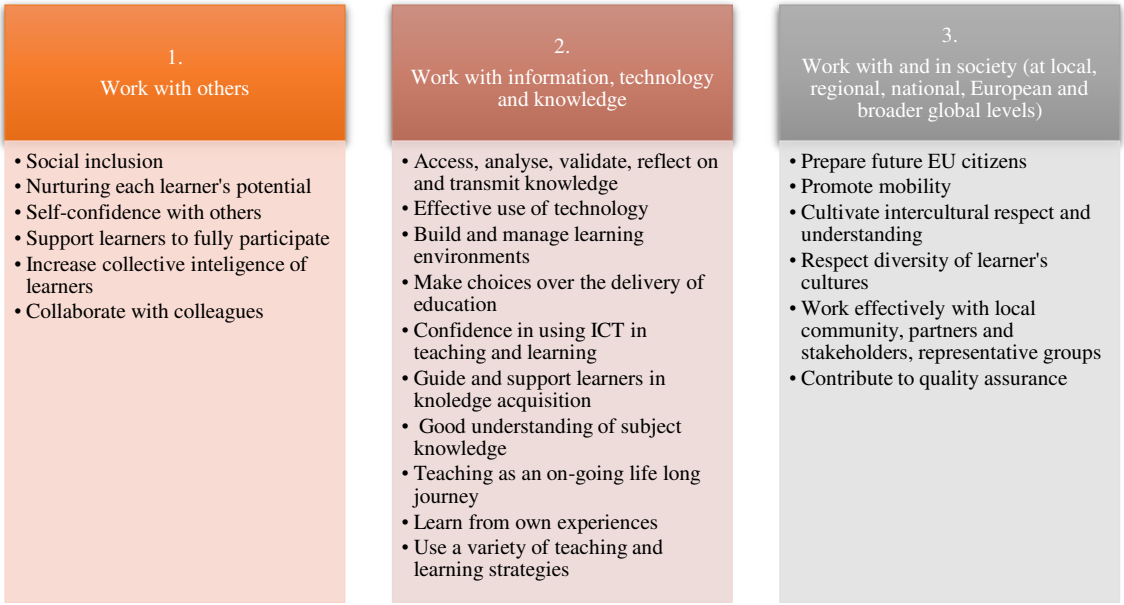

Figure 2-12: Key teacher's competences for the European Commission

Another international project that should be mentioned regarding teacher competences is the TURNING project (González & Wagenaar, 2005). The TUNING project brought together highly qualified experts from 135 European higher education institutions in 27 Countries and the competences identified are compatible with the European Qualification Framework and the Dublin descriptors for Higher Education[2]. The TURNING project report identified the key competences for the three-cycle system[3] that is presented in figure 2-13.

[2] The Dublin Descriptors are the cycle descriptors that were adopted in 2005 as the Qualifications Framework of the European Higher Education Area. The descriptors are phrased in terms of competence levels, not learning outcomes. (Further information is available at http://www.ecahe.eu/w/index.php/Dublin_Descriptors).

[3] The framework of qualifications for the European Higher Education Area was adopted in 2005 by the Ministers of Education of The Bologna Process that created the European Higher Education Area (EHEA). The framework sets the parameters within which the countries of the EHEA (including Greece from 1999 and Cyprus from 2001) will develop their national qualifications frameworks. The basic framework is three cycles of higher-education qualifications. The first cycle refers to programmes for the preparation of pre-school, primary and secondary school teachers, the second cycle refers programmes of continuing professional development e.g. Master degree and the third cycle refers to Doctorate research.

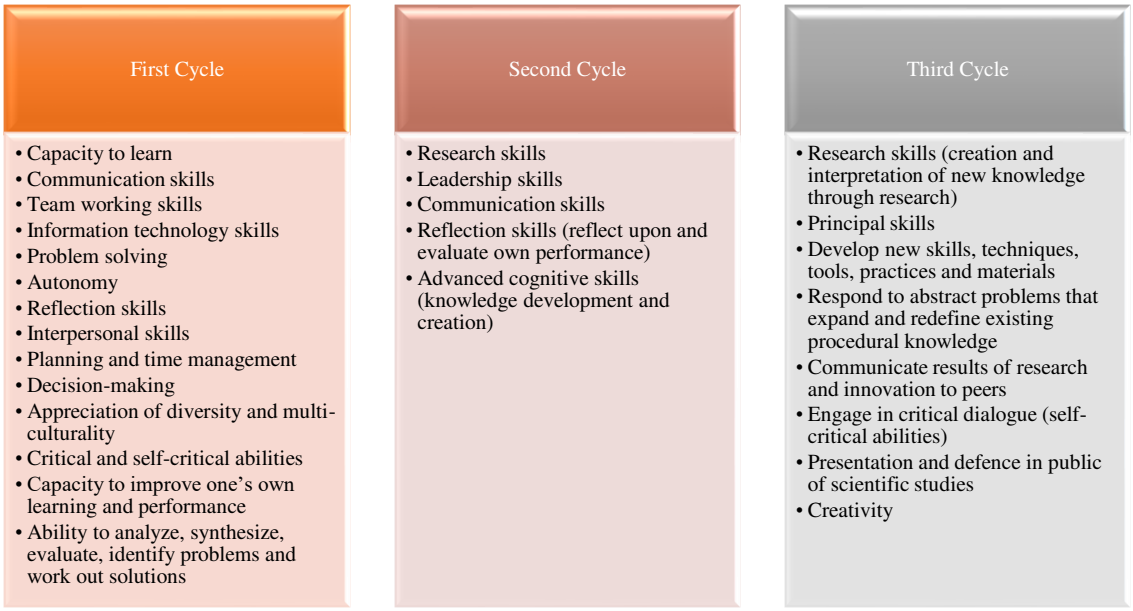

Figure 2-13: Generic key competences for teacher education according to the TURNING project

Williamson and Clevenger-Bright (2008), divide teachers' competences into three main categories (figure 2-14).

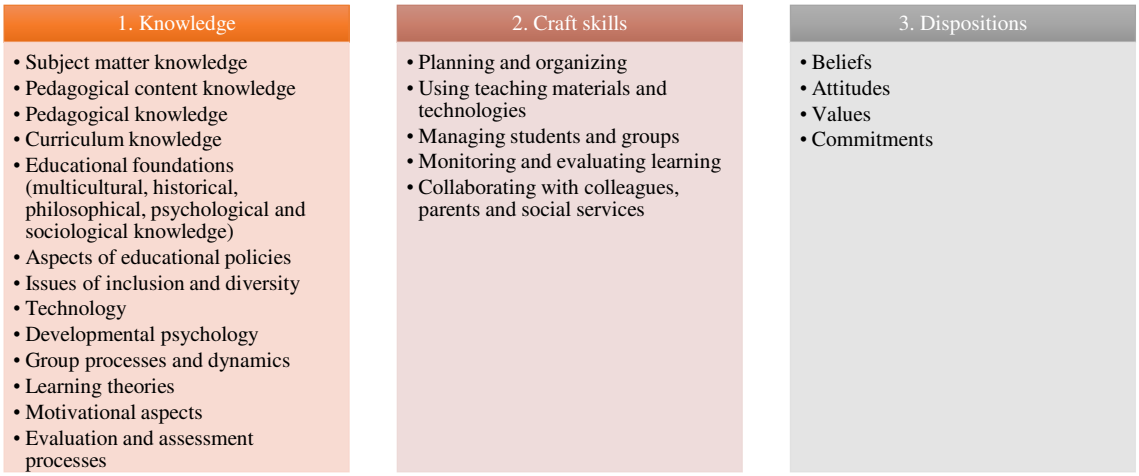

Figure 2-14: Williamson & Clevenger-Bright (2008) key competences for teachers

Caena (2011), reports based on the strategic priorities set out by the Council of the European Union during the years 2007-2009 that teacher qualifications should include: 1) knowledge of subjects; 2) pedagogical skills (including teaching heterogeneous

classes, use of ICT, transversal skills, create safe attractive schools) and 3) reflective, research, innovation, and collaboration skills. According to the European Commission (2013), it is essential to define a high standards competence framework for teachers that will ensure what teachers are expected to know and be able to do and not just focus on what they should learn as happened in most teacher education curricula. European Commission establishes several core competence requirements that are of paramount importance for effective teaching presented in figure 2-15.

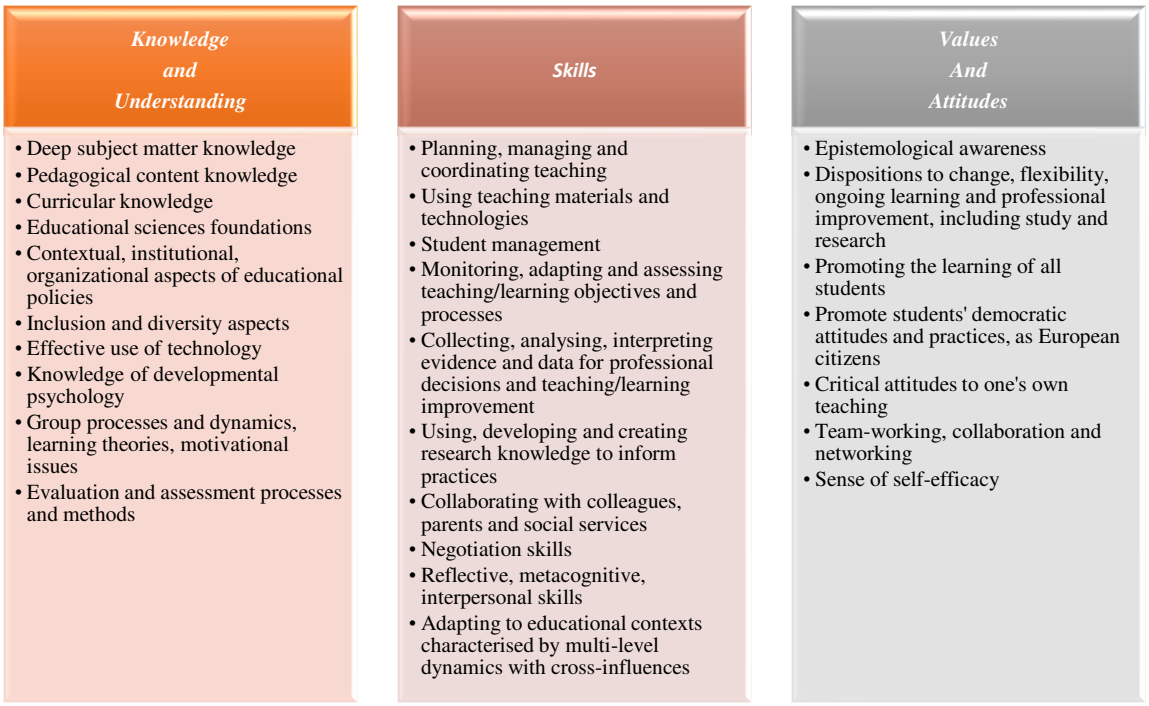

Figure 2-15: Knowledge required for effective teachers (European Commission, 2013).

All the above-mentioned competences, skills, and values cannot be fully mastered by any teacher at the very beginning of their career. Teacher training programs must be designed to help teachers deeply understand the nature of teaching and learning and be able to implement well-designed and effective curriculum into the classroom (Darling-Hammond, 2006). Nevertheless, initial teacher preparation is designed to lay the foundation for quality teachers, yet professional mastery can be achieved through continuous education.

Teachers' competences should be viewed as '*the dynamic combination of knowledge, understanding, and skills*' (Caena, 2011, p. 2). Undoubtedly, teachers need a deep content and pedagogical knowledge relative to their subject, and for this reason, most

competence models put a strong emphasis on content knowledge and pedagogical content knowledge (Baumert & Kunter, 2013; European Commission, 2013; Hagger & McIntyre, 2006; OESD, 2011). Teachers with inefficient knowledge of the subject tend to teach pre-planned lesson plans while they avoid students' questions during the lesson (European Commission, 2013; Hagger & McIntyre, 2006). Additionally, teachers must be prepared for individualized teaching for diverse, multicultural, inclusive classrooms. They must be able to understand the problems of the classroom and must be equipped with 'adaptive expertise' that is the ability to adapt their practices to meet to different students or contexts (Caena, 2014; European Commission, 2013; OESD, 2011), '*so that all learners achieve specified learning outcomes, whatever their particular learning needs, cultural or social background*' (European Commission, 2013, p. 5). Furthermore, for teachers to promote effective classroom practices, they first need to understand the personality and the spirit of every child. Without a deep understanding of students' personalities and learning styles, teachers will not be able to use the appropriate strategies that meet the needs of each student individually but also the needs of the classroom. Thus, the development of strong communication channels with the students will allow teachers to understand their needs and adapt their teaching practices to meets students' needs (Darling-Hammond, 2006).

As teachers are dealing with an uncertain educational setting, they must be also equipped with negotiation skills (European Commission, 2013). Moreover, teachers must understand the personality of every child considering students' motives and emotions (Darling-Hammond, 2006). Without understanding students' different personalities and learning styles teachers cannot design an effective curriculum that meets students' needs (Darling-Hammond, 2006).

In today's digital classroom, teachers need to know how to use new and innovative teaching strategies and methods and be able to combine different approaches with the flexibility (European Commission, 2013; OESD, 2011). Thus, ICT skills are important for the implementation of innovative practices (Darling-Hammond, 2006). Moreover, teachers must become classroom researchers integrating inquiry into their teaching that includes careful observation and reasoned analysis (Darling-Hammond, 2006).

Equally important, according to most of the models that were analyzed previously teachers need to develop reflective skills and have a critical examination of their

practice that will allow them to learn from their mistakes and improve their teaching continuously based on whether it advances learning or not (Darling-Hammond, 2006; OESD, 2011). As the EU highlights teachers need to keep their practice '*under constant, critical review and adjust it in the light of students' outcomes and latest research*' (European Commission, 2013, p. 5). Reflection skills will help '*teachers consolidate their experiences and guide them in systematically reflecting on their practices*' (NIE, 2009, p. 7). Furthermore, it is essential that teachers are members of a professional community that will not only promote collaboration with their colleagues, but it will also allow them to receive feedback from them (OESD, 2011).

Nevertheless, today's active European citizens need not only academic knowledge but a wide variety of skills that teachers themselves need to master so that the students have a reason to learn. Those skills include research skills, communication and collaboration skills, problem-solving skills, decision-making skills, creativity, critical thinking, and positive attitudes towards learning (Caena, 2014; European Commission, 2013). Through research and reflection, teachers will be able to acquire scientific knowledge that is necessary for their practical training and professional development (Caena, 2011). Lovat et al. (1995), also argue that the development of research skills should be an integral part and a goal of the curriculum of teacher education programs. Similarly, to Lovat et al. (1995), Darling-Hammond (2006) argues that teachers much also become researchers and closely collaborate with their colleagues, since nowadays teaching '*has grown so expansive that it cannot be mastered by any individual and… students' …diverse ways of learning are recognized as requiring continual adaptations in teaching*' (p. 6).

The proposed VR tool addresses the cultivation of empathy and reflection skills. The selection of these two competences is extensively in the methodological framework that is presented in chapter 3, under the second phase that deals with the identification of the competence framework for the current VR application.

2.2.3 Initial teacher education (ITE) and challenges

'Leading and supporting pupil learning requires every teacher to embark on a professional, social and personal journey that involves career-long professional development within collaborative learning environments. Initial Teacher Education lays the groundwork and sets the direction for this journey'.

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2.2.3.1 ITE: the first step of the journey in teacher training

In a fast-changing world, many expectations are placed upon beginning teachers, who from their first years of teaching are expected '*to carry out the same responsibilities and function as the seasoned veteran in the next classroom*' (Kearney, 2011, p. 2). The European Commission (2015) also confirms that beginning teachers take full responsibilities from the first days and are expected to act as their colleagues with many years of teaching experience.

Nowadays, teachers face challenges without precedent that require new skills that they do not possess, resulting in a '*teacher crisis*' (Kearney, 2011, p. 2) and '*practice shock*' (Kessels, 2010, p. 10). Dieker et al. (2008), also reports that teachers especially beginning teachers feel inadequately prepared for teaching. Additionally, the global economic crisis posed new challenges globally on how to prepare the next generations of young people to achieve a sustainable and prosperous future that also redefined the role of teachers. As teachers are the heart and the soul of every educational system around the world, the quality of their training and their new role has received significant attention within the European agenda.

Initial teacher education (ITE) is a fundamental area for every educational system as it '*is the first crucial stage in a teacher's professional journey and puts the foundations for high-quality teaching. It lays the foundations of a professional mindset and provides the new teacher with a basic toolbox to make meaningful learning happen in the classroom*' (Caena, 2014, p. 1). ITE is '*an intensive experience that requires student teachers to be both learners and teachers simultaneously' and builds 'awareness of the complexities of teaching*' (Caena, 2014, p. 1). Moreover, ITE enhances teachers' understanding and preparation in the domain and thus increases the possibility of their staying in the profession (Kosnik & Beck, 2009).

With teachers' role becoming more complex because of the new demands and challenges in today's classrooms, the focus on the professionally trained teacher that can adapt to a constantly changing context has been recognized as a key priority in the Strategic Framework ET2020 (European Commission, 2015). Policymakers are working towards the development of flexible policies that aim to increase the quality of ITE, which will lead to an improvement of the teaching workforce, and will also attract high-

quality and suitable candidates into teacher education programs (Council of the European Union, 2014; European Commission, 2015).

The European Commission (2015, p. 3) presents a set of principles that must be taken into consideration and should guide the formulation of ITE programs:

1. Instructional strategies should be defined based on understanding the teaching profession, teachers' learning needs, job and career opportunities, competence frameworks and local school culture;
2. Teaching should be seen as an attractive career;
3. Promote teachers' ability to '*develop and maintain a mindset and a practical approach which are based on reflection and inquiry and focused on ongoing professional development*'.
4. The teaching profession is a life-long learning process and ITE must be considered only the beginning of teachers' journey towards professionalism.
5. Educational bodies (including school leaders, life-long learning institutions, etc.), should play a major role in the promotion of '*practice-oriented and research-based professional development*' that will strengthen the teaching profession.
6. ITE must promote collaborative teaching culture and practices.
7. Use of social media networks, professional learning communities, etc.
8. Establishment of strong collaboration and cooperation channels between ITE providers and stakeholders, providers of Continuing Professional Development, professional bodies and associations, social partners, etc.

Several key components that are of paramount importance for ITE and the preparation of pre-service teachers have been identified and presented in table 2-1.

Table 2-1: Key components of ITE programs

A clear vision of teaching promoting quality learning experiences; Professional knowledge and practice; A curriculum based on students' needs and social and cultural contexts; Practical experiences; Focus on teachers' research skills, performance assessment, and evaluation;	Darling-Hammond (2006)

Create a strong relationship between the university and the school.	
Enhancement of core classroom teaching competences to maximize teaching effectiveness; Preparation to confront real-classroom situations; Preparation for the use of innovative teaching and learning strategies.	Caena (2014)
Academic knowledge of the subject; The theory of teaching, including teaching skills; Support for pupils during learning; Practical classroom experience.	European Commission (European Commission/EACEA/Eurydice, 2015b)

Taking into account all the above into consideration, ITE must be considered as the first phase of a long journey in teacher training and development and '*should provide… teachers with the core competences required to deliver high-quality teaching…stimulate the motivation to acquire and update competences throughout their careers… reinforced by integrated periods of practical teaching experience, but also encourage both self-reflection and collaborative working, adaptation to multicultural classrooms and acceptance of leadership roles*' (Council of the European Union, 2014, p. 3). Moreover, ITE *must lay the foundation for teachers to adopt a mind-set of self-directed professional development and a sense of being able to make a change and take action*' (European Commission, 2015).

2.2.3.1.1 A glance in the past: the apprenticeship of observation

At early times, pre-service teachers were trained through the phenomenon known as the '*apprenticeship of observation*', whereby they had to spend their entire childhoods observing teachers teach during all educational levels (Kennedy, 1999; Schwille & Dembélé, 2007). Although there is a lack of research on that area and it is not considered by many as part of teacher training, those years of observation had an impact on the development of the classroom behavior of new teachers that were more likely to teach in the way themselves were taught and adopt the practices of their former teachers (Kennedy, 1999; Schwille & Dembélé, 2007).

The apprenticeship of observation is a missing component from today's teacher preparation programs and thus, pre-service teachers lack the opportunity to learn to teach via their personal experience. Kennedy (1999) stated that apprenticeship of

observation should be the first component of learning to teach, followed by knowledge of the subject and development of personal style and technique. Even though apprenticeship of observation can provide pre-service teachers with '*a frame of reference*' (Kennedy, 1999, p. 56), the challenge is to shift their thinking towards new and alternative teaching practices, otherwise, they will learn a predefined version of practice. Initial teacher education has a key role to play in fostering conceptual change as it occurs between pre-service teachers' past experiences as students and their future experiences as new teachers.

2.2.3.1.2 Lack of connection between theory and practice

Caena (2011) argues that the predominant teacher paradigm globally seems to be the 'clinician-professional model', according to which teachers' professional development is associated with practical knowledge. The current model describes the teacher as '*a reflective practitioner, who actively carries out research and critically deploys scientific knowledge to inform practice*' (Caena, 2011, p. 2). Learning through experience or 'experiential learning' is of paramount importance in teacher training (Harrison, 2008). Thus, besides deep knowledge of their subject, prospective teachers should also acquire professional skills. For this reason, teachers' professional training should include both theoretical studies (including psychology and the theory of teaching) and practical training in schools, which is likely to include the observation of teaching and sessions with direct responsibility for classroom teaching activities (European Commission/EACEA/Eurydice, 2015[b]).

Nevertheless, the literature reveals that teacher education in general but most importantly ITE programs are theoretical having a weak or no connection with the school environment (Caena, 2011; Darling-Hammond et al., 2005; Hagger & McIntyre, 2006; Katsarou & Dedouli, 2008; Woolfolk, 2005). The National Science Foundation-NSF (2003) states that teacher education programmes are disconnected from classroom practice. Observation of a classroom '*does not give novices access to the cognitive decision-making process a teacher uses when questioning students, making suggestions or noticing signs of understanding. An observer is not a participant. Nor is a semester of practice-teaching enough to internalize the range of skills and strategies a new teacher needs to feel confident. A new teacher entering the classroom is like 'a novice pilot flying an airplane for the first time*' (Zibit & Gibson, 2005, p. 1). It seems that

there is a gap in the preparation of teachers between educational theory and practical application. Hence, more emphasis must be given in practical experience that will allow pre-service teachers to understand the requirements and the challenges of the profession, the theories, and how to implement them in their teaching (Darling-Hammond et al., 2005). Practical experience will allow pre-service teachers '*to apply what is being learned*' that is of paramount importance for the '*development of expertise*' (Darling-Hammond et al., 2005, p. 401).

Until the 1980s, teacher training programs consisted of theoretical and unrelated courses that did not prepare pre-service teachers for the demanding and constantly changing requirements of the profession (Chiero & Beare, 2010; Darling-Hammond et al., 2005; Schwille & Dembélé, 2007). Additionally, the university curriculum does not conform to the school curriculum, and thus, beginning teachers' knowledge does not meet the school curriculum requirements (Kennedy, 1991). Teachers' initial training but also their professional development throughout their lives must be in close connection to the school agenda (European Commission, 2015).

Many traditional teacher preparation programs offer practical experience at the end of the program to connect pre-service teachers with schools or schedule visits during the semesters providing real-life experiences to pre-service teachers allowing them to receive feedback and become familiar with the school environment (Chiero & Beare, 2010; Darling-Hammond et al., 2005). Nevertheless, most teacher education programs rely on traditional methods and offer only a few hours of practice in schools that in most cases has the form of observation and not of actual practice (Dieker et al., 2008; Katsarou & Dedouli, 2008; Ting, 2013; Woolfolk, 2005). Some departments offer candidate teachers laboratory-based experiences within the campus, where they must teach small groups of their peers; however, this experience is not real enough (Brown, 1999).

The most important component in teacher preparation programs is whether they include a strong relationship with schools providing on the job experiences to pre-service teachers, called '*field experiences*' or '*practicum*' (Chiero & Beare, 2010; Darling-Hammond, 2006; NACCCE, 1999; Schwille & Dembélé, 2007). As Harisson (2008) argues, '*the knowledge and theories that beginning teachers learn in the workplace (schools and colleges) are as valid as the knowledge gained through more formal*

qualifications' (p. 11-12). Furthermore, before entering the classroom beginning teachers must first understand the complexity of the classroom '*within the whole-school culture'* (Wood, 2008, p. 110).

Practice constitutes the time when the theory is connected to act, allowing candidate teachers to become familiar with the professional aspect of pedagogy, try out themselves in the profession that they had chosen so that they can identify their weaknesses and try to improve them (Chatzopoulou & Kakana, 2013). Thus, practical situations must become an integral part of ITE as they allow pre-service teachers to learn and reflect on their practice becoming '*practically wise*' and make the choices that best fit their educational needs (Caena, 2014).

Priority should be given to '*the classroom teaching expertise*' (Hagger & McIntyre, 2006, p. 20). As Darling-Hammond et al. (2005) state today teachers '*need to more than simply implement particular techniques; they need to…think pedagogically, reason through dilemmas, investigate problems, and analyze student learning…*' (p. 392). Moreover, according to the European Union (2015), a strong connection between theory and practice can support teaching within the inquiry framework. Inquiry-based teaching will allow teachers to learn through research and their own experience maximizing their professional development, while it will also help them understand the impact of their teaching actions on students (Aitken & Sinnema, 2012; European Union, 2015).

2.2.3.1.3 Lack of mentoring from experienced teachers

Another significant challenge for ITE is the lack of university-school connection that derives beginning teachers from learning through mentoring from experienced colleagues. In the past, Vygotsky's theories also stressed the importance of social interaction as people best learn from communication with other people (Fraser et al., 2014; Kearney, 2011; Menter et al., 2010). Mentoring '*is a means of providing support, challenge and extension of the learning of one person through the guidance of another who is more skilled, knowledgeable and experienced, particularly in relation to the context in which the learning is taking place*' (Pollard, 2005, p. 29). Mentoring is the key to achieve the development of highly qualified teachers and the transfer of knowledge from one generation of teachers to the next (Furlong & Maynard, 2012). Moreover, mentoring can promote the development of a bond between a beginning and

an experienced teacher and the establishment of such a channel of communication provides opportunities for professional learning and enhancement of skills and competences (Pollard, 2005).

Equally important, is the fact that through mentoring beginning teachers can learn on the job through the experience of their colleagues instead of using trial and error techniques in the classroom, risking harming the students (Hammerness et al., 2005; Kennedy, 1991; Kessels, 2010). Furthermore, mentor teachers can offer beginning teachers the support that they need to survive especially during their first years in the profession that are very stressful. It is essential that in-service teachers act as mentors in the preparation of candidate teachers (Furlong & Maynard, 2012). The establishment of a strong relationship between in-service and candidate teachers will also promote collaborative learning that is '*an important and widespread expectation of teachers in Europe*' and towards this goal, efforts must be made to ensure '*a collaborative work culture by creating and strengthening mutual trust*' (European Commission, 2015, p. 5).

Furlong and Maynard (2012) argue that in the future, schools and universities should closely cooperate in the development of the curriculum of teacher education programs. Likewise, OESD (2011) reports that teacher education programs in many countries try to promote the collaboration between the university and the school, allowing pre-service teachers to spend more time in schools and thus receiving more support from active teachers. Additionally, teachers '*professional development is connected to school development, and these two processes need to be aligned as a way of strengthening each other*' (European Commission, 2015, p. 16).

However, the European Commission (2015), points up the lack of collaboration among teachers as they tend to work isolated, occupying with their work related to their classroom, lesson, students and teaching practice. So far, the valuable teaching experience of in-service teachers has been ignored not only in ITE programs but also in life-long learning programs, deriving mostly pre-service and beginning teachers a depository of teaching experience (Hagger & McIntyre, 2006; Hammerness et al. 2005; Kearney, 2011).

School practice under the supervision experienced teachers will engage beginning teachers in reflective discussions resulting in the development of highly qualified teachers (Caena, 2014). Nevertheless, Kennedy (1991) states that on-the-job mentoring

does not guarantee that teachers will learn better teaching since their previous past experiences as students also affect their teaching practice. Moreover, teachers assigned the role of mentors may not be very effective teachers and may not be able to provide useful feedback and guidance relative to their teaching practices (Kennedy, 1991). Additionally, research indicates, pre-service teachers reported to have experienced negative attitudes from their in-service teacher mentors (Schwille & Dembélé, 2007). Furthermore, we must also consider the number of teachers getting retired which leads to losing their significant experience (European Commission, 2012).

Considering the above, pre-service teachers spend large amounts of time studying teaching pedagogy, curriculum and the disciplines of student development and little or no time in practicing for real-life classroom situations that will prepare them to respond effectively to the diversity of students' learning needs (UNESCO, 1998). However, practice alone does not lead to successful teaching performance, unless there is an effective curriculum promoting the connection between theory and practice and reflection that will allow them to understand the impact of their decisions on student learning (Darling-Hammond et al., 2005).

Equally important is that traditional ITE programs focus on classroom management and teaching aspects, leaving aside aspects related to students' cognitive, social, and emotional development (Darling-Hammond et al., 2005). As a result, beginning teachers do not have a deep understanding of their domain and feel unprepared to deal with behavior and classroom management issues, student motivation and evaluation of their teaching performance (Darling-Hammond, 2006; Deale, 2013; Ferry et al., 2004; Kirby et al., 2006; Kennedy, 1991). Beginning teachers feel unprepared for the reality of the classroom and over time they start experiencing emotions of stress, anxiety, low levels of self-efficacy, and burnout (Kessels, 2010). As a result, new teachers' inability to implement effectively their knowledge into their classroom in combination with a large number of responsibilities and the global financial-economic crisis[4] increases the probability of teachers leaving the profession during the first five years of teaching

[4] Despite the fact that the significance of education has been acknowledged and remains a top priority in the European agenda, funding for education has been reduced affecting the teaching profession as many teachers have abandoned the profession due to salary reductions (European Commission, 2012c).

(Kearney, 2011; Kessels, 2010; Kirby et al., 2006; Zibit & Gibson, 2005). Against this background, the use of induction programs may contribute positively to well-being and the professional development of beginning teachers decreasing the percentages of teachers abandoning the profession and motivating them for continuous progression (Kearney, 2011; Kessels, 2010). The European Commission (2015) also acknowledges the significance of induction programs and mentoring to support teachers especially during the first years of their careers.

Recently, it became clear that the effectiveness of new teachers depends upon the quality of their university curriculum (Darling-Hammond et al., 2005). Once new teachers enter the profession they forget about their theoretical studies as they cannot confront the complexity of the classroom in such theoretical terms (Hagger & McIntyre, 2006). Undoubtedly, pre-service and new teachers should have a good understanding of the educational theory and pedagogy to support effectively their new roles (O'Shea & Scanlon, 1997), nonetheless, the '*classroom is the place to learn to teach*' (Feiman-Nemser, 2001, p. 1020).

2.2.3.1.4 Multicultural classrooms and skills

Another challenge of today's classroom is its multicultural climate. Although all teacher preparation programs have courses relative to multiculturalism, they do not adequately prepare pre-service teachers to teach students from different cultural backgrounds (Kennedy, 1991). On the contrary, according to Kennedy (1991) teachers instead of understanding that they must treat all students equally and individualize learning, they have the impression that '*certain children cannot learn certain content*' (p. 15). It seems that university courses only inform pre-service teachers about students' different cultural backgrounds but do not enhance their teaching abilities relative to those students. Initial teacher education should also enhance teachers' ability to diagnose problematic behaviors within the classroom and promote the development of skills that will allow the effective management of those problematic behaviors (OESD, 2011).

Initial teacher education is insufficient to meet teachers' professional learning needs throughout their careers (Menter et al., 2010). Moreover, there is a lack of a commonly accepted framework among experts and policy-makers relative to the most important aspects of teacher education programs (Schwille & Dembélé, 2007). Moreover, OESD

(2005) also confirms that there is a limited connection between teacher education, teachers' professional development, and school needs affecting negatively teaching quality and student achievement.

Taking into account all the above, the current preparation of pre-service teachers is inadequate. In the coming years, the practical experience of teachers in real-life situations should come more into focus and new innovative techniques should be implemented in initial and in-service teacher training. Recent technological advancements enabled the development of virtual learning environments offering trainee and in-service teachers unique immersive and interactive learning experiences. In the last few years, educational research has shown great interest in the use of virtual learning environments to potentially support teachers' learning to a '*real*' one but not '*a physical space like a classroom*' (O'Shea & Scanlon, 1997, p. 3-4).

The current research aims to give pre-service teachers an opportunity for practical learning via a virtual classroom environment. The implementation of VR approaches within the university curriculum aims to respond to the demand for innovation in teaching and learning enabling pre-service teachers to acquire basic classroom teaching competences to be effective from the start of their career and prepare them to confront classroom situations.

2.2.4 Empathy in teacher education: a skill of paramount importance

2.2.4.1 Empathy in education

The term empathy does not have ancient roots but appeared during the 20th century. There is no consensus of a single definition of the term, as it is used by several disciplines and thus the different definitions reflect the differences of the fields including psychology, sociology, or neuroscience (Gerdes, 2011). De Waal (2009, p. 281), defines empathy as the '*capacity to (a) be affected by and share the emotional state of another, (b) assess the reasons for the other's state, and (c) identify with the other, adopting his or her perspective'*. For Lăzărescu (2013, p. 512), empathy is '*the capacity to think, feel and act like the person one enters in relation with*'. Moreover, Reniers et al. (2011) state that empathy is '*to encompass a comprehension of other people's experience (cognitive empathy) as well as the ability to vicariously experience the emotional experience of others (affective empathy)*'. Despite the variation in the

terminology of the term, all the definitions converge that empathy is the ability of '*predicting, of appreciating the psychological dispositions of a person, his/her perceptions, thoughts, feelings and attitudes as own traits… perceiving the other's mentality, his feelings, desires, opinions, and more concretely to predict his behaviors… put yourself in another's place, to see the world as he sees it*' (Lăzărescu, 2013, p. 511).

Empathy allows us to enter the position of the other and relate to their emotional states but without losing the integrity of our existence (De Waal, 2009). Recognizing and understanding someone else's position, situation, thoughts or emotions is a necessity for the establishment of social interactions and cooperation. The development of empathy skills allows us to enter the position of the other, understand his/her behavior and motives and thus see the world through his/her eyes which is a very strong communication tool.

The role of empathy is decisive in all sciences today. In psychotherapy, for instance, the therapist must experience the feelings of the client but at the same time keep a distance from them. Additionally, empathy is also important in the workplace, providing large international corporations the ability to understand the needs of potential customers and adapt to those needs. Empathy is also an integral part of education improving the relationship between the teacher and the students, and thus maximizing student's cognitive development and the quality of education itself.

Nowadays, empathy is considered a skill of paramount importance for teachers due to the challenge of multicultural classrooms and the diversity of the student population. The development of empathy skills will allow teachers to '*take on the perspective of another culture and respond to another individual from that person's perspective*' (McAllister & Irvine, 2002). In the context of education empathy '*refers to the teacher's participation in the pupils'emotions and feelings, to their sharing, to their common experience. It consists of a togetherness with pupils, to the grasp of their inner universe*' (Lăzărescu, 2013, p. 512).

Empathetic teachers can understand the world of the students as the students perceive it (Malikiosi-Loizou, 2001). This allows them to '*create a safe and encouraging learning milieu, and to foster positive relations with their students*' (Goroshit & Hen, 2014). Additionally, empathy skills will allow the teacher to '*transpose himself in the pupil's psychology, to perform his role and to anticipate, within the limits of a permissible*

error, his subsequent behavior… maintain pupils' attention in the classroom, to be accepted by the pupils, to establish balanced relations with them, thus ensuring favourable conditions for the teaching-learning process.' (Lăzărescu, 2013, p. 512).

Skills of empathy can promote the development of a strong relationship between teachers and their students. Consequently, this relationship can promote students' motivation, especially of diverse students, and their openness and attentiveness, but also can help teachers adjust their teaching practice and strategies to meet the needs of their diverse classroom (Goroshit & Hen, 2014; McAllister & Irvine, 2002). Additionally, empathic teachers can establish strong communication channels with their students, contributing to their improved behavior and encouraging them to develop such relationships with others. Furthermore, the establishment of strong relationships both with the teachers and with their classmates creates the conditions that strengthen student's sense of belonging to the school (Goroshit & Hen, 2014). Therefore, teacher education programs must promote the development of empathy skills, to enhance teachers' ability to manage effectively the needs of the diverse student population (McAllister & Irvine, 2002).

McAllister & Irvine (2002) investigated the beliefs of teachers regarding empathy and its effect on the teaching of culturally diverse students. Thirty-four teachers participated in the research and the results revealed that they consider empathy to be a key factor while working with culturally diverse students. The results also revealed that empathy skills helped teachers to adjust their teaching practice to the needs of the student population. Furthermore, teachers reported that their empathy skills allowed them to develop a positive climate in the classroom that promoted the social interactions among the students and led to a student-centered pedagogy. The results point out the need to place more emphasis on the cultivation of empathy skills in teacher education programs.

2.2.4.2 Cultivating empathy through VR and perspective-taking

VR is an '*empathy-inducing medium*' (Carey et al., 2017, p. 1) offering users a unique opportunity to change perspective and experience another person's perspective (Raij et al., 2009). Entering another person's position enables the user to see what others see, hear what others hear, move how others move, and feel the emotions others feel (Raij et al., 2009). According to Carey et al. (2017), there are two types of empathy the

cognitive and the emotional. Cognitive empathy has to do with the '*ability to consciously understand how and why someone feels what they feel that is called perspective-taking*' (Carey et al., 2017, p. 2). Emotional empathy, on the other hand, is '*an embodied reaction, reflecting one's ability to respond to another's emotions*' (Carey et al., 2017, p. 2). Cognitive empathy is associated with understanding another person's situation and be able to judge, while affective empathy deals with the emotional response to another person's situation (Schutte and Stilinović, 2017). Both types of empathy are skills that can be developed through practice.

The current research emphasizes the cognitive dimension of empathy aiming to investigate perspective-taking and its impact on the participants and the cultivation of empathy skills. VR offers the users the opportunity to experience the viewpoint of someone else getting an idea of what his/her life might be like (Axelrod, 2014). This fact makes VR a potential future tool in the cultivation of teachers' empathy skills by allowing them to experience the perspective of their students and the possible problems that they are facing. Participant's emotional reactions are investigated but concerning the VR experience and not only about perspective-taking.

The main objective of the VR application is to provide user teachers with the experience of their students' to understand their perspectives. For some minutes, teachers can live the life of their students, 'see through their eyes', face various difficult situations, reflect on them and understand the problem by entering the shoes of their students (Raij et al., 2009). The various scenarios provide empathetic moments, during which the users should understand certain problematic situations that the virtual students face. At first, the users always see the problem from their perspective as teachers, and then they relive the same scenario but from the student's perspective, meaning that they change body entering the body of the student. This perspective change can benefit teachers significantly as it allows them to enter their students' shoes improving their empathy skills. Moreover, apart from cultivating empathy skills this perspective also impacts learning raising participant's knowledge on various issues.

Previous research on perspective-taking and cultivation of empathy skills for medical students indicated the effectiveness of VR in understanding the patience problem by entering the position of the patient and see her perspective. This experience provided medical students the ability to reflect on the experience, understand the concerns of the

patient, change attitudes and feel what it looks like to be a patient (Raij et al., 2009). Similarly, the current research aims to cultivate teachers' (in-service and pre-service teachers) empathy skills by entering into the position of the student, face several problems depending on the scenario (e.g. bullying, eye disorders, multicultural issues) and see the problem from student's perspective, reflect on it and gain experience on how to handle similar incidents in the real classroom.

2.2.5 The importance of reflective skills in teacher education

Reflection comes from the Latin word 'reflectere' that means to turn back (Bengtsson, 1995; Seibert & Daudelin, 1999). It is not a new concept but dates to ancient times as Socrates and Plato were the first to use the process of reflection. There is no single definition of the term, but a variety of classifications exist representing the different viewpoints of the theorists that used the term. Dewey in 1933 defined reflection as an '*active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of grounds that support it, and the further conclusions to which it tends*' (p. 6). Reflection is an everyday process, '*an important human activity in which people recapture their experience, think about it, mull it over and evaluate it*' (Hinett, 2002, p. 1). Reflection is the process of stepping back from an experience and through extensive consideration get a better and deeper understanding of a situation promoting learning (Bengtsson, 1995; Seibert & Daudelin, 1999). For Pollard (2005), reflection is a cyclical process, in which teachers act as researchers collecting and analyzing information regarding their classroom practice, evaluate them and revise continuously the way they act and confront the various educational issues.

Even though the term dates back in time, the educational system became capable of reflection in the 18th century when education was seen as a part of the total social system (Luhmann & Schorr, 2000). The social context and its influence on the school environment cannot be omitted during the process of reflection and should be taken into consideration by teachers when reflecting on their work, especially today that both societies and classrooms have become multicultural (Pollard, 2005; Zeichner & Liu, 2010). Neglecting the social conditions that influence today's classrooms will lead to teachers who are incapable to confront the transformation and modernization of the

educational system and ineffective to achieve the educational goals and prepare today's students for tomorrow.

Reflection has been considered as a skill of paramount importance for teachers and an integral part of their professional development (Bengtsson, 1995). Dewey (1966) argued that teacher education programs should emphasize the promotion of reflection skills that will help teachers understand the connection between theory and practice maximizing their effectiveness. Reflection can promote the development of new knowledge regarding good teaching practices that goes beyond the role of the university and needs the active participation of the teacher (Zeichner & Liu, 2010). The acquisition of reflective skills concerns all teachers, educators or tutors of all educational levels, either they are beginners or experienced, who are led by their need to understand and evaluate their lesson so that they can identify possible problems and mistakes to use different teaching strategies and methods (Harrison, 2008). Student-teachers might reflect on their practice aiming to improve their teaching skills, newly appointed teachers could use reflective practice to increase their knowledge and understanding maximizing their professional development, while experienced teachers through reflection can understand in-depth the various educational issues (Pollard, 2005).

Through reflection, teachers can explore more critically their teaching practice building their professional knowledge. Nevertheless, a factor that must be taken into consideration is that teachers' life as students and all those years of experience gained during this period of their life constitute the roots of their professional development in the teaching path (Körkkö, 2016; Yost et al., 2000). Those experiences affect their beliefs regarding the teaching profession that lead their future practice affecting negatively in many cases the acquisition of reflective skills by pre-service teachers. Thus, reflective practice is essential to facilitate future teachers' understanding and change of beliefs (Yost et al., 2000).

The significance of reflection lies in its relationship with '*professional knowledge and practice'* (Harrison, 2008, p. 9). Reflective practice is a promising method to be used in education allowing people to recapture their experience and use it as an opportunity to learn (Hinett, 2002; Procee, 2006). The strong relationship of reflection with practice promotes experiential learning allowing people to learn from their experience leading to the development and maintenance of professional expertise (Boud & Walker, 1998;

Harrison, 2008; Pollard, 2005). Thus, reflection can enhance the professional development of an individual affecting implicitly society as a whole (Procee, 2006).

Reflection must become a top priority of teacher education programs, as through the reflective process teachers will be able to evaluate their experiences and throughs, especially those coming from their classroom practice and analyze different viewpoints increasing their awareness and understanding (Körkkö, 2016; Procee, 2006; Yost et al., 2000). Reflection skills have been set as a goal of many teacher education programs as there are indications that the integration of reflection within the curriculum resulted in more empowered beginning teachers (Yost et al., 2000). Moreover, Reflection is included in most teacher competence models and frameworks these days as described also in chapter 2 (Caena, 2011; European Commission, 2013; González & Wagenaar, 2005).

Nevertheless, despite the fact the reflection is a key component in most competence models, teachers do not learn how to critically evaluate and improve their practice (Hagger & McIntyre, 2006). There are indications that teacher education programs promote on the surface the cultivation of teacher's reflective skills lacking in-depth understanding (Calderhead, 1989; Conway, 2001). Moreover, teacher education focuses on the promotion of reflection regarding the teaching practice and the ways to improve the teaching strategies to respond to the standardized curriculum ignoring the importance of reflection to the promotion of teacher's professional development (Zeichner & Liu, 2010). Furthermore, results indicate that candidate teachers do not possess the ability to reflect even after receiving relevant education, and as a result, they face difficulties in critically reflect on their teaching practices (Avgitidou & Hatzoglou, 2013). This lack of teacher's reflective skills indicates a failure of the teacher education programs (Poulou & Haniotakis, 2006). Thus, there is a need to enhance teachers' reflection skills that will promote experiential learning, allowing teachers to learn from their experience leading to the development and maintenance of professional expertise (Pollard, 2005).

Taking all the above into consideration reflection is a key point in the professional development of teachers. It is an undeniable fact that notable changes take place in society and for this reason teachers must allocate the ability to respond creatively in any given situation. This can be accomplished through reflective practice. Thus, teachers

must become reflective practitioners, reflect upon their practice, seeking to detect their strengths and weaknesses, and learn through the experiences of their everyday classroom lives. Using reflecting practices will enable teachers to invent new strategies of action and make decisions based on prior experiences. Moreover, by recognizing their errors and weaknesses teachers can have an explicit picture of their progress and see what needs to be improved. Reflection is the means that will enable them to increase their self- awareness, develop critical thinking, and evaluation skills. Additionally, reflection encourages metacognition and self-empowerment, enhances creativity, and contributes to the improvement of communication, which will help them respond to the new social challenges of the 21st century.

Recently, there is a growing interest in using virtual reality (VR) based learning within teacher education and the results seem promising regarding issues such as bullying and recognition of student's vision disorders (Manouchou et al., 2016; Stavroulia et al, 2016). Moreover, the use of VREs is very useful in domains complex and difficult to master, and as such it is well suited for teacher professional development falls within this. Thus, VR has the potential to become an innovative and essential tool in teacher training offering teachers room for experimentation but without the risk of harming real students. Equally important is the fact that the knowledge gained through the use of VR can be applied to real-life and thus teachers will be able to apply the knowledge gained in their real classroom (Romano & Brna, 2001). Additionally, such a VR system can offer users the opportunity to record their performance, reflect on it, and experiment again maximizing their teaching performance.

Reflection via the use of VR will allow teachers to become '*researchers in the practice context*' (Schön, 1991, p. 68) constructing knowledge of the problematic situations that they will experience. The development of the virtual worlds in response to real teacher training needs is a crucial component that makes VR a reliable means for experimentation. Additionally, VR based approach allows the user to construct knowledge from facts and improve their teaching practice via recalling their own experiences and reflecting on them (Romano & Brna, 2001; Yost et al., 2000). Furthermore, VR offers the possibility to experience a range of professional situations while it also includes the element of repetition. A professional practitioner, experiences various situations repeatedly and through reflection, he can criticize and think back the

situations he experienced maximining his knowledge and understanding and be prepared for future situations (Schön, 1991). Thus, a teacher within a VRE can encounter a certain situation again and again and through experimentation and constant practice to be able to respond in a similar situation in the real classroom context.

Taking all the above into consideration, reflection was identified as the second competence within the established competence framework for the current research. However, enhancing reflection skills were only a goal for the first experiment as from that point on it was decided to focus only on the acquisition of empathy skills. The reason for that lies in the fact that reflection is not characterized by conceptual clarity since it has been used differently by the different scientists and practitioners (Boud & Walker, 1998; Procee, 2006). This made difficult the evaluation of reflection skills during the experiment. Moreover, as reflection is a process, another path was essential for enhancing reflection skills after the VR intervention that was beyond the scope of this research. Furthermore, due to the limited time, the development of the VR application had to be focused on one competence to investigate the effect of VR and empathy was identified by education experts as a top priority.

2.3 Conclusions

The purpose of this chapter was to review the literature and provide clear statements on the topic of VR and its use in the field of education. Moreover, the chapter provided a critical summary of teacher competences and education, along with today's challenges and problems, to identify the major problem of the lack of practical training that would maximize teachers' skills and quality that could potentially be addressed by the use of VR-based approaches. This chapter aims to provide all the necessary knowledge over the topic aiming to guide the following chapter that presents the methodological framework of the current research.

3 Methodological framework

The previous chapter provided an in-depth analysis of the existing literature related to virtual reality and its use in the education sector and more particularly in teacher education. Reflecting on the existing literature was essential to acquire an in-depth understanding of the topic and identify what has already been done and where is room for further research. Reviewing the literature regarding VR and more particularly its use in teacher education, enabled the identification of significant problems that can be addressed using a VR-based approach. This chapter describes the research design and techniques that were used to answer the research questions that were posed.

3.1 The research paradigm

In the past, a researcher could choose between two research paradigms, being quantitative or qualitative (Leech & Onwuegbuzie, 2009). However, the last few years the use of both quantitative and qualitative methods in a single study, known as mixed methods, has received increased interest in many scientific areas (Leech & Onwuegbuzie, 2009; Maxwell & Loomis, 2003; Youngs & Piggot-Irvine, 2012). Mixed methods research design emerged as an alternative '*third research paradigm in educational research*' (Johnson & Onwuegbuzie, 2004, p. 14) aiming to combine '*elements of qualitative and quantitative research approaches…for the broad purposes of breadth and depth of understanding*' (Johnson et al., 2007, p. 123). Mixed methods are not a '*mix-and-match*' research but it concerns the use of '*supplemental research strategies*' (Morse, 2003, p. 191). What is important, is that by combining quantitative and qualitative techniques, mixed methods can overcome the weaknesses of each method and utilize its strengths providing an in-depth analysis of a phenomenon and '*broaden the dimensions and hence the scope*' of the research project (Morse, 2003, p. 189).

Mixed methods research is a more suitable approach to investigate and provide insights into complex problems and research questions that quantitative or qualitative methods individually cannot answer (Almeida, 2018; Lund, 2012). The combination of approaches can provide the researcher with a more complete vision of the problem though multiple worldviews (Almeida, 2018). Additionally, quantitative and qualitative

outcomes might work complementary to each other, providing significant feedback and a full picture of the phenomenon or topic under investigation (Lund, 2012; Morse, 2003). Equally important, is that the combination of techniques that sometimes confirms each other increases significantly the validity of the outcomes, making mixed methods research an extremely valuable approach. However, even in the case of contradictory outcomes, there is room for reflection and new research goals (Lund, 2012).

The current research is a mixed methods research using both qualitative and quantitative techniques. The nature of the research led to the selection of mixed methods as the most suitable paradigm. The objective of this research is the development of a prototype and innovative VR application for teacher education and training, and the adopted methodology is composed of five fundamental phases for the design and development of the tool. Moreover, during the five phases, the investigation of several variables led to the establishment of several research questions that could not be addressed using a single qualitative or quantitative approach.

Using a mixed-methods approach contributed to deeply understand teachers' problems, problems that they face in their everyday routine, which helped the design of a VR application that meets those needs creating an added value for teachers. Additionally, using this approach promoted the development of a VR tool for teachers by teachers, as the involvement of the target group was constant during all the phases providing a clear understanding of their perspective and expectations. Furthermore, the current research conducted over an extended period and required a series of studies and steps to achieve the goal, hence it belongs to the category of multiphase mixed methods design (Maruyama & Ryan, 2014).

3.2 The multiphase design

The current research uses a multiphase mixed methods design (MD) to investigate the use of VR in teacher education and training and provide answers to the research questions. The multi-phase design '*goes beyond the basic designs (convergent, explanatory, exploratory and embedded)*' and occurs when o problem, a phenomenon or a topic is under investigation '*through an iteration of connected quantitative and qualitative studies that are sequentially aligned, with each new approach building on what was learned previously*' (Creswell & Clark, 2011, p. 100).

The purpose of MD is to '*address a set of incremental research questions that all advance one programmatic research objective. MD provides and overarching methodological framework to a multiyear project that calls for multiple phases*' (Creswell & Clark, 2011, p. 100). Using an MD approach allows the different phases to be interconnected, while the combination of techniques allows the richness of data, unexpected outcomes, and adjustments of the strategies towards the main objective.

3.3 Implementing multiphase mixed methods design for the current research

The development of a prototype and innovative VR application from scratch that needed constant evaluation, feedback, and modifications led to the selection of a mixed-methods design. More particularly Multiphase design (MD) was selected as the most appropriate approach for the current research. From an early stage, it was clear that the objective of the research could not be accomplished using a single mixed methods study (Creswell & Clark, 2011). Moreover, as the current research deals with the design and development from scratch of a VR tool for a very specific target group with very specific needs that need to be addressed, it was certain that the research would take place multiple years.

It should be noted that the target group was involved in the process from the beginning as understanding their needs and expectations of a VR application was of paramount importance to develop and provide them a tool that had an added value for their teaching practice. Thus, using qualitative methods was essential to gain an in-depth understanding of the education expert's beliefs and opinions that helped formulated the competence framework and the design of the scenario. However, it was also essential to use quantitative methods to gather data concerning the evaluation of the VR app that provided significant feedback that led to further modifications and experimentation on the VR app. Hence, a multiphase model design was used consisting of five phases. MD approach was ideal for the current research and allowed addressing a specific set of questions during the five phases that aimed to provide feedback to the general objective of the research (Creswell & Clark, 2011). Using MD and a combination of quantitative and qualitative techniques provided the necessary flexibility to investigate a set of interconnected research questions between the five phases.

The key research question that constitutes the fundamental core of this research is the following:

Research question: Can a virtual reality-based learning paradigm be used for the professional development of teachers?

To address the main objective and research question of the current research the following multiphase design was used (figure 3-1):

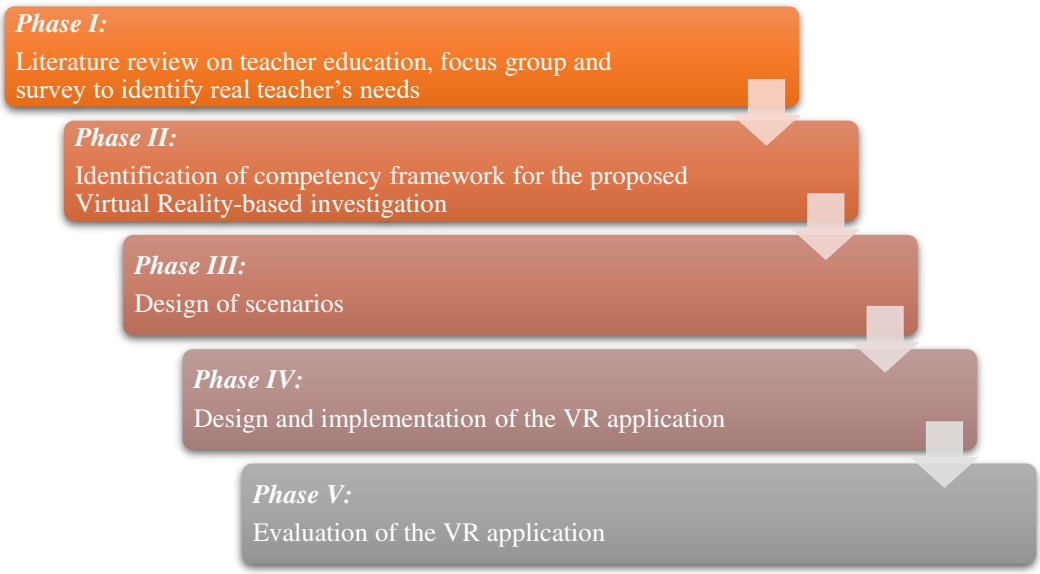


Figure 3-1: Five phase model used in the current research

The systematic approach including the five phases was formulated inspired by the ADDIE model traditionally used by instructional designers and training developers (Molenda, 2003). The five phases -Analysis, Design, Development, Implementation, and Evaluation- represent a dynamic, flexible guideline for building effective training and performance support tools. Those five phases constitute a set of steps with a specific outcome that work together to enhance the overall outcome of the proposed VR-based approach.

The five phases interconnect with each other (figure 3-2). The research purpose of Phase I was to collect data that were used for the identification of the competence framework (Phase II) and the development of the scenario (Phase III).

Phase II collected data regarding key competences that guided the design and development of the scenario during phase III. Phase II was also connected with Phase

IV as the competence framework guided the scales for the evaluation of the VR application.

Phase III deals with the design of the scenario. This phase is closely connected with Phase IV, as the various scenarios were developed within the VR environment. Phase III is also connected with Phase V, as feedback from the VR evaluation resulted in the design of a new scenario that was designed within the VR environment.

Phase IV aimed at the development of the VR training tool that was a long process. Phase IV is connected with Phase V, as three different experiments took place, and each provided significant feedback based on which several modifications were made in the VR application. The results of the third experiment provided significant feedback for future modifications as it was the final experiment under the current research and no further modifications can be made under this research. However, the final experiment opened new doors for further experimentation and poses new challenges to be investigated.

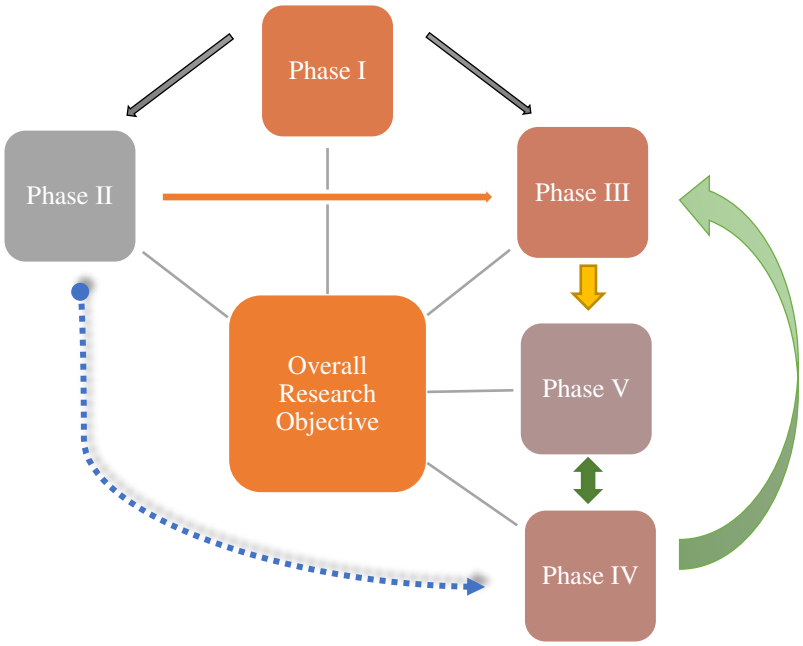


Figure 3-2: Overall research multiphase design

A detailed diagram for the design of each phase, the objective, and the data collected is presented in table 3-1.

Table 3-1: Mixed methods multiphase design applied to the current research

Research phase	Phase objective	Design	Types of data collected
Phase I	Identification of teachers' real needs	QUAL + QUAN	• Literature review • Focus group interview • Survey
Phase II	Identification of competence framework	QUAL	• Interviews • Literature
Phase III	Scenario development	QUAL + QUAN	• Interviews • Quantitative data collected during Phase I
Phase IV	VR app design and development	QUAL + QUAN	• Interviews • Survey for the design of the virtual world
Phase V	Evaluation of the VR app	QUAN + QUAL	• 3 different experiments ➢ Questionnaires ➢ EEG devices ➢ Heart-hate recordings ➢ Participants' observation ➢ Qualitative feedback by the participants

3.4 Overview of Phase I: Identification of teacher's real needs

Initially, along with literature review research, qualitative research took place aiming to understand in-depth teachers' everyday problems. The exploratory research methodology was used, and a semi-structured focus group took place to investigate and identify teacher's major problems that need to be addressed to investigate the potential use of VR. The results of the focus group data revealed the lack of practice and on the job training as a major issue during the years of studying along with the fact that

training thought out their teaching career is completely theoretical. The outcomes of the focus group confirmed literature review research and contributed to the beginning of the current research to investigate the use of VR-based approaches as part of teacher's practical training.

At a second stage, a survey was conducted to identify teacher's real needs regarding the areas they need training. The results of the survey provided critical information regarding teachers' real needs and this identification allowed the development of realistic scenarios that respond to teachers' real needs for training. The most important results of the research indicate that there is a lack of practice in teacher training, lack of experience among teachers related to the use of virtual reality and the need of further training in teaching students with special learning needs, in confronting students with disorders such as vision, hearing and speech disorders, in behavior management and body language. Moreover, participants reported that teachers need additional practical training within a virtual classroom environment.

The data collected in Phase I were used mostly in Phase III that has to do with the development of the training scenario, but also provided feedback in Phase II that deals with the competence framework. Phase I collected both types of data (qualitative through focus group and quantitative through a questionnaire), to conclude the problems and challenges that teachers face in their daily routine (figure 3-2).

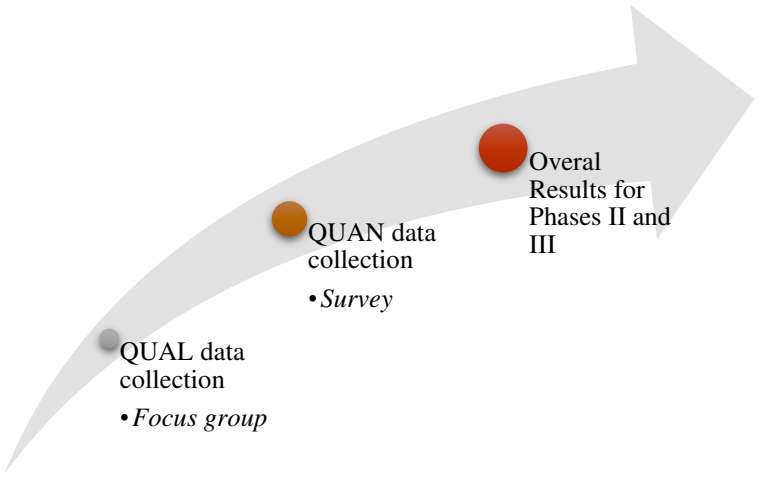


Figure 3-3: Phase I design

3.5 Overview of Phase II: Defining the competence framework

The literature review presented well-identified models regarding teachers' competences. Although the models that exist in the literature have identified the most significant competences and skills for teachers it is impossible to address them all within the framework of the current research that aims to investigate the potential of using VR-based approaches in teacher education. Therefore, a specific selection had to be made based on the needs of the current research, to design scenarios that would target the specific competences. Moreover, the current competence framework developed aims to provide a structure within which the professional standards that the proposed VR application addresses.

To define the competence model apart from an extensive literature review research, interview with education experts, such as active teachers and school psychologists, took place. According to experts' feedback empathy and reflection, skills were identified as high priority skills and of critical importance for professional development. The cultivation of empathy skills is the only way for teachers to understand their students, embrace their problems, and take the necessary course of action for their well-being. However, despite the significance of empathy skills, most teacher education competence models do not include empathy as a key competence. An extended literature review revealed that empathy is included among key competence only to a model coming from outside Europe, and more specifically by the National Institute of Education-NIE (2009) in Singapore called 'Model of Teacher Education for the 21st Century (TE21)' that is structured around six main pillars. The first pillar 'New Values3 (V) Skills (S) and Knowledge (K) Model - V3SK' (figure), aims to guide the design of teacher education programmes, to '*develop teachers who possess the positive attitudes, necessary skills, depth and breadth of content knowledge*' (NIE, 2009, p. 4). An important aspect of this pillar is that it emphasizes learner-centered values including empathy putting the learner '*at the center of teachers' work by being aware of learner development and diversity*' (NIE, 2009, p. 4). The V3SK model also presents several knowledge and skills that teachers must possess to meet the challenges of today's classrooms including reflection skills, pedagogical, management, and technological skills.

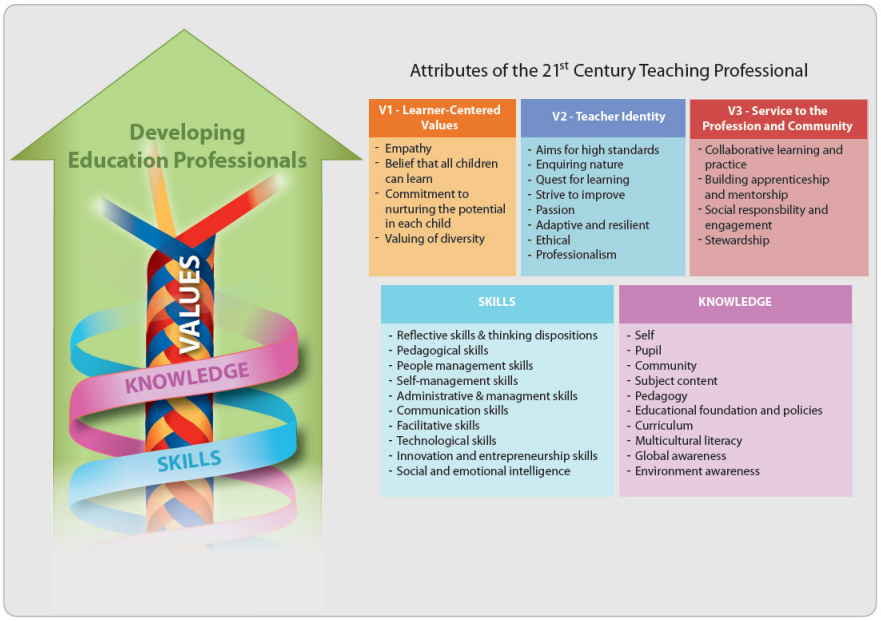


Figure 3-4: New Values3 (V) Skills (S) and Knowledge (K) Model. Adapted from A Teacher Education Model for the 21st Century, by National Institute of Education-NIE (2009), Nanyang Walk, Singapore (p. 4).

This gap regarding empathy to European competence models in conjunction with the indications by education experts led to the proposed framework of competences for the current research is associated with the cultivation of two key competences that are considered of paramount importance for teachers and are: 1) empathy and 2) reflection. Initially, both competences were addressed during the first experiment, however, later it was decided to focus only on one competence and as empathy was the one pointed out by education experts experiments 2 and 3 focus only on the cultivation of empathy skills through perspective change. Moreover, although experiment 1 indicated the potential of using VR to foster reflective skills, reflection is a systematic reviewing process that needed to be addressed differently via the VR system and the evaluation of the user. This was beyond the scope of this particular research and given also the time for the development of the application it was decided to investigate the impact of VR on reflection in the future.

The proposed framework of competences for the proposed VR application and the way they were addressed in the experiments are presented in figure 3-3.

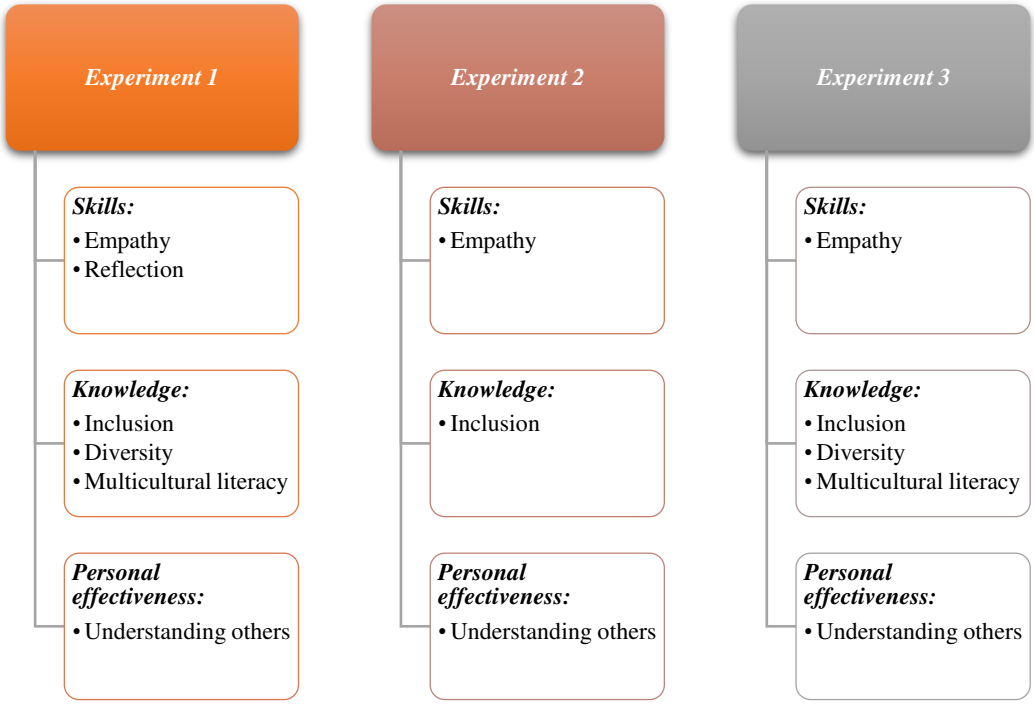


Figure 3-5: Competence framework for the current research and integration during the experiments and evaluation of the VR app

3.6 Overview of Phase III: Scenario development

This phase aims to link the scenarios to existing real classroom problems. In total, three different scenarios were developed.

The first scenario had to do with multiculturalism and verbal bullying in a typical school classroom environment represented within the virtual world. A detailed description of the scenario is presented in chapter 6.

The second scenario was inspired by the real incident and has to do with the use of substances given to a 12-year-old student by his classmates. The incident takes place in the school outdoors space during break time. A detailed description of the scenario is presented in chapter 7.

The final scenario deals with five different cases of students facing problems. The five cases are 1) student refugee; 2) Muslim student; 3) student with a prosthetic leg; 4) student with burned skin and 5) student-facing anorexia. A detailed description of the scenario is presented in chapter 8.

3.7 Overview of Phase IV: Design and development of the VR application

In parallel with the development of the scenario, the development of the application began under Phase IV. VR development started with design issues at first until the finalization of the scenario. The VR environment and the assets used were designed in a way that aimed to maximize the user's experience, satisfaction, and engagement. The design framework for the models that composed the virtual training world is extensively explained in chapter 5. Moreover, as several modifications occurred, there were differentiations regarding the assets used at the experiments, that are presented in detail at the relevant chapter.

For the development of a unique VR experience for the users, a game engine was used for the development of the virtual world. Unity 3D game engine was used, which has a free edition and is integrated with VR SDKs (software development kits), allowing the development of a VR application for the PC platform but also providing the possibility in the future to publish the app on other platforms as for androids for instance. In order to create a realistic immersive experience for the participants, Head Mounted Displays were used as a means of viewing the application. Unity also supports both VR devices used under the three experiments (HTC VIVE, Oculus Rift). As the scripting method, C# was used within Unity.

Some elements regarding the development of the VR tool are presented in table 3-2.

Table 3-2: VR design elements and integration under the three experiments

	Experiment 1	***Experiment 2***	***Experiment 3***
	Prototype	***Version 0.1***	***Version 1.0***
Target audience	Researchers, educator, teachers	In-service and Pre-service teachers	In-service and Pre-service teachers
Game World	3D	3D	3D
Camera System	1PP	1PP	1PP
VR Headset	HTC VIVE	Oculus Rift	Oculus Rift

Technical description	PC platform	PC platform	PC platform
Game Engine	Unity 3D (C#)	Unity 3D (C#)	Unity 3D (C#)
Visual Design / Text Readability	Canvas UI elements	Canvas UI elements	Canvas UI elements
Interaction	No interaction	Low interaction with controllers	Eye gaze input
Animations	MOCAP Various libraries	Mixamo 3D Various libraries	Mixamo 3D Xsens motion capture
Sound	No sound	Sound/Voice recording from real people	Sound/ text into spoken voice output

3.8 Overview of Phase V: Evaluation of the VR application

Once the development cycle began it was essential to build early a prototype and test it early to see how it works with the users. Hence, the first experiment aimed to test the VR prototype and understand if things were in the right direction. Bringing the participants in contact with the prototype was of paramount importance to test user acceptance and get the feedback necessary for modifications of the VR app.

The data gathered from experiment one led to modifications and after the development of a new scenario, the second experiment took place to test the modifications made and further improve the app to meet user's satisfaction. From the second experiment, significant data were gathered leading to further improvements in the virtual world that were tested in experiment three. The third experiment was the last one carried out within the scope of this particular research that provided significant data that will be used for future improvements.

Table 3-3 presents an overview of the three experiments concerning the research design, research questions, scenario, sampling technique, and instruments used. However, each

experiment is presented in detail in the following chapters: experiment 1-chapter 6; experiment 2-chapter 7 and experiment 3-chapter 8.

Table 3-3: Overview of the three experiments

Experiment 1	
Research design	Experimental research design
Research questions	RQ 1. To what extent did participants feel present in a virtual classroom environment that resembles a real-life class? RQ 2. To what extent did participants feel present in a virtual classroom environment that resembles an imaginary class? RQ 3. Is the use of VR-based approaches more effective for training purposes when compared to traditional physical training? RQ 4. To what extent did the VR intervention affect participants' emotional state? RQ 5. To what extent did the VR intervention affect participants' empathy? RQ 6. To what extent did the VR intervention affect participants' reflection?
Scenario	Multiculturalism and bullying
The perspectives	▪ Perspective I: Through the eyes of the foreign student ▪ Perspective II: Through the eyes of the teacher
Sampling technique	Volunteer sampling technique
Sample	33 participants (3 groups of 11 participants per group)
Instrumentation	▪ Questionnaire ▪ EEG device (BIOSEMI Active Two 64 channel amplifier system)
Experiment 2	

Research design	Experimental research design
Research questions	RQ 1. To what extent did participants feel present in the virtual school space? RQ 2. To what extent did the virtual environment affect participants' sense of embodiment? RQ 3. To what extent did the VR intervention affect participants' emotions? RQ 4. To what extent did the VR intervention affect participants' empathy? RQ 5. To what extent did perspective-taking had an impact on the levels of presence, emotions, and empathy?
Scenario	Substance use in the school environment
The perspectives	▪ Perspective I: Teacher Perspective (TP) ▪ Perspective II: Student Drug User Perspective (SDUP) ▪ Perspective III: Healthy Student Perspective (HSP)
Sampling technique	Snowball sampling technique
Sample	25 participants divided into 2 groups ▪ group 1: 12 participants ▪ group 2: 13 participants
Instrumentation	▪ Questionnaire ▪ EEG device (EMOTIV EPOC+ 14 Channel Mobile Brainwear) ▪ Fitness wristband Fitbit charge 2
Experiment 3	
Research design	Experimental research design
Research questions	RQ 1. To what extent did the VR intervention affect participants' emotional state?

	RQ 2. To what extent did the VR intervention affect participants' empathy? RQ 3. To what extent did participants feel a sense of presence in the virtual environment? RQ 4. To what extent did the virtual environment affect participants' sense of embodiment? RQ 5. To what extend did the different perspectives affected participants' emotions? RQ 6. To what extend did the different perspectives affected participants' empathy? RQ 7. To what extend did the different perspectives affected participants' sense of presence? RQ 8. To what extend did the different perspectives affected participants' sense of embodiment?
Scenario	5 student cases that required special attention: ▪ Student Refugee ▪ Muslim student ▪ Student with prosthetic leg ▪ Student with burn injuries ▪ Student facing anorexia
The perspectives and the groups	▪ Group 1 – Control Group: Teacher perspective ▪ Group 2: Teacher perspective - student with a prosthetic leg ▪ Group 3: Teacher perspective - student Refugee - student with a prosthetic leg
Sampling technique	Snowball sampling technique
Sample	69 participants – 23 per group
Instrumentation	Questionnaire, Observation, Small-scale Interviews

3.9 Sampling techniques

Two types of sampling techniques were used for the current research, snowball sampling, and volunteer sampling.

Snowball sampling is a non-probability sampling technique, where existing research participants recruit future research participants from among their acquaintances and '*the sample group appears to grow like a rolling snowball*' (Sharma, 2017, p. 752). According to Noy (2008), snowball sampling can be used as the '*main vehicle through which informants are accessed*' (p. 330). The target group of the current research, being teachers and education experts in general, is a sample difficult to access due to their complex daily program. From the beginning of the research, it was clear that access to this specific sample was difficult, while most teachers approached were unwilling to cooperate and be involved, on the pretext of their schedule and in fear of being under evaluation by the researcher regarding their teaching practice.

Reaching teachers and actively involving them in the current research was a challenge. Not only their daily schedule is complex, but many of them work privately (private lessons) making access difficult. For this reason, snowball sampling was considered as the most suitable method to use, as it is a highly effective sampling technique to approach sample difficult to reach (Waters, 2015). Furthermore, teachers interact with one another as in many cases they are cooperating with each other. Hence, approaching teachers via other teachers was considered an appropriate approach to earn their trust and overcome their hesitation if approached by a strange researcher. Initially, teachers from the friendly and family-friendly environment of the researcher were approached, who then were used as informants indicating other individuals in the same group who were also used as informants (Babbie, 2013; Cohen et al., 2007; Robson, 2002). Snowball sampling was used in surveys conducted (chapter 4 section 4.3, chapter 6 section 6.2) and in experiments two (chapter 7) and three (chapter 8) that were conducted.

Another technique was used for the needs of the first experiment. During this experiment probability sampling methods were used, and a more particularly volunteer sampling technique was used to gather the data. A request for members to take part in the experiment was disseminated within the University of Geneva through

advertisements and email invitations and participants decided on their own whether to be or not in the sample (Coleman & Briggs, 2002). This sampling method was convenient for the first experiment because an EEG device was used for the experiments, which could not be removed from the lab space due to the sensitivity and high cost of the equipment. Additionally, the possibility of bringing samples like teachers from Geneva schools to the lab would require a high fee per person based on regulations, and at that point, this was impracticable due to the high cost. As a result, asking researchers and university educators to test the VR prototype was the optimum solution. Moreover, their feedback was also essential as teacher education takes place within the University. Hence, University studies are the first step towards becoming a teacher and the implementation of the proposed VR tool could benefit future generations of teachers.

3.10 Ethical considerations

Ethical considerations can be considered as an aspect of top priority for every researcher and no research can be conducted without the proper attention to ethics (Ramrathan et al., 2017). According to the British Educational Research Association-BERA (2018) '*educational research should be conducted within an ethic of respect for: the person; knowledge; democratic values; the quality of educational research; and academic freedom*' (p. 5). Equally important is the development of trust-based relationships between the researcher and the participants.

Following BERA's guidelines, the researcher of the current research worked with respect to all the people involved and participated in all the phases of the research. All people were treated fairly and with dignity regardless of their gender, age, ethnicity, disability, cultural identity, or any other characteristic. Moreover, as the target group of the current research are education experts and more particularly teachers, it was of paramount importance to build strong trust-based relationships that would encourage the openness of the target group and thus the collection of valuable data.

Another important guideline deals with the actions to minimize potential risks or harm to the participants (BERA, 2018; Keller & Lee, 2003). This guideline was significant for the current research as it contained the use of VR headsets. VR headsets can induce participants' anxiety due to the disconnection of the real environment especially for the

participants of the target group who are unfamiliar with this kind of technology. Additionally, VR may cause dizziness, nausea, or motion sickness to some people (Munafo et al., 2017). Hence, participants' protection was of primary importance for the researcher. As the participants were not familiar with this kind of technology it was decided during the first experiment to develop an application that would not require users to move at all, but they were sitting. During the second experiment, a few movements had to be performed from the participants, and for this reason, the researcher was close to the participants to provide any help when it was needed. Finally, during the third experiment, the participants were sitting and did not have to perform excessive movements. Additionally, the participants were provided detailed instructions to instantly inform the research of possible discomfort to terminate the experiment, and also the researcher was always close to the participants to assist immediately in case needed.

Another guideline of paramount importance is participants' voluntary informed consent regarding their voluntary involvement in the research and their right to withdraw at any time from the research and for any reason (BERA, 2018; Keller & Lee, 2003; Ramrathan et al., 2017). To address this highly important issue, the researcher always explained in detail, both orally and in written form using a consent form, to the participants the research and its objectives, risks, and benefits, explaining extensively their right to withdraw at any time and for any reason from the research. Ensuring the participant's understanding was essential and necessary to build trust-based relationships. Assurances of confidentiality, anonymity, and non-traceability were also given to the participants ensuring that the data gathered were only used for the purposes of the current research and would be safely stored in accordance to the General Data Protection Regulation (GDPR) (BERA, 2018; Keller & Lee, 2003).

Taking all the above into consideration, the current research emphasized ethical principles, concerns, and dilemmas. Working with people and particularly professional teachers, education experts, researchers, and potential teachers made their protection a top priority along with building strong communication channels with them. The cultivation of trust led to participants' openness and the collection of significant data related to the use of VR as part of teacher education and training. Furthermore, the current research aimed to produce knowledge regarding the use of VR for teacher

practical training, thus, the dissemination of the outputs was crucial and in accordance with the researcher's obligations derived from ethical guidelines (BERA, 2018; Ramrathan et al., 2017).

3.11 Limitations

One of the limitations that were encountered during the research had to do with the involvement of the target population. Teachers and education experts, in general, were actively involved during all the phases of the current research. As their schedule due to their school and teaching obligations was full, the researcher had to adapt to their needs and available time, which sometimes delayed the development and implementation of the VR application. Moreover, approaching the sample for the experiments was not an easy task as many of them were very skeptical about VR technology due to their unfamiliarity making them unwilling to participants. To overcome this issue, the snowball sampling technique was used, to approach initially the sample via using the researcher's known teachers who then identified others to participate in the study. Using this approach made it easier for the sample to trust the participant and agree on participating in the study.

3.12 Conclusions

In this chapter, the main methodological aspects are presented along with the five-phase model that was used to investigate the potential use of VR in teacher education and training. An overview of each phase is presented, and ethical concerns and limitations are discussed. The methodological framework will be further discussed to the following chapters that present in detail the phases and the methodological designing followed along with the techniques used for the collection of the data and the results.

4 Investigating teacher's training needs

The previous chapter provided an in-depth analysis of the methodological framework of the current research. Moreover, chapter two presented an extensive literature review research that identified problems and challenges regarding teacher education and training, teacher's competences, and the use of VR in education. This chapter is divided into two parts. The first part presents phase I that aimed to examine the existing literature and identify relevant information regarding teachers' training needs. This fieldwork was crucial for the identification of key elements of the domain and to understand deeply teachers' problems and needs to address them accordingly using a VR-based approach. Moreover, apart from literature review research, the second part of the chapter presents one focus group and a survey conducted in Cyprus and Greece to register the teacher's real training needs. The results of the survey provided critical information regarding teachers' real needs and the data gathered from this phase along with teachers' input through the design and development process also formed the basis for the design of the scenarios of the VR tools produced as part of this work.

4.1 Reflecting on the literature regarding teachers' real needs

Despite the tremendous educational changes of recent years, teachers remain the key actors of the educational system as learning cannot be achieved without them. Therefore, it is imperative for teachers to continually update and enrich their knowledge and skills to effectively deal with today's classroom challenges and thereby improve the quality of education that is inextricably linked to their personal and professional development. After all, no initial university training is enough to equip a worker with all the necessary skills, knowledge, and competences that will be needed thought an entire career path (Lagoudakos & Karageorgos, 2014).

Designing high-quality teacher training programs requires first the investigation of teacher's real needs, to meet the established needs and formulated demands of teachers (Katsarou & Dedouli, 2008; Lagoudakos & Karageorgos, 2014). Additionally, teachers' professional development should be inextricably intertwined with the identification of teachers' needs as an individual along with the needs of the school and the educational system (Harris, 2000). Moreover, teachers' active involvement in the formation of the

training programs is a necessity to shape a curriculum that addresses their needs. However, research indicates that although the contribution of teachers in the identification of their needs is of paramount importance their participation has been neglected (Harris, 2000; Huizinga et al., 2019). Even though teacher training programs aim to enhance teacher's skills and quality, their involvement during the design phase is extremely limited if not omitted, leading to the development of a curriculum from stakeholders that may not reflect teachers' real needs, yet teachers are expected to follow it and implement it (Huizinga et al., 2019). It should also be noted that Karagianni's (2012) research in Greece that aimed to explore the aspects of significant importance for the preparation of teachers and their professional development revealed that the participant teachers had never been asked to identify their needs before. In line with Karagianni's (2012) findings, Efthimiou (2007) and Lagoudakos and Karageorgos (2014) reported teachers' non-participation to the investigation and identification of their needs and their exclusion from the design of the training programs.

On the other hand, it is possible that teachers might lack the skills and knowledge to co-design the curriculum regarding their training (Huizinga et al., 2019). Additionally, it should be noted that teachers sometimes either do not explicitly express their needs because they do not want to, or do not realize what their real needs are to express them correctly (Katsarou & Dedouli, 2008).

Training throughout the teaching career is essential as higher education cannot address all issues and challenges of teacher education. Therefore, lifelong training is of strategic importance to supplement teachers' lack of knowledge and it must be based on their real needs helping them respond to the constantly changing daily classroom routine (Harris, 2000; Katsanda, 2005). Furthermore, according to the Organization for the Training of Teachers-OEPEK (2011), the investigation of teacher's needs is the key for effective training since not all teachers have the same needs; teachers who have never entered the classroom have completely different needs from teachers with previous experience or newly appointed teachers. Karagianni's (2012) research also revealed the lack of connection between teacher's training and real classroom needs. It goes without saying, that much more attention needs to be given to the real needs of teachers.

The current research and the development of the proposed VR training tool aim to support initially the training of Cypriot and Greek teachers but in the long run support

all European teachers' professional development. For this reason, the identification of Cypriot and Greek teacher's needs, and problems is essential for the current research. Nevertheless, research so far regarding the needs and problems of Cypriot and Greek teachers has not yet received adequate attention.

Literature research revealed that there is a lack of training programs for the candidate and active teachers on issues related to everyday school practice (OEPEK, 2011; Hellenic Pedagogical Institute, 2009). Moreover, it seems that the limited training programs do not respond to teachers' needs resulting in teachers questioning their usefulness (Karagianni, 2012; Lagoudakos & Karageorgos, 2014). Teachers demand training programs that will have continuity and consistency and will consider the following needs (Hellenic Pedagogical Institute, 2009): connection between theory and practice; effective management of the educational reality and diversity of students; dealing with practical issues of teaching and addressing educational problems; familiarization with issues related to changes in education such as the utilization of ICT.

Classroom management issues were also identified of interest to Greek teachers along with issues of learning disabilities, behavioral disorders, cultivation of social skills, emotional management, and multicultural differences (Karagianni, 2012). Other thematic areas that are considered important for teachers are innovative approaches to teaching, administrative issues, implementation of new technologies, and evaluation issues (Karagianni, 2012; Lagoudakos & Karageorgos, 2014). Crisis management, bullying, and diversity management are also considered to be important aspects for further training (Lagoudakos & Karageorgos, 2014). The interest of teachers on the above-mentioned issues is related to the lack of knowledge in the context of their university studies but also due to the limited training programs. Moreover, teachers face these issues daily in their classrooms, hence their inadequacy to address them makes training a necessity.

Anastasiadis (2011) investigated the training needs of 27.785 Greek teachers (who constitute approximately 16.05% of all Greek teachers) of all specialties and levels of education to design training programs that meet those needs. One significant result of the research was the lack of connection between theory and practice confirming previous research by Patouna (2005). Teachers are in possession of rich teaching experiences and need a theoretical framework to organize their disperse knowledge.

However, theoretical programs exhaust teachers and as a result, they reject the proposed teaching practices on the ground that it is not possible to apply them in practice (Katsarou & Dedouli, 2008). Therefore, it is necessary to include practice during teacher's training. Karagianni's (2012) findings also converge with the above studies reporting that teachers want their training to connect their pedagogical needs with their everyday classroom reality, promoting the connection between theory and practice. Moreover, Anastasiadis's (2011) research revealed that most teachers consider classroom management problems as the most important training need. The use of ICT and more modern teaching approaches are also on the top five needs of teachers while multicultural education is also considered an important issue in the training agenda.

Research by the Hellenic National Support Service of the eTwinning action (2010), identified that the implementation of new technologies is highly important for teachers supporting the use of innovative classroom activities. Classroom management issues, multicultural education, strengthening relationships with parents and students, student assessment, and special education also matter a lot for teachers. Mentoring and professional guidance, social inclusion, training on web tools, development of online communities for teachers, promotion of collaboration with colleagues, and teaching performance evaluation were also aspects that were proposed by teachers as important.

Dealing with multicultural classrooms and students with diverse needs is another significant issue for teachers (Lagoudakos & Karageorgos, 2014). Research by the Institute for Rights Equality and Diversity (i-RED) (2013) on multicultural education conducted on active and candidate teachers revealed that teachers are prejudiced towards the diversity of their students. For this reason, the participants consider important the implementation of training programs on diversity issues. Moreover, according to the data training on multicultural education and diversity issues is limited during the university studies.

In Cyprus, some research has been made regarding the investigation of teachers' needs for further training and the level of satisfaction from their work, however, there is a lack of research on the needs of newly appointed teachers, which is quite important for their professional development and career (Petrou et al., 2008). Petrou et al. (2008), state that newly appointed teachers need mentoring from their experienced colleagues in key issues that are related to their teaching practice and not instructions on how to use the

photocopier. Newly appointed teachers need support and must be in close cooperation with the school principal and the other teachers to gain experience on issues of organization and administration of the classroom, methodological practice, and planning.

One of the problems that are of interest to the current study is associated with the fact that teacher training programs offer theoretical knowledge without taking into account the real needs of teachers or providing practical training in the classroom environment (Darling-Hammond et al. 2005; Chantzidimou, 2003). Moreover, lately, the educational modernization promoted the use of more active methods for teacher training such as simulations and role-playing games that provide teachers the opportunity to act both as the student and as the teacher. Such technology-based active methods support the exchange of experiences, collaboration, inquiry and experiential learning, active participation, and the development of critical reflection. Taking all the above into consideration, the current study aims to promote teacher training and professional development through practical training via a VR-based approach. However, as the main objective is the enhancement and upgrade of teachers' skills and quality, investigating their real needs was of paramount importance to develop training scenarios that would meet those needs maximizing the added value of the training tool. For this reason, a focus group and a survey were conducted, and they are presented in the following section.

4.2 Focus group

The last few years focus groups have been gaining group amongst the scientific community as a technique for gathering qualitative data providing the opportunity to actively involve users in the reflection of needs assessment (Rabiee, 2004; Stewart & Shamdasani, 2014). A focus group is a group of people who have something in common (Krueger, 2014); in the current case, there were six in-service teachers, who were gathered to discuss the topics set by the researcher aiming to investigate real teacher's needs. Using a focus group was ideal for exploring the beliefs, perceptions, and ideas of the target group regarding the problems that they face, while this technique allowed the interaction among the participants (Rabiee, 2004; Vaughn et al., 1996), their needs and the possibility to address those needs using new and innovative technology-based

approaches including VR. Additionally, the focus group method was appropriate for pilot-testing the idea of training educators via VR, bringing to the surface teachers' ideas that could form the basis for the design of the VR tool (Krueger, 2014). The focus group was the first step of the current research followed by a survey that aimed to further investigate and explain the findings (Vaughn et al., 1996).

The focus group with the six in-service teachers took place at the gymnasium of Agiou Ioanni in Limassol in June 2016 to reinforce the identification of the most important required aspects of teacher education. Before conducting the focus group, the director of the school was informed by letter about the aims of the research and the importance of teachers' participation and permission was asked to conduct the focus group within the school space to facilitate teachers (appendix A-4-1 for Greek version and appendix A-4-2 for the English version). The number of the participants was ideal, as it was neither small nor large enough, allowing a smooth conversation among the participants with equal participation that provided a diversity of ideas and beliefs (Krueger, 2014). The location was suggested by the participants as they would feel more comfortable in the school environment.

Using such a qualitative approach was a necessity as people and in this case, teachers are a valuable source of information and their opinions and perceptions about their needs were essential to proceed to the design, development, and implementation of a VR training tool. Using a focus group approach allowed a group conversation moderated by the researcher, who was very careful not to make any judgments but to encourage the conversation and all perspectives either positive or negative (Krueger, 2014; Vaughn et al., 1996). Additionally, the use of this technique promoted the development of a strong and direct relationship between the researcher and the target group providing an in-depth understanding of the topic under investigation (Vaughn et al., 1996).

The focus group interview was semi-structured with some predetermined questions as a guide, focusing on specific areas of interest for the current research, but there was also flexibility during the conversation promoting interaction among the participants bringing to the surface diverse opinions and perspectives (Krueger, 2014; Stewart & Shamdasani, 2014). The aim of the focus group was also to identify the most important aspects of teacher training based on teachers' real needs. The participants were

informed about the identity of the researcher, the aims of the research, their contribution to it, and their right to withdraw at any time without providing any explanation (Cohen et al., 2007). Anonymity and confidentiality were essential for the participants and for this reason the researcher assured that the data would be secure and that no one would have access to the recorded data that would be used only for the needs of this research. Recording the data was a necessity as people talk quickly, while the dynamic interaction between the participants could result in omitting important notes. After obtaining participants' consent the focus group interview began. In total, the focus group lasted approximately one hour and ten minutes.

One important aspect was to identify thought the focus group participants' beliefs about practical training and its significance in teachers' professional development. All six participants agreed that practical training is of paramount importance for teacher education, yet they all confirmed the lack of practice during their university studies, and before the beginning of their teaching career.

The first participant stated the lack of practical training before the beginning of his career and claimed that practical training is very important for a future teacher to become familiar with school daily life. He added that practical training should be mandatory during higher education to obtain the diploma. Moreover, the participant added that equally important for a beginning teacher is to experience teaching in collaboration with in-service teachers by working jointly in the same classroom for some time, as this experience will support them providing the mentoring that they need to confront then alone the challenges of the classroom.

The second participant considered practical training highly important as it could provide teachers with the necessary experience that will ensure their sustainability and success in their work. The participant had no practical training and no help during the early stages of entering the profession. He proposed that internships for students and newly appointed teachers could significantly contribute to their development.

The third participant stated that although he holds two different university degrees, in both cases his studies lack practical training. He described his first day in the classroom as having fallen into the deep sea trying to learn how to swim with no help at all. According to the participant, the university degree not only is theoretical but also does

not reflect the real school and classroom setting and challenges resulting in future teachers that are not prepared for their daily routine.

The fourth participant also lacked practical training before entering the profession. He claimed that to survive and deal with the challenges of the classroom he had to embrace his old teachers as role models adopting their teaching style as his own. The participant claimed that when he was appointed the situation was quite different than nowadays, while the communication with the parents was real and they were allies with the teachers towards the commonweal of the student. However, this has changed dramatically today, school-family communication is lost, hence practical training is a necessity for in-experienced but also for experienced teachers.

The fifth participant also reported a lack of practical training. She found it very difficult to manage the classroom the first days, while she lacked training on how to stand and manage the students. According to the participant even experienced teachers need constant training due to the continuous changes of the school and classroom context and to the new challenges posed. Moreover, the participant stated that the transmission of knowledge to the children is a very important skill for the teachers that need to be cultivated.

The final participant also lacked practical training, yet she stated that university studies cannot provide the student with the necessary knowledge on how to teach, while it is not certain that all the students studying to become teachers will be appointed. For this reason, before their appointment, all teachers should attend courses and practical training. But this should happen not within the university studies but afterward.

What is important, is that according to the participant teachers' insecurity and improvisation can be destructive for the students. For this reason, the participants proposed that teacher training should be experiential and supported by a mentor education expert. Additionally, the participants proposed the use of more modern training practices based on technology. Teacher training should aim to bring teachers closer to the student and promote teacher evaluation and self-assessment. Equally important, is that according to the participants practical training should be compulsory for teachers and not voluntary. According to the participants, a training tool that could provide them with the practical training that they lack could maximize their competences and skills. However, this tool should be dynamic and adjustable to

teachers' time, as many teachers are not receptive to dedicate time for training after their working hours.

As far as the training topics are concerned teachers proposed classroom management as a highly important aspect. Teachers' ability to impart knowledge was also indicated as an important aspect that should be part of the training. Organization skills, the ability to cultivate respect among the students, and discipline in the classroom are also considered to be important thematic areas. Moreover, dealing with behavioral problems and the establishment of strong communication channels with the students were also identified as important thematic areas for training.

The participants reported that training thought their teaching career is completely theoretical providing knowledge only about the pedagogical theories and no practical activities that could support them in dealing with daily classroom problems. This fact makes a necessity for the modernization of training activities as teachers experience almost the same theoretical training every time. Equally important is to consider teachers' ideas when designing a training event, however, so far, their suggestions are not considered by people responsible for the design of the training. As a result, teachers are forced to exchange experiences and good practices with colleagues during the programs to update their skills and find answers to their concerns regarding the challenges they face today.

The participants proposed that they need to have an experienced person as a mentor, a guide during their entire career path that will support them and provide the feedback that they need. According to them, the ministry appoints only evaluators regarding their teaching that do not provide any feedback to the teachers, while they need a companion, a consultant that will provide them the support that they need. Teacher's professional development is endless and as the circumstances change within the school context mentoring and the exchange of good practices are a necessity to upgrade teachers' skills and knowledge.

Another significant issue that was posed during the focus group had to do with students' disorders. The participants reported having encountered students with several disorders such as vision or hearing disorders. Nevertheless, they reported that they are usually aware of those disorders from either the school or the parents. However, they also stated that in case they are not informed about students' disorders it is not easy to identify

possible disorders (e.g. hearing or vision disorders). Another significant problem is that parents intentionally do not inform the school and teachers about disorders that the child might be facing out of fear of stigmatizing the child. A significant disorder that is difficult for teachers to identify is dyslexia. The participants stated that teachers cannot easily recognize dyslexia without the contribution of an expert in this disorder. Additionally, learning difficulties and students facing attention deficit disorders cannot be easily identified by teachers as they lack the skills needed. Therefore, further training is required for teachers to enhance their skills and be able to identify student's problems. Managing diverse and mixed classrooms is also a major concern for teachers, as they do not know how to cope with today's diverse classrooms and sometimes, they are forced to work only with the average students. Engaging actively all the students in the learning process is a challenge for today's teachers, while they must meet many diverse needs within the classroom but without downgrading excellent students. The participants put a strong emphasis on the early diagnosis of students' disorders by teachers themselves preferably from primary education, to be able to better assist the students and maximize their skills by using the more suitable approach.

The last topic concerned the use of VR in teacher education. Initially, it should be noted that the participants had no knowledge of VR, and although the subject was deeply explained by the researcher most of the participants did not appear open to the use of this innovative technology. It is worth mentioning that one of the participants stated that teachers should apply the practices of the past and go back to the techniques used 30 years ago, mainly focusing on student discipline. Another participant stated that teachers should be allowed to make mistakes in the classroom and then apologize to the students. Another participant feared that the success of a VR tool could lead to the replacement of the teacher, as a virtual teacher could directly provide training and guidance to 20 teachers located in their home. Moreover, another participant mentioned that such a VR-approach could be so successful and motivating, making the theoretical training of teachers boring, causing problems in their initial training.

However, some participants supported the use of new and innovative approaches including VR, providing teachers an experiential tool for practical training. The participants emphasized that such a tool should be dynamic, inform teachers about incorrect practices, and provide feedback not only to enhance teachers' skills but also to

make them see the tool seriously. Additionally, another participant mentioned that using a VR tool could help increase students' empathy by allowing them to enter the position of someone else. VR at the beginning of a teacher's career could provide an idea of the education and the profession. Furthermore, virtual environments could provide teachers the necessary skills to identify possible students' problems and disorders to address them as early as possible and using the appropriate course of action. For example, one participant suggested that such a virtual environment could provide behavioral data on how teachers should manage a bullying incident and provide relevant feedback within the virtual world.

To conclude, the focus group revealed the lack of practical training as a major problem and concern for teacher education. Teachers referred to their first teaching days as quite difficult, since their theoretical training did not help them to manage their classroom and students. Hence, the participants suggested that practical training should be mandatory not only during university studies but also before the appointment. Another important outcome deals with the need for mentorship and support from education experts. As the social, school, and classroom context changes, teachers find themselves confronting unprecedented challenges and need guidance during their entire career path. The participants' proposed the use of more modern and innovative teaching techniques in teacher education, yet, they were quite skeptical about using a VR-based approach. Although they require more training and they suggest being actively involved during the design of training programs, they feel threatened using technology-based approaches, thinking that approaches such as VR could degrade their role and even replace them. On the other hand, though, some support the use of approaches such as VR to support their professional development, maximizing their skills and helping them understand the students and possible problems that they face.

Teachers need guidance and advice struggling for practical training experiences. To address the issue of teacher's practical training, the current research aims to use a VR-based framework, providing teachers the necessary training via a VR application designed and developed based on their real daily needs. To collect further data regarding teachers' needs to design the training scenarios, a survey took place that is presented in the following section.

4.3 Investigating teacher's real needs: the survey

This section presents a survey that aimed to register teacher's real needs regarding the areas they need training. The results of the survey provided critical information regarding teachers' real needs and this identification will allow the development of realistic and life-based daily scenarios that respond to teachers' real needs for training. This section presents the survey that was carried out, the research design and research questions, the instrument, the sampling method, and the procedure followed. In the final part of the section, the results of the survey are presented.

4.3.1 Research method

In the last few years, online surveys have increased due to the advantages that they have to offer compared to traditional survey techniques (Fricker & Schonlau, 2002; Solomon, 2000; Wright, 2005). For the needs of the first methodological phase an online survey aiming to investigate teachers' training needs, to build a VR application with added value to teachers, was chosen as the appropriate and flexible way to gather the necessary data. Additionally, using a web-based approach had lower cost and was more environmentally friendly as no printed forms were used (Fricker & Schonlau, 2002; Tingling et al., 2003). Moreover, the online questionnaire decreased the distribution time, provided the participant's flexibility, while it was possible to overcome location restrictions (Cohen et al., 2007). Furthermore, the internet survey resulted in the collection of data that were in an electronic form and ready for processing that saved valuable time for the researcher (Lavrakas, 2008). For the needs of the survey online survey monkey software was used to collect the data.

4.3.2 Research questions

The objective of this initial online-based survey was to gather data regarding the problems and challenges that teachers face in their classrooms and identify their training needs. To address this objective the following research questions were formulated:

RQ 1. Is there a lack of practical training in teacher education?

RQ 2. What are the major problems that teachers face today in the classroom environment?

RQ 3. What are the areas in which teachers need training?

4.3.3 The sample

A major concern and challenge during the design of the online survey was the selection of the right target audience to answer the questionnaire. To minimize the possibility of gathering data from the audience outside the education sector that could provide wrong and misleading data, a snowball sampling technique was used that is analyzed in chapter 3 (section 3.9).

4.3.4 The instrument

For the purpose of the current survey, a questionnaire was developed based on OECD Teacher Questionnaire, the Questionnaire for Teachers' Training, and Annita's Woolfolk (2005) book. More specifically, questions 2, 3, 4, 5, 7, 14, and 15 were based on OECD Teacher Questionnaire[5]. Questions 7, 8, and 9 were based on the Questionnaire for Teacher Training[6] , and finally questions 19 to 23 concerning students' problems and disorders were based on Annita's Woolfolk categorization in her book Educational Psychology (2005).

The questionnaire comprised two sections and is presented in the appendices A-4-3 (in Greek) and A-4-4 (in English). In the first section (questions 1-12) demographic characteristics of participants were collected (country, gender, age, employment status, years of service, the field of specialization, educational level, the grade of education they are serving, practical training). Additionally, data related to participants' experience in the use of VR were collected within this section.

The second section (questions 13-26), consisted of thirteen closed quantitative Likert-type questions and one qualitative open-ended questions (Teddlie & Tashakkori, 2009). The use of one open-ended question at the end of the questionnaire was considered important, as although answering may require more time and might lead to irrelevant and redundant information it might also lead to a deep understanding of a phenomenon

[5] Further information regarding OECD Teacher Questionnaire are available to the following link: https://www.oecd.org/edu/school/43081350.pdf

[6] The Questionnaire for Teacher Training is available in Greek to the following link: http://peklamias.sch.gr/entipa_epimorfoumenon/erotimatologio_2014-15.pdf

since respondents can explain and justify their responses to their terms (Cohen et al., 2007).

After the questionnaire took its final form it was pre-tested by six people. The responses by those six participants were not included in the final selection, to collect unbiased data from the target group. Piloting the questionnaire was a necessity to identify possible syntax problems of the questions, to make the necessary modifications (Cohen et al., 2007). The six participants provided constructive comments on the wording that were taken into consideration for the final form of the questionnaire. The questionnaire's length and the time needed for its completion were also serious issues to deal with. Dörnyei (2003) argues that questionnaires must not be more than four pages long and must not exceed a 30-minute completion limit, otherwise it might be considered too much, and participants may withdraw. Therefore, there was an effort to avoid creating a lengthy tool that the participants might be tired of and the average time for completion of the questionnaire was 10 minutes.

4.3.5 The process

Data was collected through an online survey developed on Survey Monkey software. The questionnaire link was emailed directly to the potential respondents. The link emailed initially only to teachers' coming from the researcher's friendly and family-friendly environment, and then they emailed the link to fellow teachers. Additionally, some of the participants proposed the posting the link to closed teachers' groups existing in social media and more particularly in Facebook could help to gather the necessary data and after communication with the research for approval, the link was posted to specific closed teachers' Facebook groups. To obtain the consent of the participants there was a consent form (appendix A-4-5 for the English version and A-4-6 for the Greek version) before the first section of the questionnaire, providing information regarding the aim of the research and informing the participants about their right to withdraw at any time from the survey.

The data gathered were automatically saved within Survey Monkey and retrieved for analysis. A major concern of the current research concerned participants' personal identification numbers (PINs) or other credentials such as Internet Protocol (IP) address of the respondent's computer that could lead to their identification. To address this issue

all the information that could lead to possible identification was deleted during retrieving the data for analysis.

4.3.6 Data analysis

After the data have been collected, they were analyzed with the use of SPSS software (Statistical Package for Social Sciences). Primitively, a set of statistical methods called descriptive statistics was used to organize and describe the data, to have a first idea of the characteristics that characterize the data. For instance, it is important to know the percentage of men and women who participated in the survey.

4.3.6.1 The sample

The sample consists of teachers from two countries, Cyprus and Greece (table 4-1). A total number of 83 participants took part in the survey. A sample of 28 (33.7%) subjects from Cyprus and 55 (66.3%) from Greece. Mainly, there were 61 women (73.5%) and 22 men (26.5%), aged mostly between 30 to 49 years old (65.1%). A high percentage of the participants (45.8%) are permanent teachers. Most of the participants have more than six years of teaching experience. A notable percent of 45 participants (54.3%) have over 11 years of teaching experience with 14 teachers (16.9%) being active on the field for more than 20 years.

Table 4-1: Sample characteristics

		Sample frequency	*Sample percentage*
Country	Cyprus	28	33.7%
	Greece	55	66.3%
Gender	Women	61	73.5%
	Men	22	26.5%
Age	18-24	4	4.8%
	25-29	12	14.5%
	30-39	33	39.8%
	40-49	21	25.3%
	50-59	13	15.7%

Employment status	Permanent	38	45.8%
	Contract	12	14.5%
	Associate	4	4.8%
	Hourly	10	12%
	Not appointed	9	10.8%
	Other	10	12%
Teaching experience	Not at all	8	9.6%
	This is my first year	1	1.2%
	1-2 years	3	3.6%
	3-5 years	9	10.8%
	6-10 years	17	20.5%
	11-15 years	17	20.5%
	16-20 years	14	16.9%
	> 20 years	14	16.9%

When looking at the results for participants' areas of expertise the results vary, including foreign language, literature, science, computer, mathematics, physics, chemistry, music, theology, counseling, primary education, kindergarten education, sociology, and digital technologies (table 4-2). Nearly, half of the sample (49.4%) has a Bachelors's degree, while many participants (39.8%) have a master's degree (table 4-2). Only a small percentage (6.0%) has a Doctoral degree. Moreover, the data reveal that half of the participants (50.6%) currently teach at secondary education (table 4-2). Additionally, 16 of the participants are appointed in primary education, 4 in higher education, and 3 in vocational education. Many participants (18.1%) reported to currently work as private teachers, while it should be noted that five participants reported that they are currently working at all levels of educations (primary, secondary and higher), and one of them reported to be working at the pedagogical institute.

Table 4-2: Characteristics of the sample

		Sample frequency	*Sample percentage*
Area of expertise	Foreign languages	26	31.3%
	Literature	13	15.7%
	Computer	12	14.5%
	Mathematics	9	10.8%
	Physics	4	4.8%
	Chemistry	2	2.4%
	Other	14	16.9%
Level of education	Bachelor's degree	41	49.4%
	Master's degree	33	39.8%
	Doctoral degree	5	6.0%
	Other	1	1.2%
Level of education participants currently teach	Primary education	16	19.3%
	Secondary education	42	50.6%
	Higher education	4	4.8%
	Vocational education	3	3.6%
	Other	15	18.1%

The results revealed that nearly half of the participants (45.8%) are not permanently appointed in the education sector (table 4-3). Additionally, it seems that for those appointed it was a time-consuming process after their graduation, as 22 reported to have been waiting between 5 to 10 years and 9 reported to have been waiting over ten years for their appointment (table 4-3).

Table 4-3: Years between the participant's appointment and graduation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not appointed yet	38	45,8	45,8	45,8
	0-4 years	14	16,9	16,9	62,7
	5-10 years	22	26,5	26,5	89,2
	>10 years	9	10,8	10,8	100,0
	Total	83	100,0	100,0	

One significant result is the lack of practice during initial teacher education as half of the participants (59%) reported that their university studies did not include practical training (table 4-4). Only 37.3% of the participants experienced practical training within their studies, and those participants reported that their practical training had a limited duration between one to three months.

Table 4-4: Participants' practical training during their studies

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	31	37,3	38,8	38,8
	No	49	59,0	61,3	100,0
	Total	80	96,4	100,0	
	Missing	3	3,6		
Total		83	100,0		

Regarding the use of VR, the results revealed that half of the participants (50.6%) do not have previous experience (table 4-5). Only 10 of the participants are very familiar with the use of VR while 28 of the participants have limited experience with this kind of technology.

Table 4-5: Experience in using virtual reality learning environments

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	42	50,6	52,5	52,5
	A little	12	14,5	15,0	67,5
	Moderately	16	19,3	20,0	87,5

	Much	7	8,4	8,8	96,3
	Very much	3	3,6	3,8	100,0
	Total	80	96,4	100,0	
	Missing	3	3,6		
Total		83	100,0		

4.3.6.2 Participant's professional development

The participants were asked to identify the number of training programs that they attended in the last two years. The participants provided answers to a wide range from no training at all to attending 10 training programs (table 4-6). It should be noted that 14 of the participants did not provide an answer to the questions.

Table 4-6: Training programs the participants attended the last two years

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	8	9.6	9.6	9.6
	1	5	6.0	6.0	15.7
	2	9	10.8	10.8	26.5
	3	10	12.0	12.0	38.6
	4	9	10.8	10.8	49.4
	5	12	14.5	14.5	63.9
	6	6	7.2	7.2	71.1
	7	2	2.4	2.4	73.5
	10	8	9.6	9.6	83.1
	Missing	14	16.9	16.9	100.0
	Total	83	100.0	100.0	

Additionally, the participants were asked to identify the number of training programs that they attended the last five years. Again the participants provided answers to a wide range from no training at all to attending 10 training programs (table 4-7), while 14 of the participants did not provide an answer to the questions.

Table 4-7: Training programs the participants attended the last two years

How many training programs have you attended over the past five years?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	4	4.8	4.8	4.8
	1	2	2.4	2.4	7.2
	2	8	9.6	9.6	16.9
	3	2	2.4	2.4	19.3
	4	4	4.8	4.8	24.1
	5	5	6.0	6.0	30.1
	6	6	7.2	7.2	37.3
	7	4	4.8	4.8	42.2
	8	10	12.0	12.0	54.2
	9	2	2.4	2.4	56.6
	10	22	26.5	26.5	83.1
	Missing	14	16.9	16.9	100.0
	Total	83	100.0	100.0	

The participants were asked to evaluate the impact of some professional development activities on their professional development. The descriptive statistics for all the items are presented in appendix A-4-7. Moreover, a high percentage of the participants did not provide an answer to the question that is also presented in appendix A-4-7. Moreover, the results indicate that from the rest of the sample that responded to the question, their participation in professional development training activities did not have a significant impact on their professional development as many of the participants scored low in the scale (table 4-8). According to the results, seminars had the most important feedback on participant's professional development (M=3.02, SD=1.27). Mentoring or peer observation, educational conferences, courses, participation in networks of teachers and workshops had a low impact on the participants as most of them scored from 'not at all' to 'a little'.

Table 4-8: Participants evaluation of the impact of professional development activities on their professional development

	N	Mean	Std. Deviation
Seminars - Impact	60	3.0167	1.26881
Mentoring and/or peer observation - Impact	47	2.9574	1.61457
Educational conferences - Impact	46	2.5217	1.55976
Courses (on educational-related topics) - Impact	46	2.4565	1.54498
Participation in a network of teachers formed specifically for the professional development of teachers - Impact	46	2.3261	1.49152
Workshops - Impact	39	2.1795	1.46668

The participants were provided with several thematic areas and were asked to evaluate their need for training regarding those thematic areas (table 4-9). The descriptive statistics for each thematic area are presented in appendix A-4-8. It should be noted that many missing data are presented for all the items of the question regarding the thematic areas. The results identified as the most important thematic area for training teaching students with special learning needs (M=4.10, SD=.96). Training on how to deal with students facing disorders such as hearing, vision, speech, etc. was also identified as an important thematic area for training (M=3.82, SD=1.17). Student discipline and behavior problems (M=3.48, SD=1.27) and classroom diversity (M=3.21, SD=1.22) were also rated as important thematic areas for training. Student assessment (M=3.17, SD=1.21), individualized learning (M=3.13, SD=1.23), and classroom management (M=3.06, SD=1.31) were also suggested as important training areas. An important outcome of the research is that teachers need training on their body language within the classroom (M=3.02, SD=1.34). Other thematic areas that follow deal with ICT skills (M=2.94, SD=1.25), communication aspects within the classroom (M=2.91, SD=1.38), collaboration with colleagues (M=2.80, SD=1.32), facial expressions (M=2.72, SD=1.33), voice tone (M=2.67, SD=1.27), external appearance (M=2.42, SD=1.28) and knowledge and understanding of the subject field (M=2.33, SD=1.25).

Table 4-9: Participant's evaluation over specific thematic areas

	N	Mean	Std. Deviation
Teaching students with special learning needs	68	4.1029	.96413
Student disorders (e.g. hearing, vision, speech, etc.)	67	3.8209	1.16678
Student discipline and behavior problems	67	3.4776	1.27158
Classroom diversity	68	3.2059	1.21629
Student assessment	66	3.1667	1.21000
Approaches to individualized learning	67	3.1343	1.22963
Classroom management	67	3.0597	1.31288
Body movement within the classroom	66	3.0152	1.34155
ICT skills	67	2.9403	1.25385
Distance and communication within the classroom	66	2.9091	1.37815
Collaboration with colleagues	66	2.8030	1.31523
Facial expressions	67	2.7164	1.33492
Voice tone	67	2.6716	1.27194
External appearance	66	2.4242	1.27775
Knowledge and understanding of the subject field	66	2.3333	1.24447
Valid N	64		

The participants were asked to rank their ability to manage students within the classroom that face several disorders (table 4-10). Appendix A-4-9 presents the descriptive statistics for all the items of the question. The participants ranked Attention Deficit Disorder and Hyperactivity Disorder ADHD as the most important disorder that they must deal within the classroom (M=3.31, SD=1.09). Students' behavioral disorders (M=3.21, SD=1.18) and learning difficulties (e.g. dyslexia) (M=3.00, SD=.98) were also highly rated. Other student's disorders that teachers face within the classroom include health disorders (M=2.43, SD=1.05), communication disorders (M=2.43, SD=1.02), vision disorders (M=2.26, SD=1.11), hearing disorders (M=2.15, SD=1.04) and movement disorders (M=2.05, SD=1.02).

Table 4-10: Students' disorders that participants confronted within the classroom

	N	Mean	Std. Deviation
Attention Deficit Disorder and Hyperactivity Disorder ADHD	65	3.3077	1.08862
Behavioral disorders (e.g. aggression, disobedience, use of physical violence, etc.)	66	3.2121	1.17034
Learning difficulties (e.g. dyslexia)	66	3.0000	.97665
Health disorders	65	2.4308	1.04537
Communication disorders (e.g. stutter)	65	2.4308	1.01503
Vision disorders (e.g. myopia)	65	2.2615	1.10788
Hearing disorders	65	2.1538	1.06405
Movement disorders	65	2.0462	1.02211
Valid N	63		

The results indicate (appendix A-4-10) that the participants to a great extent can detect students in their class who are likely to experience problems and mild forms of disorders as many of them tended to rate their existing knowledge from 'moderate' to 'much' (M=3.62, SD=1.17). Additionally, the participants stated that they need further training through a theoretical approach to identify possible problems and disorders of their students (M=3.14, SD=1.18) (appendix A-4-10). Furthermore, the participants stated that they need additional practical training to enhance their knowledge regarding recognizing students 'problems and disorders (M=3.62, SD=1.17) (appendix 4-10). Many of the participants did not respond to the above questions.

The participants were asked to evaluate the training they had received regarding several student's disorders. The descriptive statistics are presented in appendix A-4-11. According to the results, the participants rated low enough their training concerning the disorders mentioned as they scored low to the scale (table 4-11). Many of the participants did not answer the question.

Table 4-11: Participants' evaluation related to their training related on students' disorders

	N	Mean	Std. Deviation
Learning difficulties	65	2.5231	1.23880

Attention Deficit Disorder and Hyperactivity Disorder ADHD	65	2.4154	1.13044
Behavioral disorders	65	2.3538	1.11005
Communication disorders	65	2.2308	1.07193
Hearing disorders	64	1.8281	1.10633
Health disorders	64	1.8125	1.03701
Vision disorders	63	1.8095	1.17579
Movement disorders	64	1.7813	1.04606
Valid N	63		

The participants were asked to evaluate themselves regarding their ability to identify students dealing with disorders. The descriptive statistics are presented in appendix A-4-12. The results indicate that the participants rated moderately their ability to identify student's disorders including behavioral disorders (M=3.75, SD=.81); movement disorders (M=3.72, SD=1.19); communication disorders (M=3.63, SD=.88); learning difficulties (M=3.62, SD=.88); Attention Deficit Disorder and Hyperactivity Disorder ADHD (M=3.51, SD=1.00); hearing disorders (M=3.45; SD=1.19); vision disorders (M=3.42, SD=1.19) and health disorders (M=2.97, SD=.98).

Table 4-12: Participants' self-evaluation regarding their ability to identify students with disorders

	N	Mean	Std. Deviation
Behavioral disorders	65	3.7538	.81069
Movement disorders	64	3.7187	1.18815
Communication disorders	65	3.6308	.87624
Learning difficulties	65	3.6154	.87843
Attention Deficit Disorder and Hyperactivity Disorder ADHD	65	3.5077	1.00192
Hearing disorders	64	3.4531	1.19429
Vision disorders	64	3.4219	1.19263
Health disorders	64	2.9688	.97539
Valid N	64		

The results indicate that additional practical training is a necessity for the participants related to the management of students with disorders. The mean score for all items of the question range from 'moderately' to 'much' (table 4-13). The descriptive statistics are presented in appendix A-4-13. Several participants did not answer the question.

Table 4-13: Participant's perceptions regarding additional training related to student's disorders

	N	Mean	Std. Deviation
Behavioral disorders	64	3.6875	1.08196
Attention Deficit Disorder and Hyperactivity Disorder ADHD	63	3.6825	1.14758
Learning difficulties	64	3.6094	1.07817
Communication disorders	63	3.5556	.99641
Health disorders	63	3.4127	1.15891
Hearing disorders	63	3.2381	1.22756
Movement disorders	62	3.2258	1.16534
Vision disorders	63	3.2222	1.25009
Valid N	61		

The results (table 4-14) indicate that practical training within the classroom is a necessity for teacher professional development (M=5.18, SD=.99). Equally important is that the participants scored highly practical training using new technologies including virtual classroom training (M=4.86, SD=1.16). The participants scored lower training using traditional training material (M=4.82, SD=.98).

Table 4-14: Participant's perceptions regarding the style of training that they need

	N	Mean	Std. Deviation
Practical training within the classroom	63	5.1746	.99255
Practical training through new technologies such as virtual reality within a virtual classroom	63	4.8571	1.16199
Suitable training material	61	4.8197	.97482
Valid N	61		

The final question aimed to investigate participants' beliefs regarding whether the students need further education to ensure their proper communication and behavior concerning their peers who may experience disorders (appendix A-4-14). The results (table 4-15) reveal that the participants believe that the students need training on issues concerning Attention Deficit Disorder and Hyperactivity Disorder ADHD (M=4.18, SD=.74); behavioral disorders (M=4.17, SD=.85); learning difficulties (M=4.13, SD=.79); communication disorders (M=4.10, SD=.84); health disorders (M=3.97, SD=.84); hearing disorders (M=3.92, SD=.87); movement disorders (M=3.89, SD=.89) and vision disorders (M=3.84, SD=.93). Many of the participants did not answer the question.

Table 4-15: Participant's perceptions regarding student's training

	N	Mean	Std. Deviation
Attention Deficit Disorder and Hyperactivity Disorder ADHD	62	4.1774	.73605
Behavioral disorders	64	4.1719	.84618
Learning difficulties	64	4.1250	.78680
Communication disorders	63	4.0952	.83694
Hearing disorders	63	3.9683	.84182
Hearing disorders	63	3.9206	.86699
Movement disorders	64	3.8906	.89296
Vision disorders	61	3.8361	.93417
Valid N	58		

The final question of the questionnaire was open-ended aiming to provide the participants the opportunity to respond to the question in a manner that best describes their perception and beliefs about the question. Only five of the participants provided an answer to this particular question. One of the participants proposed the participants of parents in teacher training, as many times families tend to deliberately ignore problems that their students face. Moreover, another participant stated that parents often do not provide the right information about the medical history of their child. Specific emphasis should be given to disabled people, especially among the students. Another participant wrote that university studies did not provide training regarding Attention Deficit

Disorder and Hyperactivity Disorder ADHD or other disorder and his/her knowledge was based on personal interest and cases of disorders within the family. Finally, another participant wrote that the questionnaire gave him/her '*the opportunity to realize that we should not wait to get into the classroom unprepared because a little mistreatment to the student nowadays puts at stake our job. We need to have at least a solid theoretical background to get the perfect balance in the classroom, which is ultimately what the customers (parents) want, who treat us as robot guides, and who are ready to kick us and throw us into the trash when making mistakes. They face us as a machine that is not worth its money and questioning the robustness and capabilities of us as robots by underestimating us. Children are now dealing with many issues, both psychosomatic and behavioral, which I believe are due to environmental factors and the dramatic societal change in a short period of time. Students are unable to handle anything and at the slightest reason, they are disturbed and feel pressured or being mocked. They have not learned to respect, and this starts with the family. Teachers need knowledge and luck*'.

4.3.7 Survey conclusions

The main objective of the survey was to identify the educational needs of teachers by exploring their perceptions. The results of the research revealed that the participants consider the training of paramount importance, mainly because university training is inadequate to prepare them for all the aspects of the teaching profession.

The results revealed the lack of practical training during the university studies, confirming previous research by Anastasiadi (2010), who identified the lack of connection between theory and practice. Teachers pose rich teaching experiences and need a theoretical framework to organize their knowledge. However, the theoretical programs tend to exhaust them, therefore it is necessary to link theory and action to understand in-depth how to use the proposed teaching practices in their classroom.

Equally important, is that most of the participants have participated in a training program. However, it is quite serious that the participants state that the various training programs they have attended had a low impact on their professional development. The results of the survey confirm previous researches by Vergidis (1998), Katsarou and Dedouli (2008), Filokosta (2010) and Efthimiou (2017).

The most important thematic areas that teachers suggest for training as prioritized by them include students with special learning needs; students facing disorders such as hearing, vision, speech, etc.; student discipline and behavior problems; classroom diversity; student assessment; individualized learning; classroom management; body language within the classroom; ICT skills; communication aspects; collaboration with colleagues; facial expressions; voice tone; external appearance and knowledge and understanding of the subject field.

The results indicate that the participants believe that they are partially able to identify and manage students with disorders within the classroom. Teachers find their training incomplete and need additional practical training to enhance their knowledge of students with various disorders.

Another significant outcome is that the participants believe that they need practical training and training via using more innovative technology-based approaches including VR and not of theoretical training based on traditional means.

Furthermore, the participants state that apart from teacher education and professional development to deal with students' problems and disorders, equally important is to train on these issues the students to learn to help and respect their classmates.

It should be noted that many of the participants did not answer many of the questions. This is an interesting result, as teachers argue that their opinion related to their actual training needs has been downgraded and they would like to be actively involved in the design of the training programs (Efthimiou, 2017). This questionnaire provided them the opportunity to anonymously express their perceptions about their true needs. Yet, they preferred not to provide answers to the most important questions. This leads to the question for further research on whether teachers do not want to express their opinion or do not know what their actual needs are to prioritize them.

To conclude, investigating teachers' needs is the key to the design of effective training programs that highlight their real needs and contribute to their personal and professional development. The results of the survey confirm also the results of the focus group regarding the lack and need for practical training on many aspects of the teaching routine including students facing problems and disorders. The circumstances nowadays

have changed, posing new needs and challenges that require new actions and constant teacher training.

Although the results of the questionnaire were taken seriously into account when formulating the scenario's of the VR-Training tool, some of the topics indicated by teachers were not included in the training tool as the inclusion of those topics was not feasible to be completed within the time framework of a Ph.D. thesis. For example, although the results identified students with special learning needs and disorders, such as attention Deficit Disorder and Hyperactivity Disorder ADHD, as a top priority for teachers, those disorders were not included in the scenarios. To approach such disorders the researcher had to be in close collaboration with experts in the special education field, which was not possible at the time. Furthermore, the inclusion of cases involving continuous movements, like the ones encountered in hyperactivity disorders, would have additional needs for technical equipment required to produce faithfully animated characters, along with the need for extra equipment in the form of motion sensors. These requirements implicate the need for additional equipment that could limit the practicality of the VR-training tool. Additionally, other thematic areas, such as vision disorders, were already addressed in our preliminary work (Manouchou et al., 2016) hence we opted to deal with issues indicated by teachers that were not previously addressed in the literature, such as classroom diversity that was identified as one of the thematic areas and was also suggested by school psychologists and teachers. Furthermore, other thematic areas concerning substance use and a situation like prosthetic parts and skin deformations (i.e. burn injuries) were proposed by school psychologists based on the frequency and impact of those cases in recent years. To conclude the final selection of the thematic areas for the training scenarios was based on the registered teachers' needs, the availability of experts to provide long-term advice related to the topic, the novelty of the topic that relates to the overall impact and contribution of our work and the level to which the development of the scenario was possible in the virtual world without the need of using high-cost equipment.

4.4 General conclusions

This chapter presented two actions that took place under the first methodological phase that aimed to investigate real teachers' needs to provide a training VR tool with realistic

scenarios that represent real-life classroom problems and challenges. One focus group and a survey took place to identify the most important problems in teacher education, with the lack of practical training being one of the most important problems that teachers face. The current research proposes a new innovative and technology-based approach to address this gap in practical training via the use of a VR framework that will be presented in the following chapters. The next chapter presents the design phases of the VR application and all the challenges that had to be addressed.

5 User-Inspired Design of Optimum VR Environments

In this chapter, several issues related to the design of the virtual reality application are described. The design of a virtual system is of paramount importance to provide end-users a high-quality environment that will also maximize the quality of their experience. At first, this chapter presents the methodological framework for the development of the VR tool based on the literature. Then the process of designing the 3D models is described, along with the presentation of the models that were used for the development of the VR application.

5.1 Designing the VR application using input from the end-users

Lately, rapid technological advancements promoted the development of many professional and realistic VR applications. However, many of those applications that require users to interact with them have not necessarily been designed with the users in mind but they '*have been engineered as systems to perform set functions*' (Preece et. al., 2002, p. 1). Those systems may be accurate and workable from an engineering perspective, however, the users may not like the system, may find it difficult to use and confusing (Penuel et al., 2007). Hence, interaction design is a necessary component within user experience (UX) design to develop systems that are '*easy, effective, and enjoyable to use-from the users' perspective', while they are also 'satisfying, enjoyable, fun, entertaining, helpful, motivating, aesthetically pleasing, supportive of creativity, rewarding and emotionally fulfilling'* (Preece et. al., 2002, p. 2).

Sherman and Craig (2003) state that the participants constitute the most important component of a VR experience. This relates to the fact that the participants that enter the virtual world have different characteristics and capabilities and as a result, their experience is unique for each one of them. Thus, virtual systems should be designed by taking into consideration the views and preferences of the participants who will experience the virtual world. A key component for the effective design of a VR system is that all information should be presented to end-users in a way that will facilitate processing (Hubbold et al., 1995). Hence, according to Hubbold et al. (1995), one of the priority objectives when designing a VR system must be to identify the parameters that will promote human perception engagement. For the authors, the technological issues

may not necessarily be the most significant parameters during the design, as in many cases users are immersed in the most simple and unsophisticated graphic design but are motivated and engaged because of the scenario. Thus, it is possible that the realistic environment alone may not be enough to engage the users if the scenario or the levels of interaction fail to intrigue them. Equally important to the authors, is the design of a VR environment within which the users will feel comfortable, while for some actions within the virtual world the system might need to respond similarly to the real-world, to enhance user's illusion of reality. Along these lines, Hubbold et al. (1995) and Penuel et al. (2007) also state that the most impressive interface alone is not enough to ensure usefulness and user-friendliness.

Purwar (2019), states that the key point when designing a VR system is to understand the users that will use it and be able to predict issues that might arise during its use. For instance, Proffitt et al. (2019) argue that when VR is used for therapeutic reasons, the VR system should respond to users' abilities and treatment objectives. The authors after several kinds of research propose several recommendations for the design of a VR system that can be applied in other fields apart from rehabilitation. According to the authors' recommendations, a critical point is the active involvement of the users from an early stage and throughout the whole process of the development of the VR system from the design, to development, implementation, and evaluation. Moreover, another important aspect is to understand the needs of the group to deliver VR systems that respond to those needs. Involving end-users to the development process can provide significant input, leading to improvements in the final VR system.

Another important issue based on Kleinermann et al. (2005), is that most VR development tools cannot be easily used by non-experts, which results in the development of VR applications only by expert developers that lack deep knowledge about the domain of the application. As a result, developers need to spend several hours to acquire the knowledge needed, and in some cases, the VR applications do not meet the needs of end-users. Hence, the authors suggest that the most suitable way to design a useful and effective VR application for end-users is to involve domain experts during the design and development process. This will allow the development of '*domain-oriented*' (Kleinermann et al., 2005, p. 2) applications that will contain the necessary information and terminology. Nevertheless, involving users in the design process is not

without risks as they must be aware of their real needs to provide significant feedback (Penuel et al., 2007).

Equally important is that the experience within the VR environment can affect either positively or negatively the emotional state and behavior of the users (Górski et al., 2017). Penuel et al. (2007), also argue that the developer's decisions related to the design of the virtual space can influence the user's experience. Hence, it is important to involve the target group during the decisions that refer to the design of the system so that the end-product is enjoyable, easy to learn, and effective to use. According to Górski et al. 2016, the support provided by end-users can improve the design process of a product or an application, the detection and elimination of possible mistakes before manufacturing, resulting in a high-quality deliverable either being an application or a product. Chaturvedi et al. (2011) state that end users are both developers and users. As developers are unaware of users' needs, users' input is significant for content creation. Users should be encouraged to get involved in the development of a VR system, as their complicity will increase the quality of the virtual world.

As far as educational software is concerned, it is important to follow a specified framework regarding the design, development, and evaluation process (Crosier et al., 2002). Crosier et al. (2002) state that teachers' participation in the development of educational software is of paramount importance to meet their needs, yet this is something that does not happen in practice. As a result, in most cases, educational software is not built based on teachers' needs and it is very difficult for teachers to find and use software that responds to the curriculum. The authors argue that the key point to ensure the usefulness of the developed educational software is to actively engage teachers in the development process.

Despite the significance of education expert's involvement when designing educational software, Crosier et al. (2002) state that there is a lack of research related to the investigation of the development of a VR system for educational purposes as a whole process, from the generation of the idea to the design, development, implementation, and evaluation of the system. The authors suggest three phases being: (1) selection, (2) design and development, and (3) evaluation of a VR system. In this process, Crosier et al. (2002) suggest the involvement of teachers from stage one that deals with the generation of the idea, as their input is of paramount importance for the development of

a successful and useful software that will respond to real classroom needs. Moreover, Crosier et al. (2002) state that teachers' contribution to the development process may make them feel a '*sense of ownership*' (p. 81), which will maximize the added value of the educational software to them and thus could guarantee in a way that it will be implemented within the classroom. Furthermore, they state that it is essential to provide directions and instructions to developers when designing an educational VR system. The mismatch of the system to real teaching and learning needs could result in poor user interaction, engagement, and performance. Even the most innovative educational software that does not match teaching methods, students' learning needs, or the curricula is less likely to be used within the classroom (Penuel et al., 2007).

Penuel et al. (2007) argue that not many research projects report the active involvement of end-users in the design process. For the current research involving the target group (teachers, educators, trainers) was of paramount importance and a great amount of effort has been put towards the establishment of strong communication channels with teachers and promote their active participation throughout the development of the VR software (Crosier et al., 2002). Furthermore, Hubbold et al.'s (1995) and Proffitt et al.'s (2019) recommendations regarding the design of a VR system, an important aspect of the current research was the design of the virtual classroom space, to provide a high-quality experience to end-users. As important knowledge comes to the end-users, the VR environment model was designed based on information provided by education specialists (e.g. teachers, trainers, school psychologists). Thus education specialists co-developed the design of the application contributing to the development of an effective and high-quality VR application.

5.2 Involving active education experts in the design process

The first step when designing a VR system should be to understand users' perspectives along with users' needs, goals, attitudes, and behavior, especially when the application or software concerns people with special needs such as autism (Putnam & Chong, 2008). According to Putnam and Chong (2008), not enough attention has been paid regarding the development of effective either software, applications, systems, or products (e.g. for Autism) that meet the needs of the target population and are in accordance with their attitudes and behaviors. The research conducted by the authors

indicated that it is essential to design and develop having in mind the user perspective, which will help the developer meet the needs of the specific population.

Penuel et al. (2007), present the co-design process that '*relies on teachers' ongoing involvement with design of educational innovations, which typically involve technology as a critical support for improving teaching practice'* (p. 52). The authors define co-design '*as a highly facilitated, team-based process in which teachers, researchers, and developers work together in defined roles to design an educational innovation, realize the design in one or more prototypes, and evaluate each prototype's significance for addressing a concrete educational need*' (p. 53). According to the authors, the co-design process shares common values with user-centered approaches that are interested in usability issues and participatory design (Duarte et al., 2018). Additionally, the co-design process shares common values with learner-centered design (LCD) theory that focuses on the development of educational tools that increase student motivation and learning. Moreover, the co-design process has also similar suppositions with design-based research related to the effect of innovative educational tools. The co-design approach allows users to give life to their inspiration and create innovative artifacts (Tobar-Muñoz et al., 2016).

Having education experts as co-designers and see through their eyes, can help the development of innovative achievements that reflect their needs, respond to student's learning needs and will not only be used within the classroom context but will also boost reformations in the educational system and curriculum, as part of the transformation and modernization that takes place today due to the technological evolution (Kali et al., 2015; Penuel et al., 2007). Additionally, co-design can enhance teachers' professional development, as their familiarization with new and innovative educational tools can affect their traditional teaching strategies and replace them with more learner-centered approaches that focus on learning (Penuel et al., 2007). However, despite teachers' active participation in the design process Penuel et al. (2007) state that teachers are not totally equal co-designers, as the final decisions lie with the development team.

Involving education experts and particularly teachers, during all five phases of the current research was a key priority. In this respect, the design process was based on methodological steps from both a user-centered and participatory approach. Initially, a

participatory design method was used, as end-users were '*active contributors*' during the development of the VR application (Duarte et al., 2018). Using this approach promoted communication and collaboration between the researcher and the targeted population being education experts and particularly teachers. On the other hand, User-Centered Design (UCD) was also used as part of the methodology. UCD also focuses on user's needs during the design, however, the active participation of end-users is not obligatory during all the stages of the design process (Zaina & Álvaro, 2015). UCD framework focuses '*on the think being designed*' (Sanders, 2002, p. 18) aiming to meet user's needs. There is a collaboration between the researcher and designer with end-users, yet users are not an active and actual part of the team.

For this reason, a participatory approach or co-design was also used to the current research to allow a real contribution of education experts (particularly teachers) making them 'design partners' to the process of developing an innovative VR educational tool for teacher education and training. Active involvement of education experts helped understanding teacher's real needs and beliefs aiming to provide a VR tool that was designed and developed to meet those needs. From the very beginning of the current research teachers from all grades were contacted about the current project and were invited to attend in interviews, surveys, workshop, and evaluations allowing them to become more familiar with VR technology, clarify their needs, express their ideas related to the use of such technology and provide significant feedback related to the design of the virtual environment. Most of the activities took place within the school year and based on teachers' schedule, yet some of the activities such as the workshop and part of the VR evaluation were scheduled early in the summertime when schools are closed and teachers are more relaxed (Penuel et al., 2007).

It should be noted that despite education expert's active involvement in the design process they could not make decisions related to the content (scenario), 3D models, interface, competence model. End-users have a different perspective that developers related to the evaluation criteria and are unaware most of the time about technical issues that can determine the way the application is designed and developed (Penuel et al., 2007). For instance, a major priority for the current research was to evaluate the sense of presence as it is the key to the user's immersion in the virtual environment. Most of the participants were unaware of the term and could not understand at first its

significance during the evaluation process. Furthermore, their limited knowledge of VR technology and equipment made it difficult to understand the technical aspects of the development process.

Without a doubt, involving end-users is not without risks, as their personal experience and beliefs sometimes result in the development in a different path than the one planned initially. Their stories and experiences all those years of teaching have affected their beliefs and it is not an easy task to segregate the most significant information or enclose all those different perspectives in a single VR system. Additionally, teachers are strongly attached to the curriculum and do not think out of the box, but contrariwise they think how to apply new innovative technological tools to their traditional teacher-centered practice (Penuel et al., 2007). Moreover, another concern deals with the fact that the survey during phase 1 along with existing research results revealed that it is possible that several teachers do not know exactly or do not want to express their true needs. Additionally, during the interviews some of the teachers were nervous and feeling uncomfortable to express freely their true needs, a problem that Penuel et al. (2007) also encountered. Despite the efforts made to encourage teachers to express their true thoughts related to their needs, the discussion was turning to their problems with the ministry of education and the conditions within the school that are unsolved after all those years of their practice. For this reason, as part of the process of designing optimum VR applications, interviews with school psychologists were also conducted. Although the views of the teachers were taken seriously into account, all the final decisions related to the scenario, 3D models, interface, etc., were taken by the researcher as not only it was impossible to satisfy all teachers' visions regarding the design of the environment and the content included but also some of the data gathered deviated from the aims of the research. Nonetheless, education experts could be considered up to a point as design partners due to their significant input.

Based on the presented findings of the literature review a group of teachers was actively involved in almost all phases of the current research. During phase 1 existing literature along with the data gathered via survey and interviews with teachers identified the needs for a practical training tool and formed the basis for the development of the scenario. Phase 2 was very significant as the competences to be cultivated via the VR application were determined. During this phase teachers' input was of paramount

importance as interviews identified as the number key priority for teacher's empathy, while the review of the existing competence models in many cases did not include empathy as a priority skill. The guidance was also provided by education experts for the identification of the various scenario. Additionally, design guidance was essential during the design of the virtual environment to achieve their engagement and immersion during the virtual experience. Education expert's input resulted in the design of two different virtual environments, one based on real-life classroom conditions and one based on an imaginary classroom scene. Moreover, teachers' input during the design of the virtual classroom and classroom models, particularly for the design of the imaginary environment was significant. During the development period of the VR application, the teacher's input was limited as this phase had to do with programming within Unity. Nevertheless, the data gathered during the evaluation of the different versions by education experts affected the development process as there were several modifications based on the teacher's feedback. Education experts' involvement during the five phases of the current research and their most significant contribution is summarized in figure 5-1.

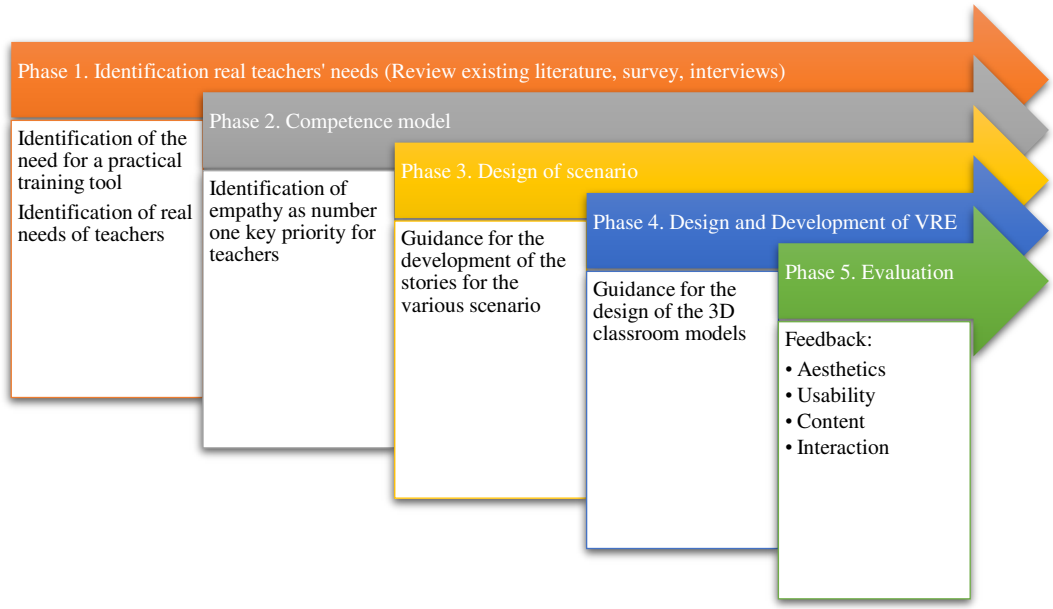


Figure 5-1: Education experts' involvement during the five phases of the research and significant outcomes. The text in the boxes indicates the end-user involvement in each phase.

5.3 The VR system

Before presenting the VR system it is essential to first define and differentiate the term VR system and VR application. The term VR application refers to the 'software application' that means to the computer-generated program designed and developed to perform a set of tasks for the users. On the other hand, the VR system consists of both software and hardware (Górski et al., 2017). As Górski et al. (2017) state, there are no standardized processes or ready VR packages, concluding that each VR system is unique as it is built each time from scratch. This could be explained by the fact that the design of each VR system aims to respond to different needs and objectives each time. Moreover, as each field has its own characteristic, a unique VR system could not reflect the various features.

The VR system of the proposed research is presented in figure 5-2.

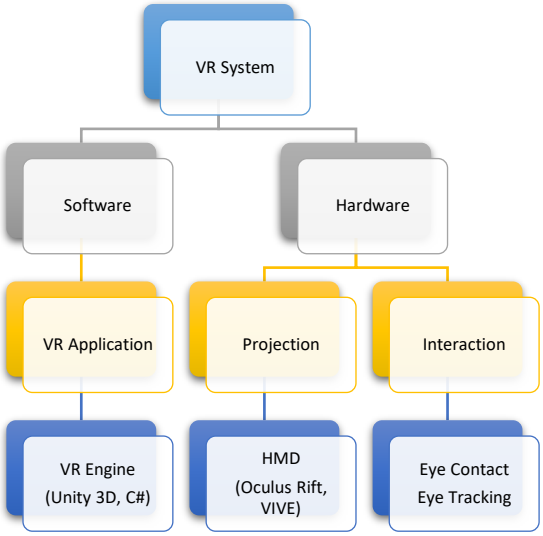


Figure 5-2: Components of the proposed VR system.

The design of the VR application should start by defining its need and purpose, while it should be determined who will be using the application and for what purpose (Górski et al., 2017). Hence, at the beginning of the process two questions were formed:

I. Who will be using the VR application?
II. What is the purpose of the application?

Based on the literature review research that revealed the problems in teacher education and on phase one (described in previous chapters) that identified also the problems and

needs, it was decided that the target group for the proposed VR applications would be in-service and future educators, teachers and trainers. Moreover, the purpose of the application would be to maximize their skills, knowledge, and professional development (Figure 5-3).

Figure 5-3: Defining the target group and the objectives of the VR application

After defining the target group and the objectives of the application, the development phase began. At first, the steps to be followed were planned, the engine to build the VR application was selected (Unity Game Engine) and the 3D models were developed using Maya Student Edition, the models were imported in Unity game engine and the building of the scenes begin. During the development process, several tests took place with or without education specialists that provided significant input along with the experiments conducted for modifications and improvements.

5.4 The 3D models

5.4.1 Real-life based 3D models

The 3D models that were used for the current application were designed with AUTODESK Maya 3D[7] animation software student edition.

One important aspect that had to be taken into consideration for the design of the virtual school and the virtual classroom was that it had to be realistic and similar to a real Cypriot and Greek classroom, to create the users a strong sense of presence that is the illusion of being an active part of the computer-generated virtual environment. For this reason, the 3D models of the virtual classroom were designed based on photographs that were taken from real classrooms in Cyprus and Greece (figure 5-4).

[7] Further information can be found in the following link https://www.autodesk.com/products/maya/overview.

Figure 5-4: A real classroom environment

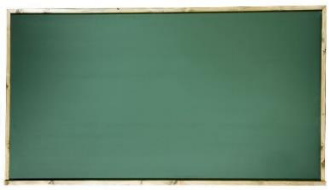
Additionally, the design of the 3D models was also based on the specifications of the School Buildings Organisation SA (SBO) company (http://www.ktyp.gr/en/) that is responsible to equip schools all over Greece with appropriate material and on the instruction provided by the Cyprus Ministry of Education, Culture, Sports and Youth[8].

The textures used for the 3D models were based on photographs that were taken from real classrooms, while simple colors such as white color were used to achieve the desired outcome. The following table presents real-life school equipment and the 3D models designed using Maya Software.

Table 5-1: Real-life school equipment and 3D models designed

	Real-life models	***3D models***
Student desk		

[8] Further information can be found in the following links http://www.moec.gov.cy/technikes_ypiresies/protypa/schediasmos_scholeio/gymnasio_protypa_sched.pdf and also http://www.moec.gov.cy/technikes_ypiresies/protypa/schediasmos_scholeio/lykeio_protypa_sched.pdf.

Teacher desk		
Student chair		
Teacher chair		
Blackboard		

The school model was based on the design of the free 3D Sketchup school building model[9] that was available at the 3D Warehouse webpage during the year 2015 (figure 5-

[9] The photographs of the Sketchup Model School Building are available in the following webpage: https://studiomugenjohncel.wordpress.com/2013/02/17/free-sketchup-model-school-building-extreme-high-detail-with-interior-%E8%A9%B3%E7%B4%B0%E3%81%AA%E6%A0%A1%E8%88%8E-for-use-with-oelvn-projects/

12). Several modifications have been made so that the school model responds to the needs of the current research (figure 5-13).

Figure 5-5: Sketchup Model School Building

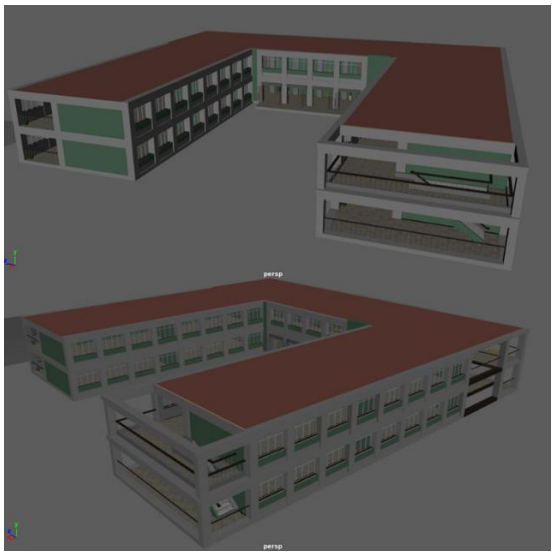


Figure 5-6: 3D school building model designed using Maya

5.4.2 The real-life based classroom environment: Interface design

Every virtual environment has an interface that deals with the way the content is presented to the user (Sherman & Craig, 2003). The user interface is '*the access point through the boundary between the recipient and the virtual world'* (Sherman & Craig, 2003, p. 51). Hence the user interface affects the way the virtual world is designed to achieve the connection of the user with the virtual world.

The design of the classroom environment was of paramount importance as the aim was to maximize the quality of the VR experience of the users and achieve high levels of sense of presence. At first, it was decided that the design of the virtual classroom should

be a replica of the physical classroom. For this reason, the 3D models of the virtual classroom were designed based on the physical ones and a great amount of effort was put to present the same characteristics (table 5-2).

Table 5-2: Real classroom and 3D classroom in Maya software

Real classroom environment	*3D classroom environment in Maya*

5.4.3 Imaginary classroom environment 3D models

As already mentioned, involving education experts was a key priority of the current research. Hence, during the design of the system, there was close collaboration with the target group. The design of the virtual space begun with the development of the real-life based classroom, to provide end-users a familiar virtual space. However, education experts involved during the development phase expressed the opinion that the virtual world should not be like the real classroom setting but more imaginary and fantasy-based. The reason for that relates to the fact that teachers spend many hours within the school and classroom environment, thus, within a virtual space where they could be trained after their working hours, they wanted an entirely different environment that would not remind them of their classroom. Teachers involved were divided with some asking for a real-life based and realistic environment and some others asking for an imaginary space. This differentiation had an impact on the development of the virtual space as it was decided to develop also an imaginary space, and investigate possible differences compared to the real-life based VR space.

The design of the imaginary virtual classroom environment was based on the suggestions provided by historian E.S., who is also a researcher focusing on game-based learning. He suggested that the ideal classroom would be in direct contact with nature and many colors. Moreover, he suggested that student's desks should be semicircular that would allow them to work alone and collaboratively depending on the task. Based on his suggestions the imaginary classroom was designed into Maya and it was inspired by greenhouses that are in direct contact with nature. Figures 5-16 and 5-17 present the imaginary classroom in Maya.

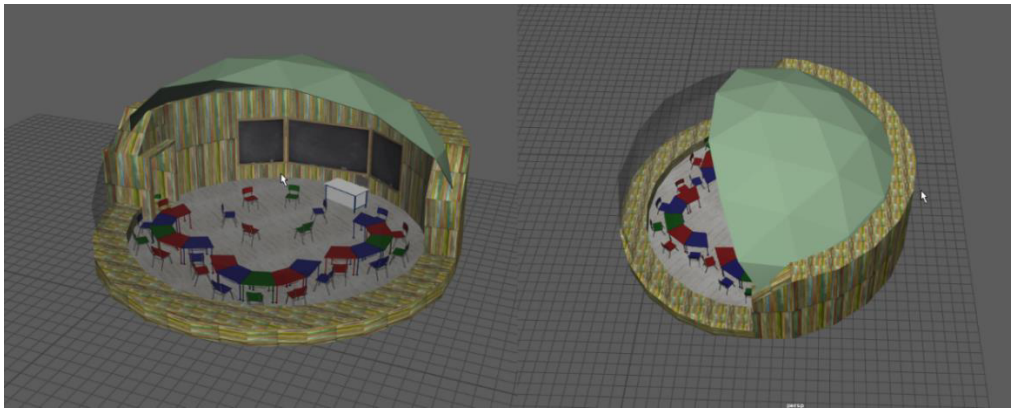


Figure 5-7: Imaginary classroom space during the development in Maya software

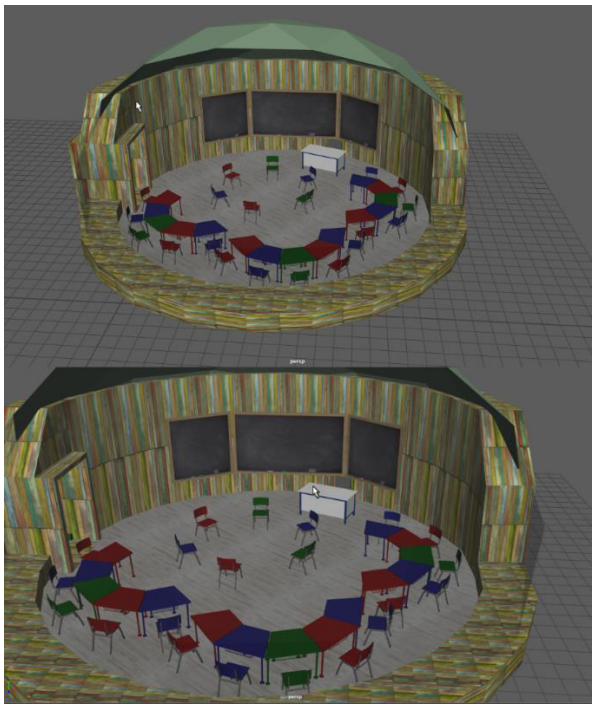


Figure 5-8: Imaginary classroom space during the development of Maya software

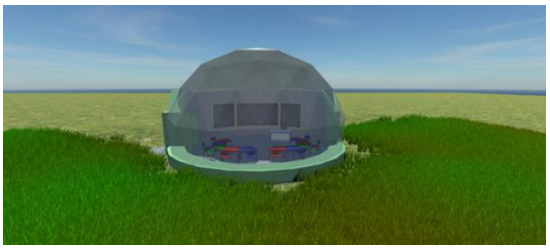
The desks were designed to be semicircular (figure 5-17), yet they can be divided into five individual desks. Three different colors were used for students' desks (red, blue, and green), after suggestions from E.S., who was actively involved in the development process, making significant comments that led to modifications and finalization of the 3D models. It should be noted that the suitability of the real-life based virtual classroom and the imaginary virtual classroom was evaluated during the evaluation process. Experiment 1 that is presented in chapter 6 investigated the impact of both VR environments, while the outcomes led to another survey that aimed to investigate participants' preferences regarding the design of the virtual space that is also presented in the second part of chapter 6.

5.4.4 Unity development of the VR app

Tutor VR application was developed using the Unity game engine (https://unity.com/) free version. Unity is a cross-platform game engine, that will also allow in the future the VR app to be easily exported onto Android making its use easier. It is a user-friendly environment to develop a VR application, providing many features even in the free version. Moreover, another reason that Unity was selected has to do with the guidance provided thought the webpage, with training sessions and multiple examples, while there is a very strong community providing also significant guidance if needed during the development phase. C-sharp was used as the programming language, as unity supports it.

All the models related to the school and classroom environment (desks, classrooms, etc.) were designed with Maya software free version for students (https://www.autodesk.com/education/free-software/maya). The models were imported within Unity and placed on the scene. Initially, two different virtual spaces were developed: 1) the real-life based school space with the real-life based classroom and 2) the fantastic virtual classroom space (table 5-2).

Table 5-3: Real-life based and fantastic virtual environments

Real-life based school space	*Fantastic virtual school space*
Outdoor space	*Outdoor space*
	
Indoor virtual classroom space	*Indoor virtual classroom space*

5.5 Conclusions

This chapter presented the framework for the design and development of the 3D virtual space. The design of the necessary assets for the virtual world was an important phase as the VR environment should be designed in a way to capture user's attention, increase motivation and engagement and provide users a unique VR experience. Initially, the design of the virtual school and classroom space aimed to be an accurate representation of a real classroom, however, along the way user input pointed out another path to follow towards the design of an imaginary virtual space. The following chapter presents the first experiment that aimed to investigate the use of the two different virtual worlds designed (real-life and fantastic), reveal potential differences, and provide feedback that would determine the next steps regarding the appearance of the final virtual space of the application.

6 Investigating the impact and appearance of virtual environments on the users

This chapter deals with the primary evaluation of the VR prototype used for teacher training. Among other factors, special consideration is given to the impact of the appearance of a virtual environment, on the overall user experience. The chapter is divided into two sub-sections. The first sub-section presents an investigation related to VR-based classroom training versus physical classroom training. This section presents the experimental design, the objectives and the research questions, the scenario while it describes in detail the methodological design of the research, the techniques and instruments used, the sampling method, and the procedure followed. The second sub-section presents a survey that aimed to investigate users' preferences regarding the design of the virtual environment. Based on the outcomes of the first experiment and considering education experts' needs regarding the appearance of the virtual space, a survey was carried out aiming to provide feedback that would determine the optimum appearance of the virtual space for the future experiments and the final VR application. Along these lines, the second sub-section presents the research questions, the sampling method, the instrument used, the process that was followed along with the survey outcomes.

6.1 Investigating the impact of virtual classroom training versus physical classroom training – Experiment 1

6.1.1 Experimental Research design

The experimental strategy was used to test the idea of using VR-based approaches as part of practical training instead of using traditional real-time physical methods. The experiment aimed to determine whether the participants who experienced VR training performed better than those who did not experience the virtual space training. The experimental design was selected as an initial evaluation method due to its potential to provide useful information about the VR application that was still under design and development (Ross & Morrison, 2004). Hence, the VR evaluation would provide significant insight related to whether the use of VR-based approaches is more effective compared to traditional approaches, that would determine future modifications and the

course of the research. The type of true experimental research design was chosen as the most suitable for the current experiment, while statistical analysis was also used to obtain the results (Robson, 2003; Ross & Morrison, 2004). The experimental design is a three-group post-test only experiment, with two experimental groups that used VR and a control group that did not use the VR system (Robson, 2003). The reason for having two experimental groups is associated with the existence of two different virtual classroom spaces (real-life based appearance and imaginary appearance that will be explained in sub-section 5.5.3) that needed to be tested to determine participants' preferences regarding the design of the virtual world. Additionally, as the true experimental design was used, the participants were randomly distributed between the three groups, which is also the main characteristic of the method (Cohen et al., 2002; Robson, 2003).

6.1.2 The objective and research questions

The main objective of this initial experiment was to investigate whether the use of VR technology is more effective for training purposes when compared to traditional teaching within the real physical space. Equally important was to evaluate the virtual environments developed, real-life based and fantastic, and investigate possible differences and participant's preferences towards the two environments. Additionally, of paramount importance was the investigation of the levels of presence in both three setting -real-life based virtual classroom environment, fantastic virtual classroom environment, physical classroom- as '*the feeling of presence gives users the subjective impression that the virtual environment in which they are immersed really exists*' (Bouchard, 2010, p. 24). The higher levels of sense of presence the participants feel, the more likely they will behave within the VR space as if they were in real space (Wiederhold & Riva, 2013).

Another important aspect of the research was to investigate the impact of the VR intervention on participants' emotions and mood states, as emotions are highly related to the sense of presence. Finally, another aim of this initial experiment was to investigate the possibility of enhancing empathy and reflection skills on the participants.

To meet the above objectives the following research questions were formed:

Primary objectives:

RQ 1. To what extent did participants feel present in a virtual classroom environment that resembles a real-life class?

RQ 2. To what extent did participants feel present in a virtual classroom environment that resembles an imaginary class?

RQ 3. Is the use of VR-based approaches more effective for training purposes when compared to traditional physical training?

Secondary objectives:

RQ 4. To what extent did the VR intervention affect participants' emotional state?

RQ 5. To what extent did the VR intervention affect participants' empathy?

RQ 6. To what extent did the VR intervention affect participants' reflection?

The above objectives and research questions were addressed using a questionnaire as the instrument to collect the data. Furthermore, an electroencephalogram (EEG) device was also used to record brain activity and investigate possible differences between training via VR and training within the physical classroom space (Baka et al, 2018). Moreover, the EEG device aimed to investigate whether there was a difference in the participant's brain activity regarding the two VR classroom setting developed (real-life based and fantastic virtual environment). The research questions that the use of the EEG device aimed to investigate was the following (Baka et al., 2018):

RQ 1. Is the VR itself able to activate specific regions of the brain, influencing behavioral, motor, or other functions?

RQ 2. Does the design of the virtual environment play a role? Which should be the most suitable features for a VE to be able to trigger desired functions and behaviors?

RQ 3. How much time does the brain need to adapt to a VE? Consequently, which is the minimum duration that a virtual task must have to be effective?

6.1.3 Classroom scenes

As part of this initial experiment three different classroom scene settings were used (figure 6-1):

1. *Virtual Environment with Realistic Appearance*: System design requires considering the target group that will use it and a major concern when designing is to develop a system that is enjoyable and easy to learn and effective to use. Thus, an important

aspect that had to be taken into consideration for the design of the virtual classroom was the resemblance of the scene to a real classroom, to create the users a strong sense of presence in the virtual environment. For this reason, the 3D models of the virtual classroom were designed based on real classrooms as previously explained in sub-section 5.4.2.

2. *Virtual Environment with Imaginary Appearance*: During the development of the VR system teachers expressed the opinion that the virtual world should not be like the real classroom setting because as they spend many hours within their real classroom that they would prefer the virtual world to be different. Therefore, taking into consideration teachers' opinions a second virtual environment was developed as previously explained in sub-section 5.4.3.
3. *Physical (Real) Class Environment:* A physical classroom space was also used for the current experiment. The initial thought was to conduct the experiment in a secondary education classroom. However, because of the difficulty in transporting the electroencephalogram (EEG) device used in the experiment, the experiment was conducted in a lecture room at the University of Geneva.

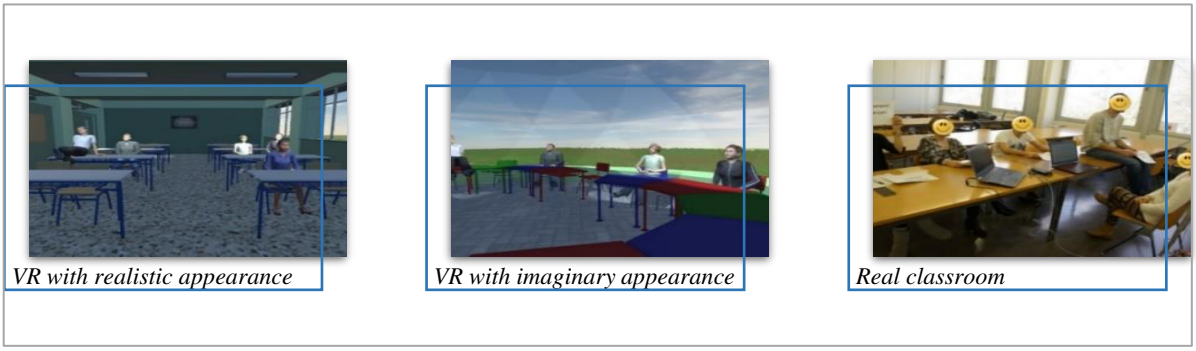


Figure 6-1: The three different classroom scene settings

6.1.4 The groups

Three groups participated in the experiment, each consisting of 11 participants and each experienced a different classroom setting among the ones described above. The first group, Virtual Realistic group (VR.group) executed all the tasks in a Virtual Environment based on a real classroom setting. The second group, Virtual Imaginary group (VI.group) executed the tasks in the Virtual Imaginary classroom Environment. Finally, the third group, Physical Space group (PS.group) experienced the same scenario

in a Physical classroom at the university. The three groups and the classroom setting that they experienced are presented in figure 6-2.

Figure 6-2: The three groups categorization based on the classroom setting

6.1.5 The scenario

The scenario had to do with multiculturalism and verbal bullying in a typical school classroom environment represented within the virtual world. The scenario begins with the teacher inside the classroom together with five students. The teacher introduces a new foreign student called Lynn to the classroom. Following her introduction to the class, Lynn receives verbal bullying from her Caucasian classmates. The complete dialogue for the first scenario is presented in figure 6-3.

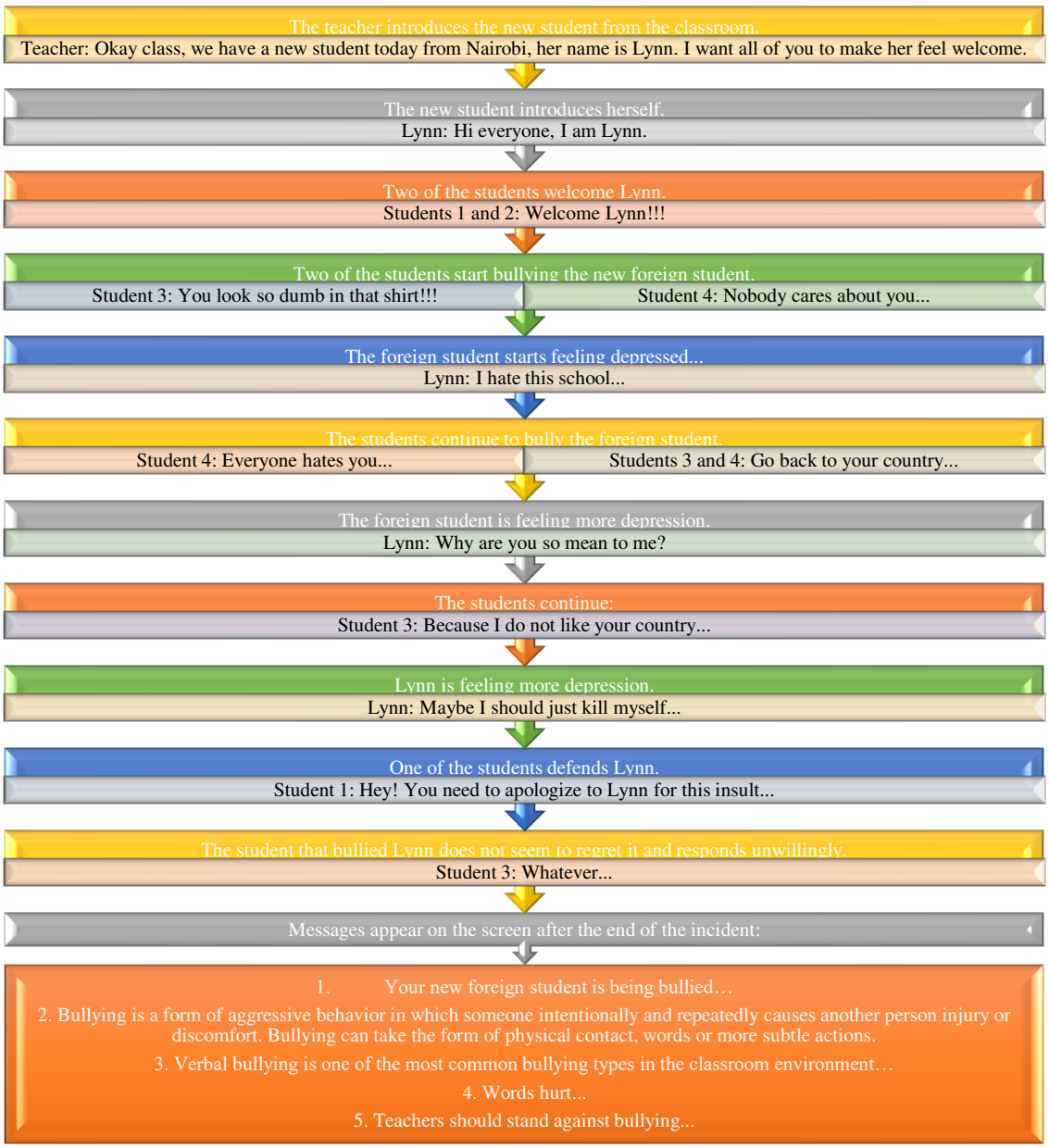


Figure 6-3: The dialogue system of the scenario

6.1.6 The perspectives

The user-teacher views the scenario from two different perspectives:

Perspective I: Through the eyes of the foreign student-Lynn (figure 6-4).

Perspective II: Through the eyes of the teacher (figure 6-5).

The scenario and the dialogues were the same at both perspectives, the only difference was the camera position allowing the user to observe the bullying incidents initially

through the eyes of the student (Perspective I) and then through the eyes of the teacher (Perspective II). Moreover, to maximize the sense of presence, users could see some part of their virtual selves, their hands, body, and legs, to create a convincing illusion that they were part of the virtual classroom world.

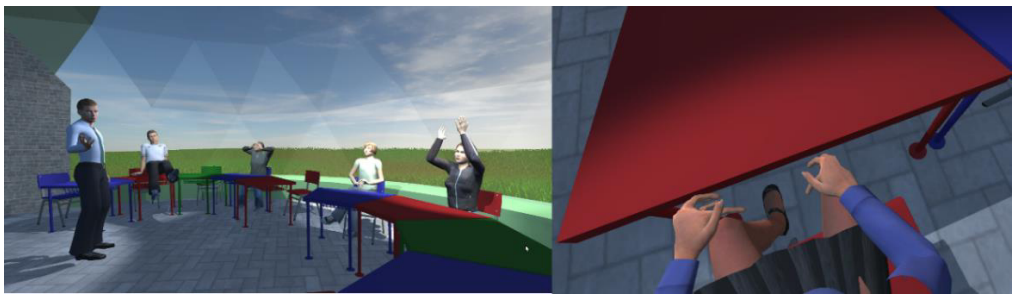


Figure 6-4: (Left) Through the eyes of the student in the imaginary virtual classroom environment, (Right) Student avatar body

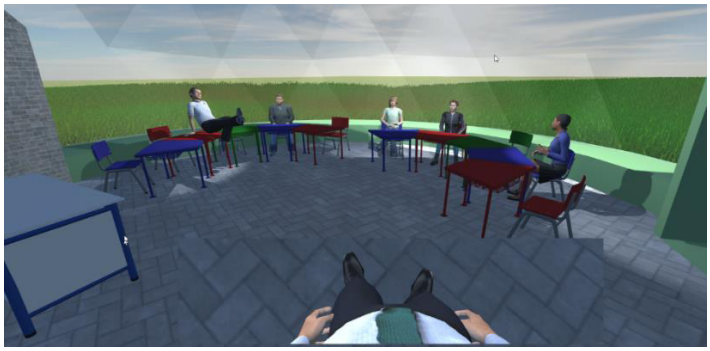


Figure 6-5: Through the eyes of the teacher in the imaginary virtual classroom environment and teacher avatar body

6.1.7 Application design and development

In this sub-section, the overall process of developing the VR application is explained in detail.

6.1.7.1 The avatars of the virtual students and teachers

3D avatars of the virtual students were developed with Autodesk® Character Generator (https://charactergenerator.autodesk.com/). Figure 6-6 presents all the avatars developed for the needs of the first experiment.

Figure 6-6: Students' avatars used in experiment 1

6.1.7.2 The sequence of scenes in the VR application

Several scenes were developed that were built differently for the two groups that experienced the virtual classroom spaces. Both groups experienced five scenes, but the virtual classroom was different as group 1 experienced the classroom with a realistic appearance and group 2 experienced the imaginary virtual classroom. The sequence of scenes presented to users from each group is in figure 6-7.

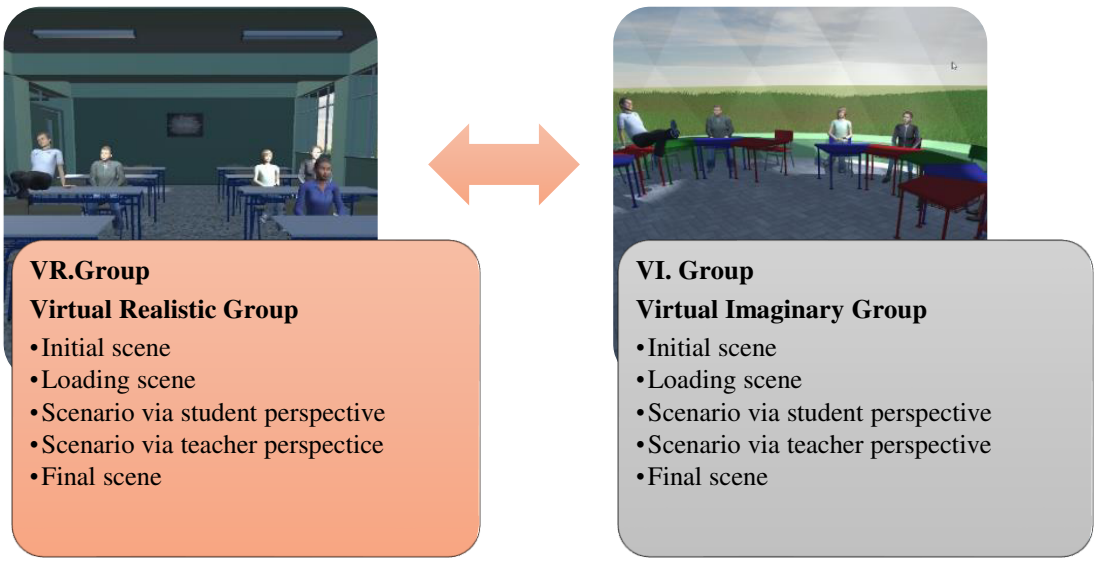


Figure 6-7: Application scenes sequence per group

The application begins with an initial scene that is common for the two groups aiming to welcome the users to the application that at that time was called 'MENTor' (figure 6-8). The two avatars represent the teachers, yet at that point, the participants could not

choose the gender of the virtual avatar. All the participants experience teacher's perspective as a male that was randomly selected, as at that point the most significant issue was to identify whether the virtual environment could provoke a sense of presence.

Figure 6-8: Initial scene to welcome the users in the VR application

After the initial scene, there was a loading scene (figure 6-9).

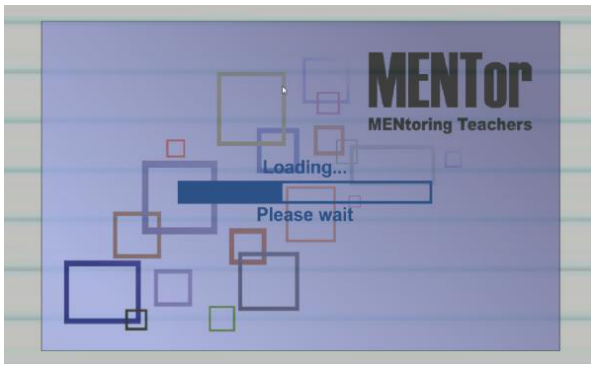


Figure 6-9: Loading scene

Then the main scenario scene begins with the participants being in the position of the teacher, introducing the new foreign student called Lynn to the rest of the classroom (figure 6-10), and after few seconds she starts receiving verbal bullying (figure 6-11). After the end of the scenario scene through the teacher's perspective another scene begins and this time the user experiences the same scenario through the perspective of the foreign student (Lynn) (figure 6-12), receiving verbal bullying from some of the classmates (figure 6-13).

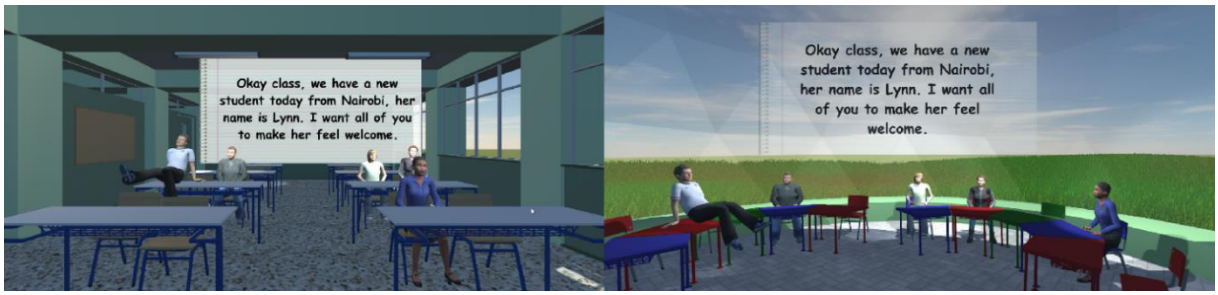


Figure 6-10: Opening of the scenario in the VR with realistic appearance (left) and the VR with fantastic appearance (right) via teacher perspective

Figure 6-11: Verbal bullying in the VR with realistic appearance (left) and the VR with fantastic appearance (right) via teacher perspective

Figure 6-12: Opening of the scenario in the VR with realistic appearance (left) and the VR with fantastic appearance (right) via student perspective

Figure 6-13: Verbal bullying in the VR with realistic appearance (left) and the VR with fantastic appearance (right) via student perspective

After the end of the main scenario scene from both perspectives, the VR app had the initial scene as the final scene (figure 6-8).

At this development stage, the VR prototype did not have sound to the students, thus users had to read the texts appearing on the screen. Moreover, there was no interaction during the scenario as the main aim was to investigate possible differences and sense of presence between the two environments that would determine the choice of the most appropriate virtual environment for further modifications. Moreover, another objective was to investigate possible differences between the VR and physical training that would determine whether there was a potential of using a VR-based approach. Hence, during the initial development stages, it was decided not to include user interaction so that the main parameter under investigation is the class environment.

6.1.7.3 VR equipment used

To create a realistic immersive experience for the participants, Head Mounted Displays and specifically VIVE virtual reality system was used as a means of viewing the application (see figure 6-14). VIVE is a highly immersive device that can provide a unique first-person perspective to the user (https://www.vive.com).

Figure 6-14: Use of VIVE during the experiments

6.1.8 The Physical (Real) Class Environment

The current experiment aimed to investigate possible differences between VR and physical classroom training. Hence, some of the participants were trained in the physical classroom space and did not use the VR environment. The overall setting and scenarios for both the physical and virtual classroom training were similar thus the participants of the physical class were trained using the scenario described in section 6.1.5. Each participant was given a role according to the scenario. It should be noted that the VR prototype was at an early stage and there was no sound at that point. In this context, to

provide a similar experience, participants of the physical class did not talk, so as not to have the audio factor to none of the trainings (VR and physical). Instead, the participants were given printed labels and according to the scenario they were using the appropriate label (figure 6-15). The participants during the physical training also changed perspectives and experienced the scenario both from the perspective of the teacher and the student (figure 6-16) in a similar manner as in the VR class scenario.

Figure 6-15: Using printed labels during the physical training

Figure 6-16: (left) Students' perspective; (right) teachers' perspective

6.1.9 The instruments

a. EEG device

A combination of instruments was used to evaluate the VR system. An electroencephalogram (EEG) was used during the experiment to measure the sense of presence as it is considered to be one of the most reliable techniques for presence measurement (Wiederhold & Riva, 2013). In several research studies, EEG devices have been used as a method of measuring presence in the VR environment (Wiederhold

& Riva, 2013). The frontal and parietal areas of the brain have been proven to play an important role in the experience of presence (Wiederhold & Riva, 2013). The focus of the research was to identify possible changes from the beta-wave state (13-25Hz) to the alpha-wave state (8-12Hz) that has been proven to be associated with the sense of presence in virtual environments (Baumgartner et al., 2006; Clemente et al., 2014). Beta-wave state is associated with focus, concentration, active thinking, high alertness, anxiety, active attention and focus on the outside world (Calore et al., 2012; Hondrou & Caridakis, 2012). On the other hand, alpha brain waves are in the middle of the brain wave spectrum and according to Brainworks neurotherapy (2019), they are '*the power of now', being here, in the present. Alpha is the resting state of the brain. Alpha waves aid overall mental coordination, calmness, alertness, mind/body integration and learning*' (https://brainworksneurotherapy.com).

The EEG signal was monitored by using BIOSEMI Active Two 64 channel amplifier system (figures 6-17 and 6-18) (https://www.biosemi.com/). BIOSEMI was selected because it can provide reliable measurements. Active electrodes were used in association with a headcap, on which '*64 electrodes were attached according to 10-20 system at the locations Fp, AF, F, FT, FC, T, C, TP, CP, P, PO, O, I based on BIOSEMI layout and referenced to Cz. BIOSEMI's acquisition program, ActiveView, was used to record the data with electrode impedance < 5kΩ and sample rate 2048 Hz*' (Baka et al., 2018).

The only limitation of BIOSEMI for the current research is that it is not a wireless device, that led to restrictions to body movements. During the experiment, all the participants were sitting to limit movements to a degree that was allowed by the EEG connecting wires. Adjusting the VR headset while the participants were wearing BIOSEMI was difficult enough, as the headset was pressing electrodes the slightest movement could interrupt EEG recording (figure 6-19).

Figure 6-17: BIOSEMI Active Two device 64 channels used during the experiment

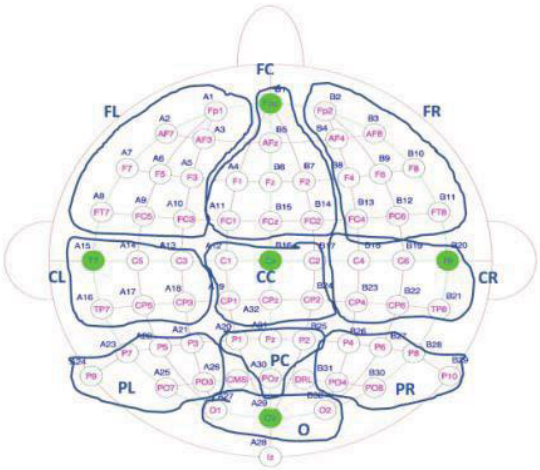


Figure 6-18: 64 channel layout (image taken from BIOSEMI Active Two Operating Guidelines), 10 Regions of Interest, separated according to the brain areas we wanted to examine: FL = Frontal left, FC = Frontal center, FR = Frontal right, CL = Central left, CC = Central center, CR = Central right, PL = Parietal left, PC = Parietal center, PR = Parietal right, O = Occipital (Figure from Baka et al., 2018)

Figure 6-19: Placing BIOSEMI to one of the participants

b. Questionnaire

After the experiment, the participants had to answer a questionnaire. There were two questionnaires, one for the two groups that used the VR application (appendix B-6-1) and one for the group that did not use the VR tool and were trained in the real classroom setting (appendix B-6-2). The only difference between the two questionnaires, was the scale that evaluated the sense of presence, as the sense of presence can only be measured in the virtual space. Thus, this scale was not included in the questionnaire administered to the participants of the physical space group.

The questionnaire for the two VR groups consisted of five parts (see appendix B-6-1). The first part consisted of a set of questions regarding participants' demographic data (country, gender, age, teaching experience, level of education in which they serve, experience in using VR). The second part aimed to evaluate the sense of presence. Presence in VR systems is measured by dedicated questionnaires, which are beneficial to the development of the theories on the sense of presence (Schuemie et al., 2001). However, Schuemie et al. also argue that many questionnaires that have been used in research have been proven unreliable. For this reason, Igroup Presence Questionnaire (IPQ)was used, which is a reliable and validated questionnaire consisting of 14 items to measure presence (http://www.igroup.org). IPQ items are divided to different presence components that were identified in the factor analyses and are one G=General item, five items for SP=Spatial presence (that evaluates the sense of being physically present in the VE), four items for INV=Involvement (measuring the attention devoted to the VE and the involvement experienced), and three items for REAL=Experienced Realism (assessing participant's evaluation of the levels of realism of the VE) that are presented in table 6-1 below.

Table 6-1: The sub-categories of IPQ questionnaire (retrieved from www.igroup.org)

IPQ item name	**IPQ question**
G	8. In the computer-generated world, I had a sense of 'being there'
SP1	9. Somehow, I felt that the virtual world surrounded me.
SP2	13. I felt like I was just perceiving pictures.
SP3	6. I did not feel present in the virtual space.
SP4	3. I had a sense of acting in the virtual space, rather than operating something from outside.
SP5	10. I felt present in the virtual space.
INV1	1. How aware were you of the real world surrounding while navigating in the virtual world? (i.e. sounds, room temperature, other people, etc.)?
INV2	7. I was not aware of my real environment.

INV3	11. I still paid attention to the real environment.
INV4	14. I was completely captivated by the virtual world.
REAL1	5. How real did the virtual world seem to you?
REAL2	4. How much did your experience in the virtual environment seem consistent with your real-world experience?
REAL3	2. How real did the virtual world seem to you?
REAL4	12. The virtual world seemed more realistic than the real world.

The empathy scale consisted of items based on other empathy scales with several modifications, as none of them responded to the needs of the current research. Table 6-2 presents the questions of the empathy scale and the source for each question.

Table 6-2: Empathy scale items

Empathy scale items	**Item source**
A teacher should be able to predict the feelings of his/her students	QCAE Questionnaire of Cognitive and Affective Empathy (Reniers et al., 2011)
A teacher should be able to spot when a student is feeling awkward or uncomfortable.	QCAE Questionnaire
A teacher should try to look at every student's side of a disagreement before making a decision.	QCAE Questionnaire
A teacher should try to understand the students better, by imagining how things look from their perspective.	QCAE Questionnaire
Teachers sometimes find it difficult to see things from the student's point of view.	QCAE Questionnaire
Teachers often get emotionally involved with the students' problems.	QCAE Questionnaire
A teacher should try to imagine how he/she would feel in the students' situation.	Empathy Formative Questionnaire (Gaumer et al., 2018)

Teachers should not be really interested in how students feel.	Toronto Empathy Questionnaire
A teacher should be upset when his/her students are being treated disrespectfully.	Toronto Empathy Questionnaire
A teacher should feel supportive of students of other racial and ethnic groups.	Scale of Ethnocultural Empathy
It is difficult for a teacher to put himself/herself in the position of someone who is racially and/or ethnically different.	Scale of Ethnocultural Empathy (SEE) (Wang et al., 2003)

The reflection scale was also developed based on questions of other validated questionnaires with several modifications, as none of the existing scales responded to the needs of the current research. Table 6-3 presents all items from the reflection scale.

Table 6-3: Reflection scale items

Reflection scale items	**Item source**
Teachers should spend time in self-reflection.	Self-Reflection and Insight Scale (SRIS) (Grant et al., 2002)
This experience within the VR environment regarding multiculturalism and bullying can challenge some of teachers' firmly held ideas.	Reflection Questionnaire (Kember et al., 2000)
A teacher should not really be interested in analyzing students' needs.	
The use of this VR experience can change the way teachers will attend to the needs of the students.	
This VR experience can help teachers change the way they will react to disruptive behavior among my students.	Teachers' self-efficacy scale (Bandura, 2006)
This VR experience can help teachers discover faults in their teaching style or their interaction with students that he/she previously believed to be right.	Reflection Questionnaire (Kember et al., 2000)

Because of this VR experience, teachers will try more frequently to enter their students' position.	QCAE Questionnaire
Because of this VR experience, teachers will support more students of other racial and ethnic groups.	Scale of Ethnocultural Empathy (SEE) (Wang et al., 2003)

The last part of the questionnaire incorporated items that aimed to measure participants' emotions and mood state after the use of VR. The emotion and mood states scale, used in the experiment, was based on the PANAS X scale by Watson and Clark (1994). PANAS X consists of several words and phrases that describe different feelings and emotions. However, the scale has many categorizations, that did not respond to the aims of the current research. Hence, only some of the scale items were used that responded to the needs of the current research. The categorization that was used based on PANAS X is presented to the following figure 6-18.

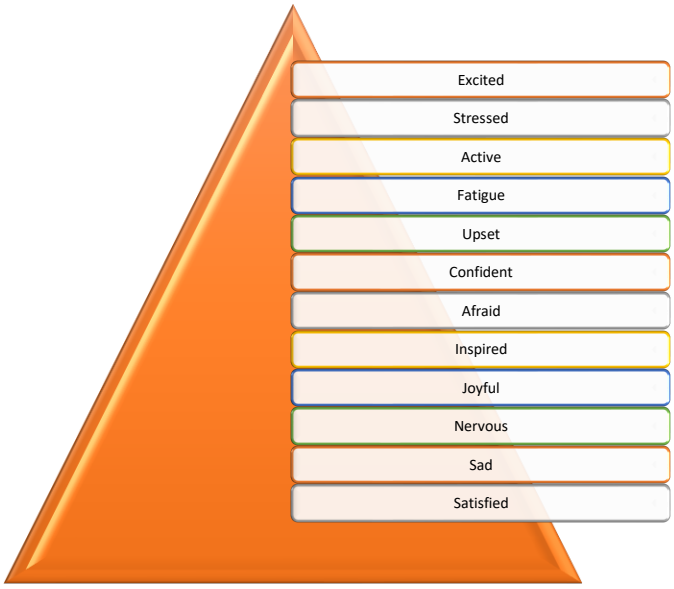


Figure 6-20: The emotions scale

6.1.10 Sampling technique and limitations

During this first experiment probability sampling methods were used, and a more particularly volunteer sampling technique. A detailed description of the technique is presented in chapter 3 (section 3.9).

6.1.11 The procedure

The first pilot test for the evaluation of the prototype application took place in Geneva at MIRALab at the University of Geneva in December 2017. Once the participants arrived at the lab, they were informed both orally and in written form about the objectives of the experiment and particularly about the process of placing the EEG device that needed approximately 10 to 15 minutes. It is noted that to ensure the conductance of the EEG sensors a gel had to be placed on the user's head. The gel was a deterrent factor especially for women with long hair and many of them refused to participate. The participants were assured that they had the right to withdraw at any time and for no reason. After voluntary informed consent was obtained (appendix B-6-3), the scenario was explained to the participants with more details. Then the EEG headcap was placed along with all the electrodes, and once there was a connection with brain signals, the VR headset was placed with caution so as not to affect the electrodes, and then the experiment began. After the end of the experiment, the participants were asked to complete the questionnaire.

6.1.12 Data analysis

6.1.12.1 The groups

After the data has been collected, they were analyzed using SPSS software (Statistical Package for Social Sciences). Before the presentation of the SPSS results, there is a need to clarify the names of the groups. Three groups participated in the experiment, each consisting of 11 participants:

- the first group, ***Virtual Realistic group (VR.group)*** executed all the tasks in a virtual environment based on a real classroom setting;
- the second group, ***Virtual Imaginary group (VI.group)*** executed the tasks in a virtual imaginary classroom environment;
- the third group, ***Physical Space group (PS.group)*** experienced the same scenario in a physical classroom with real students.

Thus, the coding name in the analysis will be VR.group, VI.group, and PS.group.

6.1.12.2 Questionnaire reliability analysis

Reliability '*refers to the consistency of the results'* (Foster, 1998, p. 202). An important part of the research and a major concern for every researcher is the reliability of the instrument that is used for the data collection (Cohen et al., 2007). One of the most widely used indicators of reliability is Cronbach's alpha or internal consistency coefficient that was estimated from Cronbach (1951). The value of Cronbach's alpha varies from 0 to 1. Where the higher the value of the coefficient alpha is the greater the internal reliability. An alpha coefficient >0.7 indicates a reliable questionnaire, values between 0.80-0.90 indicate a are highly reliable questionnaire and values >0.90 indicate a very highly reliable (Cohen et al., 2007).

Reliability analysis was conducted on presence scale items. The results revealed that the overall alpha is 0.715>0.7 indicating the reliability of the variables (table 6-4).

Table 6-4: Reliability analysis for presence scale

Cronbach's Alpha	N of Items
.715	14

Reliability analysis was conducted on the variables of the empathy scale. According to the results, the overall alpha is 0.593<0.7 indicating low reliability of the variables. Although Cronbach's Alpha indicates low reliability, Nunnally (1967) (in Gilbert & Churchill, 1979), suggests that for early stages of basic research reliabilities of .50 to .60 can be accepted. Therefore, as this was the initial stage of the research based on Nunnallys' suggestions the alpha could be accepted. However, the values of Cronbach's alpha if item deleted, reflected a significant change in Cronbach's alpha if the questions '8. Teachers should not be really interested in how students feel' and '9. A teacher should be upset when his/her students are being treated disrespectfully' are deleted, increasing the alpha reliability to 0.716 which is >0.7 indicating the reliability of the variables. Therefore, items 8 and 9 were deleted increasing reliability (table 6-5).

Table 6-5: Cronbach's Alpha for empathy scale

Cronbach's Alpha	N of Items
.716	9

Reliability analysis was conducted on the variables of the reflection scale. According to the results (table 6-6), the overall alpha is 0.88<0.7 indicating the high reliability of the variables. The values of Cronbach's alpha if item deleted, reflected a small change in Cronbach's alpha if item '1. Teachers should spend time in self-reflection' or item '3. A teacher should not really be interested in analyzing students' needs', which would increase the alpha to 0.9 which is very high reliability. However, as Cronbach's alpha is already high the items were not deleted.

Table 6-6: Cronbach's Alpha for reflection scale

Cronbach's Alpha	N of Items
.885	8

Reliability analysis was conducted on the variables of the emotional scale. According to the results (table 6-7), the overall alpha is 0.88<0.7 indicating the high reliability of the variables. The values of Cronbach's alpha if item deleted did not reflect enormous changes in Cronbach's alpha if items are deleted.

Table 6-7: Cronbach's Alpha for emotional scale

Cronbach's Alpha	N of Items
.889	12

6.1.12.3 The sample – descriptive statistics

A total number of 33 participants (n=33) took part in the experiment all from the higher education section. From the 33 participants, 66.6% (n=22) were male and 33.3% (n=11) were female (table 6-8). The reason for the low percentages of women is related to the fact that the EEG device was used, and several female volunteers refused to use the EEG device to avoid the placement of the conducting gel on their hairs.

Table 6-8: Distribution of the sample for the variable gender

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	Male	9	81.8	81.8
		Female	2	18.2	100.0
		Total	11	100.0	

VI.group	Valid	Male	7	63.6	63.6
		Female	4	36.4	100.0
		Total	11	100.0	
PS.group	Valid	Male	6	54.5	54.5
		Female	5	45.5	100.0
		Total	11	100.0	

According to table 6-9 most of the respondents, 63.6% (N=2), were aged from 25 to 29 years old. 27,3% (N=9) were aged from 30 to 39 years old, while two (N=2) of the participants were aged from 50 to 59 years old and one (N=1) was aged from 18 to 24 years old.

Table 6-9: Distribution of the sample for the variable age

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	18-24	1	9.1	9.1
		25-29	7	63.6	72.7
		30-39	2	18.2	90.9
		50-59	1	9.1	100.0
		Total	11	100.0	
VI.group	Valid	25-29	6	54.5	54.5
		30-39	4	36.4	90.9
		50-59	1	9.1	100.0
		Total	11	100.0	
PS.group	Valid	25-29	8	72.7	72.7
		30-39	3	27.3	100.0
		Total	11	100.0	

Relative to teaching experience there are differences between the three groups (table 6-10). As far as VR.group is concerned, 36.4% (N=4) of the participants claimed to have 1-2 years of teaching experience, and 36.4% (N=4) claims to have no experience at all. Two of the participants (N=2) claimed that the current semester they teach for the first time at the University while one participant has over six years of teaching experience.

Regarding VI.group, nearly half of the sample (45.5%, N=5) have teaching experience from 1 to 2 years, 27.3% (N=3) have teaching experience between 3 to 5 years, one participant has over of six years of teaching experience, one has over 20 years of teaching experience and one has no experience at all.

Regarding PS.group, most of the participants (36.4%, N= 4) have teaching experience between six to ten years, 27.3% (N=3) have teaching experience between 1 to 2 years, 18.2% (N=2) have teaching experience between 3 to 5 years, and 18.2% (N=2) claimed that they teach for the first time.

Table 6-10: Distribution of the sample for the variable teaching experience

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	Not at all	4	36.4	36.4
		First time	2	18.2	54.5
		1-2 years	4	36.4	90.9
		6-10 years	1	9.1	100.0
		Total	11	100.0	
VI.group	Valid	Not at all	1	9.1	9.1
		1-2 years	5	45.5	54.5
		3-5 years	3	27.3	81.8
		6-10 years	1	9.1	90.9
		Over 20 years	1	9.1	100.0
		Total	11	100.0	
PS.group	Valid	First time	2	18.2	18.2
		1-2 years	3	27.3	45.5
		3-5 years	2	18.2	63.6
		6-10 years	4	36.4	100.0
		Total	11	100.0	

Table 6-11 presents the distribution of the sample regarding the level of education in which they serve. In all three groups, most of the participants come from the higher education sector. In VR.group the majority of the participants (72.7%) come from

higher education, while 27.3% are university students. In the VI group, 54.5% of the participants are university students and 45.5% come from higher education. As far as PS.group is concerned, most of the participants (63.6%) come from higher education, 27.3% are university students and one participant claimed to be a Ph.D. candidate.

Table 6-11: Distribution of the sample for the variable Level of education in which you serve

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	Higher Education	8	72.7	72.7
		University student	3	27.3	100.0
		Total	11	100.0	
VI.group	Valid	Higher Education	5	45.5	45.5
		University student	6	54.5	100.0
		Total	11	100.0	
PS.group	Valid	Other: Ph.D. Candidate	1	9.1	9.1
		Higher Education	7	63.6	72.7
		University student	3	27.3	100.0
		Total	11	100.0	

Table 6-12 presents participants' experience in all groups regarding the use of VR environments. The results indicate that most of the participants were not familiar with the use of virtual reality as only one participant claimed to be 'very much' experienced in using the VR environment and two participants (6%) claimed to have 'much' experience in the use of VR. Most of the participants, 57.6% (N=19) had 'a little' experience in the use of VR, 6% (N=2) had 'moderately' experience in the use of VR and one participant had no VR experience at all.

Table 6-12: Distribution of the sample concerning the use of VR

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	Not at all	1	9.1	9.1
		A little	7	63.6	72.7
		Moderately	1	9.1	81.8

		Much	1	9.1	90.9
		Very much	1	9.1	100.0
		Total	11	100.0	
VI.group	Valid	Not at all	3	27.3	27.3
		A little	6	54.5	81.8
		Moderately	1	9.1	90.9
		Much	1	9.1	100.0
		Total	11	100.0	
PS.group	Valid	Not at all	5	45.5	45.5
		A little	6	54.5	100.0
		Total	11	100.0	

6.1.12.4 Sense of presence scale

This section presents the analysis of the results concerning presence scale items. The analysis of the presence scale includes descriptive statistics, test of normality, and non-parametric tests (see figure 6-19).

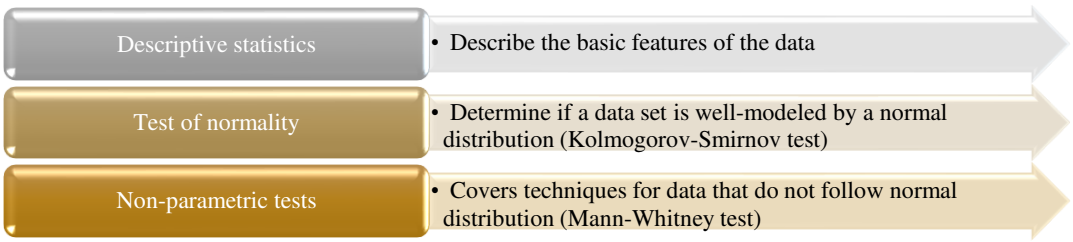


Figure 6-21: Tests carried out regarding the quantitative analysis of the presence scale items

The analysis of the presence scale items was used based on the instructions provided by the developers of the questioner.

The analysis of the presence scale items was used based on the instructions provided by the developers of the questioner.

6.1.12.4.1 Presence scale descriptive statistics

The presence scale was only administered to the participants who experienced the virtual reality environment. Hence, the following results concern only the two groups:

- Virtual Realistic group/VR.group
- Virtual Imaginary group/VI.group

I. Time in the virtual world

According to table 6-13, most of the participants in both groups claimed that their experience in the virtual world had a duration of approximately 5 minutes.

Table 6-13: Duration of time within the VR according to the participants

Q. How long did you interact with the virtual world (in minutes)?

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	4.0	1	9.1	9.1
		5.0	6	54.5	63.6
		8.0	1	9.1	72.7
		10.0	3	27.3	100.0
		Total	11	100.0	
VI.group	Valid	1.0	2	18.2	18.2
		2.0	1	9.1	27.3
		3.0	2	18.2	45.5
		4.0	1	9.1	54.5
		5.0	4	36.4	90.9
		8.0	1	9.1	100.0
		Total	11	100.0	

II. Perspective onto the virtual world

The analysis of the results regarding the perspective into the virtual world in the two groups, VR.group and VI.group, revealed that the majority of the participants (81.8%) understood correctly that within the virtual reality environment the users' viewpoint was first-person perspective (table 6-14). However, there were some participants (18.2%) that though the users' viewpoint was a third-person perspective.

Table 6-14: Participant's understanding of the perspective experienced within the virtual world

Q. What was your perspective onto the virtual world?					
GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	"Through the eyes of my own character", so-called first-person perspective	9	81.8	81.8
		"Behind/above my character", so called third-person perspective	2	18.2	100.0
		Total	11	100.0	
VI.group	Valid	"Through the eyes of my own character", so-called first-person perspective	8	72.7	72.7
		"Behind/above my character", so called third-person perspective	3	27.3	100.0
		Total	11	100.0	

III. Presence scale items

IPQ questionnaire includes 14 items. The scale development process according to the developers of the tool identified one G=General item, five items for SP=Spatial presence, four items for INV=Involvement, and three items for REAL=Experienced Realism as mentioned in section 5.5.7.4. The categorization of the 14 items is presented in the following table 6-15:

Table 6-15: IPQ items categorization based on igroup.org (http://www.igroup.org/)

Number	IPQ item name	shortcut		English question	English anchors
1	G1	sense of being there	PRES	In the computer-generated world I had a sense of "being there".	not at all--very much
2	SP1	sense of VE behind	SP	Somehow, I felt that the virtual world surrounded me.	fully disagree--fully agree

3	SP2	only pictures	SP	I felt like I was just perceiving pictures.	fully disagree--fully agree
4	SP3	not sense of being in v. space	SP	I did not feel present in the virtual space.	did not feel--felt present
5	SP4	sense of acting in VE	SP	I had a sense of acting in the virtual space, rather than operating something from outside.	fully disagree--fully agree
6	SP5	sense of being present in VE	SP	I felt present in the virtual space.	fully disagree--fully agree
7	INV1	awareness of real env.	INV	How aware were you of the real world surrounding while navigating in the virtual world? (i.e. sounds, room temperature, other people, etc.)?	extremely aware-moderately aware-not aware at all
8	INV2	not aware of real env.	INV	I was not aware of my real environment.	fully disagree--fully agree
9	INV3	no attention to real env.	INV	I still paid attention to the real environment.	fully disagree--fully agree
10	INV4	attention captivated by VE	INV	I was completely captivated by the virtual world.	fully disagree--fully agree
11	REAL1	VE real (real/not real)	REAL	How real did the virtual world seem to you?	completely real--not real at all
12	REAL2	experience similar to real env.	REAL	How much did your experience in the virtual environment seem consistent with your real-world experience?	not consistent-moderately consistent-very consistent
13	REAL3	VE real (imagined/real)	REAL	How real did the virtual world seem to you?	about as real as an imagined world--indistinguishable from the real world

14	REAL4	VE wirklich	REAL	The virtual world seemed more realistic than the real world.	fully disagree--fully agree

All items have a range from 0 to 6. The left endpoint of the scale is always 0, the right endpoint is always 6.

Regarding the general item that had to do with the sense of being there, the results revealed that participants felt a sense of being there in both groups (table 6-16). For VR.group the mean is 4.4 (SD= 1.29) and for the VI.group the mean is 3.6 (SD=1.86), which means that the participants of the VR.group tended to score from good to very good levels of sense of presence, while the participants of the VI.group tended to score from moderately to good levels of sense of presence. Appendix B-6-4 presents the descriptive statistics for the general item question, with the results indicating that most of the respondents in both groups scored positively towards the sense of being there in the virtual classroom setting.

Table 6-16: General item scores for both VR groups

GROUP			Q8. In the computer-generated world, I had a sense of 'being there'
VR.group	N	Valid	11
		Missing	0
	Mean		4.364
	Std. Deviation		1.2863
VI.group	N	Valid	11
		Missing	0
	Mean		3.545
	Std. Deviation		1.8635

Regarding spatial presence, the results indicate that participants of both groups felt moderately the sense of being physically in the virtual classroom space (table 6-17). For the question 'I felt that the virtual world surrounded me', the mean score is 3.6 (SD= 2.16) for VR.group and 3.5 (SD=1.64) for VI.group. The experience within the virtual world did not seem to the participants as simply perceiving pictures, as the mean scores indicate that the participants in both groups tend from disagree to strongly disagree. The

mean score for VR.group was 3.3 (SD= 1.68) and the VI.group was 3.9 (SD= 2.14). Although for the general item regarding the sense of presence the result revealed good levels of presence for the two groups, the question of no sense of being in the virtual space revealed the lower levels as for the VR.group the mean score 2.8 (SD= 1.68) indicates that participants tend from slightly to moderately feel of being in the virtual space, while for the VI.group the mean score 1.6 (SD= 1.51) indicates that participants tend from poor to slightly feel present in the virtual space. Moreover, according to the results the participants did not feel very active within the virtual world, as the mean score for the VR.group 2.2 (SD= 1.17) indicates that participants tend to experience slightly a sense of acting in the virtual world, while the participants of the VI.group with mean score 2.7 (SD= 1.43) tend from slightly to moderately feel active in the virtual world. Finally, for the last item of the spatial presence, the results revealed that participants felt present in the virtual space since for the VR.group the mean score 3.8 (SD= 1.74) and for the VI.group the mean score 3.6 (SD= 1.81) indicate that the participants tend from moderately to agree that they felt present in the virtual world. Appendix B-6-4 presents descriptive statistics for all spatial presence items.

Table 6-17: Spatial presence items for the VR groups

GROUP			9. Somehow, I felt that the virtual world surrounded me.	13. I felt like I was just perceiving pictures.	6. I did not feel present in the virtual space.	3. I had a sense of acting in the virtual space, rather than operating something from outside.	10. I felt present in the virtual space.
VR.group	N	Valid	11	11	11	11	11
		Missing	0	0	0	0	0
	Mean		3.5455	3.2727	2.7273	2.1818	3.7273
	Std. Deviation		2.16165	1.67874	1.67874	1.16775	1.73729
VI.group	N	Valid	11	11	11	11	11
		Missing	0	0	0	0	0
	Mean		3.4545	3.8182	1.5455	2.6364	3.5455

	Std. Deviation	1.63485	2.13627	1.50756	1.43337	1.80907
	Std. Deviation					

Regarding involvement items (table 6-18), that deals with the attention devoted to the virtual environment, the results indicate that the participants tended to be moderately aware of the real environment, with a mean score 3.1 (SD= 1.92) for the VR.group, and a mean score 2.3 (SD= 2.24) for the VI.group, which means that the participants of the VI.group tended to be more aware of the real environment that surrounded them. Moreover, the results indicate a difference between the two groups regarding paying attention to the real environment. The mean of the VR.group 2.7 (SD= 1.57) indicates that the participants tend from moderately to agree that they paid attention to the real environment, while the mean of the VI.group 4.7 (SD= 1.86) indicates that the participants tend from disagree to strongly disagree that they paid attention to the real environment. Additionally, according to the results, the participants of the VR.group with a mean score 2.5 (SD= 1.75) tend to slightly disagree that they were aware of the real environment, while the participants of the VI.group with mean score 3.8 (SD= 2.10) tend to agree that they were paying attention to the real environment. Furthermore, based on the data analysis the participants of the VR.group with mean score 2.7 (SD= 1.29) tend to disagree that they were captivated by the virtual world, while the participants of the VI.group with mean score 3.2 (SD= 1.89) tend to agree that their attention was captivated by the virtual world. Appendix B-6-4 presents descriptive statistics for all involvement items.

Table 6-18: Involvement items for the VR groups

GROUP	1. How aware were you of the real world surrounding while navigating in the virtual world? (i.e. sounds, room temperature, other people, etc.)?	11. I still paid attention to the real environment.	7. I was not aware of my real environment.	14. I was completely captivated by the virtual world.

VR.group	N	Valid	11	11	11	11
		Missing	0	0	0	0
	Mean		3.0909	2.6364	2.4545	2.6364
	Std. Deviation		1.92117	1.56670	1.75292	1.28629
VI.group	N	Valid	11	11	11	11
		Missing	0	0	0	0
	Mean		2.2727	4.6364	3.7273	3.1818
	Std. Deviation		2.24013	1.85864	2.10195	1.88776

Regarding Experienced Realism (table 6-19), the mean score of the VR.group 3.8 (SD= 1.62) indicates that the participants tend to find the virtual world unreal, while the mean score 3.1 (SD= 1.51) of the VI.group indicates that the participants tend to the middle of the Likert scale and thus they are more neutral. When participants were asked if the experience in the virtual world was similar to the real environment, participants of both groups tend to be moderately consistent, as the mean score for the VR.group is 3 (SD= 1.58) and the mean for the VI.group is 3.2 (SD= 1.40). Regarding the similarity of the virtual world to the real world, the mean score of the VR.group 2.2 (SD= 1.72) indicates that the participants tend more to the edge of the imaginary world, while the mean of the VI.group 3 (SD= 1.73), indicates that the participants are more neutral. Finally, the virtual world did not seem to the participants more realistic than the real world, as the mean of the VR.group 0.6 (SD= 1.21) indicates that the participants fully disagree that the virtual world seemed more realistic than the real world and the mean for the VI.group 13 SD= 1.35) indicates that the participants strongly disagree. Appendix B-6-4 presents descriptive statistics for all realism items.

Table 6-19: Realism items for the VR groups

GROUP	5. How real did the virtual world seem to you?	4. How much did your experience in the virtual environment seem consistent with your real-world experience?	2. How real did the virtual world seem to you?	12. The virtual world seemed more realistic than the real world.

VR.group	N	Valid	11	11	11	11
		Missing	0	0	0	0
	Mean		3.7273	2.9091	2.1818	.5455
	Std. Deviation		1.61808	1.57826	1.72152	1.21356
VI.group	N	Valid	11	11	11	11
		Missing	0	0	0	0
	Mean		3.0909	3.1818	3.0000	1.2727
	Std. Deviation		1.51357	1.40130	1.73205	1.34840

6.1.12.4.2 Test of normality

One of the assumptions for parametric tests is that the data are normally distributed. Normal distribution means that most of the results are situated around the mean value and their number decreases symmetrically to both sides. Therefore, checking the normal distribution should be the first and most basic test for a correct statistical analysis of the data of a study. Determining whether the data are normal or not will also determine the statistical tests to be used (parametric or not).

The hypothesis used are:

- The null hypothesis H_o: The sample data are NOT significantly different than a normal population (normal distribution).
- The alternative hypothesis H_1: The sample data are significantly different than a normal population (not normal distribution).

When testing for normality:

- If the p-value is > 0.05 then the data are normally distributed, and H_o is accepted.
- If the p-value is < 0.05 then the data are NOT normally distributed, and H_o is rejected.

A Kolmogorov-Smirnov test indicated that presence scale items do not follow a normal distribution, as $p = 0.000 < 0.05$ for almost all scale items (table 6-20). Only in one item, the distribution seems normal as the p-value is >0.05, however, as the rest of the

items do not follow the normal distribution parametric tests cannot be used. Thus, H_o is rejected, and non-parametric tests were used for the data analysis.

Table 6-20: One sample Kolmogorov-Smirnov Test for presence scale

Tests of Normality

	Kolmogorov-Smirnov		
	Statistic	df	Sig.
What was your perspective onto the virtual world?	.475	22	.000
8. In the computer-generated world, I had a sense of 'being there'	.241	22	.002
9. Somehow, I felt that the virtual world surrounded me.	.242	22	.002
13. I felt like I was just perceiving pictures.	.233	22	.003
6. I did not feel present in the virtual space.	.214	22	.010
3. I had a sense of acting in the virtual space, rather than operating something from outside.	.221	22	.006
10. I felt present in the virtual space.	.219	22	.007
1. How aware were you of the real world surrounding while navigating in the virtual world? (i.e. sounds, room temperature, other people, etc.)?	.245	22	.001
11. I still paid attention to the real environment.	.256	22	.001
7. I was not aware of my real environment.	.216	22	.009
14. I was completely captivated by the virtual world.	.215	22	.009
5. How real did the virtual world seem to you?	.147	22	**.200***
4. How much did your experience in the virtual environment seem consistent with your real-world experience?	.172	22	.091
2. How real did the virtual world seem to you?	.201	22	.022
12. The virtual world seemed more realistic than the real world.	.302	22	.000

*. This is a lower bound of the true significance.

6.1.12.4.3 Non-parametric tests

Mann-Whitney test was used to investigate possible differences between the two groups that used the VR application: VR.group and VI.group.

The hypothesis used are:

- The null hypothesis H_o: The two groups represented (VR.group, VI.group) have the same distribution of scores.
- The alternative hypothesis H_1: The two groups represented (VR.group, VI.group) do not have the same distribution of scores.

The Mann-Whitney test revealed a significant difference between the two groups regarding the time participants though they interacted with the virtual world (table 6-21), as the p-value is 0.012<0.05. According to the results (table 6-22), the means for the two groups, for VR.group the mean is 6.5 (SD. 2.4234) and for the VI.group the mean is 3.8 (SD 2.0889), indicating that the participants of the VR.group felt that their training within the VR environment lasted over 6 minutes, while the participants of the VI.group had the impression that their training within the VR environment lasted between 3 to 4 minutes. The results indicate that the participants of the VR.group were more immersed in the environment and had the impression that they were within the virtual world more time than they actually stayed.

Regarding the perspective, onto the virtual world (first person or third person) there are no statistically important differences between the groups.

Moreover, there are no statistically significant differences between the groups regarding their preference for training within a real classroom setting without any technology instead of a virtual classroom. The mean scores indicate that the participants of both groups tend from ‘disagree’ to ‘undecided’, regarding training with no use of VR technology.

Table 6-21: Mann-Whitney test to investigate differences between the two VR groups

	Mann-Whitney U	Asymp.Sig. (2-tailed)
How long did you interact with the virtual world (in minutes)?	24.000	**.012**
What was your perspective onto the virtual world?	55.000	.619
Would you prefer your training within a real classroom setting without any technology instead of a virtual classroom?	55.500	.728

Table 6-22: Mean scores of the two groups regarding time in the VR space, perspective and training using VR

	GROUP					
	VR.group			VI.group		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation
How long did you interact with the virtual world (in minutes)?	6.545	11	2.4234	3.818	11	2.0889
What was your perspective onto the virtual world?	1.1818	11	.40452	1.2727	11	.46710
Would you prefer your training within a real classroom setting without any technology instead of a virtual classroom?	2.7273	11	.90453	2.8182	11	.98165

Mann-Whitney test revealed that for nearly all items of IPQ the p-value is >0.05 and thus we accept the null hypothesis that there are no differences between the two groups that used the VR application concerning the sense of presence (table 6-23). However, one of the items that are question ’11. I still paid attention to the real environment’ the p-value is .014<0.05, indicating a significant difference between the two groups.

Table 6-23: Mann-Whitney test to investigate differences between the two VR groups regarding the 14 questions of the IPQ questionnaire

	Mann-Whitney U	Asymp.Sig. (2-tailed)
8. In the computer-generated world, I had a sense of ‘being there’	43.500	.244
9. Somehow, I felt that the virtual world surrounded me.	53.000	.615
13. I felt like I was just perceiving pictures.	49.000	.440
6. I did not feel present in the virtual space.	37.000	.113
3. I had a sense of acting in the virtual space, rather than operating something from outside.	46.000	.327
10. I felt present in the virtual space.	55.000	.709

1. How aware were you of the real world surrounding while navigating in the virtual world? (i.e. sounds, room temperature, other people, etc.)?	47.000	.365
11. I still paid attention to the real environment.	24.000	**.014**
7. I was not aware of my real environment.	38.500	.137
14. I was completely captivated by the virtual world.	51.500	.546
5. How real did the virtual world seem to you?	47.000	.368
4. How much did your experience in the virtual environment seem consistent with your real-world experience?	54.000	.663
2. How real did the virtual world seem to you?	43.500	.255
12. The virtual world seemed more realistic than the real world.	37.500	.097

Question 11 has to do with participants' involvement in the VR environment and according to table 6-24, for the VR.group the mean is 2.6 (SD. 1.56670) and for the VI.group the mean is 4.6 (SD 1.85864). The means indicate that the participants of the VR.group tend to be ‘moderately aware’ of the real environment while they were using the VR application, while the means of the VI.group indicate that the participants tend to be ‘slightly’ to ‘poor’ aware of the real environment while they were using the VR. Therefore, there are indications that the participants of the VI.group were more immersed in the VR environment that the participants of the VR.group. However, this comes in contrast to the time participants though that they interacted with the virtual world as VI.group scored lower than VR.group.

Table 6-24: Mean scores of the two groups regarding the items of the presence scale

	GROUP					
	VR.group			VI.group		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation
Experience in using Virtual Reality environments	2.4545	11	1.12815	2.0000	11	.89443
How long did you interact with the virtual world (in minutes)?	6.545	11	2.4234	3.818	11	2.0889

What was your perspective onto the virtual world?	1.1818	11	.40452	1.2727	11	.46710
8. In the computer-generated world, I had a sense of 'being there'	4.364	11	1.2863	3.545	11	1.8635
9. Somehow, I felt that the virtual world surrounded me.	3.5455	11	2.16165	3.4545	11	1.63485
13. I felt like I was just perceiving pictures.	3.2727	11	1.67874	3.8182	11	2.13627
6. I did not feel present in the virtual space.	2.7273	11	1.67874	1.5455	11	1.50756
3. I had a sense of acting in the virtual space, rather than operating something from outside.	2.1818	11	1.16775	2.6364	11	1.43337
10. I felt present in the virtual space.	3.7273	11	1.73729	3.5455	11	1.80907
1. How aware were you of the real world surrounding while navigating in the virtual world? (i.e. sounds, room temperature, other people, etc.)?	3.0909	11	1.92117	2.2727	11	2.24013
11. I still paid attention to the real environment.	**2.6364**	11	1.56670	**4.6364**	11	1.85864
7. I was not aware of my real environment.	2.4545	11	1.75292	3.7273	11	2.10195
14. I was completely captivated by the virtual world.	2.6364	11	1.28629	3.1818	11	1.88776
5. How real did the virtual world seem to you?	3.7273	11	1.61808	3.0909	11	1.51357
4. How much did your experience in the virtual environment seem consistent with your real-world experience?	2.9091	11	1.57826	3.1818	11	1.40130
2. How real did the virtual world seem to you?	2.1818	11	1.72152	3.0000	11	1.73205
12. The virtual world seemed more realistic than the real world.	.5455	11	1.21356	1.2727	11	1.34840
Would you prefer your training within a real classroom setting without any technology instead of virtual classroom?	2.7273	11	.90453	2.8182	11	.98165

To conclude, most of the participants understood correctly that they experienced a first-person perspective in the virtual environment.

Regarding the sense of presence, the general item of the questionnaire reported good levels of presence for both VR groups, with VR.group scoring higher.

Regarding spatial presence, the results indicate that participants at both groups felt moderately the sense of being physically in the virtual classroom space. Equally important, is that the experience within the virtual world did not seem to the participants as simply perceiving pictures. Interesting is the fact that although for the general item regarding the sense of presence the result revealed good levels of presence for both groups, for the question 'I did not feel present in the virtual space' which was one of the items to measure the spatial presence, the participants reported low levels of presence. It is possible that as this was a negative question, the participants were confused with the Likert scale when they gave their answer. Moreover, the participants were unfamiliar with VR systems and the meaning of presence, thus this could also have affected their answers. Nonetheless, the participants did not feel very active within the virtual world, which is probably related to the fact that there was no interaction during the current scenario as the primary aim was to test the virtual environments from the perspective of the graphics and presence. Possibly the sense of presence could have been enhanced if the scenario was more interactive, but this could probably have affected the EEG recordings as the 64 electrodes were very sensitive.

As far as involvement is concerned there are indications that the participants were not fully disconnected from the physical space. Moreover, the results indicate a significant statistical difference between the two groups regarding paying attention to the real environment as the participants of the VR.group tended to be more aware of the real environment that the participants of the VI.group. Hence, there are indications that the participants of the VI.group were more immersed in the VR environment that the participants of the VR.group.

Regarding Experienced Realism, the results indicate that the participants of the VI.group were more neutral as far as the realism of the virtual world is concerned, whereas VR.group tended to score lower.

The results also revealed differences between the two groups related to the time in the virtual environment. According to the results, the participants of the VR.group claimed to spend more time within the virtual world that the participants of the VI.group. This outcome is interesting concerning groups' awareness of the physical space, as VI.group scored lower regarding the time spent in the VR environment, yet the participants were more detached from the real environment.

6.1.12.5 Empathy scale

This section presents the analysis of the results concerning empathy scale items. The analysis of the empathy scale includes descriptive statistics, test of normality and non-parametric tests, as shown in figure 6-22:

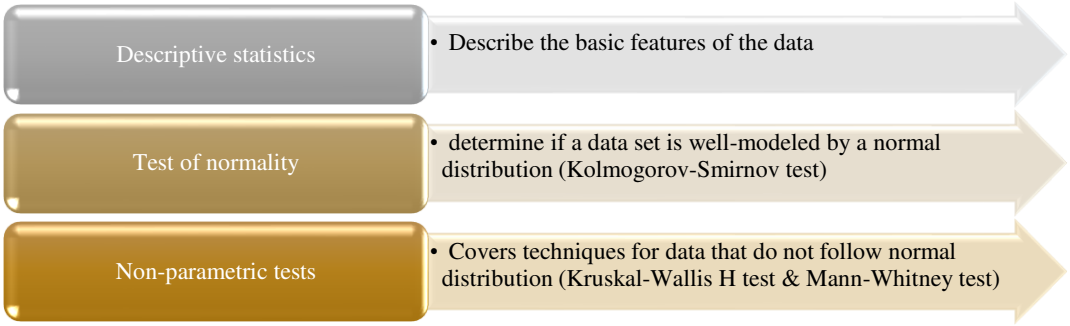


Figure 6-22: Tests carried out regarding the quantitative analysis of the empathy scale items

6.1.12.5.1 Empathy scale – descriptive statistics

The mean scores indicate small differences between the three groups regarding empathy (table 6-25). Regarding the teacher's ability to predict the feelings of his/her students the participants of all the groups tend to agree with the PS.group scoring higher M=. 5.0909, SD=.83121 (VR.group M=4.6364, SD=.80904, VI.group M=4.9091 SD=1.37510). Participants tend to agree that a teacher should be able to spot when a student is feeling awkward or uncomfortable, with the VI.group scoring higher and with a tendency to strongly agree to M=5.6364, SD=.50452 (VR.group M=5.3636 SD=.50452, PS.group M=5.1818 SD=.40452). Moreover, the results indicate that participants tend to agree that teachers should try to look at every student's side of a disagreement before making a decision (VR.group M=5.2727 SD=.46710, VI.group M= 5.0909 SD=.83121, PS.group M=5.1818 SD=.60302). Participants of all groups tend to agree that teachers should try to understand the students better, by imagining how things

look from their perspective, with the VI.group scoring higher and with a tendency to strongly agree to M=5.6364, SD=.50452 (VR.group M=5.2727 SD=.46710, PS.group M=5.2727 SD=.64667). Regarding teachers' ability to see things from the student's point of view, the participants of the VR.group tend from undecided to agree (M=4.5455, SD=1.36848), the participants of the VI.group tend to agree (M=4.9091, SD=1.44600) and the participants of the PS.group tend to agree (M=5.0909, SD=.83121). The results indicate that as far as teachers' emotional involvement with students' problems, the participants of the VR.group tend to be from undecided to agree (M=3.8182, SD=1.32802) and the participants of the VI.group (M=4.1818, SD=1.53741) and PS.group (M=4.0909, SD=1.30035) tend to agree. The participants of all groups believe that a teacher should try to imagine how he/she would feel in the students' situation, with the VI.group scoring higher M=5.2727, SD=.78625 (VR.group M=5.0909 SD=.83121, PS.group M=5.1818 SD=.40452). Regarding teacher's support of students of other racial and ethnic groups, the participants of all groups tend to agree, with VI.group scoring higher M=5.3636, SD=.67420 (VR.group M=5.0909, SD=.83121, PS.group M=4.9091 SD=.70065). Finally, the results indicate a difference among the groups regarding teachers' ability to put himself/herself in the position of someone who is racially and/or ethnically different, as the participants of the VR.group tend from disagreeing to undecided M= 3.5455, SD=1.12815, participants from VI.group also tend from disagreeing to undecided M=3.6364, SD=1.43337, while the participants of the PS.group tend from undecided to agree to M=4.7273, SD=.90453. Appendix B-6-5 presents the descriptive statistics for all items of the empathy scale.

Table 6-25: Mean scores for all groups regarding empathy scale

	VR.group			VI.group			PS.group		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation	Mean	N	Std. Deviation
1. A teacher should be able to predict the feelings of his/her students.	4.6364	11	.80904	4.9091	11	1.37510	5.0909	11	.83121
2. A teacher should be able to spot when	5.3636	11	.50452	5.6364	11	.50452	5.1818	11	.40452

a student is feeling awkward or uncomfortable.									
3. A teacher should try to look at every student's side of a disagreement before making a decision.	5.2727	11	.46710	5.0909	11	.83121	5.1818	11	.60302
4. A teacher should try to understand the students better, by imagining how things look from their perspective.	5.2727	11	.46710	5.6364	11	.50452	5.2727	11	.64667
5. Teachers sometimes find it difficult to see things from the student's point of view.	4.5455	11	1.36848	4.9091	11	1.44600	5.0909	11	.83121
6. Teachers often get emotionally involved with the students' problems.	3.8182	11	1.32802	4.1818	11	1.53741	4.0909	11	1.30035
7. A teacher should try to imagine how he/she would feel in the students' situation.	5.0909	11	.83121	5.2727	11	.78625	5.1818	11	.40452
10. A teacher should feel supportive of students of other racial and ethnic groups.	5.0909	11	.83121	5.3636	11	.67420	4.9091	11	.70065
11. It is difficult for a teacher to put himself/herself in	3.5455	11	1.12815	3.6364	11	1.43337	4.7273	11	.90453

the position of someone who is racially and/or ethnically different.

6.1.12.5.2 Test of normality

A Kolmogorov-Smirnov test indicated that empathy scale items do not follow a normal distribution, as $p = 0.000 < 0.05$ for all scale items (table 6-26).

Table 6-26: One sample Kolmogorov-Smirnov Test for empathy scale

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
1. A teacher should be able to predict the feelings of his/her students.	.426	33	.000
2. A teacher should be able to spot when a student is feeling awkward or uncomfortable.	.392	33	.000
3. A teacher should try to look at every student's side of a disagreement before making a decision.	.310	33	.000
4. A teacher should try to understand the students better, by imagining how things look from their perspective.	.337	33	.000
5. Teachers sometimes find it difficult to see things from the student's point of view.	.398	33	.000
6. Teachers often get emotionally involved with the students' problems.	.218	33	.000
7. A teacher should try to imagine how he/she would feel in the students' situation.	.304	33	.000
10. A teacher should feel supportive of students of other racial and ethnic groups.	.283	33	.000
11. It is difficult for a teacher to put himself/herself in the position of someone who is racially and/or ethnically different.	.247	33	.000

6.1.12.5.3 Non-parametric tests

The Kruskal-Wallis H test showed that between the three groups there was no statistically significant difference for almost all items of the empathy scale, as the p-value for is >0.05. However, there is one item, question '11. It is difficult for a teacher

to put himself/herself in the position of someone who is racially and/or ethnically different', that seems to statistically differ between the groups as the p-value is 0.027<0.05 (table 6-27).

Table 6-27: Kruskal-Wallis H test to investigate possible differences between the three groups

	Kruskal-Wallis H	df	Asymp. Sig.
1. A teacher should be able to predict the feelings of his/her students	3.050	2	.218
2. A teacher should be able to spot when a student is feeling awkward or uncomfortable.	4.677	2	.096
3. A teacher should try to look at every student's side of a disagreement before making a decision.	.251	2	.882
4. A teacher should try to understand the students better, by imagining how things look from their perspective.	3.166	2	.205
5. Teachers sometimes find it difficult to see things from the student's point of view.	1.553	2	.460
6. Teachers often get emotionally involved with the students' problems.	.786	2	.675
7. A teacher should try to imagine how he/she would feel in the students' situation.	.413	2	.813
10. A teacher should feel supportive of students of other racial and ethnic groups.	2.093	2	.351
11. It is difficult for a teacher to put himself/herself in the position of someone who is racially and/or ethnically different.	7.214	2	.027
Kruskal Wallis Test			
Grouping Variable: GROUP			

According to the mean scores, the mean score of the VR.group is 3.55 (SD 0.13), the mean score for the VI.group is 3.64 (SD. 1.43) and the mean score for the PS.group is 4.73 (SD. 0.91). Therefore, the results indicate that the two groups that used the VR environment tend to be from undecided to disagree that it is difficult for a teacher to put himself/herself in the position of someone who is racially and/or ethnically different', while the PS.group that did not use the VR environment tend from disagree to strongly disagree.

Mann-Whitney test between the groups revealed that the difference is between the two groups that used the VR environment, VR.group and VI.group, and the PS.group that did not use the VR. According to the Mann-Whitney test, the p-values between the VR.group and the VI.group are 0.68>0.05 indicating that there is no difference between the two groups (table 6-28). On the contrary, the Mann-Whitney test between the VR.group and the PS.group revealed a p-value 0.011<0.05 and between the VI.group and the PS.group revealed a p-value 0.034>0.05 indicating the statistically significant difference between the groups (figure 6-23).

Table 6-28: Mann-Whitney to investigate differences between VR.group and VI.group

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
11. It is difficult for a teacher to put himself/herself in the position of someone who is racially and/or ethnically different.	54.500	120.500	-.407	.684

Table 6-29: Mann-Whitney to investigate differences between VR.group and PS.group

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
11. It is difficult for a teacher to put himself/herself in the position of someone who is racially and/or ethnically different.	24.000	90.000	-2.553	.011

Table 6-30: Mann-Whitney to investigate differences between VI.group and PS.group

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
11. It is difficult for a teacher to put himself/herself in the position of someone who is racially and/or ethnically different.	31.000	97.000	-2.122	.034

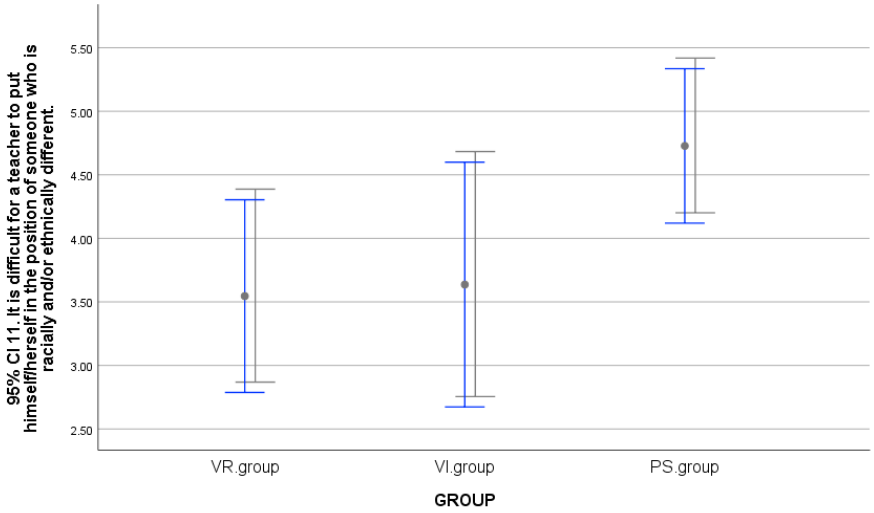


Figure 6-23: The differences between the three groups indicating that PS.group find it difficult to enter the position of someone who is racially and/or ethnically different

Taking all the above into consideration, the empathy-skills assessment revealed participants' empathetic response. The participants of all groups reported that teachers' ability to empathize with student's feelings is important scoring high at the scale. Moreover, the results indicate that for the participants of all groups it is significant for a teacher to be able to look at every student's side of a disagreement before deciding regarding a situation, a problem, or an issue. Equally important for the participants is the ability of a teacher to understand the students better, by imagining how things look from their perspective and try to see things from the student's point of view. Additionally, the participants tend to agree that teachers should be emotionally involved with student's problems and try to imagine how they would feel in the students' situation. The participants of all groups argued that teachers must support students of other racial and ethnic groups. Non-parametric tests did not reveal statistically significant differences between the three groups, apart from one variable that relates to teachers' ability to put himself/herself in the position of a student who is racially and/or ethnically different. The results revealed a significant difference between the participants that used the VR system and those who were trained in the physical environment as those experienced the virtual world claimed that teachers have the ability to put himself/herself in the position of someone who is racially and/or ethnically different, while the physical group claimed that it is difficult to enter the position of someone who is racially and/or ethnically different. Thus, there are serious indications

that perspective-taking enhanced participants' sense of embodiment and development of embodied thinking skills resulting in the understanding of a problematic situation like bullying due to multiculturalism and enhancing empathy skills concerning multiculturalism. Nevertheless, further research is needed to investigate the impact of VR approaches on the cultivation of empathy skills, as empathy was not a primary parameter of the experiment.

6.1.12.6 Reflection scale

This section presents the analysis of the results concerning reflection scale items. The analysis of the reflection scale includes descriptive statistics, test of normality and non-parametric tests, as shown in figure 6-24:

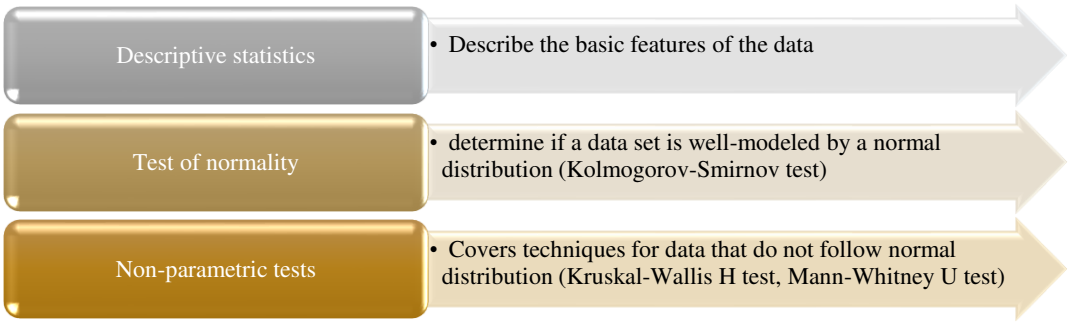


Figure 6-24: Tests carried out regarding the quantitative analysis of the reflection scale items

6.1.12.6.1 Reflection scale – descriptive statistics

The results (table 6-31) indicate that reflection is considered an important process for all of the participants as the vast majority tend to score from agreeing to strongly agree in all groups (VR.group M=5.00, SD=.00; VI.group M=5.36, SD=.67; PS.group M=5.27, SD=.47). From the data (table 6-31) it can be concluded that the participants who were trained in the virtual classroom space scored higher to the change of their beliefs and ideas regarding multiculturalism and bullying as for the VI.group the majority tended to score from agreeing to strongly agree (M=5.18, SD=.60) and for the VR.group tended to agree (M=4.81, SD=.41). On the other hand, the participants of the control group tend to be more neutral and undecided (PS.group M=4.36, SD=.51). The output states that participants of all groups disagree with teachers' lack of interest in analyzing student's needs as they tended to score from disagreeing to strongly disagree (VR.group M=4.73, SD=.47; VI.group M=4.64, SD=.51; PS.group M=4.36 SD=.51). The results also

indicate that the two groups that used the VR system argued that such an experience can change the way teachers attend the needs of their students, as the participants tended to score from agreeing to strongly agree (VR.group M=5.18 SD=.41; VI.group M=5.27, SD=.47). The majority of the participants of the control group tended to be more undecided and neutral indicating their training experience in the real classroom setting did not have the same impact as the VR experience to the other two groups (PS.group M=4.36 SD=.51). From the data it can be also concluded that both the VR and the real-time classroom training experience can help teachers change the way they will react on disruptive behavior among my students, nevertheless, many of the participants tended to be neutral especially those of the control group (VR.group M=4.64, SD=.67; PS.group M=4.36 SD=.51), while the participants of VI.group tended to score higher towards agree (M=5.00, SD=.89). Moreover, the results indicate that training both via VR and real-time can help teachers discover dysfunctions in their interaction with students that they previously believed to be right as the participants tended to score from agreeing to strongly agree, however, many of the participants tended to be neutral and undecided in VR.group (M=4.64, SD=.67) and PS.group (M=4.55 SD=.52), while the VI.group scored higher towards agree (M=5.00, SD=.89). Additionally, the participants who used the VR system tended from agreeing to strongly agree that VR experience can offer them the ability to enter their student's position, while the participants of the control group tended to be more neutral regarding entering their student's position (VR.group M=5.55, SD=.52; VI.group M=5.55, SD=.52; PS.group M=4.36 SD=.51). Furthermore, the results suggest that the use of VR can promote teacher's ability to support more students of other racial and ethnic groups, as the majority of the participants that used the VR system tended to score from agreeing to strongly agree (VR.group M=4.91, SD=.54; VI.group M=5.09, SD=.70), while the participants of the control group scored lower tended from disagreeing to agree, indicating that their training in the real classroom did not seem to promote at a high level their ability to support more students of other racial and ethnic groups (PS.group M=4.09 SD=.70). Appendix B-6-6 presents the descriptive statistics for all the items of the reflection scale.

Table 6-31: Mean and Std. Deviation scores for the three groups in the items of the reflection scale

	VR.group			VI.group			PS.group		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation	Mean	N	Std. Deviation
1. Teachers should spend time in self-reflection.	5.0000	11	.00000	5.3636	11	.67420	5.2727	11	.46710
2. This experience within the VR environment/the physical classroom training regarding multiculturalism and bullying can challenge some of teachers' firmly held ideas.	4.8182	11	.40452	5.1818	11	.60302	4.3636	11	.50452
3. A teacher should not really be interested in analyzing students' needs.	4.7273	11	.46710	4.6364	11	.50452	4.3636	11	.50452
4. The use of this VR experience/ The use of this training experience can change the way teachers will attend to the needs of the students.	5.1818	11	.40452	5.2727	11	.46710	4.3636	11	.50452
5. This VR experience/ This training experience can help teachers change the way they	4.6364	11	.67420	5.0000	11	.77460	4.3636	11	.50452

will react to disruptive behavior among my students.									
6. This VR experience/This training experience can help teachers discover faults in their teaching style or in their interaction with students that he/she previously believed to be right.	4.6364	11	.67420	5.0000	11	.89443	4.5455	11	.52223
7. Because of this VR experience / Because of this training experience, teachers will try more frequently to enter their students' position.	5.5455	11	.52223	5.5455	11	.52223	4.3636	11	.50452
8. Because of this VR experience/ Because of this training experience, teachers will support more students of other racial and ethnic groups.	4.9091	11	.53936	5.0909	11	.70065	4.0909	11	.70065

6.1.12.6.2 Test of normality

A Kolmogorov-Smirnov test indicated that reflection scale items do not follow a normal distribution, as $p = 0.000 < 0.05$ for all scale items (table 6-32).

Table 6-32: One sample Kolmogorov-Smirnov Test for reflection scale items

	Kolmogorov-Smirnov		
	Statistic	df	Sig.
1. Teachers should spend time in self-reflection.	.427	33	.000
2. This experience within the VR environment/ the physical classroom training regarding multiculturalism and bullying can challenge some of teachers' firmly held ideas.	.335	33	.000
3. A teacher should not really be interested in analyzing students' needs.	.377	33	.000
4. The use of this VR experience/ The use of this training experience can change the way teachers will attend to the needs of the students.	.327	33	.000
5. This VR experience/ This training experience can help teachers change the way they will react to disruptive behavior among my students.	.287	33	.000
6. This VR experience/this training experience can help teachers discover faults in their teaching style or their interaction with students that he/she previously believed to be right.	.268	33	.000
7. Because of this VR experience / Because of this training experience, teachers will try more frequently to enter their students' position.	.233	33	.000
8. Because of this VR experience/ Because of this training experience, teachers will support more students of other racial and ethnic groups.	.289	33	.000

6.1.12.6.3 Non-parametric tests

The Kruskal-Wallis H test showed that there are statistically significant differences between the three groups regarding four items of the reflection scale. According to the results (table 6-33) for items 2, 4, 7 and 8 the p-value is <0.05 indicating that there are differences between the three groups.

Table 6-33: Kruskal-Wallis H test to investigate possible differences between the three groups regarding reflection items

	Kruskal-Wallis H	df	Asymp. Sig.
1. Teachers should spend time in self-reflection.	3.901	2	.142

2. This experience within the VR environment/ the physical classroom training regarding multiculturalism and bullying can challenge some of teachers' firmly held ideas.	10.194	2	.006
3. A teacher should not really be interested in analyzing students' needs.	3.128	2	.209
4. The use of this VR experience/ The use of this training experience can change the way teachers will attend to the needs of the students.	15.235	2	.000
5. This VR experience/ This training experience can help teachers change the way they will react to disruptive behavior among my students.	4.254	2	.119
6. This VR experience/this training experience can help teachers discover faults in their teaching style or in their interaction with students that he/she previously believed to be right.	1.765	2	.414
7. Because of this VR experience / Because of this training experience, teachers will try more frequently to enter their students' position.	17.163	2	.000
8. Because of this VR experience/ Because of this training experience, teachers will support more students of other racial and ethnic groups.	10.355	2	.006
Kruskal Wallis Test			
Grouping Variable: GROUP			

Mann-Whitney U test between the three groups revealed statistically significant differences between the two VR groups and PS.group. No statistically significant differences were identified between the two VR groups, as p-value>0.05 (table 6-34).

Table 6-34: Mann-Whitney U test to identify differences between the two VR groups

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
2. This experience within the VR environment/ the physical classroom training regarding multiculturalism and bullying can challenge some of teachers' firmly held ideas.	41.500	107.500	-1.595	.111
4. The use of this VR experience/ The use of this training experience, can change the way teachers will attend to the needs of the students.	55.000	121.000	-.497	.619

7. Because of this VR experience / Because of this training experience, teachers will try more frequently to enter their students' position.	60.500	126.500	.000	1.000
8. Because of this VR experience/ Because of this training experience, teachers will support more students of other racial and ethnic groups.	51.500	117.500	-.691	.490

From the Mann-Whitney U test, it can be concluded that reflective practice for VR.group is statistically significantly higher than for PS.group (table 6-35). More particularly, for VR.group the experience within the VR environment regarding multiculturalism and bullying was challenging for firmly held ideas, while the physical classroom training did not have the same impact on PS.group (U=33, p=.034). Additionally, according to the results, VR intervention can change the way they attend the needs of their students, while the physical training experience did not have the same impact on the PS.group that scored statistically significantly lower than VR.group (U=18, p=.001). Moreover, VR intervention had a statistically significant impact on VR.group related to participants' ability to enter the position of the student, while the physical training did not have the same impact on PS.group regarding the ability to enter a different position and see things through student's eyes (U=10, p=.000). Furthermore, for VR.group the experience within the virtual environment changed their perspective regarding supporting more students of other racial and ethnic groups, while the physical training did not have an impact on PS.group (U=24, p=.008).

Table 6-35: Mann-Whitney U test indicating differences between VR.group and PS.group regarding reflection items

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
2. This experience within the VR environment/ the physical classroom training regarding multiculturalism and bullying can challenge some of teachers' firmly held ideas.	33.000	99.000	-2.118	.034
4. The use of this VR experience/ The use of this training experience can change the way teachers will attend to the needs of the students.	18.000	84.000	-3.196	.001

7. Because of this VR experience / Because of this training experience, teachers will try more frequently to enter their students' position.	10.000	76.000	-3.533	.000
8. Because of this VR experience/ Because of this training experience, teachers will support more students of other racial and ethnic groups.	24.000	90.000	-2.634	.008

Mann-Whitney U test also indicates that reflective practice for VI.group is statistically significantly higher than for PS.group (table 6-36). For VI.group the experience within the VR environment regarding multiculturalism and bullying was also challenging for firmly held ideas, while the physical classroom training did not have the same impact on PS.group (U=21.5, p=.005). Additionally, according to the results, VR intervention can change the way VI.group attends the needs of the students, while the physical training experience did not have the same impact on the PS.group that scored statistically significantly lower than VI.group (U=16, p=.001). Moreover, VR intervention had a statistically significant impact on VI.group related to participants' ability to enter the position of the student, while the physical training did not have the same impact on PS.group regarding the ability to enter a different position and see things through student's eyes (U=10, p=.000). Furthermore, for VI.group the experience within the virtual environment changed their perspective regarding supporting more students of other racial and ethnic groups, while the physical training did not have an impact on PS.group (U=21, p=.006).

Table 6-36: Mann-Whitney U test indicating differences between VI.group and PS.group regarding reflection items

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
2. This experience within the VR environment/ the physical classroom training regarding multiculturalism and bullying can challenge some of teachers' firmly held ideas.	21.500	87.500	-2.818	.005
4. The use of this VR experience/ The use of this training experience can change the way teachers will attend to the needs of the students.	16.000	82.000	-3.258	.001

7. Because of this VR experience / Because of this training experience, teachers will try more frequently to enter their students' position.	10.000	76.000	-3.533	.000
8. Because of this VR experience/ Because of this training experience, teachers will support more students of other racial and ethnic groups.	21.000	87.000	-2.762	.006

Figure 6-25 graphically presents the differences between the three groups that the Mann-Whitney U test revealed. PS.group scored significantly lower than the VR groups indicating that their training in the real classroom setting did not impact their firmly held ideas regarding multiculturalism and bullying. Among the two VR groups, the results indicate that VI.group scored higher than VR.group yet the difference is not statistically significant.

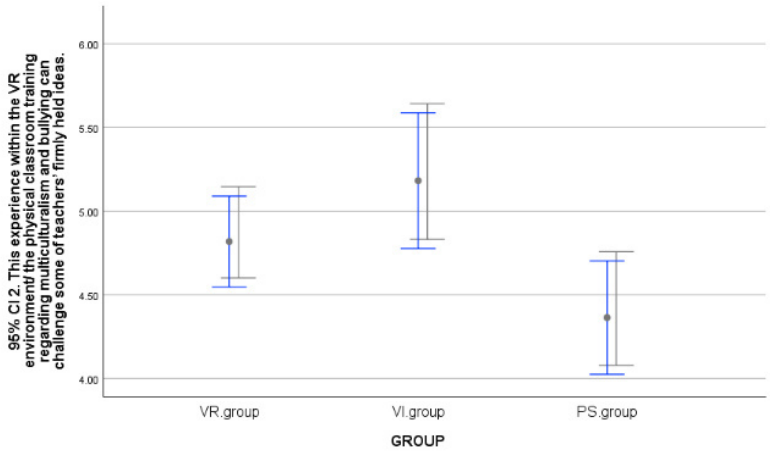


Figure 6-25: The physical training did not impact PS.group regarding attitude towards multiculturalism and bullying.

Figure 6-26 graphically presents the difference between the three groups regarding the way they approach students' needs. It seems that the physical training did not impact PS.group that scored significantly lower than the VR groups.

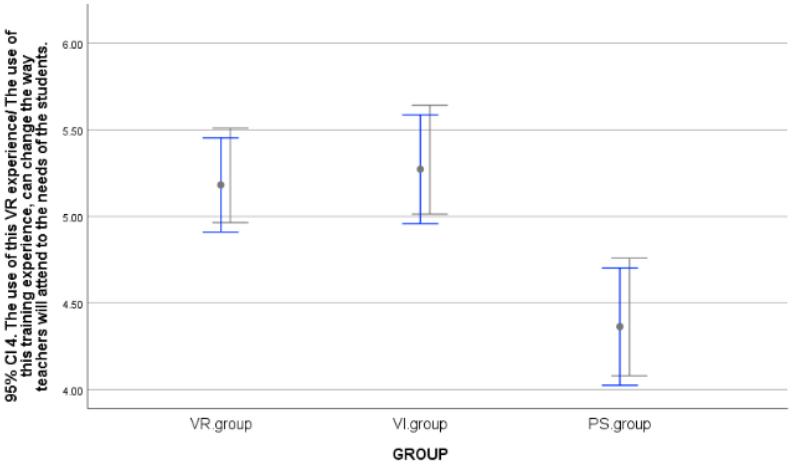


Figure 6-26: Differences between the three groups regarding the way student's needs must be addressed

Figure 6-27 graphically presents the difference between the three groups regarding their ability to enter the students' position and see the problem through him/her eyes. It seems that the physical training did not affect PS.group that scored significantly lower than the two VR groups.

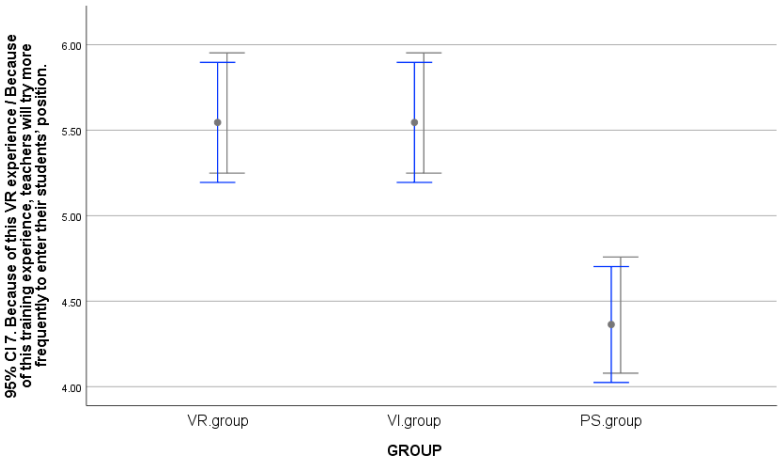


Figure 6-27: Physical training did not affect the ability to enter to student's position for PS.group

Figure 6-28 graphically presents the difference between the three groups regarding supporting students of other racial and ethnic groups. The results indicate that the physical training did not affect the PS.group that much as the participants scored significantly lower than both VR groups.

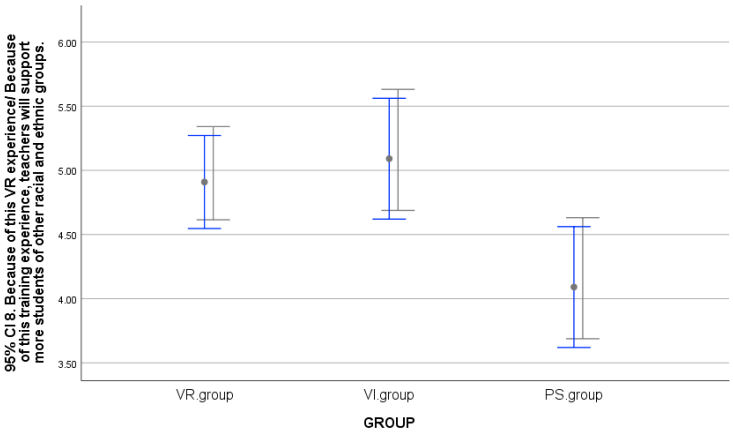


Figure 6-28: The differences between the three groups regarding supporting students of other racial and ethnic groups.

In conclusion, according to the results, the process of reflection is considered of significant importance for the participants of all groups. Additionally, both VR groups agreed that the VR experience can challenge some of the teachers' firmly held ideas concerning multiculturalism and bullying and change the way teachers attend the needs of their students. On the contrary, the control group that was trained in the physical classroom scored significantly lower than the VR groups and tended to be neutral and undecided. All the participants argued that teachers should be interested in analyzing student's needs. The results also indicate that training either VR or traditional can change the way they will react on disruptive behavior among my students, with VR groups scoring higher in the scale and the control group being neutral and undecided. Moreover, the results indicate that training both via VR and real-time can help teachers discover dysfunctions in their interaction with students. What is more, the results revealed that the VR experience can enhance teachers' ability to enter student's positions, while the participants of the control group tended to be more neutral and scored statistically significantly lower. Furthermore, the results suggest that the use of VR can promote teacher's ability to support more students of other racial and ethnic groups, while the participants of the control group scored lower, indicating that their training in the real classroom did not seem to promote significantly their ability to support more students of other racial and ethnic groups. Non-parametric tests confirmed statistically significant differences among the three groups concerning reflections items indicating a strong impact of the VR experience on the two VR groups. Furthermore, it

seems that the physical training experience did not impact participants' reflection practice as the difference between PS.group and the VR groups were significant.

6.1.12.7 Emotional scale

This section presents the analysis of the results concerning emotional scale items. The analysis of the emotional scale includes descriptive statistics, test of normality and non-parametric tests, as shown in figure 6-29:

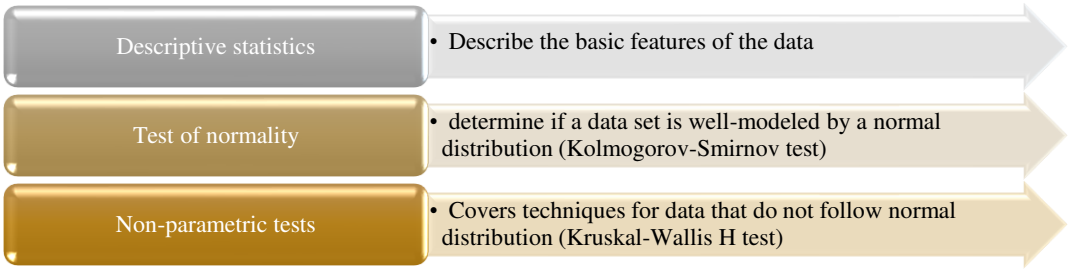


Figure 6-29: Tests carried out regarding the quantitative analysis of the emotion scale items

6.1.12.7.1 Emotions and mood states – descriptive statistics

The results (see table 6-37) indicate that the participants of all groups experienced several positive and negative emotions during the experiment, with the negative emotions being dominant (table 6-37). The participants of the VI.group tended to be more excited (M=3.18, SD=1.60) than the participants of the VR.group (M=2.82, SD=.98) and PS.group (M=2.55, SD=1.13). According to the results, all groups were stressed, with participants of the PS.group (M=5.36, SD=.81) being more stressed than the participants of VR.group (M=4.91, SD=1.14) and VI.group (M=5.09, SD=.94). The participants of all groups did not feel very active after the experiment as they tended to score from 'low' to 'a little' (VR.group M=2.55, SD=1.21; VI.group M=3.00, SD=1.18; PS.group M=2.46, SD=0.93). Moreover, it seems that all the participants felt tired after the experiment, with PS.group scoring higher towards 'extremely' (M=5.73, SD=.65), followed by VR.group (M=5.55, SD=.82) and VI.group (M=5.18, SD=.87). The results indicated that PS.group felt quite upset scoring from 'very' to 'extremely' (M=5.55, SD=.82). VR.group (M=4.55, SD=1.51) and VI.group (M=4.37, SD=1.36) also scored high to the item upset from 'moderately' to 'very'. The participants of all groups felt from 'a little' to 'moderately' confident after the experiment (VR.group M=3.64, SD=1.29; VI.group M=3.64, SD=1.50; PS.group M=3.27, SD=1.27). The results also

indicate that the participants of all groups felt afraid after the experiment scoring high from ‘very’ to ‘extremely’ (VR.group M=5.36, SD=1.03; VI.group M=5.55, SD=.69; PS.group M=5.91, SD=.30). The participants did not feel inspired enough scoring from ‘low’ to ‘a little’ and with the VI.group (M=3.18, SD=1.40) scoring higher than VR.group (M=2.91, SD=1.76) and PS.group (M=2.91, SD=1.30). Additionally, it seems that the experience was not very enjoyable as the participants scored from ‘low’ to ‘a little’ (VR.group M=2.64, SD=1.57; VI.group M=2.73, SD=1.74; PS.group M=2.91, SD=1.14). Moreover, the participants experienced high levels of nervousness scoring from ‘very’ to ‘extremely’, with PS.group scoring higher (M=5.73, SD=.47) than VR.group (M=4.82, SD=.98) and VI.group (M=5.27, SD=1.01). another outcome is that the participants also felt sad, scoring high to the scale from ‘very’ to ‘extremely’, with PS.group scoring higher (M=5.73, SD=.65) than VR.group (M=4.55, SD=1.51) and VI.group (M=4.91, SD=1.05). Finally, the participants were ‘a little’ satisfied with VI.group scoring higher (M=3.00, SD=1.73) than PS.group (M=2.82, SD=1.17) and VR.group (M=2.73, SD=1.56). Appendix B-6-7 presents the descriptive statistics for all the items of the emotion scale.

Table 6-37: Mean scores for the three groups in the items of the emotion scale

GROUP	VR.group			VI.group			PS.group		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation	N	Mean	Std. Deviation
Excited	11	2.8182	0.98165	11	3.1818	1.60114	11	2.5455	1.12815
Stressed	11	4.9091	1.13618	11	5.0909	0.94388	11	5.3636	0.80904
Active	11	2.5455	1.21356	11	3.0000	1.18322	11	2.4545	0.9342
Fatigue	11	5.5455	0.8202	11	5.1818	0.87386	11	5.7273	0.64667
Upset	11	4.5455	1.50756	11	4.3636	1.36182	11	5.5455	0.8202
Confident	11	3.6364	1.28629	11	3.6364	1.50151	11	3.2727	1.27208
Afraid	11	5.3636	1.02691	11	5.5455	0.68755	11	5.9091	0.30151
Inspired	11	2.9091	1.7581	11	3.1818	1.4013	11	2.9091	1.30035
Joyful	11	2.6364	1.5667	11	2.7273	1.73729	11	2.9091	1.13618
Nervous	11	4.8182	0.98165	11	5.2727	1.00905	11	5.7273	0.4671

Sad	11	4.5455	1.50756	11	4.9091	1.04447	11	5.7273	0.64667
Satisfied	11	2.7273	1.55505	11	3.0000	1.73205	11	2.8182	1.16775

Figure 6-30 presents the negative emotions that participants of the three groups experienced. Although all groups scored high to the negative emotions, the PS.group, the group that was trained in the physical space scored higher and the VI.group scored lower.

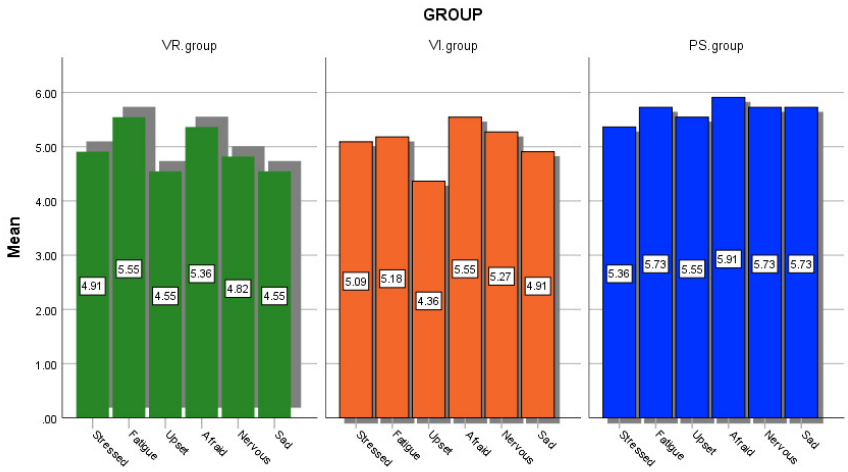


Figure 6-30: Negative emotions experienced for the 3 groups

6.1.12.7.2 Test of normality

A Kolmogorov-Smirnov test indicated that emotion scale items do not follow a normal distribution, as p< 0.05 for all scale items (table 6-38).

Table 6-38: One sample Kolmogorov-Smirnov Test for emotion scale items

	Kolmogorov-Smirnov		
	Statistic	df	Sig.
1. Excited	.175	33	.012
2. Stressed	.274	33	.000
3. Active	.272	33	.000
4. Fatigue	.408	33	.000
5. Upset	.297	33	.000
6. Confident	.188	33	.004

7. Afraid	.428	33	.000
8. Inspired	.178	33	.010
9. Joyful	.183	33	.007
10. Nervous	.303	33	.000
11. Sad	.329	33	.000
12. Satisfied	.179	33	.009

6.1.12.7.3 Non-parametric tests

The Kruskal-Wallis H test did not reveal any statistically significant differences regarding all the items of the emotion scale, as the p-value for all cases is >0.05 (table 6-39).

Table 6-39: Kruskal-Wallis H test to investigate possible differences between the three groups regarding emotion items

	Kruskal-Wallis H	df	Asymp. Sig.
1. Excited	1.294	2	.523
2. Stressed	.960	2	.619
3. Active	1.428	2	.490
4. Fatigue	3.126	2	.210
5. Upset	5.091	2	.078
6. Confident	.554	2	.758
7. Afraid	2.872	2	.238
8. Inspired	.279	2	.870
9. Joyful	.477	2	.788
10. Nervous	5.675	2	.059
11. Sad	5.423	2	.066
12. Satisfied	.203	2	.903

To conclude, the participants of all groups experienced multiple positive and negative emotions during the experiment, with negative emotions being dominant especially for

the control groups (trained in the physical classroom environment). Non-parametric tests did not reveal statistically significant differences between the three groups.

6.1.12.8 Training Via Virtual Reality versus training via a simulated environment in the physical world

Within the questionnaire there was a question regarding the type of training participants would prefer after the experiment concerning the use of virtual reality or not.

The question posed to the participant used virtual reality was:

Would you prefer your training within a real classroom setting without any technology instead of a virtual classroom?

The question posed to the participants of the physical group was:

Would you prefer your training within a virtual classroom (with the use of Virtual Reality technology) instead of a real classroom?

The descriptive statistics for the first question are presented in table 6-40. The results indicate that for VR.group half of the participants 54.5% would not prefer training without the use of virtual reality technology. 27.3% would prefer not to be trained via virtual reality and two of the participants are undecided. Regarding VI.group 36.4% of the participants prefer training via VR, 27% of the participants would prefer training without the use of VR, and a significant number of participants 36.4% are undecided.

Table 6-40: Physical training versus virtual training for VR.group and VI.group

Would you prefer your training within a real classroom setting without any technology instead of a virtual classroom?

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	Disagree	6	54.5	54.5
		Neither agree nor disagree	2	18.2	72.7
		Agree	3	27.3	100.0
		Total	11	100.0	
VI.group	Valid	Strongly Disagree	1	9.1	9.1
		Disagree	3	27.3	36.4

	Neither agree nor disagree	4	36.4	72.7
	Agree	3	27.3	100.0
	Total	11	100.0	

The descriptive statistics for the second question are presented in table 6-41. According to the results, more than half of the participants 54.4% strongly agree that they would prefer training with the use of VR technology. 27.3% of the participants would not prefer to be trained via VR, while one participant was undecided.

Table 6-41: Physical training versus virtual training for PS.group

Would you prefer your training within a virtual classroom (with the use of Virtual Reality technology) instead of a real classroom?					
GROUP			Frequency	Percent	Cumulative Percent
PS.group	Valid	Disagree	3	27.3	27.3
		Neither agree nor disagree	1	9.1	36.4
		Agree	1	9.1	45.5
		Strongly agree	6	54.5	100.0
		Total	11	100.0	

The results indicate participants' preference regarding the type of training. Half of the participants who used the VR system would not prefer to be trained without the use of VR, while a significant percentage were undecided may be due to their inexperience and familiarization with such technology. Moreover, half of the participants who were trained in the physical (real) classroom setting claimed that they would prefer to be trained within a virtual classroom world, although they were also unfamiliar with such technology. Thus, there are strong indications that VR has the potential to become a training tool at the disposal of teachers.

6.1.13 Correlations

Correlation analysis is used to investigate possible relationships between the variables of the different scales. The bivariate Pearson Correlation was used to measure the strength and direction of linear relationships between pairs of variables. Correlations

estimate the strength of the linear relationship between two variables and range from -1.0 (perfect negative correlation) to 1.0 (perfect positive correlation). The closer correlation coefficients get to -1.0 or 1.0, the stronger the correlation is.

The null hypothesis (H_{null}) and the alternative hypothesis (H_{alt}) of the significance test for correlation are the following:

H_{null}: $\rho = 0$ (the population correlation coefficient is 0; there is no significant relationship)

H_{alt}: $\rho \neq 0$ (the population correlation coefficient is not 0; there is a statistically significant relationship)

Hinkle et al. (2003), define correlations into five categories presented in table 6-42:

Table 6-42: Correlations categorization according to Hinkle et al. (2003)

.90 to 1.00 (−.90 to −1.00)	Very high correlation
.70 to .90 (−.70 to −.90)	High correlation
.50 to .70 (−.50 to −.70)	Moderate correlation
.30 to .50 (−.30 to −.50)	Low correlation
.00 to .30 (.00 to −.30)	Negligible correlation

The presentation of the correlations follows Hinkle et al.'s categorization.

It is important to note that when the direction of the relationship is positive, this indicates that the variables tend to increase together. On the contrary, when the direction of the relationship is negative, when one variable increases, the other decreases.

The results indicated the following:

- Low to high positive and negative correlations among presence scale items (appendix B-6-8).
- Low and moderate positive correlations among empathy scale items (appendix B-6-9).
- Low and moderate positive correlations among reflection scale items (appendix B-6-10).
- Low to high positive correlations among emotions scale items (appendix B-6-11).

6.1.14 EEG results

The EEG device was used during the experiment to record the participant's brain activity during the exposure in the VR environment. The analysis of the EEG data was carried out using MATLAB (figure 6-31).

The results of the EEG recordings verified the results of the questionnaire related to presence, as both VR.group and VI.group managed to be synchronized in the alpha state, whereas the PS.group remained in the beta state that is linked mainly to memory recall (Baka et al., 2018). Hence, there were high levels of presence in both groups that were exposed to VR. The results also revealed that VR.group scored higher than VI.group. The participants of the PS.group had to confront an experience that they face in their everyday life, thus it is possible that they were not activated to provide an effort, but the experience was more of memory recall for them.

Equally important is that for this experiment the scenario had no interaction and sound to avoid the possible influence of the EEG signal by further noise from participant's movements. Despite the lack of interaction, the results revealed that the sense of presence was achieved, hence, interaction might not play a major role in the sense of presence and immersion in a VR environment (Baka et al., 2018).

Another significant outcome of the results was that both VR groups were synchronized in a theta state in the frontal area, indicating '*the cognitive effort and representing the attentional processing*' (Baka et al., 2018, p. 114). It seems that the scenario was effective in activating cognitive processes. PS.group, on the other hand, remained on the beta state, indicating the lack of cognitive processes.

Additionally, the results indicated differences regarding the occipital lobe that is the visual processing center of the brain. Only the VI.group managed to be synchronized in the alpha band, indicating differences in terms of visual attention mechanism between the two VR groups (Baka et al., 2018). It seems that the VR.group experienced a more familiar real-life based environment and the participants did not have to process any new features. On the other hand, the participants of the VI.group experienced a fantastic world that triggered the processing of new features.

Furthermore, the results indicated that the average time the brain needs to perceive and be adapted in a VR environment is 42.8 sec (SD=4.1 sec). Hence, it is important that a

VR application under development to last at least 42.8 seconds to have an impact on the participants (Baka et al., 2018).

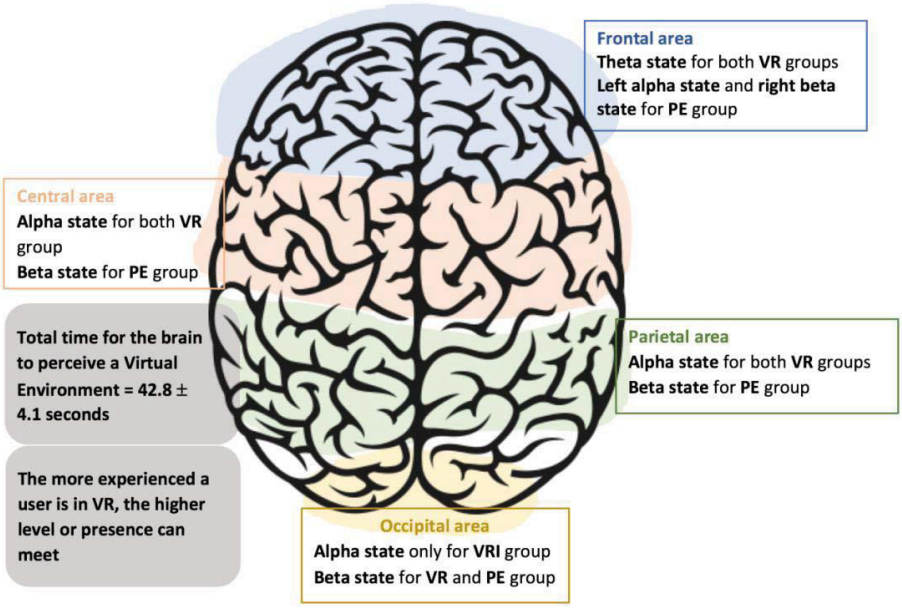


Figure 6-31: Summary of the results based on the EEG data and the questionnaire (from Baka et al., 2018)

6.1.15 Conclusions

In this sub-section of the chapter, the experimental set up of the first experiment was presented along with the aims of the research, the research methods, and questions. The scenario, the application development, and the research tools used were explained in detail. After the main findings regarding the research questions were presented. The general conclusions based on the findings are the following:

1. ***To what extent did participants feel present to the real-life based virtual classroom environment?***

The results indicate good levels of presence for the participants of VR.group that involved training in the real-life based virtual classroom. The results of the questionnaire were also confirmed by the EEG results. The virtual world was not perceived by the participants just as images, however, the lack of interaction during the scenario possibly affected the levels of presence and made participants feel inactive. Additionally, the results revealed that the VR.group tended to be aware of the physical

space they were located in. Equally important is that most of the participants were unfamiliar with VR and with the term sense of presence, resulting in the constant asking of questions about the meaning of the scale items. This issue could have affected the participant's answers, nonetheless, the sense of presence was achieved.

2. ***To what extent did participants feel present in the fantastic virtual classroom environment?***

According to the results, a sense of presence was achieved for VI.group that involved training in the virtual classroom space. VI.group was more immersed in the virtual environment and felt more detached from reality. The results were also confirmed by the EEG analysis. Equally important was that the EEG results revealed differences for VI.group regarding the occipital lobe, which is the visual processing center of the brain. It seems that the fantastic design of the virtual classroom activated participants' visual attention mechanisms as they were within an unfamiliar world that they needed to explore and process. Overall, the sense of presence was achieved, although it should be noted that the participants of the VI.group were also unfamiliar with VR systems and expressed several questions during the completion of the questionnaire due to the lack of knowledge of sense of presence.

3. ***Is the use of VR-based approaches more effective for training purposes when compared to traditional physical training?***

The results indicate the effectiveness of the VR-based approach for educational training purposes. Most of the participants trained using the VR system, would not prefer to be trained using traditional teaching approaches. Moreover, the results also revealed that the participant's training in the physical classroom space would prefer to be trained using a VR approach, although they did not see the system and were quite unfamiliar with this technology. The results were also confirmed from the EEG results, according to which the VR groups were synchronized in a theta state in the frontal areas indicating cognitive processes. On the other hand, PS.group remained in a beta state, indicating the lack of cognitive processes. Undoubtedly, further research is required regarding the comparison between training using VR approaches and traditional approaches. Nevertheless, the current research outcomes indicate higher effectiveness of VR-based approaches when compared to traditional training methods regarding the activation of cognitive processes.

4. ***To what extent did the VR intervention affect participants' emotional state?***

The results indicate that both the VR intervention and the traditional-based training approach triggered several emotional reactions to the participants both positive and negative, with negative emotions being dominant. Moreover, according to the results the participants of the PS.group experienced higher levels of negative emotions.

5. ***To what extent did the VR intervention affect participants' empathy?***

Empathy-skills assessment revealed the participant's empathetic respondence in all groups. Non-parametric tests did not reveal statistically significant differences between the three groups, apart from one variable that relates to teachers' ability to enter the position of a student who is racially and/or ethnically different. The results revealed a significant difference between the participants trained in the VR system and those trained in the physical classroom space. The VR groups scored higher to the question related to teachers 'ability to put himself/herself in the position of someone who is racially and/or ethnically different, while the physical group claimed that it is difficult to enter the position of someone who is racially and/or ethnically different. Thus, there are serious indications that perspective-taking within the virtual world and body change enhanced participants' sense of embodiment and development of embodied thinking skills resulting in the understanding of a problematic situation like bullying due to multiculturalism and enhancing empathy skills concerning multiculturalism. Nevertheless, further research is needed to investigate the impact of VR approaches on the cultivation of empathy skills, as empathy was not a primary parameter of the experiment.

6. ***To what extent did the VR intervention affect participants' reflection?***

According to the results, the process of reflection is considered of significant importance for the participants of all groups. Nevertheless, from the data, it can be concluded that the VR groups scored higher to most items of the reflection scale, with the control group being more neutral and undecided. The results indicate that the VR experience can contribute to the change of beliefs and ideas regarding multiculturalism and bullying, change the way teachers attend the needs of their students, and react to disruptive behavior among the students. Moreover, the VR experience offered the participants the opportunity to enter the student's position and experience bullying

through the student's viewpoint, challenging some firmly held ideas and promoting more support to students of other racial and ethnic groups. Within the VR environment, the camera was placed in a way allowing the participants to see themselves as being in the body of the student, offering a more immersive experience and a deeper understanding of the problem. This could not be achieved in the real classroom setting where the participants felt more like themselves, resulting in more neutral scores in the scale items. It seems that although there are indications that reflection skills were cultivated at all groups, the VR based approach was more effective encouraging reflection and understanding of different views at a higher level. The key point consists in the ability of VR to offer the user the opportunity to enter another's body, making their experience a unique learning opportunity. The great variation of the different points of view does not seem possible to achieve in a real classroom setting, and as a result, multiple perspectives reflection cannot be achieved. Overall, there are several indications regarding the effective use of VR for the cultivation of reflection skills. However, further research is required to investigate the difference in participant's reflective thoughts before and after the use of the VR system to identify its effectiveness.

7. ***Is the VR itself able to activate specific regions of the brain, influencing behavioral, motor, or other functions?***

The results of the EEG analysis indicate that a VR experience can influence the function of the brain, affecting different brain areas. Thus, VR can influence behavioral, motor, or other functions (Baka et al., 2018).

8. ***Does the design of the virtual environment play a role? Which should be the most suitable features for a VE to be able to trigger desired functions and behaviors?***

The EEG analysis revealed some differences between the two virtual environments - real-life based and fantastic- mainly in the frontal and occipital lobe, indicating at an initial stage that the design of the virtual world can play a significant role to the experience of the expected outcomes (Baka et al., 2018). Nevertheless, further research is required to investigate design issues and their role in the experience of the users.

9. ***How much time does the brain need to adapt to a VE? Consequently, which is the minimum duration that a virtual task must have to be effective?***

According to the results, the average time the brain needs to perceive and be adapted in a VR environment is 42.8 sec to be effective (Baka et al, 2018).

Furthermore, the results revealed several positive correlations (low, moderate, and few strong) between the items of the various scales.

6.2 Investigating user's virtual reality preferences

This section presents a survey that aimed to investigate the user's preferences regarding the design of the virtual environment. Research results of the first experiment, described in section 6.1, revealed that sense of presence was achieved in both VR environments, real-life based, and imaginary. The results indicated that there were few differences between the two VR groups that were not statistically significant, yet it seems that there was a preference towards the imaginary virtual environment. Moreover, the EEG results revealed that the imaginary environment activated more processes to the participants, as it was an entirely new world that they needed to explore and process. For this reason, after the analysis of the results from experiment one, it was considered of paramount importance the investigation of teachers' preferences related to the design of the virtual environment, to respond to their needs, and achieve higher levels of presence. This section presents the survey that was carried out to explore teacher's opinions regarding the design of the virtual world, the research questions, the methodological design of the research, the technique and instrument used, the sampling method, and the procedure followed.

6.2.1 Research method

The first experiment revealed small differences between the two VR groups that were not statistically significant. However, the results indicated that there might be a preference towards the fantastic virtual classroom environment, while the EEG data also indicated that the VR experienced activated more processes for the VR.group (the group that experienced the imaginary VR space). Moreover, after the end of the experiment, the participants who experienced VR were divided regarding the virtual space, with some arguing that a real-life based space is ideal for teachers, as it represents their daily

routine making them feel familiar and comfortable, and others claiming that since training will take place after their work they need to be trained in a more relaxing and fantastic environment. Hence, a need arose to investigate the needs of the target group (being teachers) related to the design of the virtual classroom space, to achieve their motivation and engagement in the training process.

An internet-based survey was carried out to investigate teachers' preferences related to the aesthetics of the virtual world. The web-based survey was chosen as the appropriate course of action due to its potential to gather greater numbers of participants (Cohen et al., 2007). Moreover, this kind of research was environment friendly and reduced the costs as the questionnaire used was not printed (Tingling et al., 2003). Additionally, using a web-based approach reduced the time to distribute the instrument and gather the data, while it enabled wider access to the target group overcoming location restrictions, that in the case of physical distribution would be impossible to approach (Cohen et al., 2007). Furthermore, the participants were able to complete the questionnaire at any time and from anywhere that resulted in achieving a higher response rate. Equally important is that according to Cohen et al. (2007) '*because of volunteer participation, greater authenticity of responses may be obtained*' (p. 230). Another important reason for choosing a web-based approach has to do with the fact that this approach allows higher-quality graphics, which was essential for this part of the research where the participants had to evaluated figures that represented different virtual environments (Tingling et al., 2003).

6.2.2 Research questions

The primary objective of the web-based survey focused on the investigation of teacher's preferences regarding the design of the virtual environment (figure 6-30). To address the above objective the following research question was formulated:

RQ. Do teachers prefer to be trained in a real-life based virtual environment or a fantastic virtual space?

Additionally, a secondary objective was set, is the investigation of teachers' training needs related to specific thematic areas that would form the basis for the design of future scenarios (figure 6-32). To address this objective the following research questions were formulated:

- What are the most significant thematic areas for teacher training?

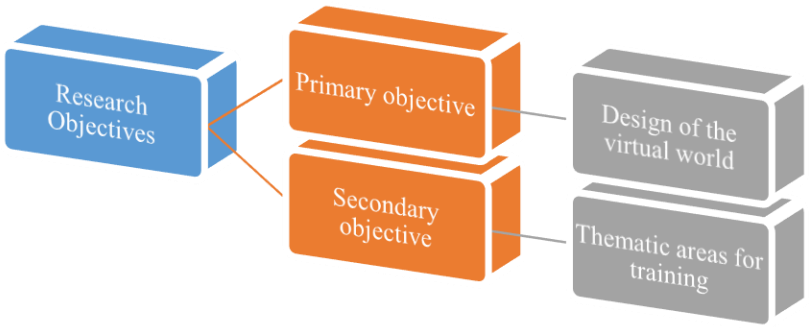


Figure 6-32: The objectives (primary and secondary) of the web-based survey

6.2.3 Sampling technique

Teachers are a difficult target group to approach due to their complex schedules and lack of time. Moreover, in some cases, teachers are negative towards participating in research as they feel that they are under evaluation. Thus, it is easier to approach the sample by contacting sample members. For this reason, the snowball sampling technique was used and at first teachers from the researcher's friendly and family-friendly environment were approached, who then were used as informants indicating other individuals in the same group who were also used as informants (Cohen et al., 2007; Robson, 2002).

6.2.4 The instrument

The questionnaire was chosen as the most appropriate instrument for the web-based survey. As the needs of this survey were specific, the questionnaire was designed from scratch to meet the needs of the research both in English and in Greece language (appendices B-6-12 and B-6-13 respectively). The questionnaire was designed within the SurveyMonkey online survey tool, to get a sharable link that was sent to potential participants.

The questionnaire consisted of four parts. The first part consisted of demographic data (country, gender, age, teaching experience, teaching specialty, current employment, teaching grade level).

Part two consisted of questions regarding virtual reality. At first, there was a definition of VR to provide feedback to those who were unfamiliar and there was a question related to participant's experience in the use of VR. The next question concerned the design of the virtual world. Three different scenes were developed within unity. The first two were the design of the virtual space for the first experiment (real-life based and imaginary classroom environments). Apart from those scenes, a third one was designed within unity representing an imaginary virtual space consisting of an ancient monument by the sea that could be used as an imaginary training scene, yet familiar to real-life based monument places (figure 6-33). Photographs were captured from unity and presented to the question and the participants had to evaluate each one of those figures using a 7-point Likert scale from absolutely inappropriate to absolutely appropriate. There were two more questions within this part of the questionnaire, one being additional comments regarding the three figures used and one being additional comments regarding their preferences of the virtual environment.

Figure 1: Real-life based environment used in experiment 1

Figure 2: Imaginary monumental environment

Figure 3: Imaginary classroom environment used in experiment 1

Figure 6-33: The three figures evaluated for the design of the virtual environment

The third part consisted of three questions. The first question included several thematic areas that the participants had to evaluate on a 5-point Likert scale from not important to very important (figure 6-34) to educators.

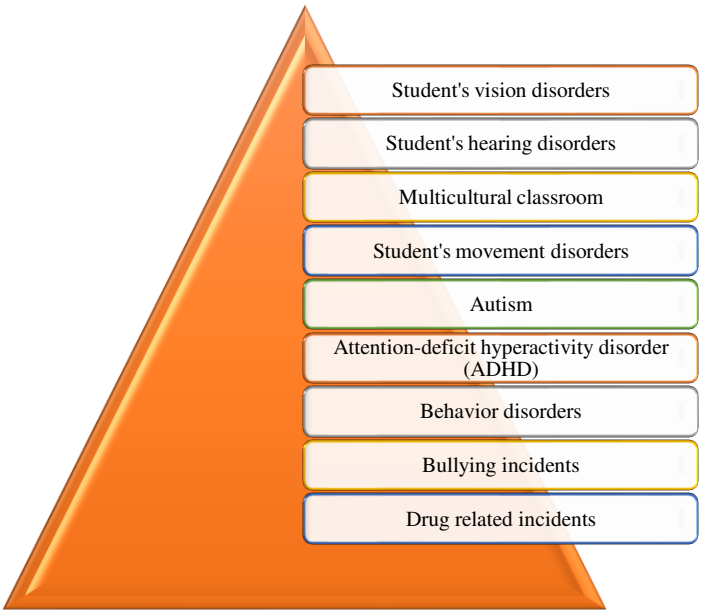


Figure 6-34: Thematic areas under evaluation

The second open-ended question concerned additional comments related to other thematic areas of significant importance. The third question concerned the kind of feedback participants would expect after a VR experience. In this question, the participants had to choose among several provided options but there was also the possibility to write their answer if they wished.

The final part of the questionnaire concerned participant's personal experience and the open-ended question aimed to collect data regarding real incidents that occurred to them during their career as teachers. This question was not obligatory.

6.2.5 The process

As it was an internet-based survey, the questionnaire link was emailed directly to the potential respondents. The link emailed initially only to teachers' coming from the researcher's friendly and family-friendly environment, and then they emailed the link to fellow teachers. Additionally, teachers approached also posted the link to closed teachers' groups existing in social media and more particularly on Facebook after

communication with the research for approval. The data gathered were automatically saved within Survey Monkey and retrieved from there.

A serious disadvantage concerning web-based research deals with participants' personal identification numbers (PINs) or other credentials such as Internet Protocol (IP) address of the respondent's computer that could lead to their identification. To address this issue all that information that could lead to possible identification was deleted during retrieving the data for analysis. Moreover, before starting completing the questionnaire there was a consent form (appendix B-6-14 for the English version and B-6-15 for the Greek version) describing the aim of the research and informing the participants about their right to withdraw at any time from the survey.

6.2.6 Data Analysis

This part presents the results of the survey related to participants' preferences about the design of the virtual world and participants' preference regarding the thematic areas that should be considered for the training scenario. More particularly results of questionnaire reliability analysis, descriptive statistics, test of normality, and non-parametric tests are presented (see figure 6-33).

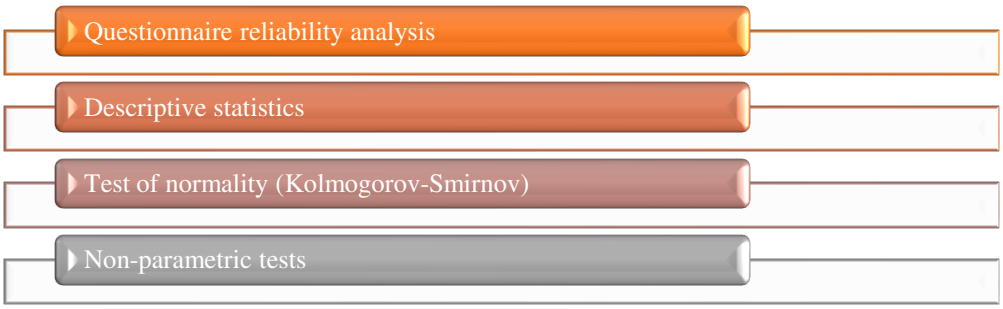


Figure 6-35: Steps of statistical analysis followed

6.2.6.1 Reliability analysis

Reliability analysis was conducted on the variables of parts II-IV. According to the results (table 6-43), the overall alpha is 0.714>0.7 indicating the reliability of the 18 variables.

Table 6-43: Reliability analysis for items of parts II-IV

Cronbach's Alpha	N of Items
.714	18

6.2.6.2 Descriptive statistics

6.2.6.2.1 The sample

In total, 78 participants completed the questionnaire. According to the results, 56.4% of the respondents were Cypriot, 39.7% were Greek, and there was also one respondent from Australia, one from Malta and one from Portugal. 65.4% of the respondents were female and 34.6% were male. Participants' age ranged from 18-60+, with half of the sample (43.6%) being 30-39 years old (figure 6-36). Participant's teaching experience ranges from 1 to 33 years (figure 6-37). As far as teaching specialty is concerned the participants come from a variety of fields including primary education, literature, physics, mathematics, art, English language, economics, special education, music (table 6-44).

Table 6-44: Participants' teaching specialty

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Art	1	1.3	1.3	1.3
	Biology	2	2.6	2.6	3.8
	Chemistry	2	2.6	2.6	6.4
	Economics	1	1.3	1.3	7.7
	English and Media	1	1.3	1.3	9.0
	English Language	11	14.1	14.1	23.1
	French language	1	1.3	1.3	24.4
	Informatics	8	10.3	10.3	34.6
	Literature	13	16.7	16.7	51.3
	Mathematics	9	11.5	11.5	62.8
	Mechanical Engineer	2	2.6	2.6	65.4
	Multimedia, Robotics	1	1.3	1.3	66.7

Music	1	1.3	1.3	67.9
Physics	7	9.0	9.0	76.9
Primary education	14	17.9	17.9	94.9
Public Relations	2	2.6	2.6	97.4
Special Education	1	1.3	1.3	98.7
Theologist	1	1.3	1.3	100.0
Total	78	100.0	100.0	

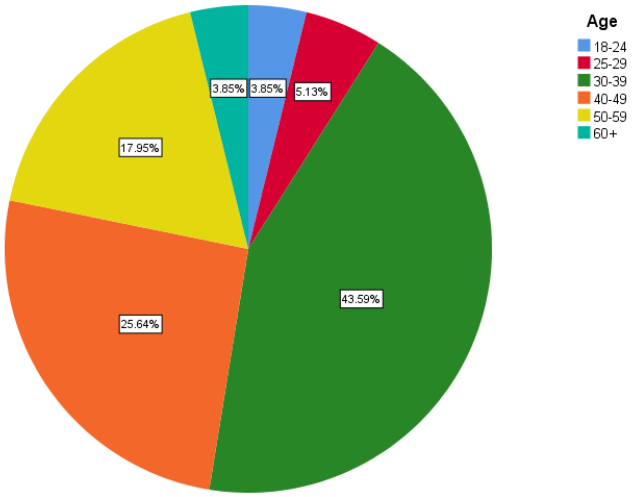


Figure 6-36: Participant's age range

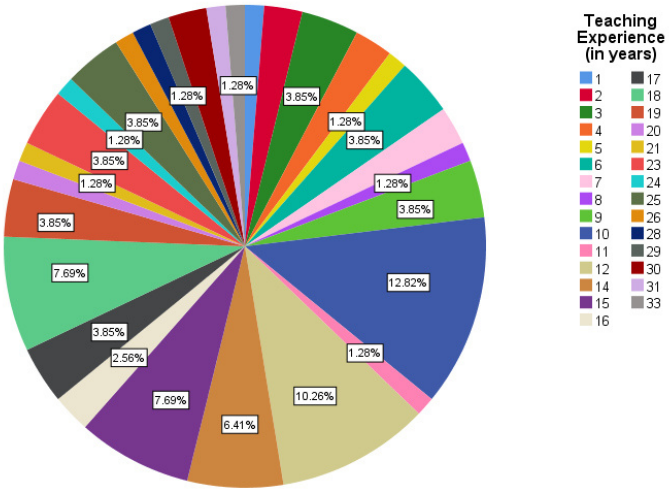


Figure 6-37: Participant's teaching experience in years

All the participants were currently working as teachers in all grades of education, from primary education to higher education, adult education, and private education sector (figure 6-38).

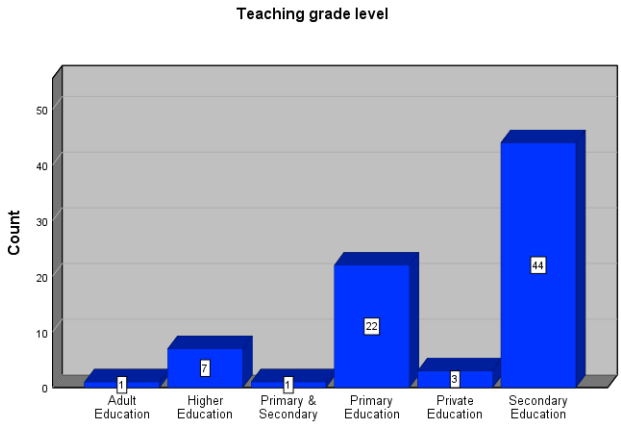


Figure 6-38: Participant's teaching grade level

Furthermore, most of the participants (78.2%) claimed to be inexperienced and unfamiliar concerning the use of VR, with few participants claiming to be from moderately to very much familiar with VR technology (figure 6-39).

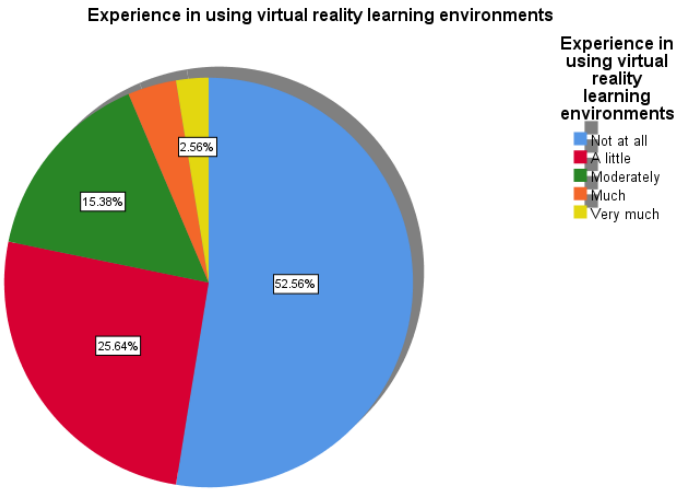


Figure 6-39: Participants familiarity with VR

6.2.6.2.2 Participant's preferences regarding the design of the virtual environment

The participants had to evaluate three photographs, each one representing a different virtual environment developed within unity. One of the photographs represented a real-

life based classroom environment, while the other two represented imaginary virtual spaces. The results indicate that the participants found figure 1 inappropriate as a training scene scoring low (table 6-45).

Table 6-45: Participants preference in figure 1

Please indicate your preference for figure 1.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Absolutely inappropriate	24	30.8	30.8	30.8
	Inappropriate	14	17.9	17.9	48.7
	Slightly inappropriate	13	16.7	16.7	65.4
	Neutral	18	23.1	23.1	88.5
	Slightly appropriate	2	2.6	2.6	91.0
	Appropriate	5	6.4	6.4	97.4
	Absolutely appropriate	2	2.6	2.6	100.0
	Total	78	100.0	100.0	

The results identified that figure 2 was considered appropriate for training purposes, with most of the participants (58.9%) scoring from slightly to absolutely appropriate and 33.3% being neutral (table 6-46).

Table 6-46: Participants preference in figure 2

Please indicate your preference for figure 2.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Inappropriate	2	2.6	2.6	2.6
	Slightly inappropriate	4	5.1	5.1	7.7
	Neutral	26	33.3	33.3	41.0
	Slightly appropriate	16	20.5	20.5	61.5
	Appropriate	16	20.5	20.5	82.1
	Absolutely appropriate	14	17.9	17.9	100.0
	Total	78	100.0	100.0	

Furthermore, according to the results participants evaluated positively the third figure as well, with 67.9% scoring from slightly to absolutely appropriate and 28.2% being neutral (table 6-47).

Table 6-47: Participants preference in figure 3

Please indicate your preference for figure 3.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Inappropriate	1	1.3	1.3	1.3
	Slighly inappropriate	2	2.6	2.6	3.8
	Neutral	22	28.2	28.2	32.1
	Slightly appropriate	14	17.9	17.9	50.0
	Appropriate	28	35.9	35.9	85.9
	Absolutely appropriate	11	14.1	14.1	100.0
	Total	78	100.0	100.0	

Hence, the results indicate that the imaginary scenes were the most preferable virtual environment to be used for training purposes. The mean score indicated that figure 2 (the monument scene) scored a little higher than the virtual classroom scene of figure 3, yet a large number of participants claimed to be undecided towards the monument scene (figure 6-40).

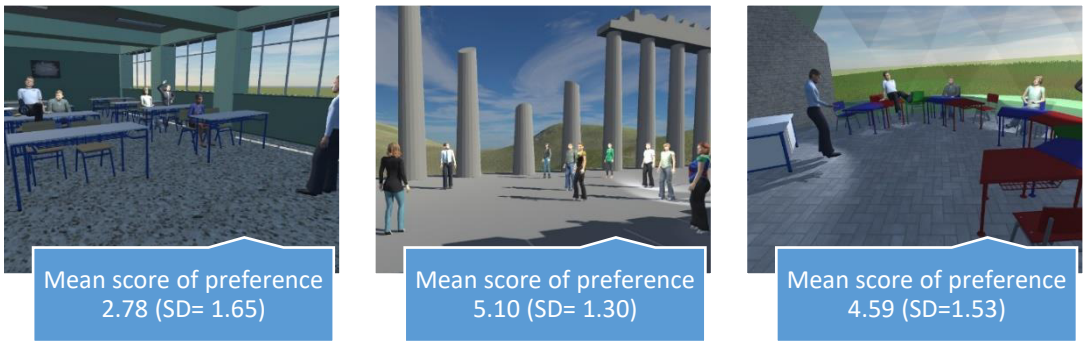


Figure 6-40: Mean scores related to participants preferences towards the three difference virtual scenes

To the question for additional comments, some of the participants proposed their ideas that can be summarized in table 6-48.

Table 6-48: Participant's additional comments regarding the virtual environment

The meeting environment should not be full like a classroom.
More colors.
Expressions in avatar faces.
Figure 1 has no potential; Figure 2 is perfect for the virtual tour and Figure 3 is suitable for relaxation.
Better lighting.
The expected classroom environment should not be avoided. However, the VR application should support advanced informal learning environments.
The 2nd and 3rd images are closer to teachers' demands.
Figures 2 and 3 are appropriate to live the experience.
The environment must be attractive and interesting.

6.2.6.2.3 Participants' preferences about the thematic areas to be trained

The participants were asked to identify the most important thematic areas for training. Nine thematic areas were proposed to the participants and they were also provided the ability to state their own opinion towards this significant issue. The results revealed that all thematic areas were identified as quite important for the participants. According to table 6-49, autism and bullying incidents were identified with a very small difference as the most important ones with a mean score of 3.76 (SD=1.02) for autism and 3.74 (SD=.97) for bullying incidents. Attention-deficit hyperactivity disorder (ADHD) was also considered to be an important thematic area with a mean score of 3.70 (SD=.99) followed by drug-related incidents (M=3.62, SD=1.05). Nevertheless, the rest of the thematic areas student's vision, hearing, and movement disorders, multicultural classroom, and behavior disorders are also considered to be highly important for teacher training and there are no significant differences among mean scores (figure 6-41).

Table 6-49: Participants' preferences about the thematic areas to be trained

	N Valid	Mean	Std. Deviation	Minimum	Maximum
Student's vision disorders	78	3.6026	.77861	2.00	5.00
Student's hearing disorders	78	3.5897	.82864	2.00	5.00

Multicultural classroom	78	3.3590	.88236	1.00	5.00
Student's movement disorders	78	3.5128	.93619	1.00	5.00
Autism	78	3.7564	1.02166	1.00	5.00
Attention-deficit hyperactivity disorder (ADHD)	78	3.6923	.99750	1.00	5.00
Behavior disorders	78	3.6026	.90223	1.00	5.00
Bullying incidents	78	3.7436	.97282	1.00	5.00
Drug related incidents	78	3.6154	1.04733	1.00	5.00

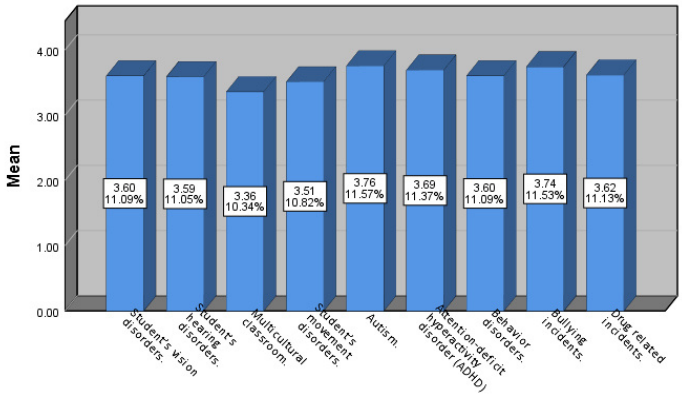


Figure 6-41: Participants' preferences regarding the thematic areas

The participants could propose other thematic areas that could be part of the training scenario, yet only a few proposed other thematic area that was: student's encouragement to develop their skills; dyslexia; delinquency incidents; student's personal problems and enhance teacher's skills on the identification of problems and disorders that students might face.

6.2.6.2.4 Participant's preferences regarding the feedback

The participants were asked to identify their preferences regarding the feedback that they expect after VR training through multiple response questions. According to the results, 78.2% of the participants would expect good practice advice (table 6-50). Moreover, performance evaluation also seems important as 59% of the participants selected this response (table 6-50). Additionally, it seems that the participants would

prefer individual performance assessment rather than performance assessment comparatively to other users (table 6-50).

Table 6-50: Participant's preferences regarding the feedback

		Responses		Percent of Cases
		N	Percent	
Feedback	Good practice advice	61	39.4%	78.2%
	Performance evaluation	46	29.7%	59.0%
	No feedback	1	0.6%	1.3%
	Individual performance assessment	34	21.9%	43.6%
	Performance assessment comparatively to other users	13	8.4%	16.7%
Total		155	100.0%	198.7%

a. Dichotomy group tabulated at value 1.

The participants were given the ability to propose their own opinion regarding the expected feedback, yet none answered this question.

6.2.6.3 Normality tests

The One-Sample Kolmogorov-Smirnov procedure was used to test whether the sample distribution is homogenous, which would determine the use of parametric or non-parametric tests. The One-Sample Kolmogorov-Smirnov procedure was used to test the variables that concerned the evaluation of the three figures, the thematic areas, and the feedback items. As the Sig. value under the One-Sample Kolmogorov-Smirnov column is lower than 0.05, we can conclude that all items tested are not normally distributed (table 6-51). For this reason, non-parametric tests were used.

Table 6-51: Normality test output

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Please indicate your preference for figure 1.	.170	78	.000
Please indicate your preference for figure 2.	.213	78	.000
Please indicate your preference for figure 3.	.193	78	.000

Student's vision disorders.	.281	78	.000
Student's hearing disorders.	.287	78	.000
Multicultural classroom.	.235	78	.000
Student's movement disorders.	.221	78	.000
Autism.	.184	78	.000
Attention-deficit hyperactivity disorder (ADHD).	.192	78	.000
Behavior disorders.	.261	78	.000
Bullying incidents.	.201	78	.000
Drug-related incidents.	.183	78	.000
Good practice advice feedback	.482	78	.000
Performance evaluation feedback	.386	78	.000
No feedback	.532	78	.000
Individual performance assessment	.373	78	.000
Performance assessment comparatively to other users	.505	78	.000

6.2.6.4 Non-parametric tests for figures

The main objective of the survey was to investigate participant's preferences related to the design of the virtual environment. For this reason, the participants were provided with three figures that they had to evaluate as appropriate or not for the virtual training space. Descriptive statistics indicated that the participants preferred the figures that represented an imaginary virtual space. Friedman Test reported that there was a statistically significant difference between the evaluation of the three figures, $\chi^2(2) = 74.858$, $p = 0.000$ (table 6-52 and figure 6-42).

Table 6-52: Friedman test for the three figures

N	78
Chi-Square	74.858
df	2
Asymp. Sig.	.000

Hypothesis Test Summary

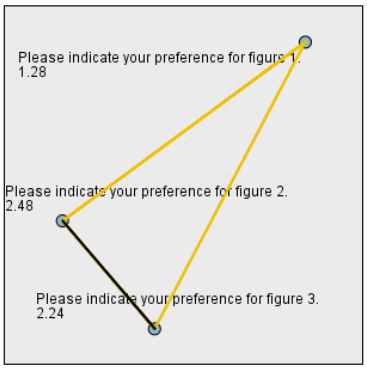
	Null Hypothesis	Test	Sig.	Decision
1	The distributions of Please indicate your preference for figure 1. , Please indicate your preference for figure 2. and Please indicate your preference for figure 3. are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Figure 6-42: Friedman test to evaluate the three figures

Pairwise Comparison revealed statistically significant differences between the three groups. The diagram in figure 6-43 shows the mean rank for each method and an orange line joins significantly different pairs. The difference in the mean ranks for figures 1 and 3 is -.955, the standardized test statistic -5.965 and the p-value to be reported is p=0.000. Additionally, the difference in the mean ranks for figures 1 and 2 is -1.199, the standardized test statistic -7.486 and the p-value to be reported is p=0.000. Furthermore, the difference in the mean ranks for figures 2 and 3 is .244, the standardized test statistic 1.521 and the p-value to be reported is p=0.385.

Pairwise Comparisons



Each node shows the sample average rank.

Sample1-Sample2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj.Sig.
Please indicate your preference for figure 1. -Please indicate your preference for figure 3.	-.955	.160	-5.965	.000	.000
Please indicate your preference for figure 1. -Please indicate your preference for figure 2.	-1.199	.160	-7.486	.000	.000
Please indicate your preference for figure 3.-Please indicate your preference for figure 2.	.244	.160	1.521	.128	.385

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .05.
Significance values have been adjusted by the Bonferroni correction for multiple tests.

Figure 6-43: Pairwise comparison for the three figures

From the results, it can be concluded that there was a statistically significant difference between the three figures (figure 6-44). According to the results, the participants found inappropriate for training purposes of the real-life based virtual classroom scene and selected the imaginary virtual spaces. No statistically significant differences were identified between the figures that represented the two imaginary virtual spaces.

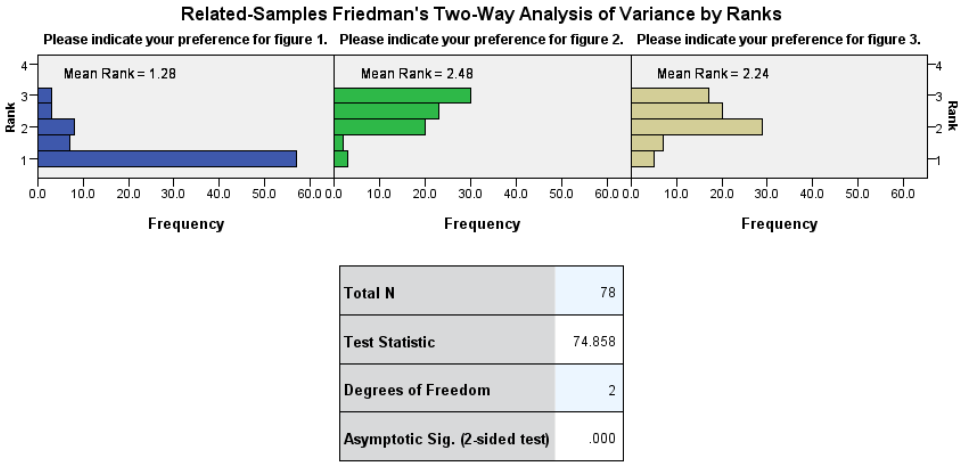


Figure 6-44: Mean-score differences between the three figures under evaluation

6.2.6.5 Non-parametric tests for the thematic areas

Related to participant's preferences regarding the thematic areas that are important as part of the training scenario Friedman Test reported that there was a statistically significant difference between the items, $\chi^2(2) = 20.948$, $p = 0.007$ (table 6-53 and figure 6-45).

Table 6-53: Friedman test for the thematic areas

N	78
Chi-Square	20.948
df	8
Asymp. Sig.	.007

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distributions of Student's vision disorders., Student's hearing disorders., Multicultural classroom., Student's movement disorders., Autism., Attention-deficit hyperactivity disorder (ADHD)., Behavior disorders., Bullying incidents. and Drug related incidents. are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.007	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Figure 6-45: Friedman test to evaluate the significance of the thematic areas

Pairwise Comparison revealed statistically significant differences for two thematic areas. The diagram in figure 6-46 shows the mean rank for each thematic area and the black line joins significantly different pairs. The difference in the mean ranks for multicultural classroom and bullying incidents is -1.013, the standardized test statistic -2.310 and the p-value to be reported is p=0.021. Additionally, the difference in the mean ranks for multicultural classroom and autism is -1.090, the standardized test statistic -2.485 and the p-value to be reported is p=0.013 (figure 6-47). For the rest thematic areas, pairwise comparisons did not reveal any statistically significant differences. It can be concluded that multicultural classrooms, bullying incidents, and autism are the most important thematic areas for training scenarios.

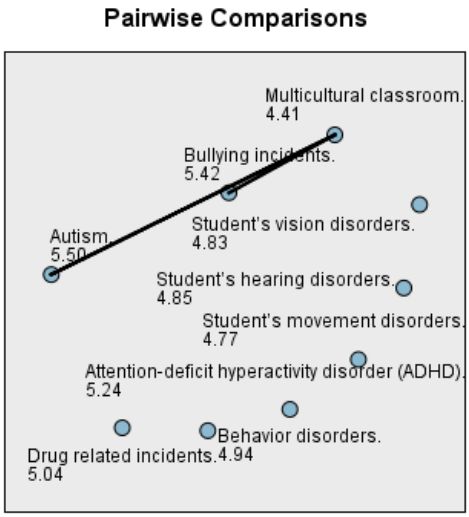


Figure 6-46: Pairwise comparison for the thematic areas

Each node shows the sample average rank.

Sample1-Sample2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj.Sig.
Multicultural classroom.-Student's movement disorders.	-.359	.439	-.819	.413	1.000
Multicultural classroom.-Student's vision disorders.	.423	.439	.965	.335	1.000
Multicultural classroom.-Student's hearing disorders.	.436	.439	.994	.320	1.000
Multicultural classroom.-Behavior disorders.	-.526	.439	-1.199	.231	1.000
Multicultural classroom.-Drug related incidents.	-.635	.439	-1.447	.148	1.000
Multicultural classroom.-Attention-deficit hyperactivity disorder (ADHD).	-.827	.439	-1.886	.059	1.000
Multicultural classroom.-Bullying incidents.	-1.013	.439	-2.310	.021	.753
Multicultural classroom.-Autism.	-1.090	.439	-2.485	.013	.466
Student's movement disorders.-Student's vision disorders.	.064	.439	.146	.884	1.000
Student's movement disorders.-Student's hearing disorders.	.077	.439	.175	.861	1.000
Student's movement disorders.-Behavior disorders.	-.167	.439	-.380	.704	1.000
Student's movement disorders.-Drug related incidents.	-.276	.439	-.629	.530	1.000
Student's movement disorders.-Attention-deficit hyperactivity disorder (ADHD).	-.468	.439	-1.067	.286	1.000
Student's movement disorders.-Bullying incidents.	-.654	.439	-1.491	.136	1.000
Student's movement disorders.-Autism.	-.731	.439	-1.666	.096	1.000
Student's vision disorders.-Student's hearing disorders.	-.013	.439	-.029	.977	1.000
Student's vision disorders.-Behavior disorders.	-.103	.439	-.234	.815	1.000
Student's vision disorders.-Drug related incidents.	-.212	.439	-.482	.630	1.000
Student's vision disorders.-Attention-deficit hyperactivity disorder (ADHD).	-.404	.439	-.921	.357	1.000
Student's vision disorders.-Bullying incidents.	-.590	.439	-1.345	.179	1.000
Student's vision disorders.-Autism.	-.667	.439	-1.520	.128	1.000
Student's hearing disorders.-Behavior disorders.	-.090	.439	-.205	.838	1.000
Student's hearing disorders.-Drug related incidents.	-.199	.439	-.453	.650	1.000
Student's hearing disorders.-Attention-deficit hyperactivity disorder (ADHD).	-.391	.439	-.892	.373	1.000
Student's hearing disorders.-Bullying incidents.	-.577	.439	-1.316	.188	1.000
Student's hearing disorders.-Autism.	-.654	.439	-1.491	.136	1.000
Behavior disorders.-Drug related incidents.	-.109	.439	-.248	.804	1.000
Behavior disorders.-Attention-deficit hyperactivity disorder (ADHD).	.301	.439	.687	.492	1.000
Behavior disorders.-Bullying incidents.	-.487	.439	-1.111	.267	1.000
Behavior disorders.-Autism.	.564	.439	1.286	.198	1.000
Drug related incidents.-Attention-deficit hyperactivity disorder (ADHD).	.192	.439	.439	.661	1.000
Drug related incidents.-Bullying incidents.	.378	.439	.862	.388	1.000
Drug related incidents.-Autism.	.455	.439	1.038	.299	1.000
Attention-deficit hyperactivity disorder (ADHD).-Bullying incidents.	-.186	.439	-.424	.672	1.000
Attention-deficit hyperactivity disorder (ADHD).-Autism.	.263	.439	.599	.549	1.000
Bullying incidents.-Autism.	.077	.439	.175	.861	1.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .05.
Significance values have been adjusted by the Bonferroni correction for multiple tests.

Figure 6-47: Pairwise comparison for the thematic areas

6.2.6.6 Participant's personal experience

The final question was an open-ended question concerning teacher's personal experiences from their teaching career. This question aimed to collect data about real incidents that occurred that could be used for the development of future training scenario, as the aim of the application is to prepare and train teachers to deal with real-life circumstances. Only a few of the participants answered this question and their experiences-thematic areas are presented in table 6-54.

Table 6-54: Participant's experiences during their teaching life

1.	Teaching at prison school, a shocking experience due to the special category and special interest of the students for learning and re-integration into the society.
2.	Students refuse to participate in the lesson and bad behavior.
3.	A student with problematic behavior, with no boundaries, disrespecting teachers throughout the year, getting expulsions, and inability to communicate with student's parents.
4.	'Teaching about bullying and presenting a corresponding movie video. All the students in the class became aware of the problem and participated in this lesson and especially in the discussion. What I will not forget was my thinking at the time that my students were mature and had reached a level where they expressed their views on the topic that they were interested in taking the floor without raising their hand, with no fuss or help, by achieving the main goal that was respecting each other'. (participants' comment)
5.	Managing an incident of epilepsy.
6.	An incident that had to do with separating a student and an intruder to the school who was holding a knife.
7.	Students who challenge teachers to make them engage in banned behaviors (e.g. assault the student).
8.	'A lesson in the countryside and the areas of Performing Arts. It is very important to encourage the recruitment of both teachers and students in informal learning environments. The stimuli should encourage all senses that should not be reproduced solely through technology. Interaction should focus not only on potential environments but on real-world interaction. Augmented reality can work very well in this direction as it combines the natural environment. Examples of such interactions must also be simulated on similar training platforms'. (participant's comment)
9.	'When a sixth-grade student with Asperger's Syndrome felt that his classmates were indifferent to him, at the time during the break he found a hole in the school fence and went home. When the lesson resumed, and we understood all in the classroom that the student was missing we tried to find him. We spent moments of anxiety until we saw the child's mother bring him back to school. All the students and I were quiet. As soon as we saw him, we ran to welcome him, and he burst into tears'. (participant's comment)

10. ‘After using some applications that enriched the teaching process, the children's enthusiasm that they accomplished something important’. (participant’s comment)
11. Students crying constantly, destroying group cohesion, and making inappropriate suggestions to the teacher.
12. Two autistic students in the same classroom.
13. ‘When a first-grade girl pee in the classroom because she thought it was bad to ask to go to the toilet, as I had told the students not to ask for the toilet during class time to lose classroom time and that they would go to the toilet during break time. When I noticed the situation that the child had fallen into due to my observation, I was very embarrassed and did not know how to handle the situation to make it easier for the girl without putting her in a worse position than she already was especially with her classmates’. (participant’s comment)

6.2.7 Survey Conclusions

The primary aim of the survey was to identify teachers’ needs related to the design of the virtual training space. As experiment 1 indicated a small preference for the imaginary virtual classroom environment, it was considered essential to identify the preferences of the group would. Feedback from the target groups was of paramount importance for the further development and modifications to the VR application to meet their needs and active their engagement and participation in the virtual training. The results of the survey indicated that most of the teachers found the real-life based virtual classroom as inappropriate to be used in the virtual world and selected the virtual classroom space used in experiment 1 and also the imaginary monument scene. This outcome was extremely significant for the design of the other experiments that followed. Moreover, the outcome confirmed the opinions of the target group during the design phase of the models that expressed claimed that as their daily routing is within a classroom they would like to be training in a more imaginary environment.

Regarding the thematic areas, the results indicate that all are highly important for teacher training and there are no significant differences among mean scores. However, non-parametric tests revealed that there was a statistically significant difference regarding the thematic areas: multicultural classroom, bullying incidents, and autism. Furthermore, as far as participant’s preferences regarding the feedback that they expect after VR training it seems that most of them prefer good practice advice, performance evaluation, and individual performance assessment rather than performance assessment comparatively to other users of the system.

6.3 Conclusions

This chapter was divided into two parts. The first part presented the first evaluation of the VR prototype that was developed. The objectives of the experiment were to investigate the levels of presence in the two VR environments (real-life based and fantastic) that were developed and identify possible differences between training in a virtual classroom and a physical classroom. The outcomes of the research indicated good levels of presence at both VR environments, while VR-based training had a higher impact on the participants than traditional classroom training. There were also indications of a positive impact of VR-based training on participants' empathy and reflection skills. The results revealed small but not statistically significant differences between the group that was trained in the real-life based virtual classroom space and the group that used the fantastic virtual classroom space. To determine which classroom space (real-life based or fantastic) is more appropriate for the target group a survey was conducted aiming to investigate user's preferences regarding the design of the virtual environment. The results revealed that active teachers preferred to be trained in a more fantastic classroom space probably because they spend daily many hours within a classroom. Hence, within the virtual space, they prefer a different environment that does not represent their daily routine. Both the outcomes of the first experiment and the survey contributed to further modification of the VR system and app and led to the second experiment and evaluation that is presented in the next chapter.

7 Investigating presence, empathy, emotions, and perspective-taking in a VR environment simulating drug use in the school context

Chapter 6 presented the primary evaluation of the VR prototype concerning issues related to the appearance of the virtual environment. Moreover, the previous chapter presented an investigation of the impact of VR classroom training versus physical classroom training. The experiment presented in the previous chapter led to significant outcomes and modifications of the VR application. This chapter presents the second evaluation of the VR application aiming to investigate the levels of presence in the VR environment and whether the levels of presence are affected by different viewing perspectives. Moreover, the second experiment aimed to investigate the impact of VR on participants' emotions and empathy.

7.1 Experimental Research design

The experimental strategy was used to investigate the impact of the VR application (Robson, 2003; Ross & Morrison, 2004). The main aim of this second experiment was to identify whether perspective-taking during the experiment had an impact on participants' sense of presence. Moreover, participants' emotional experiences were under investigation along with the impact of the VR training on their empathy skills. The experimental design was selected as the most suitable approach to provide feedback about the VR application leading to the last modifications of the last version of the VR app that was evaluated (the third evaluation is presented in the next chapter 8). The experiment design is a two-group pre/post-test experiment. Both groups used the VR system for training and the control group did not experience the perspective of the student facing the disorder, to investigate whether the perspective plays a role in the VR experience. The participants were randomly distributed between the two groups (Cohen et al., 2002; Robson, 2003).

7.2 The objective and research questions

The main aim of the second experiment was to investigate the levels of presence and whether the different perspectives that the participants experience affected their presence. Another important objective was to evaluate the impact of the VR experience

on participants' emotions and empathy skills and whether the different perspectives impacted also emotions and the cultivation of empathy. To address the above objectives the following research questions were formulated:

RQ 1. To what extent did participants feel present in the virtual school space?

RQ 2. To what extent did the virtual environment affect participants' sense of embodiment?

RQ 3. To what extent did the VR intervention affect participants' emotions?

RQ 4. To what extent did the VR intervention affect participants' empathy?

RQ 5. To what extent did perspective-taking had an impact on the levels of presence, emotions, and empathy?

The above objectives and research questions were measured using apart from a questionnaire, an electroencephalogram (EEG) device that recorded brain activity (Christofi et al., 2018).

7.3 The scenario

The scenario was inspired by the real bullying incident that took place in 2017 in a high school in Cyprus associated with the use of substances given to a 12-year-old student by his classmates, in the form of pills and after threats (Kounnou, 2017).

The scenario that was designed takes place in the school outdoors space during break time. A female student (named Anna) is approaching her classmate (Nikos), who is sitting on a bench, facing substance use disorder. Anna is asking another classmate (Kostas) what has happened to Nikos who responds with laughs, trying to pressure her to take and smoke a cannabis cigarette by threatening to hurt her little sister. Anna refuses to take the cigarette, while the teacher approaches them. The teacher asks for clarifications while wondering what happened to the student sitting on the bench. Anna out of fear of putting her sister into trouble is afraid and leaves without telling the teacher what happened.

The scenario portrays cannabis use which is also mentioned as marijuana in the scenario (which is a name for the cannabis plant). It was important to simulate the symptoms of substance use to provide the participants with experience close to reality. For this reason, motion blur was added as an effect to the camera and the colors were brighter (figure 7-1) (marijuana may cause head rush or dizziness and heightened sensory

perception) (Djulus et al., 2005; Thomas et al., 2014). Moreover, the eyes of the avatar were colored red, as reddened eyes are an effect of marijuana use (Djulus et al., 2005; Halikas et al., 1985) (figure 7-7 below). Furthermore, the audio files have been edited, echo effects were added along with lowering the pitch, while the font of the text appearing to the users was modified so that those experiencing the perspective of the drug user could not read it (see figure 7-1).

Figure 7-1: Left: bright colors and font appearance in student drug user scene, Right: the student-drug user

7.3.1 Addressing substance use in school via VR and perspective-taking

A systematic review of empirical studies was conducted about VR in the assessment, understanding, and treatment of mental health disorders (Freeman et al., 2017). They concluded, from the early studies, that VR environments can elicit psychiatric symptoms and that the adequate manipulation of such environments can give information about the understanding of disorders. Moreover, simpler psychological treatments can be successfully administered in VR.

VR has the potential to present individuals with a simulation of the cues that lead to the cravings that drive subsequent problematic behaviors such as drug misuse, alcohol abuse, or excessive gambling. There have been 22 VR studies on substance disorders, with 15 concerning assessment, and the rest treatment and theory development. The overwhelming majority of the studies have simply shown that appropriate VR environments can trigger cravings. However, most of the work has concerned smoking (Bordnick et al., 2005).

Substance use is not only a major societal concern but also a serious problem within the school environment. Data reported in the literature related to drug use in educational premises indicate the cause for concern across European countries as there are many

cases recorded, even in primary education (Kounnou, 2017). Hence, substance use in schools is a fact and a real problem and not a possibility and as such should be treated. However, this specific type of problem in schools has always been a taboo subject and neglect has been an ongoing challenge as the school and the teachers are afraid to deal with it. It is essential that both the school and the teachers are in the position to realize that students dealing with drug use disorders are not the problem, but they are facing a problem. It is of paramount importance that teachers are open to accepting this type of student disorder that might occur in the school or their classroom. Moreover, teachers should be able to detect possible symptoms of students associated with such disorders (such as aggression towards teachers or classmates, indolence, sleepiness, etc.), as their role is significant to the promotion of preventive actions and raising student's awareness. However, preventive actions by teachers are unclear and teacher training in issues concerning substance use in school is missing. As a result, teachers face similar situations with embarrassment, weakness, and fear to face them, while at the school level when such an incident occurs, the proper solution is their transportation to another school to transfer the problem elsewhere.

Taking all the above into consideration, the purpose of the second scenario was to promote systematic teacher training concerning substance use in schools and the cultivation of empathic skills towards the student that face this serious problem. To address this objective the most important parameter of the current experiment was perspective-taking. Using VR based methodology will allow teachers to put themselves to the position of a student facing substance use disorder, explore the attitudes of others, and understand the problem of raising their awareness.

7.4 The groups and perspectives

The users who participated in the experiment were divided into two groups. Users of all groups initially experienced the perspective of the teacher. During the progress of the scenario, the perspective of the users changed, and they were able to change perspective entering the position of the student. All the perspectives were first-person perspectives (1PP).

The three perspectives were the following:

- Perspective I: Teacher Perspective (TP) (figure 7-2)
- Perspective II: Student Drug User Perspective (SDUP) (figure 7-3)
- Perspective III: Healthy Student Perspective (HSP) (figure 7-4)

Figure 7-2: Teacher's perspective during the scenario (watching the three student avatars)

Figure 7-3: Student Drug User Perspective (Nikos)

Figure 7-4: Healthy Student Perspective (Anna)

The participants were divided into two groups:

Group 1: The participants initially experienced the teacher's perspective and then they changed avatar and experienced the same scenario through the eyes of the student drug user.

Group 2: The participants initially experience the teacher's perspective and then they entered the virtual body of the healthy student Anna.

The two groups and the perspectives participants experienced are presented in figure 7-5 below.

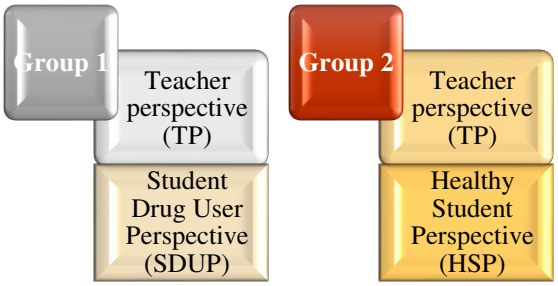


Figure 7-5: The 2 groups and perspectives

7.5 Application design and development

In this sub-section, the overall process of developing the VR application is explained in detail.

7.5.1 The avatars of the virtual students and the teacher

All of the 3D avatars of the virtual students were developed using Autodesk® Character Generator (https://charactergenerator.autodesk.com). The avatar of the teacher is presented in figure 7-6 (left). The avatar of the teacher was female randomly chosen. The avatar of the healthy student is presented in figure 7-6 (right).

Figure 7-6: Teacher's avatar (left), healthy student (right)

For the purpose of the research and to simulate the student-drug user, to one of the avatars the eyes were colored red. The avatar of the student-drug user (Nikos) is presented in figure 7-7 (left). In figure 7-7 (middle) the symptom of the colored eyes is presented. Figure 7-7 on the right presents the avatar of the student responsible for giving the substances to Nikos.

Figure 7-7: The avatar of the student-drug user (left), the red-eye symptom (right)

Users' viewpoint was a first-person perspective (1PP). 1PP was chosen as the most suitable perspective for the current experiment due to its positive impact on users' sense of embodiment and presence (Gorisse et al., 2017; Slater et al., 2010). The literature so far reveals that the viewpoint can affect the sense of presence and the sense of embodiment (Gorisse et al., 2017). However, this was not the main reason for choosing 1PP for the experiment. The aim of the research was to allow the users to experience different viewpoints and body change within the virtual world to better understand virtual student's situations by 'entering in their shoes' and as such 1PP was considered the most suitable approach. The current research focuses on 1PP and the camera was placed at the height of the avatar's eyes (figure 7-8).

Figure 7-8: Camera position at the height of the avatar's eyes for 1PP

7.5.2 VR application development

7.5.2.1 The virtual school world

The virtual scene represented the outdoor school space, as due to teacher's suggestions drug-related incidents usually take place in the outdoor space. Hence the school model

presented in chapter 5 was used and the outdoor space was developed within Unity. The virtual school outdoor space is presented in figure 7-9.

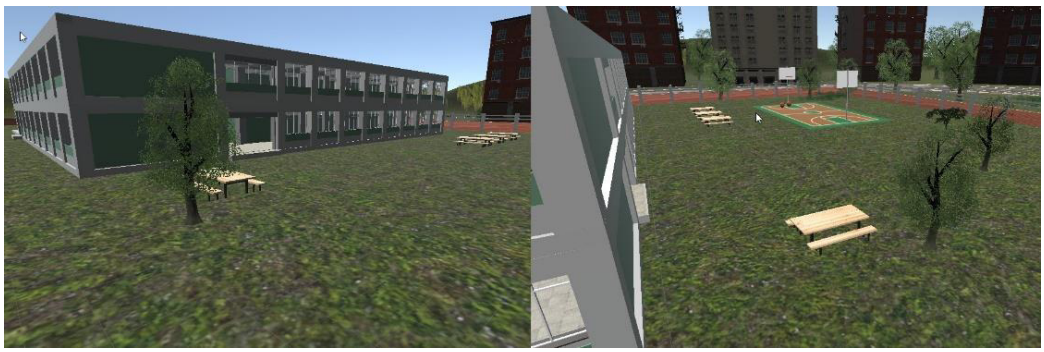


Figure 7-9: Virtual outdoor space within Unity

7.5.2.2 The sequence of scenario in the VR application

The sequence of the facts happening during the teacher's perspective is presented in figure 7-10.

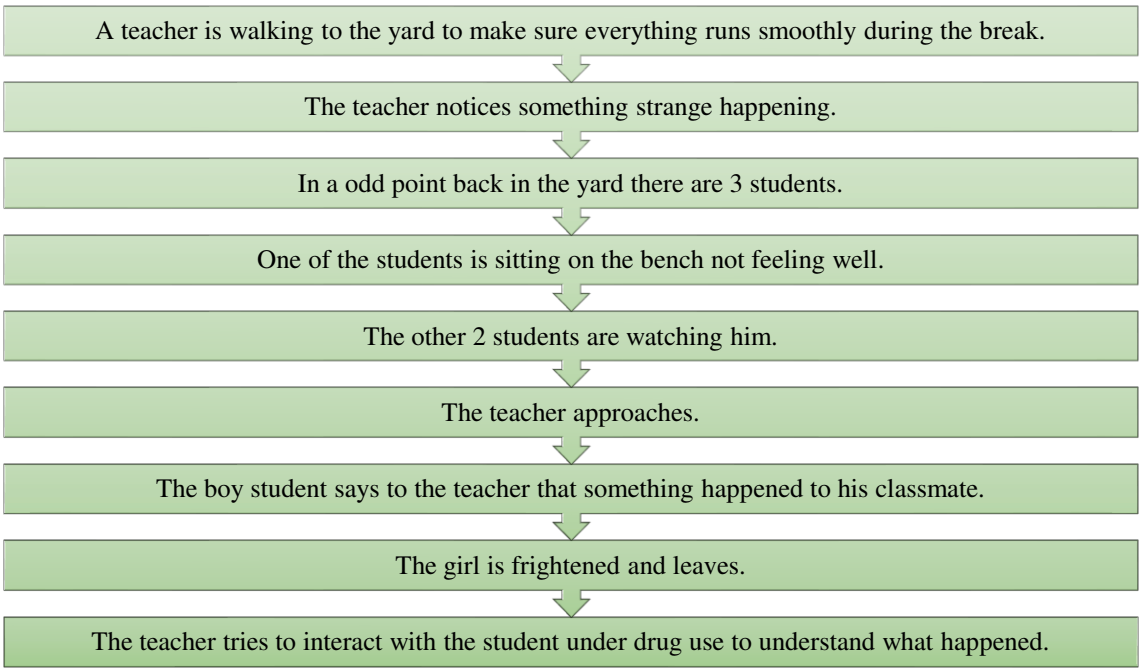


Figure 7-10: The sequence of the scenario in the teacher's perspective

The sequence of the facts happening during Anna's (healthy student) perspective is presented in figure 7-11.

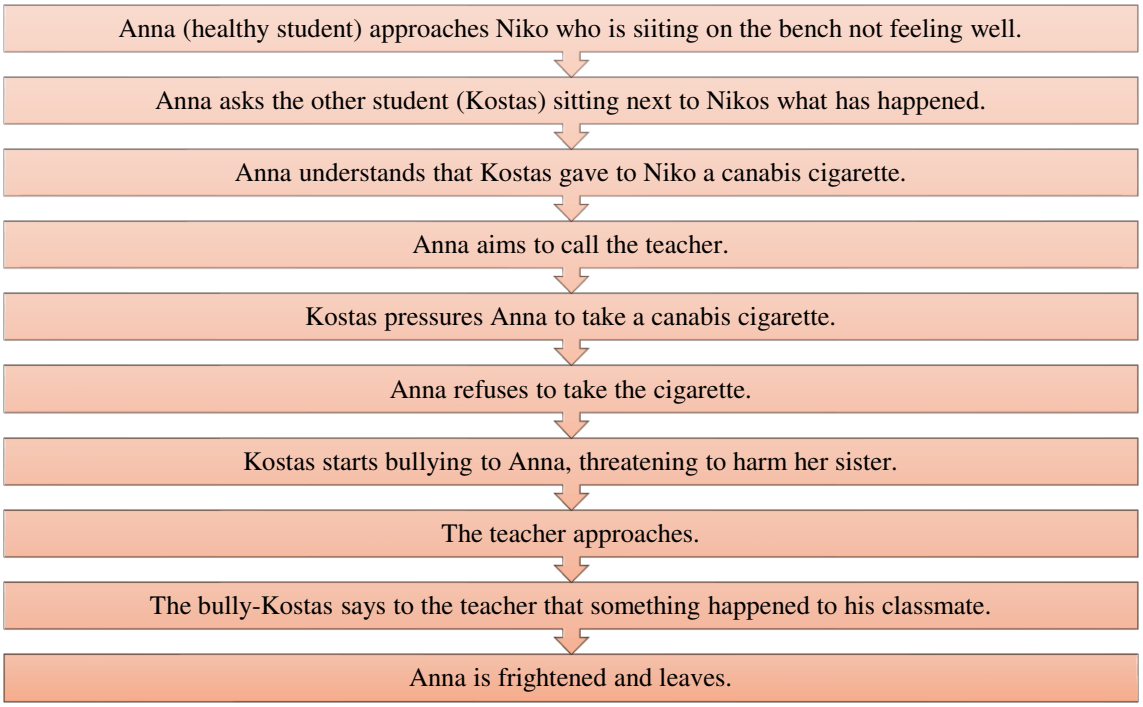


Figure 7-11: The sequence of the scenario in Anna's perspective

The sequence of the facts happening during Nikos's (drug user student) perspective is presented in figure 7-12.

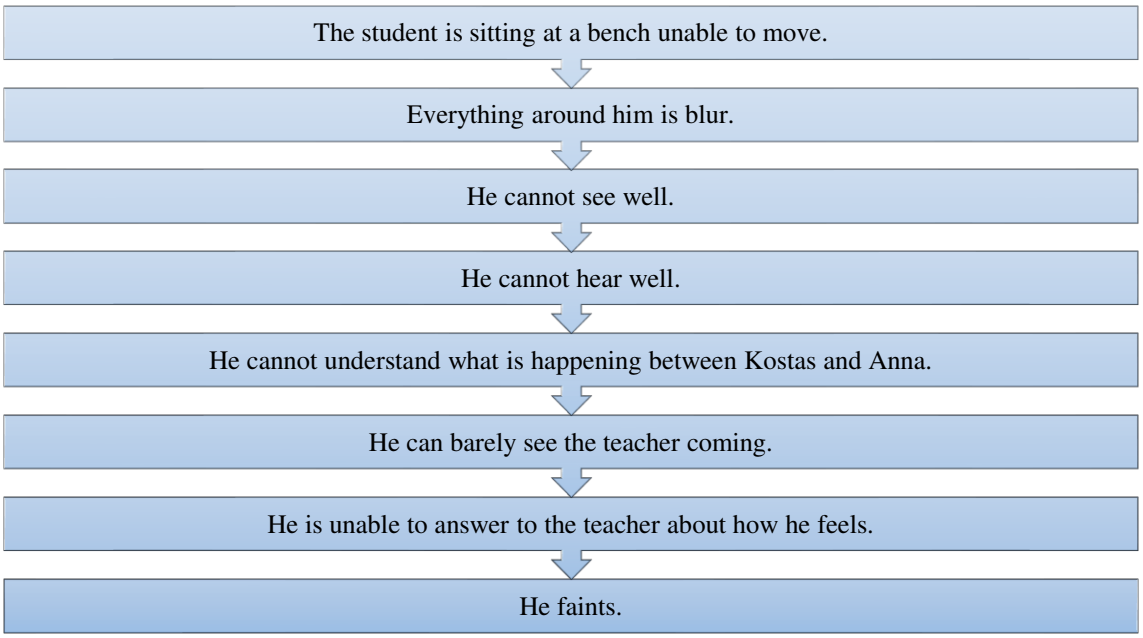


Figure 7-12: The sequence of the scenario in Nikos's perspective

7.5.2.3 Mirror training to achieve embodiment and presence

The objective of the mirror training is to familiarize the users with their virtual bodies. The participant's body and head movements were mapped in real-time to the virtual body, as they were tracked using the motion-sensing device Kinect for Windows v2. The participants were able to look at their virtual body both by looking directly down and by looking in the mirror that was located in front of them. the participants could spend the time they needed in the mirror scene to become familiar with their virtual body. The mirror training aimed to familiarize the users with their non-physical body (avatar), identify with the virtual body, and feel in control of it. This process was necessary to achieve participants' sense of embodiment. The mirror training was the initial point for every scene and each perspective. Hence, there was a mirror training scene for the teacher (figure 7-13 up), for the student-drug user (figure 7-13 middle) and the healthy student (figure 7-13 down).

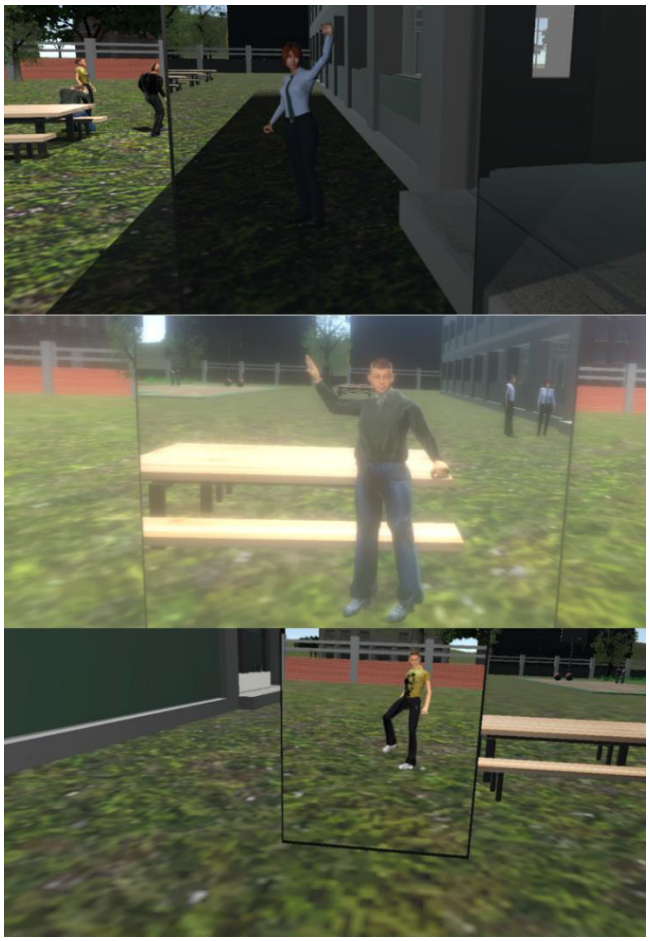


Figure 7-13: Mirror scene: 1) Up: teacher, 2) Middle: student drug user, 3) Down: healthy student

7.5.2.4 VR Equipment Used

During the experiment, the Oculus Rift Commercial Head-Mounted Display was used (figure 7-14). Using immersive HMD equipment such as Oculus Rift, made it possible to develop an application without the need to embody the virtual students with actors. Moreover, the use of VR special electronic equipment, such as VR headsets (e.g. Oculus Rift) allows the users to interact with the virtual environment, experience a first-person view and take a 360-degree look inside the virtual space and thus look at any direction as in the physical world (Desai et al., 2014) so that the overall experience is highly realistic. Furthermore, the last few years improvements in HMDs, such as Oculus Rift, have increased the performance of the devices maximizing the realistic experience of the users. Previous research by Shu et al. (2018), indicated that the use of HMD equipment was critical for the visual experience of the users resulting in higher levels of being in the scene than the desktop version of the virtual environment. Moreover, another research also showed that the use of HMD motivated and engaged more the users compared to conventional displays (Lhemedu-Steinke et al., 2018).

Figure 7-14: Participants wearing Oculus Rift during the experiments

7.5.2.5 Avatar's speech and interaction

All the voices used for this scenario were recorded from real students playing the role provided. Their act was recorded, and the files were imported in unity, used during the scenes. Recording the voices was beneficial for providing the participants with an authentic experience while fostering tension during the scenario. For the interaction with the virtual world, the participants used a controller.

7.6 The instruments

7.6.1 Questionnaires

A combination of tools was used in the second experiment aiming to collect the necessary data for an in-depth analysis of the VR intervention and its impact on end-users. The main research instrument was the questionnaire. Two questionnaires were administered to the participants, one before (pre) the VR intervention and one after (post). The questionnaire was administered in the Greek language (appendices C-7-1 and C-7-2). The English version of the questionnaire is presented in appendix C-7-3 and the post-questionnaire in appendix C-7-4. The main scales of the questionnaire were based on already existing and validated scales with minor modifications to respond to the needs of the current research (figure 7-15). As all the scales were in English, they had to be translated in Greek, and to identify possible confusing points the questionnaires were pre-tested, while English teachers supervised the translation process making suggestions with modifications that made the questionnaire more understandable. The respondents who participated in the pilot testing did not participate in the experiments and did not experience the VR application.

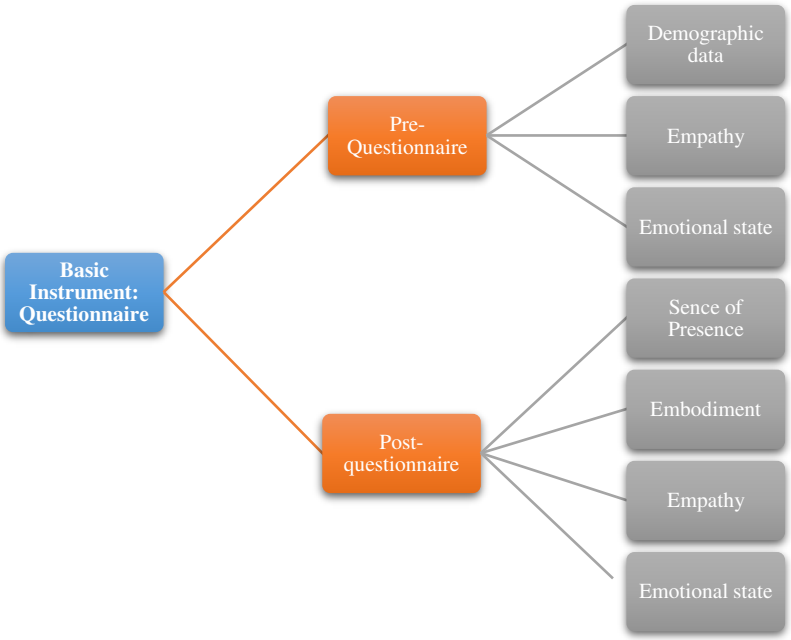


Figure 7-15: Pre and post questionnaire logic

The pre-questionnaire consisted of three parts: The first part covered demographic information (country, gender, age, employment status, teaching experience, teaching specialty, experience in using VR). The second part aimed to measure empathy and the third part incorporated items that aimed to measure participants' emotions and mood state before the VR intervention.

To measure empathy, the scale was developed for the needs of the current research as the existing and validated scales did not meet the research needs of the current experiment. The scale consisted of a 6-point Likert scale ranging from not at all to strongly agree.

The scale that was developed along with the scales that were based on is presented in table 7-1.

Table 7-1: Empathy scale items

Empathy items of the proposed scale	*Scales based on*
When I see someone who is facing drug problems, I often wonder about why they got involved with drugs and consider their situation later in the day.	Existing Teacher Empathy Scale (TES) Bouton & Buxton (2014)
When I hear about a drug situation in the news, I immediately feel sad.	TES
I have volunteered to assist drug users who needed help in some way.	TES
I find it difficult to relate to students going through drug problems.	TES
I try to see things from my student's points of view.	Empathy Questionnaire Research Collaboration (2015)
When I see a student in distress because of drug problems and I am not able to help, I am deeply troubled and revisit the situation many times after the fact.	TES
I believe that understanding student's drug-related problems make me a better teacher.	TES

I have little sympathy for students who face problems such as drug use.	TES
I try to think like drug users in order to better understand them.	TES
. It is important for my students to know that I care about them.	TES
. I do not feel sympathy for students who cause their own serious illnesses such as drug-related problems.	Torronto Empathy Questionnaire (2009)
. Sometimes I wonder what it would feel like to be in my student's situation.	Empathy Questionnaire Research Collaboration (2015)
. Sometimes I don't feel very sorry for my students when they are having problems such as drug problems.	IRI - Interpersonal Reactivity Index Davis (1980)
. I sometimes find it difficult to see things from the student's point of view.	IRI - Interpersonal Reactivity Index Davis (1980)
. Before criticizing a student, I try to imagine how I would feel if I were in their place.	IRI - Interpersonal Reactivity Index Davis (1980)

The emotions and mood states items scale are based on the PANAS X scale by Watson and Clark (1994). PANAS X consists of several words and phrases that describe different feelings and emotions. However, the scale has many categorizations, that did not respond to the aims of the current research. Hence, only some of the scale items were used that responded to the needs of the current research. The categorization that was used based on PANAS X is presented to the following table 7-2:

Table 7-2: Emotions and mood states scale items

General Dimension Scales	
Negative Affect:	afraid, nervous, upset, ashamed
Positive Affect:	interested, active, alert, determined, inspired
Basic Negative Emotion Scales	
Fear:	scared, nervous
Guilt:	ashamed

Sadness:	sad, downhearted
Basic Positive Emotion Scales	
Joviality:	excited
Self-Assurance:	strong, confident, fearless
Attentiveness:	alert, concentrating, determined
Serenity:	Calm, relaxed
Other Affective States	
Fatigue:	tired, sleepy

The post-questionnaire consisted of three parts. The first part aimed to measure the presence, and the Igroup Presence Questionnaire (IPQ)was used, which was used also in experiment 1 presented in chapter 6 (see section 6.1.8). The outcomes of the previous chapter confirmed the reliability of the questionnaire and for this reason, the same scale was used in the current experiment. IPQ questionnaire has been analytically presented and explained in previous chapter 6.

Apart from the IPQ questionnaire, a second scale was used because the participants of experiment 1 suggested that some of the IPQ questions were difficult to understand. For this reason, the Slater-Usoh-Steed questionnaire (SUS) was also used to measure the sense of presence, consisting of 6 items on a 7-Likert point scale with minor modifications. The presence scale items are presented in table 7-3.

Table 7-3: Presence scale items based on the SUS questionnaire

1. I had a sense of "being there" in the school space…
2. There were times during the experience when the school space was the reality for me…
3. The school space seems to me to be more like...
4. I had a stronger sense of...
5. I think of the school space as a place in a way similar to other places that I've been today…
6. During the experience, I often thought that I was really standing in the school space

After the presence scales, there was a scale to measure the sense of embodiment. The embodiment scale was based on the paper of Hasler et al., (2017) and is presented in table 7-4.

Table 7-4: Embodiment scale items

1.	Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.
2.	Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.
3.	I felt that the virtual body was not mine.
4.	During the experiment, there were moments when I felt I had more than one body.
5.	I felt that I controlled the avatar as if it were my body.
6.	The virtual body moved according to my movements.

The second part of the post-questionnaire aimed to measure participants' empathy skills, and the final part addressed participant's emotions and mood state after the VR intervention. The second and third parts consisted of the same scales used in the pre-questionnaire presented in tables 7-1 and 7-2 above.

7.6.2 EEG and Heart Rate monitoring

An electroencephalogram (EEG) was used during the experiment to measure the sense of presence and also investigate potential differences between the different perspectives. As explained in the previous chapter 6 (section 6.1.8) EEG devices are considered to be the most reliable methods for measuring presence (Wiederhold & Riva, 2013). For the current research EMOTIV EPOC+ 14 Channel Mobile Brainwear was used (Figure 7-16). Although EMOTIV EPOC+ is a device of lower performance and cost compared to the BIOSEMI Active Two 64 channel amplifier system that was used in experiment 1 (Chapter 6), research indicated that the results of this EEG device are still satisfactory and reliable (Duvinage et al., 2012; Duvinage et al., 2013; Stytsenko et al., 2011).

Apart from the EEG device, fitness wristband Fitbit charge 2 was used to record participant's Heart Rate (HR) (figure 7-16). HR monitoring aimed to measure the effects of the VR intervention on participants' HR. HR recordings aimed to provided data related to participant's physiological reactions, and it was a way to investigate stress-related aspects, as an increase in HR indicated stress (Meehan et al., 2003). In the current experiment, heart rate was measured for all participants during the time of their virtual training.

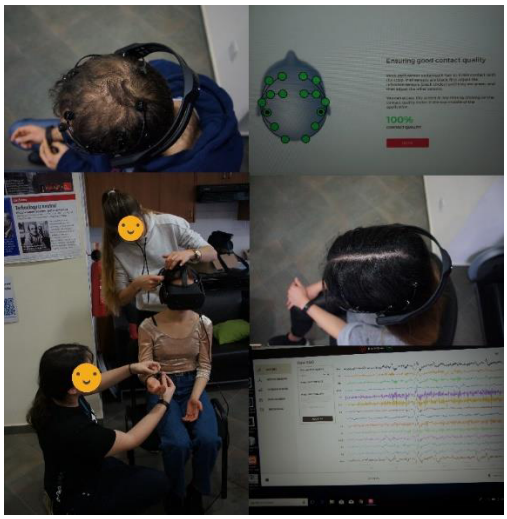


Figure 7-16: Placing EMOTIV EPOC and wristband to the participants

7.7 The sample

For the current experiment, snowball sampling was considered as the most suitable method to use to approach teachers and earn their trust and active participation in the research. The Snowball sampling technique is presented in chapter 3 (section 3.9).

7.8 The procedure

The experiment was conducted during March 2017 in Cyprus. The experiments lasted one week, and each day one-hour appointments were booked for each participant, to have the necessary time for explaining the procedure and manage possible problems that could arise during the VR experience. In the beginning, the participants had to read the consent form and agree to participate in the experiment. As the experiment was recorded by video and photographs it was essential to obtain participants' permission and for this reason, all that information was included in the consent form (appendix C-7-5 for the Greek version and C-7-6 for the English version). After the participant's informed consent, they had to complete the pre-questionnaire. Then the process was explained to the participants to understand the use of both VR headset and EEG device. At the same time, some information was provided to the participants regarding the scenario that would experience but only the completely necessary. Participants were informed that they had to view a VR environment depicting a school backyard were one of the students is under drug influence. The setup was done to each participant with the

EEG device and VR headset. The experiment was then beginning and after the end of the experiment the participants had to complete the second questionnaire.

7.9 Data analysis

This section presents an analysis of the results. The analysis initially presents the demographic characteristics of the sample (descriptive statistics). Then the analysis presented the results concerning the consistency of the questionnaire scales (reliability analysis) and then each scale is separately analyzed. The steps of the analyses are presented in figure 7-17:

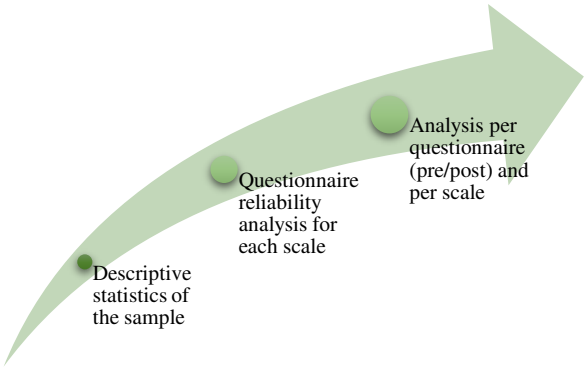


Figure 7-17: Tests carried out regarding the data analysis

7.9.1 The sample- descriptive statistics

A total number of 25 participants (n=25) took part in the experiment with 88% (n=22) coming from Cyprus, one participant from Greece, one from Serbia and one from Ukraine. From the 25 participants, 52% experienced within the VR the perspectives of the teacher and the students' drug users and 48% experienced the perspectives teachers and student Anna. 72% (n=18) were female and 28% (n=7) were male. Most of the respondents aged 18 to 39 years old (84%). 64% of the participants are active teachers, while 36% of the participants are not currently working as teachers. The results indicate that 36% of the participants have no teaching experience, while for the rest of the participants teaching experience ranges from 1 year to over 20 years. The results indicate that 36% of the participants currently serve in secondary education, 36% do not serve as teachers, 24% serve in higher education, and 4% in primary education. Regarding participant's teaching specialty, the results indicate a variety of fields including computer science, multimedia, and graphic arts, mathematics, literature,

foreign language, primary school teacher, physical education (sports), sociology, speech pathology, web design. Regarding participants' experience in the use of VR environments, the results indicate that most of the participants were not familiar with the use of VR. Table 7-5 present the demographic data of the sample.

Table 7-5: Demographic data of the sample

Participants per group and perspective in the VR environment					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Group 1: Teacher Student drug user	12	48.0	48.0	48.0
	Group 2: Teacher Healthy student	13	52.0	52.0	100.0
	Total	25	100.0	100.0	
		Country			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Other	2	8.0	8.0	8.0
	Cyprus	22	88.0	88.0	96.0
	Greece	1	4.0	4.0	100.0
	Total	25	100.0	100.0	
		Gender			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	7	28.0	28.0	28.0
	Female	18	72.0	72.0	100.0
	Total	25	100.0	100.0	
		Age			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-24	7	28.0	28.0	28.0
	25-29	7	28.0	28.0	56.0
	30-39	7	28.0	28.0	84.0

	40-49	2	8.0	8.0	92.0
	50-59	2	8.0	8.0	100.0
	Total	25	100.0	100.0	

Teaching experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	9	36.0	36.0	36.0
	<1 year	4	16.0	16.0	52.0
	1-4 years	3	12.0	12.0	64.0
	5-10 years	5	20.0	20.0	84.0
	11-20 years	3	12.0	12.0	96.0
	> 20 years	1	4.0	4.0	100.0
	Total	25	100.0	100.0	

Are you currently employed as a teacher?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	16	64.0	64.0	64.0
	No	9	36.0	36.0	100.0
	Total	25	100.0	100.0	

Level of education in which you serve

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary Education	1	4.0	4.0	4.0
	Secondary Education	9	36.0	36.0	40.0
	Higher Education	6	24.0	24.0	64.0
	I do not serve currently as a teacher	9	36.0	36.0	100.0
	Total	25	100.0	100.0	

Teaching specialty

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Other	11	44.0	44.0	44.0
	Literature	3	12.0	12.0	56.0
	Mathematics	3	12.0	12.0	68.0
	Foreign languages	2	8.0	8.0	76.0
	Computer Science	5	20.0	20.0	96.0
	Primary school teacher	1	4.0	4.0	100.0
	Total	25	100.0	100.0	

Teaching specialty - other

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		14	56.0	56.0	56.0
	Design	1	4.0	4.0	60.0
	Design-technician	1	4.0	4.0	64.0
	New technologies in education	1	4.0	4.0	68.0
	Multimedia and Graphic Arts	4	16.0	16.0	84.0
	Physical Education (Sports)	1	4.0	4.0	88.0
	Sociology	1	4.0	4.0	92.0
	Speech Pathologist	1	4.0	4.0	96.0
	Web design and development	1	4.0	4.0	100.0
	Total	25	100.0	100.0	

Experience in using Virtual Reality environments

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	9	36.0	36.0	36.0
	A little	8	32.0	32.0	68.0
	Moderately	3	12.0	12.0	80.0
	Much	3	12.0	12.0	92.0
	Very much	2	8.0	8.0	100.0
	Total	25	100.0	100.0	

7.9.2 Questionnaire reliability analysis

7.9.2.1 Pre-empathy scale

Reliability analysis was conducted on the variables of the pre-empathy scale. According to the results, the overall alpha is 0.645<0.7 indicating low reliability of the variables. Nunnally (1967) (in Gilbert & Churchill, 1979), suggests that research reliabilities of .50 to .60 can be accepted. However, the values of Cronbach's alpha reflected a significant change in Cronbach's alpha if the question '13. Sometimes I don't feel very sorry for my students when they are having problems such as drug problems' is deleted. Hence, question 13 was erased increasing the alpha reliability to 0.701 indicating the reliability of the variables. Therefore, item 13 was deleted increasing reliability (table7-6). Item 13 was deleted also from the post-empathy scale.

Table 7-6: Reliability analysis for pre-empathy scale

Cronbach's Alpha	N of Items
,701	14

7.9.2.2 Pre-emotions scale

Reliability analysis was conducted on the variables of the pre-emotions scale. According to the results (table 7-7), the overall alpha is 0.841>0.7 indicating high reliability of the variables. The values of Cronbach's alpha if item deleted, reflected very small changes in Cronbach's alpha items are deleted. Thus, no item was deleted from the scale.

Table 7-7: Reliability analysis for pre-emotions scale

Cronbach's Alpha	N of Items
,841	17

7.9.2.3 Post-empathy scale

Reliability analysis was conducted on the variables of the post-empathy scale. According to the results, the overall alpha is 0.759>0.7 indicating the reliability of the variables (table 7-8).

Table 7-8: Reliability analysis for post-empathy scale

Cronbach's Alpha	N of Items
,759	14

7.9.2.4 Post-emotions scale

Reliability analysis was conducted on the variables of the post-emotions scale. According to the results (table 7-9), the overall alpha is 0.864>0.7 indicating high reliability of the variables.

Table 7-9: Reliability analysis for post-emotions scale

Cronbach's Alpha	N of Items
,864	14

7.9.2.5 Post-presence scale

I. IPQ scale

Reliability analysis was conducted on the variables of the post-presence IPQ scale items. According to the results, the overall alpha is 0.620<0.7 indicating low reliability of the variables (table 7-10). The values of Cronbach's alpha if item deleted, reflected a significant change in Cronbach's alpha if some of the questions were deleted, however, those questions were important for the research, thus no question was deleted.

Table 7-10: Reliability analysis for IPQ post-presence scale

Cronbach's Alpha	N of Items
,620	14

II. SUS scale

Reliability analysis was conducted on the variables of the post-presence SUS scale items. According to the results, the overall alpha is 0.620<0.7 indicating low reliability of the variables (table 7-10).

Table 7-11: Reliability analysis for SUS post-presence scale

Cronbach's Alpha	N of Items
,863	6

7.9.2.6 Post-embodiment scale

Reliability analysis was conducted on the variables of the post-embodiment scale items. According to the results, the overall alpha is 0.743<0.7 indicating low reliability of the variables (table 7-12). The values of Cronbach's alpha if item deleted, reflected a significant change in Cronbach's alpha if some of the questions were deleted, however, those questions were important for the research, thus no question was deleted.

Table 7-12: Reliability analysis for embodiment scale

Cronbach's Alpha	N of Items
,743	6

7.9.3 Time in the virtual environment

According to table 7-12, participants claimed that their experience in the virtual world had a duration of 3 to 15 minutes.

Table 7-13: Duration of time within the VR according to the participants

How long did you interact with the virtual school environment (min)?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	10 min	11	44.0	44.0	44.0
	15 min	1	4.0	4.0	48.0
	3 min	2	8.0	8.0	56.0
	4 min	1	4.0	4.0	60.0
	5 min	5	20.0	20.0	80.0
	6 min	1	4.0	4.0	84.0
	7 min	2	8.0	8.0	92.0
	7.5 min	1	4.0	4.0	96.0
	8 min	1	4.0	4.0	100.0

	Total	25	100.0	100.0

7.9.4 Perspective into the virtual world

The analysis of the results regarding the perspective into the virtual world revealed that most of the participants understood that within the virtual reality environment they experienced a first-person perspective (through the eyes of virtual character) (table 7-13).

Table 7-14: Participant's understanding of the perspective experienced within the virtual world

What was your perspective on the virtual school environment?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	First-person perspective	19	76.0	76.0	76.0
	Third-person perspective	6	24.0	24.0	100.0
	Total	25	100.0	100.0	

7.9.5 Presence scale

This section presents the analysis of the results concerning presence scale items. The analysis of the presence scale includes descriptive statistics, test of normality, and non-parametric tests (see figure 7-18).

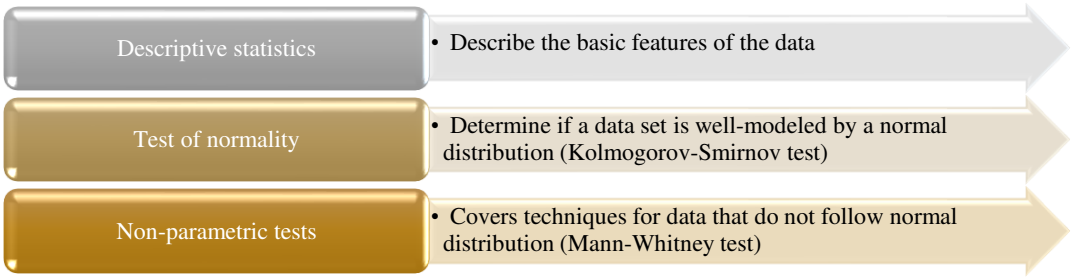


Figure 7-18: Tests carried out regarding the analysis of the presence scale items

The presence scale was administered to the participants after the VR intervention. The following results concern both groups:

- Group 1: Teacher/student drug user perspectives
- Group 2: Teacher/healthy student perspectives

7.9.5.1 IPQ scale – descriptive statistics

IPQ questionnaire includes 14 items. The scale development process according to the developers of the tool identified one G=General item, five items for SP=Spatial presence, four items for INV=Involvement, and three items for REAL=Experienced Realism. The categorization of the 14 items is presented in chapter 6 in table 6-15.

Regarding the general item that had to do with the sense of being there, the results revealed that participants felt a high sense of being there in both groups (table 7-15). However, the group that experienced the teacher/healthy student perspectives scored higher (M=5.23, SD=1.17), from the group that experienced teacher/student drug user perspectives (M=4.75, SD= 1.49). The participants of group 2 tended to score from good to very good levels of sense of presence, while the participants of group 1 tended to score from moderately to good levels of sense of presence. Appendix C-7-7 presents the descriptive statistics for the general item question, with the results indicating that most of the respondents in both groups scored positively towards the sense of being there in the virtual classroom setting.

Table 7-15: General item scores for both VR groups

Group 1: Teacher/student drug user perspectives			
	N	Mean	Std. Deviation
Q8. In the computer-generated school, I had a sense of 'being there'.	12	4.7500	1.48477
Valid N (listwise)	12		
Group 2: Teacher/healthy student perspectives			
	N	Mean	Std. Deviation
Q8. In the computer-generated school, I had a sense of 'being there'.	13	5.2308	1.16575
Valid N (listwise)	13		

Regarding spatial presence, the results indicate that the participants of both groups felt moderately the sense of being physically in the virtual school space (table 7-16). According to the results the participants had moderately the sense of acting in the virtual school space, rather than operating something from outside, with a mean score of 4.0 (SD= 1.86) for group 1 and a mean score of 3.85 (SD=1.91) for group 2. To the question 'Q6. I did not feel present in the virtual school space' the participants of both

groups tended to moderately feel present to the virtual school space (Group 1: M=5.17, SD=1.59; Group 2: M=4.92, SD=2.02), confirming the general item that deals with the sense of being there. The results reveal that the participants felt moderate that the virtual school environment surrounded them, as they scored towards the positive side of the Likert scale (Group 1: M=4.92, SD=1.24; Group 2: M=5.23, SD=1.36). Moreover, the results indicate that participants felt present moderately present in the virtual space since for group 1 the mean score is 5.00 (SD= 1.28) and for group 2 the mean score 4.92 (SD= 1.55). Finally, for the last item of the spatial presence, the results indicate that the participants tended to be neutral towards the question 'Q13. I felt like I was just perceiving pictures', with a mean score of 4.00 (SD=1.71) for group 1 and a mean score of 3.00 (SD= 1.58) for group 2. Appendix C-7-7 presents descriptive statistics for all spatial presence items.

Table 7-16: Spatial presence items per group

Group 1 / Perspective = Teacher-Student drug user			
	N	Mean	Std. Deviation
Q3. I had a sense of acting in the virtual school space, rather than operating something from outside.	12	4.0000	1.85864
Q6. I did not feel present in the virtual school space.	12	5.1667	1.58592
Q9. Somehow, I felt that the virtual school environment surrounded me.	12	4.9167	1.24011
Q10. I felt present in the virtual school.	12	5.0000	1.27920
Q13. I felt like I was just perceiving pictures.	12	4.0000	1.70561
Valid N (listwise)	12		
Group 2 / Perspective = Teacher-healthy student			
	N	Mean	Std. Deviation
Q3. I had a sense of acting in the virtual school space, rather than operating something from outside.	13	3.8462	1.90815
Q6. I did not feel present in the virtual school space.	13	4.9231	2.01914
Q9. Somehow, I felt that the virtual school environment surrounded me.	13	5.2308	1.36344

Q10. I felt present in the virtual school.	13	4.9231	1.55250
Q13. I felt like I was just perceiving pictures.	13	3.0000	1.58114
Valid N (listwise)	13		

Regarding involvement items (table 7-17), that deals with the attention devoted to the virtual environment, the results indicate that the participants tended to be moderately aware of the real environment, with a mean score 4.08 (SD=.90) for group 1, and a mean score of 3.77 (SD=1.69) for group 2. Moreover, the participants tend to slightly disagree that they were aware of the real environment (Group 1: M=4.58, SD=1.31; Group 2: M=4.08, SD=1.89). The results indicate that the participants tend to disagree that they paid attention to the real environment (Group 1: M=3.83, SD=2.08; Group 2: M=3.62, SD=1.81). Furthermore, based on the data analysis the participants tended to disagree that they were completely captivated by the virtual school environment (Group 1: M=3.67, SD=2.06; Group 2: M=3.39, SD=1.85). Appendix C-7-7 presents descriptive statistics for all involvement items.

Table 7-17: Involvement items per group

Group 1 / Perspective = Teacher-Student drug user			
	N	Mean	Std. Deviation
Q1. How aware were you of the real world surrounding while navigating in the virtual school? (i.e. sounds, room temperature, other people, etc.)?	12	4.0833	.90034
Q7. I was not aware of my real environment.	12	4.5833	1.31137
Q11. I still paid attention to the real environment.	12	3.8333	2.08167
Q14. I was completely captivated by the virtual school environment.	12	3.6667	2.05971
Valid N (listwise)	12		
Group 2 / Perspective = Teacher-healthy student			
	N	Mean	Std. Deviation
Q1. How aware were you of the real world surrounding while navigating in the virtual school? (i.e. sounds, room temperature, other people, etc.)?	13	3.7692	1.69085

Q7. I was not aware of my real environment.	13	4.0769	1.89128
Q11. I still paid attention to the real environment.	13	3.6154	1.80455
Q14. I was completely captivated by the virtual school environment.	13	3.3846	1.85016
Valid N (listwise)	13		

Regarding Experienced Realism (table 7-18), it seems that the participants tended to be neutral regarding the levels of realism of the virtual school (Group 1: M=4.08, SD=1.93; Group 2: M=3.54, SD=1.33). To the question of whether the experience in the virtual school was similar to the real school setting, the participants tend to score from disagreeing to neutral (Group 1: M=3.92, SD=1.83; Group 2: M=4.23, SD=1.59). To the question regarding how real the virtual school environment seems the participants tend to score from disagreeing to neutral (Group 1: M=3.67, SD=1.50; Group 2: M=4.62, SD=1.33). Finally, the virtual world did not seem to the participants more realistic than the real world as the participants scored from strongly disagree to disagree (Group 1: M=2.58, SD=1.62; Group 2: M=2.69, SD=1.38). Appendix C-7-7 presents descriptive statistics for all realism items.

Table 7-18: Realism items per group

Group 1 / Perspective = Teacher-Student drug user			
	N	Mean	Std. Deviation
Q2. How real did the virtual school seem to you?	12	4.0833	1.92865
Q4. How much did your experience in the virtual school environment seem consistent with your real-school experience?	12	3.9167	1.83196
Q5. How real did the virtual school environment seem to you?	12	3.6667	1.49747
Q12. The virtual school environment seemed more realistic than the real school environment.	12	2.5833	1.62135
Valid N (listwise)	12		
Group 2 / Perspective = Teacher-healthy student			
	N	Mean	Std. Deviation
Q2. How real did the virtual school seem to you?	13	3.5385	1.33012

Q4. How much did your experience in the virtual school environment seem consistent with your real-school experience?	13	4.2308	1.58923
Q5. How real did the virtual school environment seem to you?	13	4.6154	1.32530
Q12. The virtual school environment seemed more realistic than the real school environment.	13	2.6923	1.37747
Valid N (listwise)	13		

7.9.5.2 IPQ scale – test of normality

One of the assumptions for parametric tests is that the data are normally distributed. Normal distribution means that most of the results are situated around the mean value and their number decreases symmetrically to both sides. Therefore, checking the normal distribution should be the first and most basic test for a correct statistical analysis of the data of a study. Determining whether the data are normal or not will also determine the statistical tests to be used (parametric or not).

The hypothesis used are:

- The null hypothesis H_o: The sample data are NOT significantly different than a normal population (normal distribution).
- The alternative hypothesis H_1: The sample data are significantly different than a normal population (not normal distribution).

When testing for normality:

- If the p-value is > 0.05 then the data are normally distributed, and H_o is accepted.
- If the p-value is < 0.05 then the data are NOT normally distributed, and H_o is rejected.

A Kolmogorov-Smirnov test indicated that not all IPQ presence scale items follow a normal distribution, as the p-value is < 0.05 for many scale items (table 7-19). Thus, H_o is rejected, and non-parametric tests were used for the data analysis.

Table 7-19: One sample Kolmogorov-Smirnov Test for IPQ presence scale

	Kolmogorov-Smirnov		
	Statistic	df	Sig.
Q1. How aware were you of the real world surrounding while navigating in the virtual school? (i.e. sounds, room temperature, other people, etc.)?	.204	25	.009
Q2. How real did the virtual school seem to you?	.171	25	.057
Q3. I had a sense of acting in the virtual school space, rather than operating something from outside.	.157	25	.112
Q4. How much did your experience in the virtual school environment seem consistent with your real-school experience?	.161	25	.094
Q5. How real did the virtual school environment seem to you?	.144	25	.196
Q6. I did not feel present in the virtual school space.	.211	25	.005
Q7. I was not aware of my real environment.	.182	25	.032
Q8. In the computer-generated school, I had a sense of 'being there'.	.175	25	.046
Q9. Somehow, I felt that the virtual school environment surrounded me.	.162	25	.088
Q10. I felt present in the virtual school.	.231	25	.001
Q11. I still paid attention to the real environment.	.189	25	.021
Q12. The virtual school environment seemed more realistic than the real school environment.	.243	25	.001
Q13. I felt like I was just perceiving pictures.	.212	25	.005
Q14. I was completely captivated by the virtual school environment.	.167	25	.071

7.9.5.3 IPQ presence scale: non-parametric tests

Mann-Whitney test was used to investigate possible differences between the two groups related to the different perspectives that the participants experienced.

The hypothesis used are:

- The null hypothesis H_o: The two groups represented (Group 1, Group 2) have the same distribution of scores.
- The alternative hypothesis H_1: The two groups represented (Group 1, Group 2) do not have the same distribution of scores.

The Mann-Whitney test did not reveal any statistically significant difference between the two groups (table 7-20), as the p-value for all scale items in >0.05.

Table 7-20: Mann-Whitney test to investigate differences between the two groups

	Mann-Whitney U	Asymp. Sig. (2-tailed)
Q1. How aware were you of the real world surrounding while navigating in the virtual school? (i.e. sounds, room temperature, other people, etc.)?	67.500	.552
Q2. How real did the virtual school seem to you?	76.500	.933
Q3. I had a sense of acting in the virtual school space, rather than operating something from outside.	74.500	.846
Q4. How much did your experience in the virtual school environment seem consistent with your real-school experience?	70.500	.678
Q5. How real did the virtual school environment seem to you?	48.500	.101
Q6. I did not feel present in the virtual school space.	77.000	.956
Q7. I was not aware of my real environment.	64.000	.433
Q8. In the computer-generated school, I had a sense of 'being there'.	62.000	.372
Q9. Somehow, I felt that the virtual school environment surrounded me.	65.500	.486
Q10. I felt present in the virtual school.	75.500	.888
Q11. I still paid attention to the real environment.	71.500	.719
Q12. The virtual school environment seemed more realistic than the real school environment.	71.000	.692
Q13. I felt like I was just perceiving pictures.	51.000	.134
Q14. I was completely captivated by the virtual school environment.	71.500	.719

7.9.5.4 SUS questionnaire

The six items related to the sense of presence had a 7-scale score range from -3(not at all) to 3(very much) (table 7-21). Regarding their sense of being in the virtual school space, the participants tended to be neutral to slightly agree (Group 1: M=4.33, SD=1.92; Group 2: M=5.39, SD=1.33). The results indicated that participants tended to

slightly agree that there were times during the experience when the school space was the reality for them (Group 1: M=4.42, SD=1.88; Group 2: M=4.92, SD=1.32). According to the results, the virtual school space was not experienced by the participants as just perceiving pictures, yet they did not feel it as a place they visited as they tended to score from neutral to slightly agree (Group 1: M=3.75, SD=1.55; Group 2: M=4.77, SD=1.33). Regarding their sense of being in the virtual school space, the participants scored from neutral to slightly agree (Group 1: M=4.08, SD=1.51; Group 2: M=4.46, SD=1.56). Moreover, the results suggest that the participants were from neutral to slightly thinking of the virtual school space as a place in a way similar to other places that they have visited that day (Group 1: M=4.00, SD=1.81; Group 2: M=3.46, SD=1.90). Furthermore, the results indicate that the participants felt during the experience that was standing in the school space as they scored from slightly to very (Group 1: M=4.42, SD=1.68; Group 2: M=5.15, SD=1.41). Appendix C-7-8 presents descriptive statistics for all SUS presence items.

Table 7-21: SUS means scores per group

Perspective = Teacher-Student drug user			
	N	Mean	Std. Deviation
Q15. I had a sense of "being there" in the school space	12	4.3333	1.92275
Q16. There were times during the experience when the school space was the reality for me…	12	4.4167	1.88092
Q17. The school space seems to me to be more like...	12	3.7500	1.54479
Q18. I had a stronger sense of...	12	4.0833	1.50504
Q19. I think of the virtual school space as a place in a way similar to other places that I've been today…	12	4.0000	1.80907
Q20. During the experience, I often thought that I was really standing in the school space	12	4.4167	1.67649
Valid N (listwise)	12		
Perspective = Teacher-healthy student			
	N	Mean	Std. Deviation

Q15. I had a sense of "being there" in the school space	13	5.3846	1.32530
Q16. There were times during the experience when the school space was the reality for me…	13	4.9231	1.32045
Q17. The school space seems to me to be more like...	13	4.7692	1.23517
Q18. I had a stronger sense of...	13	4.4615	1.56074
Q19. I think of the virtual school space as a place in a way similar to other places that I've been today…	13	3.4615	1.89804
Q20. During the experience, I often thought that I was really standing in the school space	13	5.1538	1.40512
Valid N (listwise)	13		

7.9.5.5 SUS questionnaire - test of normality

A Kolmogorov-Smirnov test indicated that not all SUS presence scale items follow a normal distribution, as the p-value is < 0.05 for most scale items (table 7-22). Thus, H_o is rejected, and non-parametric tests were used for the data analysis.

Table 7-22: One sample Kolmogorov-Smirnov Test for SUS presence scale

	Kolmogorov-Smirnov		
	Statistic	df	Sig.
Q15. I had a sense of "being there" in the school space	.181	25	.033
Q16.There were times during the experience when the school space was the reality for me…	.259	25	.000
Q17. The school space seems to me to be more like...	.209	25	.006
Q18. I had a stronger sense of...	.187	25	.025
Q19. I think of the virtual school space as a place in a way similar to other places that I've been today…	.131	25	.200*
Q20. During the experience, I often thought that I was really standing in the school space	.137	25	.200*

7.9.5.6 SUS presence scale: non-parametric tests

A Mann-Whitney U test revealed that are is no statistically significant difference regarding the sense of presence between the two groups that experienced the different perspectives as the p-value is for all the items is >0.05 (table 7-23).

Table 7-23: Mann-Whitney test to investigate differences between the two groups

	Mann-Whitney U	Asymp. Sig. (2-tailed)
Q15. I had a sense of "being there" in the school space	48.000	.095
Q16. There were times during the experience when the school space was the reality for me…	65.500	.481
Q17. The school space seems to me to be more like...	49.000	.103
Q18. I had a stronger sense of...	63.000	.400
Q19. I think of the virtual school space as a place in a way similar to other places that I've been today…	64.000	.439
Q20. During the experience, I often thought that I was really standing in the school space	57.000	.244

7.9.5.7 Conclusions regarding presence scale

For the current experiment, two different scales were used to measure presence. IPQ and SUS scales were used to collect the data. Using two different scales was a necessity as during the previous experiment the participants stated that they found some IPQ's questions difficult to understand. The results suggest that the participants felt moderately the sense of presence as the mean scores tend to be higher in the middle of the scale. The results of the two scales confirm each other. Equally important is that perspective taking did not affect the levels of presence as non-parametric tests did not reveal statistically significant differences between the two groups that experienced different perspectives.

7.9.6 Embodiment scale

This section presents the analysis of the results concerning embodiment scale items. The analysis of the embodiment scale includes descriptive statistics, tests of normality, and non-parametric tests (see figure 7-19).

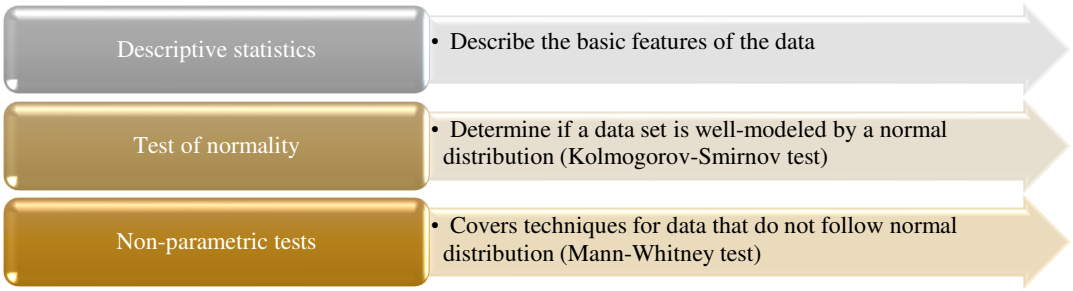
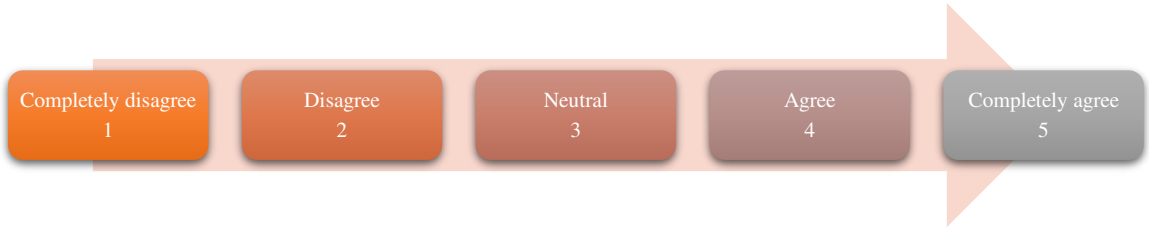


Figure 7-19: Tests carried out regarding the analysis of the embodiment scale items

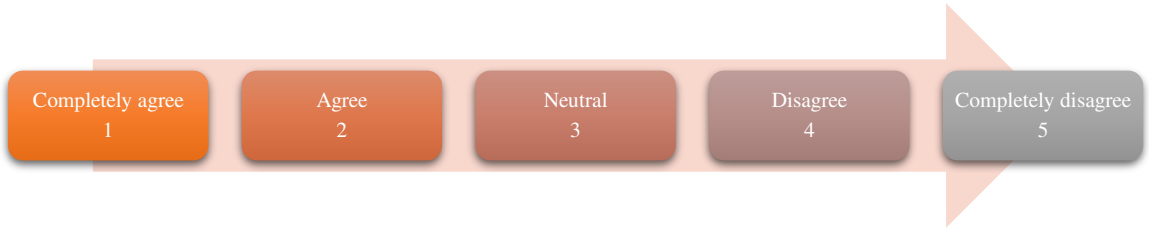
7.9.6.1 The Likert scale and reverse coding

Before the presentation of the results, it is considered appropriate to present the Likert scale being used in the Embodiment Scale and then present also the reverse scoring, as one of the items was negative and had to be reversed within SPSS.

The following 5-point Likert scale was used:



Which, for the reverse-scored items becomes:



7.9.6.2 Descriptive statistics

The results indicate a moderate sense of embodiment for the participants (table 7-24). The mean scores tend to be higher in the middle of the scale for both groups, yet it

seems that group 2 scored higher than group 1. The participants scored from neutral to agree related to the sensation that the virtual body they saw in the mirror scene was their own (Group 1: M=3.08, SD=1.00; Group 2: M=3.69, SD=.86). Additionally, the participants scored from neutral to agree regarding their sense that the virtual body the had within the virtual world was their own (Group 1: M=3.25, SD=1.06; Group 2: M=3.69, SD=.95). The participants tend to score from neutral to disagree that they felt the virtual body as their own (Group 1: M=3.33, SD=.99; Group 2: M=3.77, SD=1.09). Moreover, the participants tend to disagree that during their virtual experience they felt that they had more than one body (Group 1: M=2.67, SD=1.16; Group 2: M=2.69, SD=1.44). Furthermore, the participants tended to be undecided related to whether they were in control of the avatar (Group 1: M=3.25, SD=.97; Group 2: M=3.15, SD=1.14). and whether the avatar responded to the movements of their real body (Group 1: M=3.17, SD=1.41; Group 2: M=3.08, SD=1.26). Appendix C-7-9 presents descriptive statistics for all embodiment items.

Table 7-24: Descriptive statistics of embodiment scale

Perspective = Teacher-Student drug user			
	N	Mean	Std. Deviation
1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.	12	3.0833	.99620
2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.	12	3.2500	1.05529
3. I felt that the virtual body was mine.	12	3.3333	.98473
4. During the experiment, there were moments when I felt I had more than one body.	12	2.6667	1.15470
5. I felt that I controlled the avatar as if it were my body.	12	3.2500	.96531
6. The virtual body moved according to my movements.	12	3.1667	1.40346
Valid N (listwise)	12		
Perspective = Teacher-healthy student			
	N	Mean	Std. Deviation

1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.	13	3.6923	.85485
2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.	13	3.6923	.94733
3. I felt that the virtual body was not mine.	13	3.7692	1.09193
4. During the experiment, there were moments when I felt I had more than one body.	13	2.6923	1.43670
5. I felt that I controlled the avatar as if it were my body.	13	3.1538	1.14354
6. The virtual body moved according to my movements.	13	3.0769	1.25576
Valid N (listwise)	13		

7.9.6.3 Test of normality

A Kolmogorov-Smirnov test indicated that the embodiment scale items do not follow a normal distribution, as the p-value is <0.05 for all scale items (table 7-25). Thus, H_o is rejected, and non-parametric tests were used for the data analysis.

Table 7-25: Tests of normality for embodiment scale items

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.	.215	25	.004
2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.	.338	25	.000
3. I felt that the virtual body was mine.	.223	25	.002
4. During the experiment, there were moments when I felt I had more than one body.	.208	25	.007
5. I felt that I controlled the avatar as if it were my body.	.259	25	.000
6. The virtual body moved according to my movements.	.191	25	.020

7.9.6.4 Non-parametric test

A Mann-Whitney U test revealed that are is no statistically significant difference regarding the sense of embodiment between the two groups that experienced the different perspectives as the p-value is for all the items is >0.05 (table 7-26).

Table 7-26: Mann-Whitney U test to investigate possible differences between the two groups

	Mann-Whitney U	Asymp. Sig. (2-tailed)
1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.	50.000	.111
2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.	60.500	.292
3. I felt that the virtual body was mine.	59.500	.295
4. During the experiment, there were moments when I felt I had more than one body.	78.000	1.000
5. I felt that I controlled the avatar as if it were my body.	74.000	.818
6. The virtual body moved according to my movements.	74.000	.824

7.9.6.5 Conclusion regarding embodiment scale

The results reveal an uncertainty regarding the achievement of the sense of embodiment as the participants tended to be more neutral regarding the sense of embodiment. Some of the mean scores lean towards the positive side of the 5-Likert scale, yet the central tendency seems to be more neutral. The participants were provided instructions and support during the mirror scene, while they could spend the time needed to become familiar with their virtual body. However, the researcher noticed that despite the instructions, support, and inducement to spend time with their virtual body, the participants were indifferent to the mirror scene and most of them spend a few seconds only in the scene. Hence, at first glance, the participants did not spend time to get familiar with the VR environment and their virtual avatar that probably impacted the sense of embodiment. Additionally, there is a high possibility that the participants did not understand the questionnaire items. Most of the participants were unfamiliar with the use of VR and they were not familiar with the terminology of embodiment. Hence, they might have felt uncertain when answering. Moreover, to achieve higher levels of

embodiment Kinect was used, so that the virtual body could follow the movements of the participant's real body. Unfortunately, several problems were encountered during the use of Kinect, there were some disconnect moments during the experiments that were addressed properly but they might also have affected participant's experience and sense of embodiment.

7.9.7 Empathy scale

This section presents the analysis of the results concerning empathy scale items. The analysis of the empathy scale includes descriptive statistics, tests of normality, and non-parametric tests (see figure 7-20).

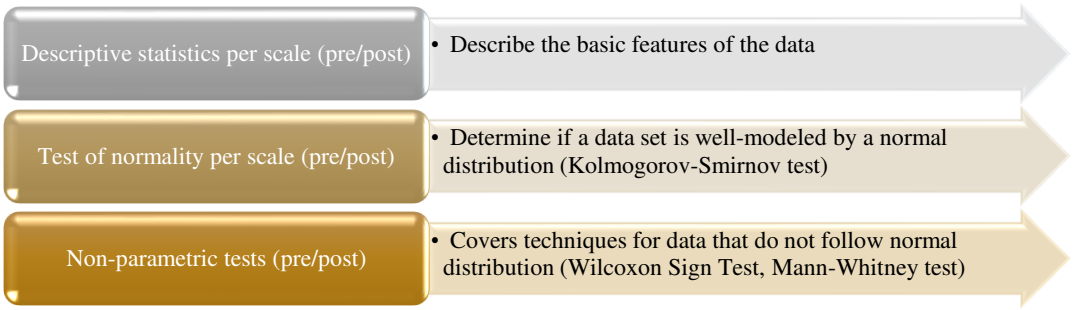


Figure 7-20: Tests carried out regarding the analysis of the empathy scale items

7.9.7.1 Pre-empathy scale – descriptive statistics

The results (table 7-27) indicate that the participants tend to agree that when they see someone who is facing drug problems, they often wonder why they got involved with drugs and consider their situation later in the day (M=4.52, SD=1.26). Moreover, the participants tend to agree that they feel sad when they hear drug-related incidence (M=4.44, SD=1.00). To the question of whether they have volunteered to assist drug users who needed help the participants tended to disagree (M=3.20, SD=1.80).The participants also tended to score neutral to the question of whether they can relate to students going through drug problems (M=3.64, SD=1.52). According to the results, the participants agree that they try to see things from the student's perspective (M=5.16, SD=.80). Moreover, the participants tended to score from neutral to agree to the question of whether they are deeply troubled when they see a student in distress because of drug problems, and they not able to help (M=4.60, SD=1.12). The participants' scored from neutral to agree that understanding student's drug-related problems can

make them better teachers (M=4.64, SD=1.29). The results also revealed that the participants scored from disagreeing to neutral regarding feeling sympathy for students who face problems such as drug use. (M=3.72, SD=1.54). What is more, it seems that the participants are neutral concerning thinking as drug users to better understand the problem that they face (M=4.24, SD=1.30). The participants agree that it important for students to know that as teachers they care about them (M=5.64, SD=.57). The participants tend from disagree to neutral concerning feeling sympathy for students who cause their own serious illnesses such as drug-related problems (M=3.28, SD=1.59). To the question 'Sometimes I wonder what it would feel like to be in my student's situation' the results indicate that the participants tend to be from neutral to agree (M=4.84, SD=1.31), while according to the results the participants find it difficult to see things from student's point of view (M=4.12, SD=1.17). Furthermore, the participants claimed that before criticizing a student, they try to imagine how the student feels (M=5.24, SD=.72). Appendix C-7-10 presents descriptive statistics for all pre-empathy items.

Table 7-27: Descriptive statistics of the pre-empathy scale items

	N	Mean	Std. Deviation
1. When I see someone who is facing drug problems, I often wonder about why they got involved with drugs and consider their situation later in the day.	25	4.5200	1.26227
2. When I hear about a drug situation in the news, I immediately feel sad.	25	4.4400	1.00333
3. I have volunteered to assist drug users who needed help in some way.	25	3.2000	1.80278
4. I find it difficult to relate to students going through drug problems.	25	3.6400	1.52425
5. I try to see things from my student's points of view.	25	5.1600	.80000
6. When I see a student in distress because of drug problems and I am not able to help, I am deeply troubled and revisit the situation many times after the fact.	25	4.6000	1.11803
7. I believe that understanding student's drug related problems make me a better teacher.	25	4.6400	1.28712
8. I have little sympathy for students who face problems such as drug use.	25	3.7200	1.54164

9. I try to think like drug users in order to better understand them.	25	4.2400	1.30000
10. It is important for my students to know that I care about them.	25	5.6400	.56862
11. I do not feel sympathy for students who cause their own serious illnesses such as drug-related problems.	25	3.2800	1.59478
12. Sometimes I wonder what it would feel like to be in my student's situation.	25	4.8400	1.31276
14. I sometimes find it difficult to see things from the student's point of view.	25	4.1200	1.16619
15. Before criticizing a student, I try to imagine how I would feel if I were in their place.	25	5.2400	.72342
Valid N (listwise)	25		

7.9.7.2 Pre-empathy scale: test of normality

A Kolmogorov-Smirnov test indicated that the pre-empathy scale items do not follow a normal distribution, as the p-value is <0.05 for all scale items (table 7-28). Thus, H_o is rejected, and non-parametric tests were used for the data analysis.

Table 7-28: Tests of normality for pre-empathy scale items

	Kolmogorov-Smirnov		
	Statistic	df	Sig.
1. When I see someone who is facing drug problems, I often wonder about why they got involved with drugs and consider their situation later in the day.	.408	25	.000
2. When I hear about a drug situation in the news, I immediately feel sad.	.312	25	.000
3. I have volunteered to assist drug users who needed help in some way.	.209	25	.006
4. I find it difficult to relate to students going through drug problems.	.214	25	.005
5. I try to see things from my student's points of view.	.261	25	.000
6. When I see a student in distress because of drug problems and I am not able to help, I am deeply troubled and revisit the situation many times after the fact.	.320	25	.000
7. I believe that understanding student's drug-related problems make me a better teacher.	.290	25	.000
8. I have little sympathy for students who face problems such as drug use.	.200	25	.011

9. I try to think like drug users in order to better understand them.	.241	25	.001
10. It is important for my students to know that I care about them.	.417	25	.000
11. I do not feel sympathy for students who cause their own serious illnesses such as drug-related problems.	.229	25	.002
12. Sometimes I wonder what it would feel like to be in my student's situation.	.349	25	.000
14. I sometimes find it difficult to see things from the student's point of view.	.255	25	.000
15. Before criticizing a student, I try to imagine how I would feel if I were in their place.	.253	25	.000

7.9.7.3 Post-empathy scale – descriptive statistics

The results after the VR intervention indicate (table 7-29) that the participants tend to agree that when they see someone who is facing drug problems, they often wonder why they got involved with drugs and consider their situation later in the day (M=4.64, SD=1.29). Moreover, the participants tend to agree that they feel sad when they hear drug-related incidence (M=4.52, SD=1.01). To the question of whether they have volunteered to assist drug users who needed help the participants tended to disagree (M=3.12, SD=1.69). The participants also tended to score from neutral to agree to the question of whether they can relate to students going through drug problems (M=4.48, SD=1.12). According to the results, the participants agree that they try to see things from the student's perspective (M=5.12, SD=.67). Moreover, the participants tended to score from neutral to agree to the question of whether they are deeply troubled when they see a student in distress because of drug problems, and they not able to help (M=4.96, SD=.89). The participants agreed that understanding student's drug-related problems can make them better teachers (M=5.24, SD=.78). The results also revealed that the participants scored from disagreeing to neutral regarding feeling sympathy for students who face problems such as drug use. (M=3.68, SD=1.60). What is more, it seems that the participants are neutral concerning thinking as drug users to better understand the problem that they face (M=4.56, SD=1.19). The participants agree that it important for students to know that as teachers they care about them (M=5.56, SD=.51). The participants tend from disagree to neutral concerning feeling sympathy for students who cause their own serious illnesses such as drug-related problems (M=3.52, SD=1.53). To the question 'Sometimes I wonder what it would feel like to be in my

student's situation' the results indicate that the participants tend to be from neutral to agree (M=4.72, SD=1.24), while according to the results the participants find it difficult to see things from student's point of view (M=4.08, SD=1.35). Furthermore, the participants claimed that before criticizing a student, they try to imagine how the student feels (M=4.96, SD=1.21). Appendix C-7-11 presents descriptive statistics for all post-empathy items.

Table 7-29: Descriptive statistics of the post-empathy scale

	N	Mean	Std. Deviation
1. When I see someone who is facing drug problems, I often wonder about why they got involved with drugs and consider their situation later in the day.	25	4.6400	1.28712
2. When I hear about a drug situation in the news, I immediately feel sad.	25	4.5200	1.00499
3. I have volunteered to assist drug users who needed help in some way.	25	3.1200	1.69115
4. I find it difficult to relate to students going through drug problems.	25	4.4800	1.12250
5. I try to see things from my student's points of view.	25	5.1200	.66583
6. When I see a student in distress because of drug problems and I am not able to help, I am deeply troubled and revisit the situation many times after the fact.	25	4.9600	.88882
7. I believe that understanding student's drug-related problems make me a better teacher.	25	5.2400	.77889
8. I have little sympathy for students who face problems such as drug use.	25	3.6800	1.60000
9. I try to think like drug users in order to better understand them.	25	4.5600	1.19304
10. It is important for my students to know that I care about them.	25	5.5600	.50662
11. I do not feel sympathy for students who cause their own serious illnesses such as drug-related problems.	25	3.5200	1.53080
12. Sometimes I wonder what it would feel like to be in my student's situation.	25	4.7200	1.24231
14. I sometimes find it difficult to see things from the student's point of view.	25	4.0800	1.35154

15. Before criticizing a student, I try to imagine how I would feel if I were in their place.	25	4.9600	1.20692
Valid N (listwise)	25		

7.9.7.4 Post-empathy scale: test of normality

A Kolmogorov-Smirnov test indicated that the post-empathy scale items do not follow a normal distribution, as the p-value is <0.05 for almost all scale items (table 7-30). Thus, H_o is rejected, and non-parametric tests were used for the data analysis.

Table 7-30: Tests of normality for post-empathy scale items

	Kolmogorov-Smirnov		
	Statistic	df	Sig.
1. When I see someone who is facing drug problems, I often wonder about why they got involved with drugs and consider their situation later in the day.	.370	25	.000
2. When I hear about a drug situation in the news, I immediately feel sad.	.324	25	.000
3. I have volunteered to assist drug users who needed help in some way.	.187	25	.024
4. I find it difficult to relate to students going through drug problems.	.318	25	.000
5. I try to see things from my student's points of view.	.348	25	.000
6. When I see a student in distress because of drug problems and I am not able to help, I am deeply troubled and revisit the situation many times after the fact.	.278	25	.000
7. I believe that understanding student's drug-related problems make me a better teacher.	.259	25	.000
8. I have little sympathy for students who face problems such as drug use.	.173	25	.052
9. I try to think like drug users in order to better understand them.	.284	25	.000
10. It is important for my students to know that I care about them.	.367	25	.000
11. I do not feel sympathy for students who cause their own serious illnesses such as drug-related problems.	.160	25	.100
12. Sometimes I wonder what it would feel like to be in my student's situation.	.309	25	.000
14. I sometimes find it difficult to see things from the student's point of view.	.272	25	.000
15. Before criticizing a student, I try to imagine how I would feel if I were in their place.	.233	25	.001

7.9.7.5 Pre and Post empathy scales: non-parametric tests

Both pre and post empathy scales do not follow the normal distribution, hence, non-parametric tests are used. The Wilcoxon signed-rank test was used to compare the two sets of scores (pre and post questionnaire) that came from the same participants. The test aims to investigate any change in the scores from a one-time point (before the VR intervention) to another (after the VR intervention).

The Wilcoxon signed-rank test showed that the VR intervention elicited a statistically significant change only in two empathy items (table 7-31). The VR intervention elicited a statistically significant difference in participants' ability to relate to students going through drug problems (Z=-2.770, p=0.006). Moreover, the VR intervention had an impact on participants' belief that understanding student's drug-related problems make can make them better teachers (*Z* = -2.289, p=0.022). Indeed, the mean score rating for the question '4. I find it difficult to relate to students going through drug problems' was 4.48 (pre) and 3.64 (post). Hence, the VR intervention affected the participants, who after the experiment felt that they can relate to students facing drug-related issues. For the question '7. I believe that understanding student's drug-related problems make me a better teacher' mean score rating was 5.24 (pre) and 4.64 (post). Hence, after the VR intervention, the participants tended to be more neutral. Appendix C-7-12 presents the ranks table providing some interesting data on the comparison of participants' before (pre) and after (post) empathy scores.

Table 7-31: Wilcoxon Sign-Rank Test concerning empathy scales

	Z	Asymp. Sig. (2-tailed)
1. When I see someone who is facing drug problems, I often wonder about why they got involved with drugs and consider their situation later in the day. (post) - 1. When I see someone who is facing drug problems, I often wonder about why they got involved with drugs and consider their situation later in the day. (pre)	-.828[b]	.408
2. When I hear about a drug situation in the news, I immediately feel sad. (post) - 2. When I hear about a drug situation in the news, I immediately feel sad. (pre)	-.577[b]	.564

3. I have volunteered to assist drug users who needed help in some way. (post) - 3. I have volunteered to assist drug users who needed help in some way. (pre)	-.405[c]	.685
4. I find it difficult to relate to students going through drug problems. (post) - 4. I find it difficult to relate to students going through drug problems. (pre)	-2.770[b]	**.006**
5. I try to see things from my student's points of view. (post) - 5. I try to see things from my student's points of view. (pre)	-.206[c]	.837
6. When I see a student in distress because of drug problems and I am not able to help, I am deeply troubled and revisit the situation many times after the fact. (post) - 6. When I see a student in distress because of drug problems and I am not able to help, I am deeply troubled and revisit the situation many times after the fact. (pre)	-1.507[b]	.132
7. I believe that understanding student's drug-related problems make me a better teacher. (post) - 7. I believe that understanding student's drug-related problems make me a better teacher. (pre)	-2.289[b]	**.022**
8. I have little sympathy for students who face problems such as drug use. (post) - 8. I have little sympathy for students who face problems such as drug use. (pre)	-.346[c]	.729
9. I try to think like drug users in order to better understand them. (post) - 9. I try to think like drug users in order to better understand them. (pre)	-1.259[b]	.208
10. It is important for my students to know that I care about them. (post) - 10. It is important for my students to know that I care about them. (pre)	-.816[c]	.414
11. I do not feel sympathy for students who cause their own serious illnesses such as drug-related problems. (post) - 11. I do not feel sympathy for students who cause their own serious illnesses such as drug-related problems. (pre)	-.728[b]	.467
12. Sometimes I wonder what it would feel like to be in my student's situation. (post) - 12. Sometimes I wonder what it would feel like to be in my student's situation. (pre)	-.595[c]	.552
14. I sometimes find it difficult to see things from the student's point of view. (post) - 14. I sometimes find it difficult to see things from the student's point of view. (pre)	-.159[c]	.874
15. Before criticizing a student, I try to imagine how I would feel if I were in their place. (post) - 15. Before criticizing a student, I try to imagine how I would feel if I were in their place. (pre)	-1.064[c]	.287

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

c. Based on negative ranks.

7.9.7.6 Pre and Post empathy scales: non-parametric tests per group

The Wilcoxon signed-rank test was used to compare the two sets of scores (pre and post questionnaire) that came from the participants of the two groups that experience the two different perspectives. The test aims to investigate any change in the scores from a one-time point (before the VR intervention) to another (after the VR intervention) but this time per group. The results indicate that the VR intervention elicited a statistically significant change in two empathy scores only for group 1 that experienced the perspectives teacher and student drug-user (tables 7-32). The VR intervention elicited a statistically significant difference in participants' ability to relate to students going through drug problems (Z=-2.266, p=0.023). Indeed, the mean score rating for the question '4. I find it difficult to relate to students going through drug problems was 4.67 (pre) and 3.58 (post). *The results indicate a significant change of the participants who experience the student drug-student perspective because before the VR intervention they claimed that is it difficult to relate to a student facing a drug situation, but after the VR experience and perspective change the participants felt closer to a student facing such problems.*

Table 7-32: Wilcoxon Sign-Rank Test concerning pre/post empathy change for group 1

	Z	Asymp. Sig. (2-tailed)
1. When I see someone who is facing drug problems, I often wonder about why they got involved with drugs and consider their situation later in the day. (post) - 1. When I see someone who is facing drug problems, I often wonder about why they got involved with drugs and consider their situation later in the day. (pre)	-1.000[c]	.317
2. When I hear about a drug situation in the news, I immediately feel sad. (post) - 2. When I hear about a drug situation in the news, I immediately feel sad. (pre)	-.378[c]	.705

3. I have volunteered to assist drug users who needed help in some way. (post) - 3. I have volunteered to assist drug users who needed help in some way. (pre)	.000[d]	1.000
4. I find it difficult to relate to students going through drug problems. (post) - 4. I find it difficult to relate to students going through drug problems. (pre)	-2.266[c]	**.023**
5. I try to see things from my student's points of view. (post) - 5. I try to see things from my student's points of view. (pre)	-.486[e]	.627
6. When I see a student in distress because of drug problems and I am not able to help, I am deeply troubled and revisit the situation many times after the fact. (post) - 6. When I see a student in distress because of drug problems and I am not able to help, I am deeply troubled and revisit the situation many times after the fact. (pre)	-1.098[c]	.272
7. I believe that understanding student's drug-related problems make me a better teacher. (post) - 7. I believe that understanding student's drug-related problems make me a better teacher. (pre)	-1.725[c]	.084
8. I have little sympathy for students who face problems such as drug use. (post) - 8. I have little sympathy for students who face problems such as drug use. (pre)	-.682[e]	.495
9. I try to think like drug users in order to better understand them. (post) - 9. I try to think like drug users in order to better understand them. (pre)	-1.186[c]	.236
10. It is important for my students to know that I care about them. (post) - 10. It is important for my students to know that I care about them. (pre)	.000[d]	1.000
11. I do not feel sympathy for students who cause their own serious illnesses such as drug-related problems. (post) - 11. I do not feel sympathy for students who cause their own serious illnesses such as drug-related problems. (pre)	-.419[c]	.675
12. Sometimes I wonder what it would feel like to be in my student's situation. (post) - 12. Sometimes I wonder what it would feel like to be in my student's situation. (pre)	-.264[e]	.792
14. I sometimes find it difficult to see things from the student's point of view. (post) - 14. I sometimes find it difficult to see things from the student's point of view. (pre)	-.431[c]	.666
15. Before criticizing a student, I try to imagine how I would feel if I were in their place. (post) - 15. Before criticizing a student, I try to imagine how I would feel if I were in their place. (pre)	-.707[e]	.480

a. Perspective = Teacher-Student drug user

b. Wilcoxon Signed Ranks Test

c. Based on positive ranks.

d. The sum of negative ranks equals the sum of positive ranks.

e. Based on negative ranks.

According to the results, the VR intervention did not elicit a statistically significant change in the empathy score of participants of group 2 (table 7-33). *Hence, not experiencing the drug problem through the eyes of the student did not impact their empathy. As the participants of group 2 experienced the perspective of the healthy student they probably felt only as observers of the problem.*

Table 7-33: Wilcoxon Sign-Rank Test concerning pre/post empathy change for group 2

	Z	Asymp. Sig. (2-tailed)
1. When I see someone who is facing drug problems, I often wonder about why they got involved with drugs and consider their situation later in the day. (post) - 1. When I see someone who is facing drug problems, I often wonder about why they got involved with drugs and consider their situation later in the day. (pre)	-.378[c]	.705
2. When I hear about a drug situation in the news, I immediately feel sad. (post) - 2. When I hear about a drug situation in the news, I immediately feel sad. (pre)	-.447[c]	.655
3. I have volunteered to assist drug users who needed help in some way. (post) - 3. I have volunteered to assist drug users who needed help in some way. (pre)	-.431[d]	.666
4. I find it difficult to relate to students going through drug problems. (post) - 4. I find it difficult to relate to students going through drug problems. (pre)	-1.552[c]	.121
5. I try to see things from my student's points of view. (post) - 5. I try to see things from my student's points of view. (pre)	-.378[c]	.705
6. When I see a student in distress because of drug problems and I am not able to help, I am deeply troubled and revisit the situation many times after the fact. (post) - 6. When I see a student in distress because of drug problems and I am not able to help, I am deeply troubled and revisit the situation many times after the fact. (pre)	-.970[c]	.332

7. I believe that understanding student's drug-related problems make me a better teacher. (post) - 7. I believe that understanding student's drug-related problems make me a better teacher. (pre)	-1.511[c]	.131
8. I have little sympathy for students who face problems such as drug use. (post) - 8. I have little sympathy for students who face problems such as drug use. (pre)	-.142[c]	.887
9. I try to think like drug users in order to better understand them. (post) - 9. I try to think like drug users in order to better understand them. (pre)	-.541[c]	.589
10. It is important for my students to know that I care about them. (post) - 10. It is important for my students to know that I care about them. (pre)	-1.414[d]	.157
11. I do not feel sympathy for students who cause their own serious illnesses such as drug-related problems. (post) - 11. I do not feel sympathy for students who cause their own serious illnesses such as drug-related problems. (pre)	-.586[c]	.558
12. Sometimes I wonder what it would feel like to be in my student's situation. (post) - 12. Sometimes I wonder what it would feel like to be in my student's situation. (pre)	-.743[d]	.458
14. I sometimes find it difficult to see things from the student's point of view. (post) - 14. I sometimes find it difficult to see things from the student's point of view. (pre)	-.816[d]	.414
15. Before criticizing a student, I try to imagine how I would feel if I were in their place. (post) - 15. Before criticizing a student, I try to imagine how I would feel if I were in their place. (pre)	-.811[d]	.417

a. Perspective = Teacher-healthy student

b. Wilcoxon Signed Ranks Test

c. Based on positive ranks.

d. Based on negative ranks.

7.9.7.7 Conclusions of the empathy scale

The results indicate the potential of using VR to cultivate empathy skills as there are indications the VR can have a positive impact on participants' empathy. However, the VR intervention elicited a statistically significant change only in two of the fourteen empathy items (items '4. I find it difficult to relate to students going through drug problems' and '7. I believe that understanding student's drug-related problems make me a better teacher'). It is possible that the empathy scale used was not the most suitable for

the current experiment. Even though there are several trustworthy and validated empathy scale, none of them was designed to address the cultivation of empathy skills through VR intervention. Additionally, the fact that the used scale was based on several items from other scales could also have affected the results. There was an effort via the VR intervention and perspective-taking changes to investigate empathy changes, but maybe the empathy scale used was not able to identify those changes. Nevertheless, there are some indications that the VR intervention had an impact on participants' empathy, yet further research is needed. Moreover, one of the two items that presented statistically significant change is of paramount importance for the current research as it concerns the ability of a teacher to enter 'the shoes of the student' and experience any problem through the student's eyes. Based on the research outcome there are indications that the VR intervention affected participants' ability to relate to students going through drug problems and had an impact on participants' belief that understanding student's drug-related problems make can make them better teachers.

Equally important is that according to the results indicate the VR intervention elicited a statistically significant change of the participants who experience the student drug-student perspective because before the VR intervention they claimed that is it difficult to relate to a student facing a drug situation, but after the VR experience and perspective change the participants felt closer to a student facing such problems. Perspective-taking and the experience of the drug-related symptoms that were described in the scenario section had an impact on the participants and helped them understand the problem via the eyes of the student. Moreover, after the end of the experiments, many of the participants of group 1 reported to the researcher that they were problematized and admitted that they tend to ignore substance use problems because they do not know how to handle them, while they should not. They claimed that in the future they should find a different approach to deal with those incidents and support more the students facing such serious problems. On the other hand, participants of group 2 who did not experience the drug problem through the eyes of the student did not impact their empathy. As the participants of group 2 experienced the perspective of the healthy student they probably felt only as observers of the problem.

To sum up, the indication is positive concerning the possibility to cultivate empathy skills via using a VR approach, yet the results are not that strong and further research is needed to determine the effect of VR on empathy skills.

7.9.8 Emotions scale

This section presents the analysis of the results concerning emotions scale items. The analysis of the emotions scale includes descriptive statistics, tests of normality, and non-parametric tests (see figure 7-21).

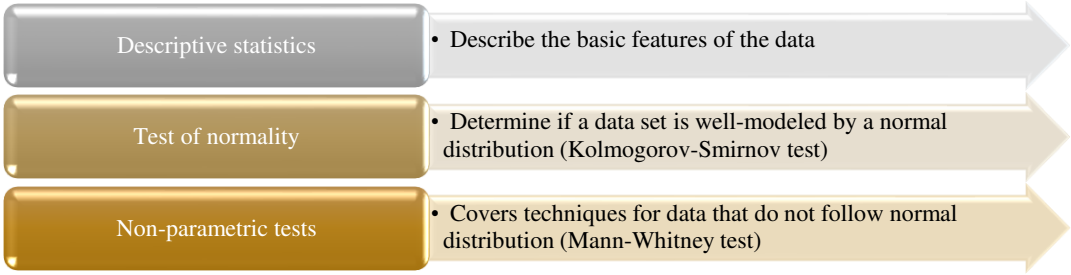
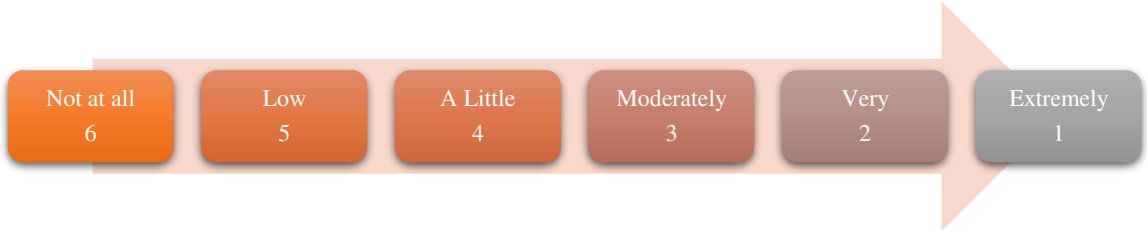


Figure 7-21: Tests carried out regarding the analysis of the emotions scale items

7.9.8.1 Reverse coding

Before the presentation of the results, it is considered appropriate to present the Likert scale being used in the Emotional Scale and then present also the reverse scoring, as many of the items were negative words that need to be reversed within SPSS. The following 5-point Likert scale was used:

Which, for the reverse-scored items becomes:



7.9.8.2 Pre-emotions scale: Descriptive statistics

According to the results, before the VR intervention, the participants experienced several positive and negative emotions (table 7-34). The results indicate that as far as the negative emotions are concerned, the participants before the beginning of the experiment experienced the following emotions at a very low level: afraid (M=5.52, SD=1.05); nervous (M=4.56, SD=1.73); sadness (M=5.08, SD=1.55); upset (M=5.56, SD=.92); downhearted (M=5.12, SD=1.13). Additionally, the participants felt moderately sleepy (M=4.56, SD=1.19), a little tired (M=3.44, SD= 1.78), and felt quite ashamed (M=1.64, SD=1.11).

As far as the positive emotions are concerned, the participants before the VR intervention experienced the following emotions: interested (M=4.54, SD=1.19); active (M=4.32, SD=1.22); inspired (M=3.80, SD=1.53); calm (M=4.00; SD=1.71); confident (M=4.16, SD=1.21); alert (M=3.40, SD=1.66); relaxed (M=3.44, SD=1.61); determined (M=4.48, SD=1.33) and concentrating (M=4.44, SD=1.23). Appendix C-7-13 presents the descriptive statistics for the pre-emotions scale items.

Table 7-34: Descriptive statistics of the pre-emotions scale

	N	Mean	Std. Deviation
1. Afraid (pre) (reversed)	25	5.5200	1.04563
2. Interested (pre)	25	4.5600	1.19304
3. Active (pre)	25	4.3200	1.21518
4. Nervous (pre) (reversed)	25	4.5600	1.73397
5. Inspired (pre)	25	3.8000	1.52753
6. Sad (pre) (reversed)	25	5.0800	1.55242
7. Upset (pre) (reversed)	25	5.5600	.91652
8. Calm (pre)	25	4.0000	1.70783
9. Confident (pre)	25	4.1600	1.21381
10. Tired (pre) (reversed)	25	3.4400	1.78139
11. Ashamed (pre) (reversed)	25	1.6400	1.11355
12. Sleepy (pre) (reversed)	25	4.5600	1.19304

13. Alert (pre)	25	3.4000	1.65831
14. Downhearted (pre) (reversed)	25	5.1200	1.12990
15. Relaxed (pre)	25	3.4400	1.60935
16. Determined (pre)	25	4.4800	1.32665
17. Concentrating (pre)	25	4.4400	1.22746
Valid N (listwise)	25		

7.9.8.3 Pre-emotions scale Test of Normality

The Kolmogorov-Smirnov test indicated that the pre-emotions scale items do not follow a normal distribution, as the p-value is <0.05 for almost all scale items (table 7-35). Thus, Ho is rejected, and non-parametric tests were used for the data analysis.

Table 7-35: Test of normality for pre-emotions scale items

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
1. Afraid (pre) (reversed)	.437	25	.000
2. Interested (pre)	.244	25	.001
3. Active (pre)	.232	25	.001
4. Nervous (pre) (reversed)	.240	25	.001
5. Inspired (pre)	.192	25	.018
6. Sad (pre) (reversed)	.363	25	.000
7. Upset (pre) (reversed)	.444	25	.000
8. Calm (pre)	.180	25	.036
9. Confident (pre)	.248	25	.000
10. Tired (pre) (reversed)	.158	25	.111
11. Ashamed (pre) (reversed)	.397	25	.000
12. Sleepy (pre) (reversed)	.244	25	.001
13. Alert (pre)	.161	25	.093
14. Downhearted (pre) (reversed)	.302	25	.000
15. Relaxed (pre)	.194	25	.016

16. Determined (pre)	.252	25	.000
17. Concentrating (pre)	.236	25	.001

7.9.8.4 Post-emotions: descriptive statistics

According to the results, after VR intervention, the participants experienced several positive and negative emotions (table 7-36). The results indicate that as far as the negative emotions are concerned, the participants after the end of the experiment experienced the following emotions at a very low level: afraid (M=3.28, SD=2.05); nervous (M=3.32, SD=1.99); sadness (M=3.12, SD=1.97); upset (M=3.00, SD=1.96); tired (M=3.08, SD= 1.44); ashamed (M=3.32, SD=2.21); sleepy (M=2.92, SD=1.80) and downhearted (M=3.36, SD=1.89).

As far as the positive emotions are concerned, the participants before the VR intervention experienced the following emotions: interested (M=4.08, SD=1.52); active (M=356, SD=1.50); inspired (M=3.72, SD=1.52); calm (M=3.60; SD=1.55); confident (M=3.88, SD=1.54); alert (M=3.40, SD=1.61); relaxed (M=3.24, SD=1.72); determined (M=4.08, SD=1.52) and concentrating (M=4.12, SD=1.45). Appendix C-7-13 presents the descriptive statistics for the pre-emotions scale items. Appendix C-7-14 presents the descriptive statistics for the pre-emotions scale items.

Table 7-36: Descriptive statistics of the post-emotions scale

	N	Mean	Std. Deviation
1. Afraid (post) (reversed)	25	3.2800	2.05183
2. Interested (post)	25	4.0800	1.52534
3. Active (post)	25	3.5600	1.50222
4. Nervous (post) (reversed)	25	3.3200	1.99416
5. Inspired (post)	25	3.7200	1.51438
6. Sad (post) (reversed)	25	3.1200	1.96469
7. Upset (post) (reversed)	25	3.0000	1.95789
8. Calm (post)	25	3.6000	1.55456
9. Confident (post)	25	3.8800	1.53623
10. Tired (post) (reversed)	25	3.0800	1.44106

11. Ashamed (post) (reversed)	25	3.3200	2.21209
12. Sleepy (post) (reversed)	25	2.9200	1.80093
13. Alert (post)	25	3.4000	1.60728
14. Downhearted (post) (reversed)	25	3.3600	1.89033
15. Relaxed (post)	25	3.2400	1.71464
16. Determined (post)	25	4.0800	1.52534
17. Concentrating (post)	25	4.1200	1.45258
Valid N (listwise)	25		

7.9.8.5 Post-emotions: test of normality

The Kolmogorov-Smirnov test indicated that the pre-emotions scale items do not follow a normal distribution, as the p-value is <0.05 for almost all scale items (table 7-37). Thus, Ho is rejected, and non-parametric tests were used for the data analysis.

Table 7-37: Test of normality for post-emotions scale items

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
1. Afraid (post) (reversed)	.227	25	.002
2. Interested (post)	.287	25	.000
3. Active (post)	.151	25	.144
4. Nervous (post) (reversed)	.198	25	.013
5. Inspired (post)	.213	25	.005
6. Sad (post) (reversed)	.236	25	.001
7. Upset (post) (reversed)	.215	25	.004
8. Calm (post)	.210	25	.006
9. Confident (post)	.207	25	.007
10. Tired (post) (reversed)	.173	25	.051
11. Ashamed (post) (reversed)	.247	25	.000
12. Sleepy (post) (reversed)	.196	25	.014
13. Alert (post)	.206	25	.008

14. Downhearted (post) (reversed)	.204	25	.009
15. Relaxed (post)	.165	25	.077
16. Determined (post)	.207	25	.007
17. Concentrating (post)	.208	25	.007

7.9.8.6 Pre/Post emotions scale: non-parametric tests

A Wilcoxon signed ranks-test indicated that some post-test scores were statistically significantly different than pre-test scores. Thus, some of the participants' mood states were statistically significantly different after the use of the VR (table 7-38).

More specifically, the use of VR elicited a statistically significant change in participants' state of fear (Z=-3.508, p=0.000). Indeed, the mean score rating for the state afraid was M=5.52 (SD=1.05) before the use of VR and M=3.28 (SD=2.05) after the use of VR. Thus, we reject the null hypothesis for the mood state of fear.

The results indicate a change in participants' mood state of interest before and after the use of VR Z=-2.144, p=0.032. The mean score rating for the mood interest was M=4.56 before (SD=1.19) and M=4.08 (SD=1.53) after the VR intervention. The participants tended to be more active before the use of VR (M=4.32, SD=1.22) than after (M=3.56, SD=1.50), Z=-2.431, p=0.015.

The results indicate that the VR intervention elicited a statistically significant difference in participants' state of being nervous before and after the use of VR, Z=-2.310, p=0.21. Indeed, the mean score rating for the state nervous was M=4.56 (SD=1.73) before the use of the VR and M=3.32(SD=1.99) after the use of VR. Moreover, the results indicate that the use of VR elicited a statistically significant change in participants' state of sadness, Z=-2.940, p=0.003. The mean score rating for the state sad was M=5.08 (SD=1.55) before the use of the VR and M=3.12 (SD=1.97) after the use of VR. Furthermore, the results indicated a statistically significant change in participants' state upset, Z=-3.919, p=0.000. The mean score rating for the state upset was M=5.56 (SD=0.92) before the use of the VR and M=3.0 (SD=1.96) after the use of VR.

A Wilcoxon signed-rank test showed that the use of VR elicited a statistically significant change regarding participants' state of feeling ashamed before (M=1.64, SD=1.11) and after (M=3.32, SD=2.21) the use of VR, Z=-2.726, p=0.006.

Additionally, there are indications for participants' fatigue after the use of the VR, since the mean score rating for the state sleepy was M=4.56 (SD=1.19) before the use of the VR and M=2.92 (SD=1.80) after the use of VR. Moreover, according to the results, the participants were more downhearted after the use of VR, Z=-3.199, p=0.001. The mean score rating for the state downhearted was M=5.12 (SD=1.13) before the use of the VR and M=3.36 (SD=1.89) after the use of VR.

A Wilcoxon signed-rank test showed that the use of VR did not elicit a statistically significant change in participants' inspiration (Z=-0.254, p=0.799). Moreover, a Wilcoxon signed-rank test showed that the use of VR did not elicit a statistically significant change in the states of calm (Z =-0.826, p=0.409), confidence (Z=-1.224, p=0.221), tired (Z=-0.470, p=0.639), alert (Z=-0.096, p=0.923), relaxed (Z=-0.637, p=0.524), determined (Z=-1.403, p=0.161) and concentrating (Z=-1.890, p=0.059).

Table 7-38: Wilcoxon signed-rank test for pre and post emotions scale (the statistically significant outcome are bold)

	Z	Asymp. Sig. (2-tailed)
1. Afraid - 1. Afraid	**-3.508[a]**	**.000**
2. Interested - 2. Interested	**-2.144[a]**	**.032**
3. Active - 3. Active	**-2.431[a]**	**.015**
4. Nervous - 4. Nervous	**-2.310[a]**	**.021**
5. Inspired - 5. Inspired	-.254[a]	.799
6. Sad - 6. Sad	**-2.940[a]**	**.003**
7. Upset - 7. Upset	**-3.919[a]**	**.000**
8. Calm - 8. Calm	-.826[a]	.409
9. Confident - 9. Confident	-1.224[a]	.221
10. Tired - 10. Tired	-.470[a]	.639
11. Ashamed - 11. Ashamed	**-2.726[b]**	**.006**
12. Sleepy - 12. Sleepy	**-3.140[a]**	**.002**
13. Alert - 13. Alert	-.096[a]	.923
14. Downhearted - 14. Downhearted	**-3.199[a]**	**.001**

15. Relaxed - 15. Relaxed	-.637[a]	.524
16. Determined - 16. Determined	-1.403[a]	.161
17. Concentrating - 17. Concentrating	-1.890[a]	.059

a. Based on positive ranks.

b. Based on negative ranks.

Figure 7-22 represents the changes the VR intervention elicited to the participants. The green color represents the mean values before the VR intervention and the blue color the values after the experiment.

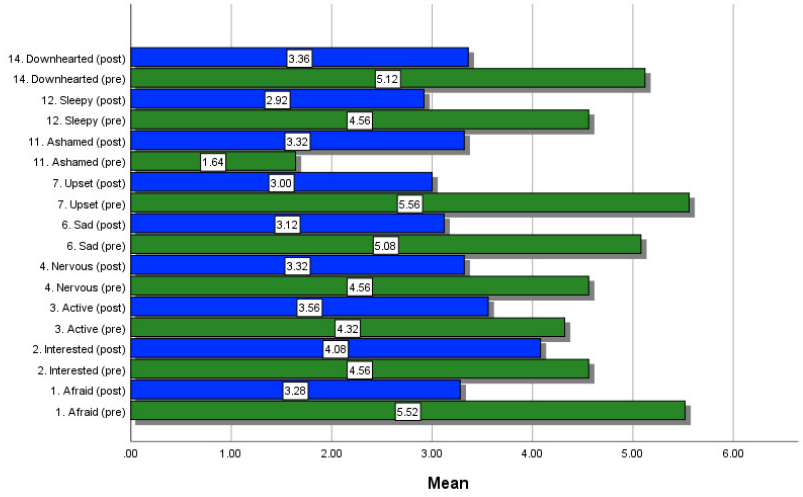


Figure 7-22: The impact of the VR on the participant's emotions

7.9.8.7 The impact of perspective-taking on participants emotions

The perspective-taking was of paramount importance for the current research, thus the researcher is interested to investigate the change of emotional levels for each of the two groups (table 7-39). Wilcoxon test revealed that for group 1 (teacher-student drug user perspective), the VR intervention increased the levels of fear (Z=-1.979, p=0.48), increased participants' interest (Z=-2.121, p=0.34), upset them (Z=-2.532, p=0.11), while it decreased their feeling of shame (Z=-2.239, p=0.25) and increased the levels of feeling sleepy (Z=-2.532, p=0.11). The mean scores for group 1 are presented in appendix C-7-15.

As far as group 2 (teacher-healthy student perspective) is concerned, the VR intervention increased the levels of fear (Z=-2.979, p=0.003), increased the levels of

feeling nervous (Z=-2.102, p=0.36), increased their sadness (Z=-2.611, p=0.009), upset them (Z=-2.969, p=0.003), increased the levels of feeling sleepy (Z=-1993, p=0.46) and made them feel more downhearted (Z=-2.781, p=0.005). The mean scores for group 2 are presented in appendix C-7-15.

Table 7-39: Wilcoxon test per group

Perspective = Teacher-student drug user [a,b]		
	Z	Asymp. Sig. (2-tailed)
1. Afraid (post) - 1. Afraid (pre)	-1.979[c]	**.048**
2. Interested (post) - 2. Interested (pre)	-2.121[c]	**.034**
3. Active (post) - 3. Active (pre)	-1.802[c]	.072
4. Nervous (post) - 4. Nervous (pre)	-1.132[c]	.257
5. Inspired (post) - 5. Inspired (pre)	-.597[d]	.551
6. Sad (post) - 6. Sad (pre)	-1.336[c]	.182
7. Upset (post) - 7. Upset (pre)	-2.573[c]	**.010**
8. Calm (post) - 8. Calm (pre)	-1.150[c]	.250
9. Confident (post) - 9. Confident (pre)	-1.725[c]	.084
10. Tired (post) - 10. Tired (pre)	-.480[d]	.631
11. Ashamed (post) - 11. Ashamed (pre)	-2.239[d]	**.025**
12. Sleepy (post) - 12. Sleepy (pre)	-2.532[c]	**.011**
13. Alert (post) - 13. Alert (pre)	-1.069[c]	.285
14. Downhearted (post) - 14. Downhearted (pre)	-1.529[c]	.126
15. Relaxed (post) - 15. Relaxed (pre)	-1.289[c]	.197
16. Determined (post) - 16. Determined (pre)	-.686[c]	.493
17. Concentrating (post) - 17. Concentrating (pre)	-.707[c]	.480
a. Perspective = Teacher-Student drug user		
b. Wilcoxon Signed Ranks Test		
c. Based on positive ranks.		
d. Based on negative ranks.		
Perspective = Teacher-healthy student [a,b]		

	Z	Asymp. Sig. (2-tailed)
1. Afraid (post) - 1. Afraid (pre)	-2.979[c]	**.003**
2. Interested (post) - 2. Interested (pre)	-1.218[c]	.223
3. Active (post) - 3. Active (pre)	-1.631[c]	.103
4. Nervous (post) - 4. Nervous (pre)	-2.102[c]	**.036**
5. Inspired (post) - 5. Inspired (pre)	-1.029[c]	.303
6. Sad (post) - 6. Sad (pre)	-2.611[c]	**.009**
7. Upset (post) - 7. Upset (pre)	-2.969[c]	**.003**
8. Calm (post) - 8. Calm (pre)	-.175[d]	.861
9. Confident (post) - 9. Confident (pre)	-.087[c]	.931
10. Tired (post) - 10. Tired (pre)	-1.043[c]	.297
11. Ashamed (post) - 11. Ashamed (pre)	-1.488[d]	.137
12. Sleepy (post) - 12. Sleepy (pre)	-1.993[c]	**.046**
13. Alert (post) - 13. Alert (pre)	-1.186[d]	.236
14. Downhearted (post) - 14. Downhearted (pre)	-2.781[c]	**.005**
15. Relaxed (post) - 15. Relaxed (pre)	-.120[d]	.904
16. Determined (post) - 16. Determined (pre)	-1.518[c]	.129
17. Concentrating (post) - 17. Concentrating (pre)	-1.897[c]	.058

a. Perspective = Teacher-healthy student

b. Wilcoxon Signed Ranks Test

c. Based on positive ranks.

d. Based on negative ranks.

Figure 7-23 presents the mean scores for all emotions items before the VR intervention for group 1 (teacher-student drug user perspective) and table 7-24 presents the changes to the mean scores indicating the impact of the VR experience. Moreover, figure 7-25 presents the mean scores for all emotions items before the VR intervention for group 2 (teacher-student healthy user perspective) and table 7-26 presents the changes to the mean scores indicating the impact of the VR experience.

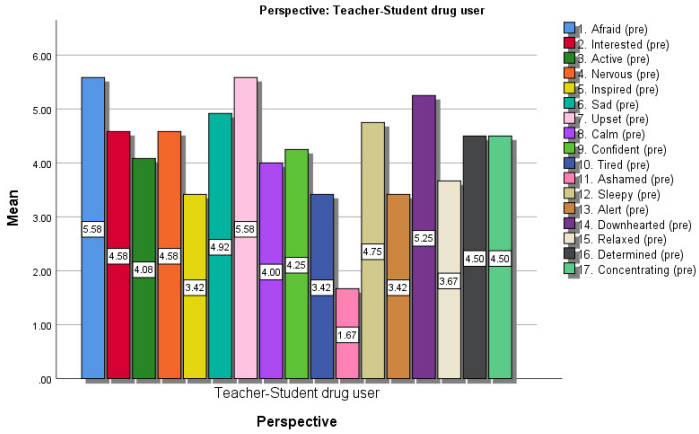


Figure 7-23: Mean score of pre-emotions scale items for group 1

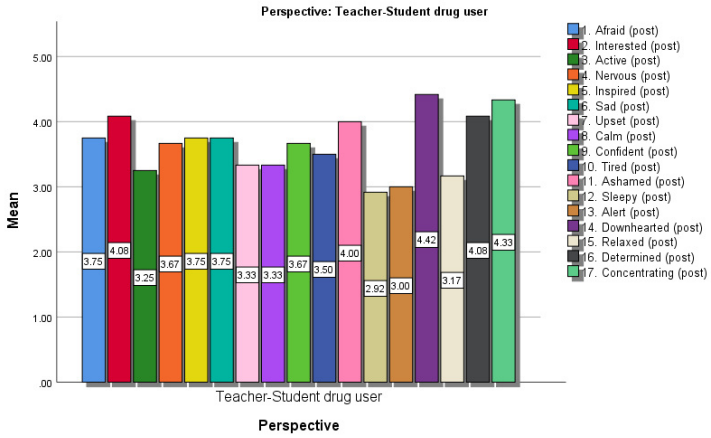


Figure 7-24: Mean score of post-emotions scale items for group 1

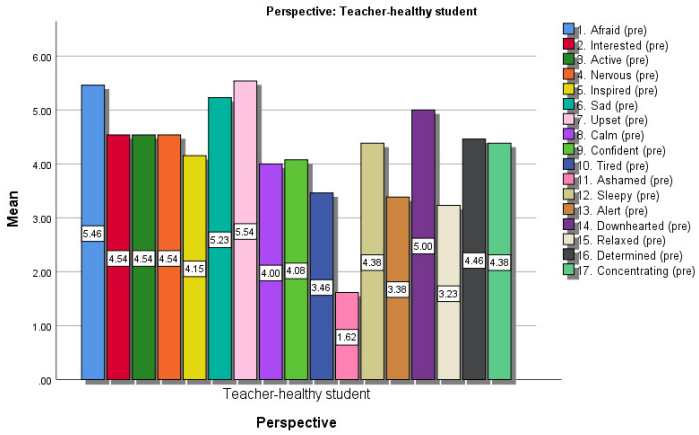


Figure 7-25: Mean score of pre-emotions scale items for group 2

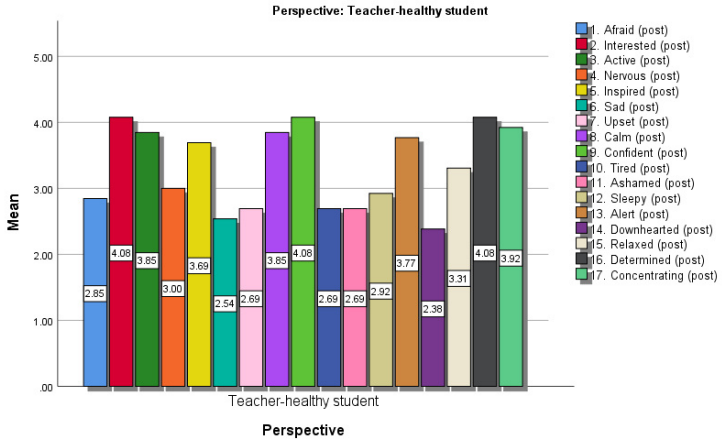


Figure 7-26: Mean score of post-emotions scale items for group 2

7.9.8.8 Conclusions of the emotions scale

The results revealed that the VR intervention ***elicited a statistically significant change in the participant's negative emotions and mood states***. Before the VR experiment, the participants did not feel fear, nervousness, sadness, upset, ashamed, or downhearted. However, after the VR experiment, their scores indicate a significant change in those states. Hence, it seems that the VR experience had a strong impact on them and possibly the context of the scenario affected them enough, especially group 1 that experienced also the substance used problem through the eyes of the students' drug user. Regarding the positive emotions, the results did not reveal statistically significant changes after the use of VR. Thus, the scenario affected only the negative states that were absent before the experiment.

7.10 Heart rate

Participants' heart rate was monitored to measure the effects of the VR intervention on the participants, providing data about the physiological reactions. The results revealed a significant difference between the beginning and the end of the experiment (Christofi et al., 2018). HB1 represents the heart rate at the beginning of the experiment, with a mean score of 80.92 bpm (SD=10.59 bpm), while HB2 is the heart rate after the end of the experiment, with the mean score of 87.21 bpm (SD=10.97 bpm). Hence, the results indicate that the VR intervention had an impact on the participants' physiological reactions as their HR was increased (figure 7-27).

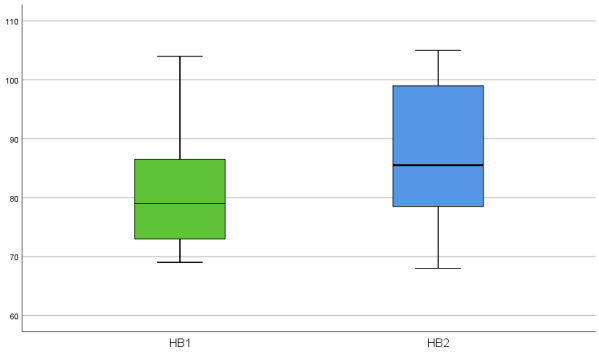


Figure 7-27: Participant's heart rate pre and post the VR intervention

Moreover, the Wilcoxon test revealed that the VR intervention elicited a statistically significant change in participants' HR (Z=-2.862, p=0.004). Additionally, the Wilcoxon test revealed that the VR intervention elicited a statistically significant change to the participants of group 1 (Z=-2.670, p=0.008), who experienced the perspectives teacher and student drug user. The results do not indicate a statistically significant change for the HR of participants of group 2 (Z=-1.225, p=0.222), whose HR was increased as also presented in figure 7-28, yet the difference was not statistically significant. It seems that perspective-taking and the scenario affected participant's heart rate response. Those who experienced the student drug user perspective and the symptoms of cannabis use experienced higher levels of stress and anxiety and thus, their heart rate was increased significantly. On the other hand, those who saw the problem from the eyes of the teacher and of the heathy student were not affected that much, as they probably felt more like observing the problem.

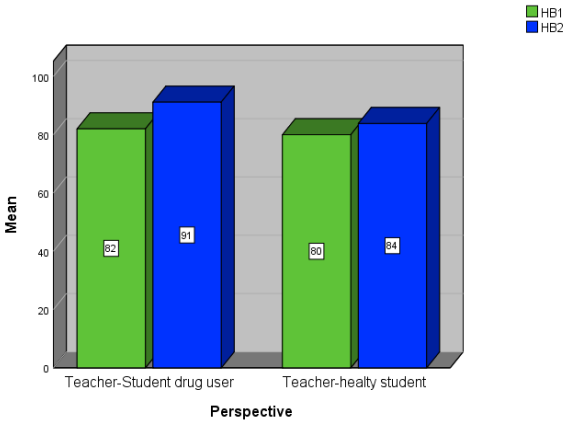


Figure 7-28: Participant's heart rate pre and post the VR intervention per group

7.11 EEG results

EMOTIV EPOC EEG device was used to monitor participants' brain signals and investigate the possible impact of perspective-taking. For the needs of the current research, the main focus was the frontal and parietal areas of the brain that play an important role in the levels of presence (Christofi et al., 2018). The data were analyzed using EEGlab was used and MATLAB toolbox.

The results indicate statistically significant differences among the different perspectives (teacher-healthy student-drug user student) regarding participants' brainwaves including the alpha and the beta rhythm. The alpha state (8.0–12.5 Hz) is associated with relaxation and with the sense of presence in VR environments (Baumgartner et al., 2006; Clemente et al., 2014), while the beta state (12.5 and 30 Hz) with focus, concentration, critical thinking, decision making, high alertness, active attention and focus on the outside world (Calore et al., 2012; Hondrou & Caridakis, 2012; Ramirez & Vamvakousis, 2012). The results indicate that alpha waves were detected only when the participants experienced the perspective of the students (both healthy student and drug user), while beta waves were detected in all perspectives (Christofi et al., 2018; Stavroulia et al., 2019). This outcome could be explained by the fact that initially, all the participants started the experiment experiencing the perspective of the teacher. Based on the scenario, this was a short scene in time duration, as through teachers' perspective the drug-related problem was not obvious. It is possible, that there was a need for more time, and for this reason the participants once experienced the other two perspectives and spend more time in the virtual scene, they entered the alpha state. In total, the participants entered the alpha state, indicating the sense of level that was also confirmed by the two questionnaire scales.

7.12 General conclusions

The main aim of the current experiment was to investigate the levels of presence and investigate the possible impact of experiencing different perspectives on the levels of presence, embodiment, empathy, and emotions. To address the main objective the following research questions were identified:

1. *To what extent did participants feel present in the virtual school space?*

Two different scales were used to measure the presence, namely IPQ and SUS scales. The results suggest that the participants felt moderately the sense of presence as the mean scores tend to be higher in the middle of the scale. The results of the two scales confirm each other. For the measurement of presence, an EEG device was also used, called EMOTIV EPOC. The results of the EEG device indicate that participants' brain waves entered the alpha state that is associated with the sense of presence but only for the perspective of the students both the student-drug user and the healthy student. Beta waves were detected in all perspectives. The EEG results confirmed the results of the questionnaire indicating that the participants experienced a sense of presence.

2. *To what extent did the virtual environment affect participants' sense of embodiment?*

The results indicate uncertainty regarding the achievement of the sense of embodiment as the central tendency in the scale is neutral.

3. *To what extent did the VR intervention affect participants' empathy?*

The results indicate the potential of using VR to cultivate empathy skills. The VR intervention elicited a statistically significant change for two empathy items. However, one of those two items is of paramount importance for the current research as it concerns the ability of a teacher to enter 'the shoes of the student' and experience any problem through the student's eyes.

4. *To what extent did the VR intervention affect participants' emotions?*

The results revealed that the VR intervention elicited a statistically significant change in the participant's negative emotions and mood states. Before the VR experiment, the participants did not feel fear, nervousness, sadness, upset, ashamed, or downhearted. However, after the VR experiment, their scores indicate a significant change in those states. Regarding the positive emotions, the results did not reveal statistically significant changes after the use of VR.

5. *To what extent did perspective-taking had an impact on the levels of presence, emotions, and empathy?*

Perspective-taking did not affect the levels of presence as non-parametric tests did not reveal statistically significant differences between the two groups that experienced different perspectives.

Perspective-taking did not affect the sense of embodiment.

Concerning empathy, the VR intervention elicited a statistically significant change of the participants who experience the student drug-student perspective because before the VR intervention they claimed that is it difficult to relate to a student facing a drug situation, but after the VR experience and perspective change the participants felt closer to a student facing such problems. Perspective-taking and the experience of the drug-related symptoms that were described in the scenario section had an impact on the participants and helped them understand the problem via the eyes of the student.

The VR experience had a strong impact on participants' emotions and mood states for both groups, thus perspective taking did not elicit a statistically significant difference between the two groups.

The results of the current research were of paramount importance for the current research. The outcomes regarding the impact of perspective-taking led to several modifications on the application and on the way, perspective-taking was approached for the final application and experiment. Equally important is that the sense of presence was confirmed again as in experiment 1 and was also confirmed by the EEG device. For this reason, there was no need to use again an EEG device for the final experiment as the virtual world had been tested twice with positive outcomes. The next chapter presents the modification and the final scenario and VR application, along with the final evaluation.

8 Investigating the impact of a VR intervention on end-users' empathy and emotional state

In Chapter 7 the experiment related to substance use within the school environment was presented, its objectives, the experimental design, and the results from the analysis. In this chapter, the final experiment is presented along with the experimental set up that was used to investigate the impact of the VR system developed is explained. This chapter is divided into two main parts. The first part deals with the objective of the experiment and the research questions. Moreover, the scenario is explained along with the stories of the five virtual students, to understand each problematic situation. After, the perspectives and the groups of participants are explained, as the different perspectives formed a key parameter for the experiment to determine whether a perspective change can affect more end-users. Then the application development will be explained, the instruments used for the evaluation of the application will be explained, followed by information related to the sampling technique and the procedure that was followed for conducting the experiment. The second part presents the quantitative and qualitative analysis of the data gathered from the experiment.

8.1 Experimental research design

The experimental strategy was used to investigate the impact of the VR application (Robson, 2003; Ross & Morrison, 2004). The main aim of the third experiment was to evaluate the final version of the VR application that was modified based on the outcomes of the previous experiments. Once more, the experimental design was selected as the most suitable approach to provide feedback about the impact of the VR application leading to future modifications and further research on the field. The experiment design is a three-group pre/post-test experiment. All three groups used the VR system for training, but the control group experienced only the perspective of the teacher in a classroom with all the students facing various disorders and problems. The participants were randomly distributed between the three groups (Cohen et al., 2002; Robson, 2003).

8.2 The objective and research questions

The main objective of the current experiment was to investigate the impact of the developed VR system on participants' empathy skills. The VR environment was developed to increase participants' empathic skills by placing them ‘in another person's shoes’, in an effort to experience a different perspective and understand various problems. Moreover, another significant objective was the investigation of the impact of the VR system on participants' emotions and mood states. Furthermore, two more key variables under investigation were the sense of presence and embodiment as they contribute significantly to the user’s experience in a virtual world. In addition, the impact of the perspective from which the VR world was visualized was analyzed. Along these lines, users could experience the VR application through the eyes of the virtual students rather than through the eyes of the teachers.

To meet the above objectives the following research questions were formed:

Primary objectives:

RQ 1. To what extent did the VR intervention affect participants’ emotional state?

RQ 2. To what extent did the VR intervention affect participants’ empathy?

Secondary objectives:

RQ 3. To what extent did participants feel a sense of presence in the virtual environment?

RQ 4. To what extent did the virtual environment affect participants’ sense of embodiment?

RQ 5. To what extend did the different perspectives affected participants’ emotions?

RQ 6. To what extend did the different perspectives affected participants’ empathy?

RQ 7. To what extend did the different perspectives affected participants’ sense of presence?

RQ 8. To what extend did the different perspectives affected participants’ sense of embodiment?

The following graphical representation presents the primary and secondary objectives of the current research (figure 8-1):

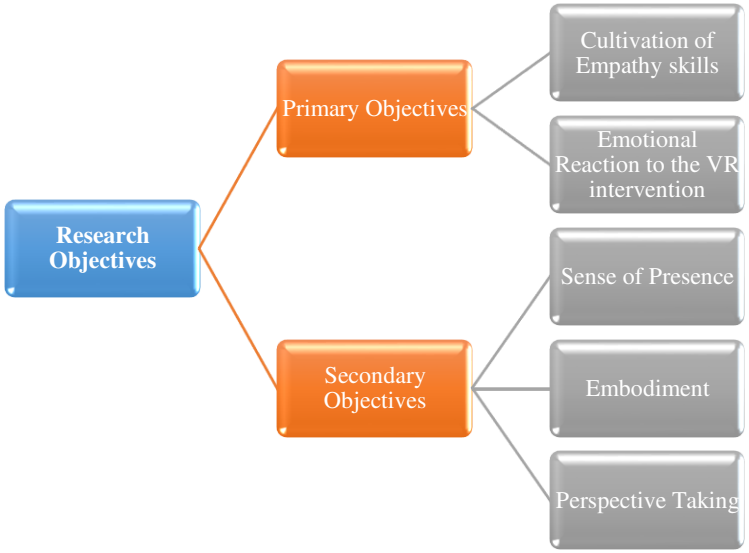


Figure 8-1: The primary and secondary objectives of the research

8.3 The scenario

The main scene comprises the teacher and five students. All users are placed first in the position of the teacher. The teacher has called the five students at a meeting, as some bullying incidents have come to his/her attention. As a first step, the teacher is asking the students to say a few words about themselves and the problems that they face. Each user is free to choose as a teacher which story to hear and in what terms.

Each student has a story to narrate that related to a problematic situation they faced in school. The test cases appearing in the scenario were proposed by psychologists and teachers, as they were cases that they had encountered in the school environment and were difficult to handle. The five students and their problems are presented in figure 8:2.

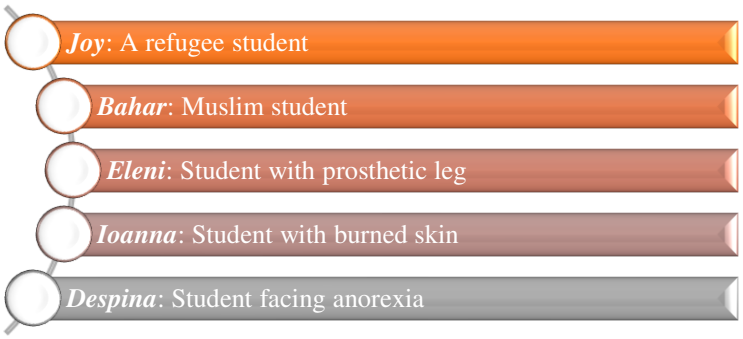


Figure 8-2: Test cases encountered by the users during the scenario

The stories of each student were the following:

- **Joy:** The student is coming from abroad and specifically he is a refugee from Africa. He does not speak very well the official language of the schools and it is not easy for him to follow the lessons. As a result, the rest of the class is making fun of him. Nevertheless, Joy wants to be educated to find a well-paid job that will allow him to live in better conditions and support his family.
- **Bahar:** Due to her fathers' work Bahar moved to another area that forced her to be enrolled in a non-minority school as she was in the previous years. Her classmates do not like her because she is wearing a scarf and for this reason, she is pressing her family to find a minority school for her that will allow her to be among girls that dress similarly.
- **Eleni:** After a car accident Eleni lost her leg. She now has a prosthetic leg. Before the car accident, she was always close to her classmates and very loved. After the accident, her friends walked away. She was a top student and now her grades are low. Yet, she is trying hard to increase her grades and enter medical school to help other people facing a problem like hers.
- **Ioanna:** During Easter time a firecracker accidentally dropped to Ioanna and she was injured and burned. This left her marks and her parents cannot afford to economically to make a plastic surgery. She was a good student but now she lacks motivation as she does not like the way she looks. Her friends did not support her anymore, she feels alone. She makes a lot of absences and does not want to come to school.
- **Despina:** The student had the impression of being fat although she was a normal girl. As a result, she started losing a lot of weighing, which resulted in putting her life at risk. She is trying to overcome this problem, but she is feeling lonely as her friends turned their back to her.

8.4 The groups and perspectives

The users who participated in the experiment were divided into three groups. Users of all groups experienced the view of the teacher, however, users of groups 2 and 3 also could change perspective to enter the position of the student and experience the problem from the students' perspective.

- Group 1 – Control Group (C-Group): The users of the first group experienced only the perspective of the teacher. Thus, the users were able to hear student's stories, give advice, yet they were not able to change perspective and enter the body of the virtual student to view the problem through the eyes of the student.
- Group 2 (TP-Group / 2P-Group): The users of the second group initially entered the position of the teacher, to hear the stories of the student. After the end of the stories and of the meeting with the virtual students, users were changing perspective and body, entering the body of Eleni, the virtual student with the prosthetic leg, to understand the problem through Eleni's eyes.
- Group 3 (TFP-Group / 3P-Group): The users of the third group initially entered the position of the teacher, to hear the stories of the student. After the end of the stories and of the meeting with the virtual students, users were changing perspective and body, entering the body of Joy, the refugee virtual student. Then, after experiencing Joy's problem, the users were also given the choice to enter the body of Eleni.

In summary, users could experience three different perspectives that were the following:

Perspective 1. Teacher perspective

Perspective 2. Eleni's perspective – student with a prosthetic leg

Perspective 3. Joy's perspective – student Refugee

The three groups and the perspectives are presented in figure 8-3 below:

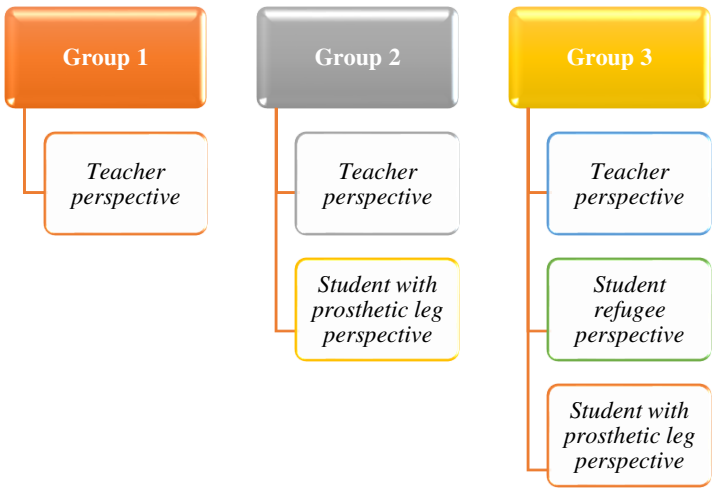


Figure 8-3: The 3 groups and perspectives

8.5 Application design and development

In this sub-section, the overall process of developing the VR application is explained in detail.

8.5.1 The avatars of the virtual students and teachers

Most of the 3D avatars of the virtual students were developed with Autodesk® Character Generator (https://charactergenerator.autodesk.com/). However, some of the virtual students' stories had unique features that could not be developed within Autodesk® Character Generator. Thus, some of the virtual characters were modified using Autodesk® Maya® student edition, to better represent the test cases.

Eleni's' avatar had to be with a prosthetic leg. The avatar was developed using Autodesk® Character Generator. Then, the textures from the one leg were deleted using Autodesk® Maya® student edition and the prosthetic leg model was attached. The prosthetic leg was downloaded free from GrabCAD by Dexter (https://www.thingiverse.com/thing:1359011) and was modified for the needs of the specific virtual character (figure 8-4).

Figure 8-4: Student avatar (Eleni) with a prosthetic leg

Regarding the burned and injured skin of Ioanna's avatar, the appropriate texture was developed using Adobe Photoshop® and then the texture was imported and implemented as the new texture of the avatar within Autodesk® Maya® student edition (figure 8-5).

Figure 8-5: Student avatar (Ioanna) with burn texture

Despina's avatar was designed using Autodesk® Character Generator and the body was developed by choosing the options that made it look like suffering from anorexia (figure 8-6).

Figure 8-6: Student avatar (Despina) with anorexia problems

Joys' avatar (figure 8-7) was also designed using Autodesk® Character Generator as there were not particular parts of the body that needed to be modified using different software.

Figure 8-7: Student avatar (Joy)

The Muslim student model was a free model downloaded from Archive3d net (https://archive3d.net/) and was used with no further modifications (figure 8-8).

Figure 8-8: Muslim student avatar (Bahar)

Related to the teacher's virtual avatar, the participants were given the option to choose between a female and a male virtual avatar, to make the choice that would make them

feel comfortable in the virtual space. The two characters were designed and developed using Autodesk® Character Generator (figures 7-9 and 7-10).

Figure 8-9: Female teacher avatar

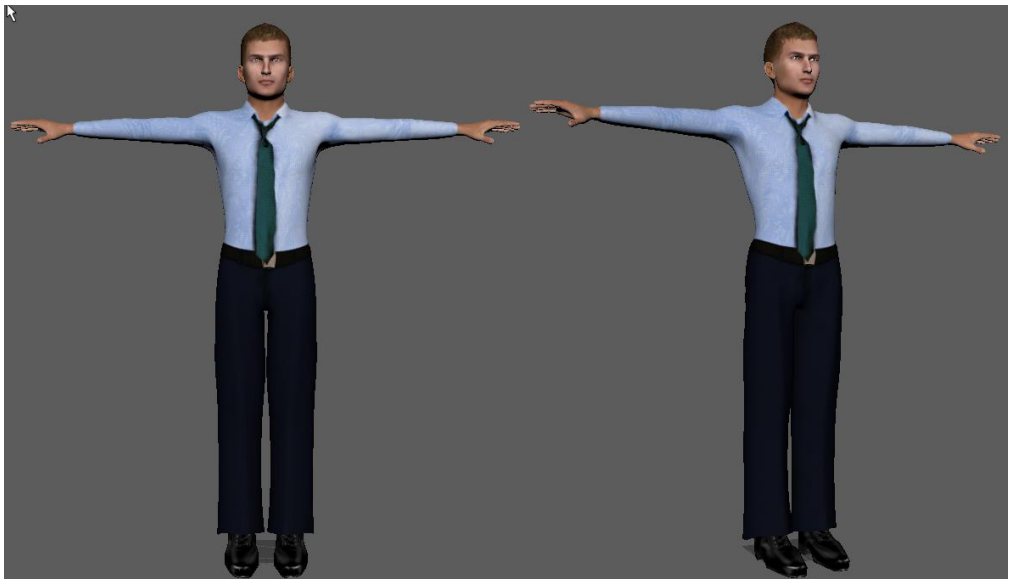


Figure 8-10: Male teacher avatar

8.5.2 The perspective

As in the previous experiments, users' viewpoint was 1PP. Based on the previous experiments and outcomes 1PP was chosen as the most suitable perspective for the current experiment, due to its positive impact on users' sense of embodiment and presence. Moreover, the research aimed to allow the users to experience different

viewpoints, Hence the participants of groups 2 and 3 experienced also body change within the virtual world to better understand virtual student's situations by 'entering in their shoes'. Hence, 1PP was considered more suitable for this experiment. For example, when using 1PP from the student avatar with prosthetic leg users can better conceive the problem of a prosthetic leg and feel it as part of their virtual self (figure 8-11). Even from the perspective of the teacher, the aim was to see the virtual students and be able to understand their problems 'thought the eyes' of the teacher (figure 8-12). Hence, the current research focuses on 1PP and the camera was placed at the height of the avatar's eyes (figure 8-13), providing the opportunity to the users to experience the scenario through the eyes different avatars as described in section 8.3.

Figure 8-11: Student's avatar with a prosthetic leg (top) and refugee student's virtual body (bottom) as seen from FPP.

Figure 8-12: Female avatar body (top) and Male avatar body (bottom) as seen from FPP.

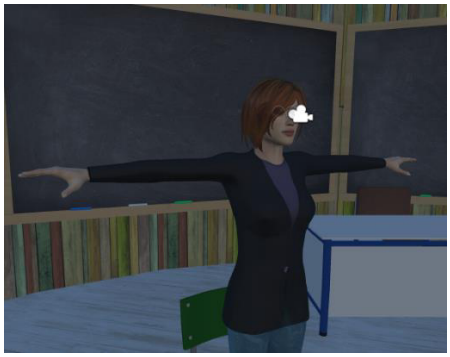


Figure 8-13: Camera position at the height of the avatar's eyes for FPP in Unity 3D

8.5.3 VR application development

8.5.3.1 The virtual classroom environment

The application used for the experiment was developed using Unity 3D development platform (https://unity.com/). The virtual environment used for the scenario scenes was the imaginary classroom environment as previously described in chapter 5. The imaginary classroom environment was chosen as the most suitable one due to previously conducted research, the results of which, presented in chapter 5, indicated that the majority of the participated teachers would like to be trained in a virtual imaginary space and not in a virtual real-life based classroom. Thus, the virtual classroom setting that was used for the current experiment is presented in figure 8-14.

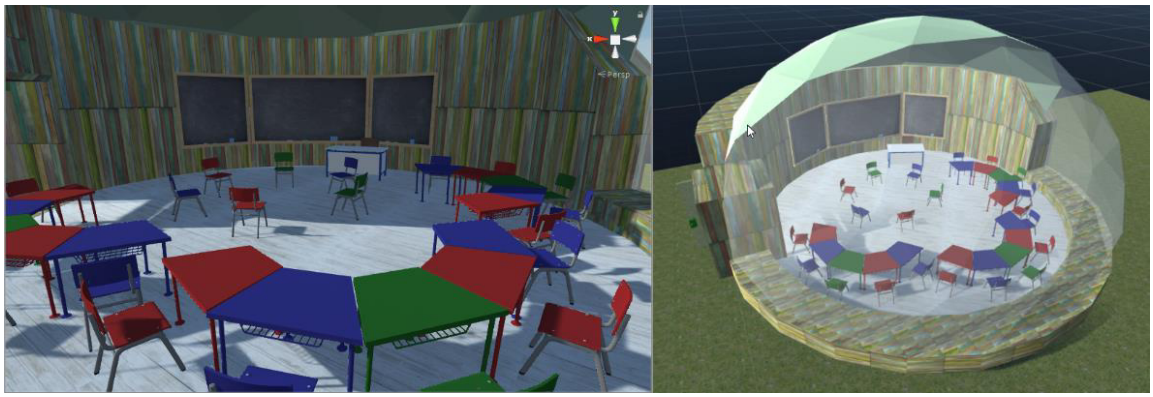


Figure 8-14: The imaginary virtual classroom in Unity

Nevertheless, another scene was used based on a real-life classroom environment for the initial, training, and mirror scenes (figure 8-15). The reason for using another real-life based classroom environment had to do with users' familiarization with the virtual space. For many of the participants, it was the first time of using VR, thus it was considered suitable to begin their introduction to the virtual world in a more familiar setting. Moreover, users' preference between the two virtual environments (imaginary vs real-life based) was a parameter to be investigated.

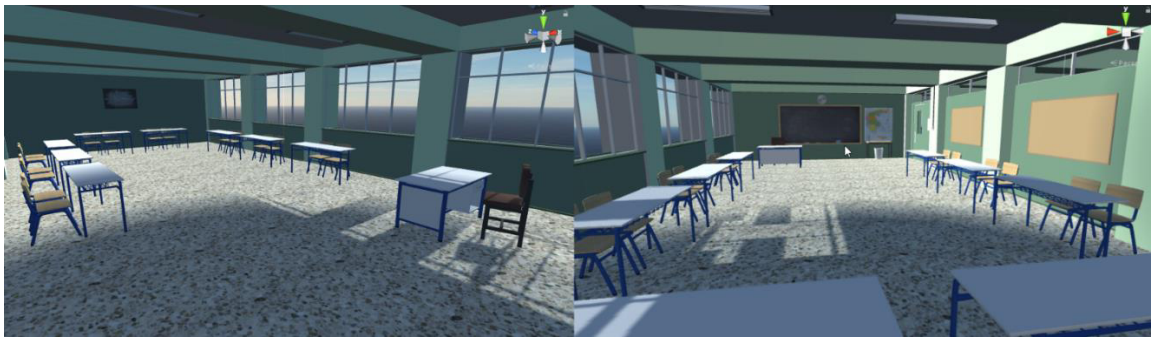


Figure 8-15: Real-life based virtual classroom environment used in the initial, training and mirror scenes

8.5.3.2 Sequence of scenes in the VR application

Several scenes were developed that were built differently for each of the groups based on the needs of the scenario. Group 1 experienced only the teacher's perspective whereas users from groups 2 and 3 were exposed to additional scenes. The sequence of scenes presented to users from each group is in figure 8-16.

The sequence of scenes for each group is presented in figure 8-16.

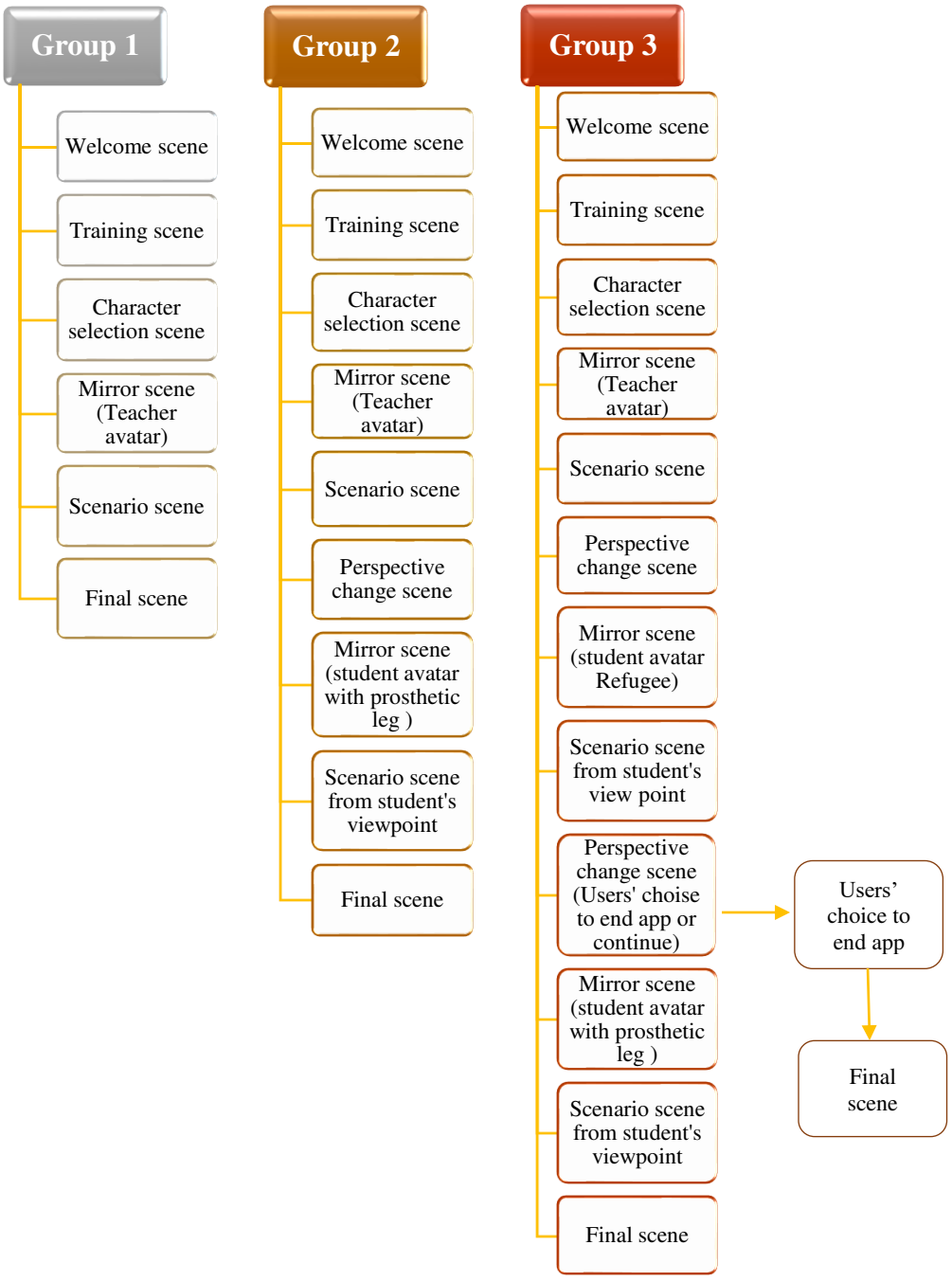


Figure 8-16: Application scenes sequence per group

The application begins with a welcome scene that is common for all three groups - aiming to welcome the users to the 'TuToR' application (figure 8-17).

Figure 8-17: Welcome scene (Unity) (Text on billboard translated to English: "Dear User, Welcome to TutoR Virtual World")

A training scene follows aiming to provide user's instructions related to interaction with the virtual world (figure 8-18).

Figure 8-18: Training scene (Text on billboard translated to English: "Let's do a test! Focus your eyes on the example button.")

After the training scene that is essential for users' familiarization with the virtual world, the character selection follows where users can use gaze-based interaction to choose either a female (Zoi) or male (Nikos) avatar of the teacher (figure 8-19). Choosing their character was important, as in the previous experiments users could not choose their

virtual character and they expressed their discomfort of being on the body of the opposite gender. The system also stores users' gender choice that aimed to gather data related to users' choice, to see participants' preferences.

Figure 8-19: Character selection scene (Text on billboard translated to English: "To select the character, look prolonged the button with the name".

After the selection of the character the mirror scene begins. The objective of the mirror scene is to familiarize the users with their virtual bodies. There are four mirror scenes: 1) female teacher; 2) male teacher; 3) student with a prosthetic leg and 4) student Refugee (figure 8-20). The participants experience the character scenes based on selection and group categorization. The participants of group 1 viewed only the female and male mirror scenes based on character selection. The participants of groups 2 and 3 viewed the female and male mirror scenes based on character selection. Then, they also could view the student's cases (prosthetic leg and refugee) depending on the group to which they belonged to. The development of mirror scenes for the virtual students was essential to prepare the users for the body change, perspective change, and familiarize them with their new bodies. Within the scene, there were buttons that the users could choose allowing the avatars to talk, move hands and salute, while they could see the gestures on the virtual mirror to facilitate the embodiment process through the observation of avatar motion synchronized with the user's movements (Peck et al., 2013; Slater et al., 2010; Spanlang et al., 2014).

Figure 8-20: Mirror scene: 1) Top-left: Female teacher avatar, 2) Top-right: Student with prosthetic leg, 3) Bottom-left: Male teacher avatar and 4) Bottom-right: Student refugee. On the left, there are instructions "Use the buttons to the right of the mirror to familiarize yourself with your virtual body. When you feel ready, click the Continue button to proceed below". On the right of each figure, there are buttons with the green color that the user can press to interact with the virtual avatars. For figures Top-left and Bottom-left, there were three options: "Speak", "Look hands" and "Greeting". For figure Top-right and Bottom-right, there were two options: "Look hands" and "Greeting".

After the mirror scene, the main scenario scene begins. At the beginning of the main scene, users listen to instructions (figure 8-21) and then five buttons appear above the head of each student avatar allowing the user to select an avatar to interact with (figure 8-22).

Figure 8-21: Main Scenario scene-instructions phase

Figure 8-22: Main Scenario scene – Virtual student's buttons for interaction

The users can choose any of the virtual students to begin with and listen to his/her stories and problem. Then, after the narration of the story, the users may opt to talk to an avatar to provide a piece of advice or the system provides advice related to the test case based on suggestions from active teachers and school psychologists (figure 8-23). The users are free to interact with whoever virtual student they wish, in any order.

Figure 8-23: Ability to provide advice to the virtual students by using the advice buttons

In the case participants choose to provide a piece of advice to the virtual students, the advice is recorded, to create a pool of good practices and also to allow the investigation

of the user's reactions. For the recording, there were two buttons, one initiating the recording and a second storing it in a separate folder for each virtual student. Using the two buttons was considered important to store the information needed separately for each virtual avatar. Those good practices will be used to update the system providing significant advice from experienced teachers to the trainees. Moreover, each virtual student has a negative slider bar, indicating low motivation that changes towards higher motivation when advice is given, providing in that way an incentive for users to interact with the student avatars.

After the end of the main scenario scene, users Group 1 enters the final scene whereas users from Groups 2 and 3 experience the same scenario but through the eyes of a virtual student (figure 8-24). While participating in a virtual world as a student it is not possible to interact and provide advice to other students.

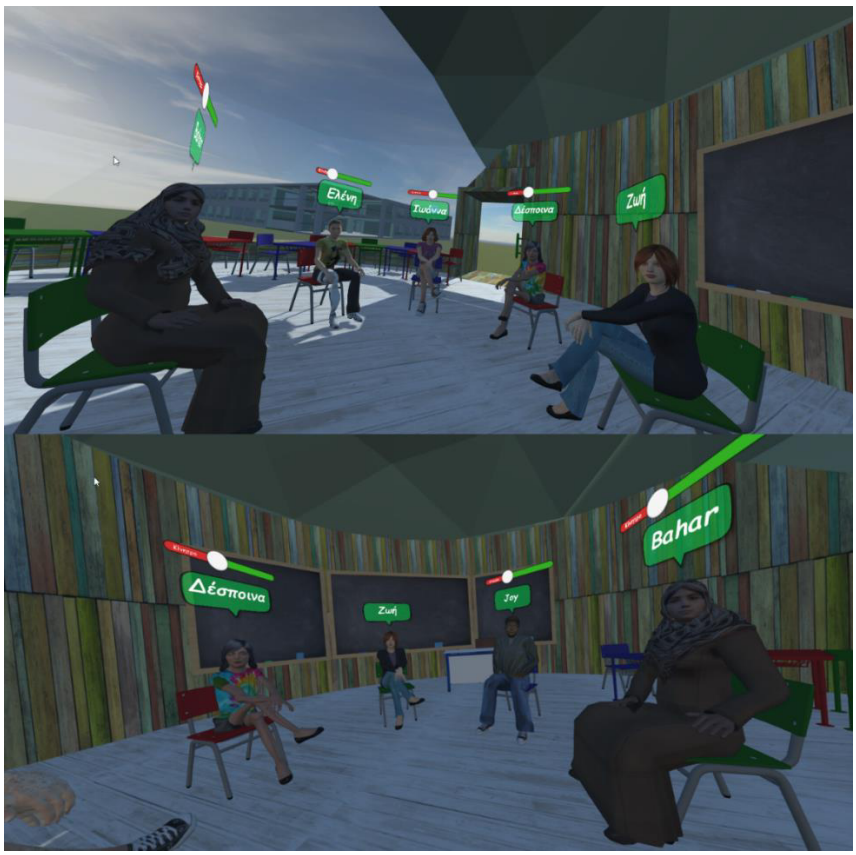


Figure 8-24: Scenario scene from the student's viewpoint (Up: Via Joy's eyes and Bottom: Via Eleni's eyes. Zoi is the teacher in both cases.

8.5.3.3 VR Equipment Used

During the experiment, the Oculus Rift Commercial Head-Mounted Display was used (figure 8-14). The use of Oculus Rift allowed the development of an application without the need to embody the virtual students with actors. Moreover, the use of the VR headset allowed the users to interact with the virtual environment through eye gaze, experience a first-person view, and take a 360-degree look inside the virtual space resulting in a highly realistic experience.

Figure 8-25: Use of Oculus Rift during the experiments

8.5.3.4 Avatar's speech

A text to speech online engine was used to convert text into spoken voice output. As the outcome had to be in the Greek language, there were limited options, yet there were online systems that supported the language (http://ttsdemo.com/; https://www.ispeech.org/text.to.speech; https://texttospeech.io/). Due to the limited time and also due to the inability to find people willing to record their voices, text to speech converter was chosen as the most appropriate solution.

8.5.3.5 Interaction – eyes gaze input

Eye gaze is used as the interaction technique in the current VR application. The interaction with the buttons is based on a person's looking at the button he/she wants to interact with. Eye gaze was considered to be a better approach than using selection with mouse or controllers. This derives from the fact that the vast majority of the participants (being teachers), where unfamiliar with VR, for many it was the first contact, thus the use of HMDs in combination with the controllers could cause interaction problems, as the controllers have many buttons, the participants could not see the buttons because of the

headset and hence there could be a problem with pressing the right buttons during the VR experience.

Moreover, there are indications that participants perform better with eye gaze interaction while feeling quite comfortable in using their eyes (Sibert & Jacob, 2000). Additionally, gaze input allows the users to have free their hands (Sibert & Jacob, 2000) that in the case of teachers can allow them to use their hands for another task. For example, in the long term, the VR application aims to be used as a training tool for body language during teaching. Thus, eye gaze will allow teachers to have their hands free and be trained for the appropriate body language within the classroom.

Sibert and Jacob (2000), also suggest the eye gaze is a more effective approach due to the fact the eyes are moving faster than the hands leading to faster selections within the virtual world. Furthermore, the authors argue that eye gaze is *'attractive because people naturally look at the object of interest'* (p. 282). This is an important parameter for the current research, as it can provide crucial information related to the virtual students of interest. Some of the student's avatars were extremely problematic cases, e.g. having prosthetic parts and burn injuries, and it is important to investigate whether avatars' appearance might discourage participants' interaction with those avatars. This fact is crucial for future work as in the long term the goal of the VR application is to expand the test cases by considering other types of disorders (e.g. students with autism, vision disorders, etc.).

For the development of eye gaze interaction system Oculus utilities packages were imported in unity. OVR camera rig was used and OVR physics raycaster, while the gaze pointer ring was attached to the Canvas for interaction with the UI Buttons. Moreover, a gaze ring image was used as a cursor to help the users understand where they are looking and make the various selections (figure 8-26). To select a UI button the participants had to look protracted for some seconds with the cursor was loading indicating that they are selecting the button.

Figure 8-26: Eye gaze ring as a cursor to help users understand where they are looking

8.5.3.6 Animations

Many of the animations were downloaded from Mixamo 3D animation software (https://www.mixamo.com/#/). Additionally, some of the animations were downloaded from the Unity asset store. Nevertheless, as the main scenario takes place within a classroom environment, that avatars needed to be sitting for all the main scenes. Because there are limited sitting animations that did not respond precisely to the needs of the current project, most sitting animations used were recorded using the Xsens motion tracker system (https://www.xsens.com/motion-capture), (figure 8-27 and 7-28).

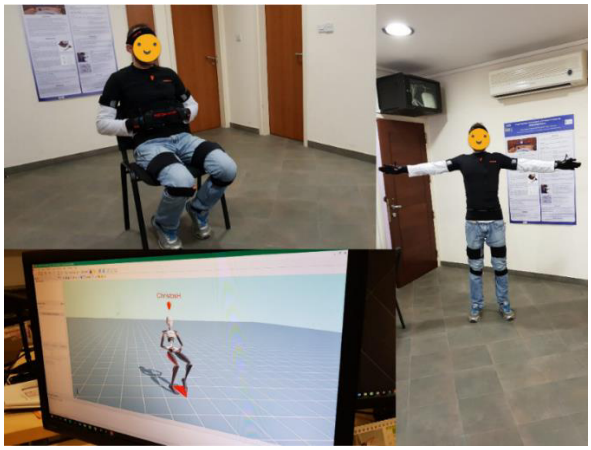


Figure 8-27: Motion capture using Xsens

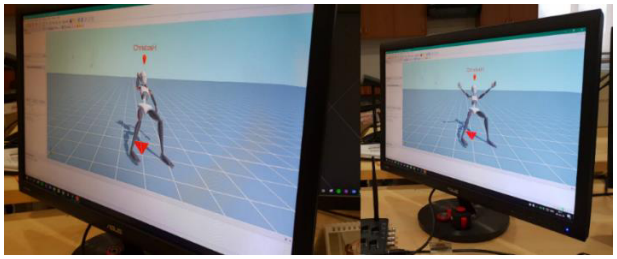


Figure 8-28: Motion capture recording

8.6 The research method and the instruments

A combination of methods was used in the study aiming to collect the necessary data for an in-depth analysis of the VR intervention and its impact on end-users. Methodological triangulation and more specifically 'across method' was used, combining quantitative and qualitative data collection techniques (Bekhet & Zauszniewski, 2012). This approach was considered to be more suitable for the current research in providing more comprehensive and in-depth data related to the VR intervention, while the combination of methods made possible confirmation of data increasing also the validity of the research (Bekhet & Zauszniewski, 2012).

The main research instrument of the current research was the questionnaire with the major challenge being its clarity to the participants. For this reason, the main scales of the questionnaire were based on already existing and validated scales with minor modifications to respond to the needs of the current research (see the graphical representation in figure 8-29).

modifications to respond to the needs of the current research (see the graphical representation in figure 8-29).

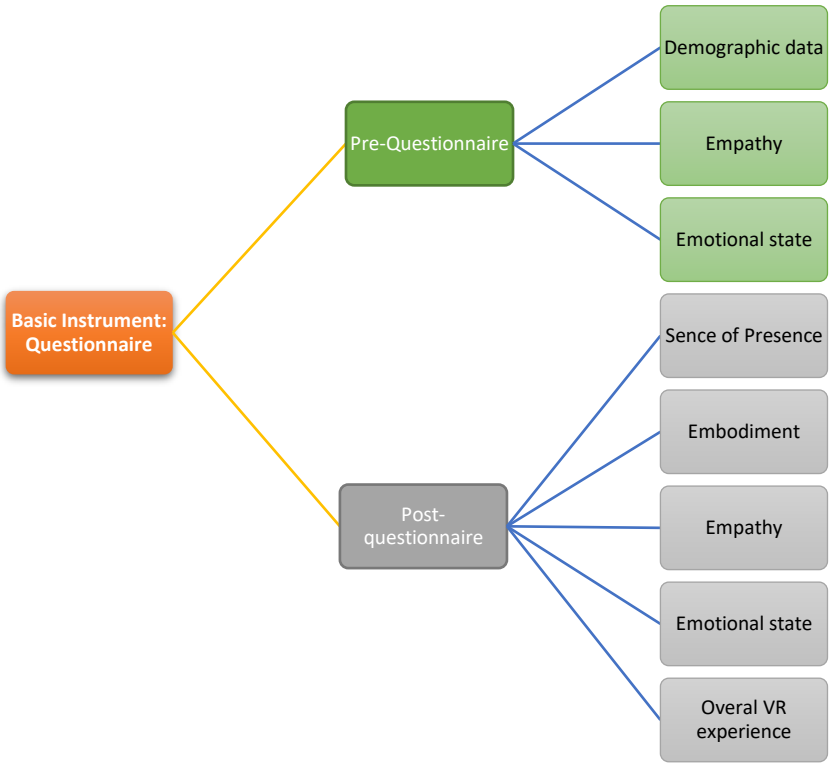


Figure 8-29: Pre and post questionnaire logic

Two questionnaires were administered to the participants, one before (pre) the VR intervention and one after (post) in the Greek language (appendices D-8-1 and D-8-2 respectively). The English version of the pre-questionnaire is presented in appendix D-8-3 and the post-questionnaire in appendix D-8-4. Moreover, as the participants' native language was Greek, the questionnaires had to be translated in Greek, thus to identify possible confusing points, the questionnaires were pre-tested, while English teachers supervised the translation process making suggestions with modifications that made the questionnaire more understandable (the Greek version of the pre-questionnaire is in appendix D-8-1 and the post-questionnaire in appendix D-8-2). The respondents who participated in the pilot testing did not participate in the experiments and did not experience the VR application.

The pre-questionnaire consisted of three parts: The first part covered demographic information (country, gender, age, employment status, teaching experience, experience in using VR). The second part incorporated items that aimed to measure participants' emotions and mood state before the VR intervention. The emotions and mood states scale is based on the PANAS X scale by Watson and Clark (1994). PANAS X consists of several words and phrases that describe different feelings and emotions. However, the scale has many categorizations, that did not respond to the aims of the current research. Hence, only some of the scale items were used that responded to the needs of the current research. The categorization that was used based on PANAS X is presented to the following table 8-1:

Table 8-1: Emotions and mood states scale

General Dimension Scales	
Negative Affect:	afraid, nervous, upset, ashamed
Positive Affect:	active, alert, determined, excited, inspired, strong
Basic Negative Emotion Scales	
Fear:	scared, nervous
Guilt:	ashamed
Sadness:	sad

Basic Positive Emotion Scales	
Joviality:	excited
Self-Assurance:	strong, confident
Attentiveness:	alert, concentrating, determined
Other Affective States	
Fatigue:	tired

The third part of the pre-questionnaire dealt with empathy scale, aiming to measure participants' belief of their empathy skills, to investigate possible differences after the VR intervention. As far as empathy is concerned there are many well-validated scales, however, most of them did not respond to the needs of the current research. The Interpersonal Reactivity Index (IRI) developed by Davis (1980), was found to be the most suitable for the current research. Davis's scale consists of 28 items on a 5-point Likert scale ranging from 'Does not describe me well' to 'Describes me very well'. The scale consists of four subscales that are (Davis, 1980, p. 6):

- Perspective Taking items, that reflect a tendency or ability of the respondent to adopt the perspective, or point of view, of other people;
- Fantasy items, which denoted a tendency of the respondent to identify strongly with fictitious characters in books, movies, or plays;
- Empathic Concern items, that aim to assess a tendency for the respondent to experience feelings of warmth, compassion and concern for others undergoing negative experiences and
- Personal Distress items, that indicate that the respondent experienced feelings of discomfort and anxiety when witnessing the negative experiences of others.

For the needs of the current research, not all items were used. Fantasy items and personal distress items were not used. The empathy scale used in the current research consisted of all Davis's perspective-taking items and some empathic concern items with minor modifications. Moreover, the empathy scale used consisted of four items from the Toronto Empathy Questionnaire (TES) with minor modifications. All the items of the empathy scale used are presented in table 8-2:

Table 8-2: Empathy scale items

Items based on Davis' s scale
Perspective Taking:
1. I sometimes find it difficult to see things from the "other guy's person's" point of view.
2. I try to look at everybody's side of a problem before making a decision.
3. I sometimes try to understand others better by imagining how things look from their perspective.
4. If I am sure I am right about something, I do not waste much time listening to other people's arguments.
5. I believe that there are two sides to every situation and try to look at them both.
6. When I am upset at someone, I usually try to "put myself in his shoes" for a while.
7. Before criticizing somebody, I try to imagine how I would feel if I were in their place.
Empathic concern:
8. Sometimes I do not feel very sorry for other people when they are having problems.
9. Other people's misfortunes do not usually disturb me a great deal.
10. When I see someone being treated unfairly, I sometimes do not feel very much pity for them.
11. I am often quite touched by things that I see happen.
12. I would describe myself as a pretty soft-hearted person.
Items based on TES
13. I do not feel sympathy for people who cause their own serious illnesses.
14. I am really interested in how other people feel.

15. When I see someone being taken advantage of, I feel kind of protective towards him\her.

The post-questionnaire consisted of four parts: The first part consisted of questions that aimed to measure participants' sense of presence in the virtual world. Slater-Usoh-Steed questionnaire (SUS) was used to measure the sense of presence, consisting of 6 items on a 7-Likert point scale with minor modifications. The presence scale items are presented in table 8-3.

Table 8-3: Presence scale items based on SUS questionnaire

1. Please rate your sense of being in the virtual environment, on a scale of 1 to 7, where 7 represents your normal experience of being in a place. I had a sense of "being there" in the virtual classroom ...
2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?
3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?
4. During the time of the experience, which was the strongest, on the whole, your sense of being in the virtual classroom environment or of being elsewhere?
5. I think of the virtual classroom as a place in a way similar to other places that I've been today.
6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?

Part two dealt with the sense of embodiment. The embodiment scale was based on the paper of Hasler et al., (2017).

Table 8-4: Embodiment scale items

1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.
2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.

3. I felt that the virtual body was not mine.
4. During the experiment, there were moments when I felt I had more than one body.
5. I felt that I controlled the avatar as if it were my body.
6. The virtual body moved according to my movements.

Part three incorporated items that aimed to measure participants' emotions and mood state after the VR intervention. The emotions and mood states scale used was the same as the pre-questionnaire as presented to table 8-1 above. Part four consisted of the empathy items and the same scale with the pre-questionnaire was also used (table 8-2 above).

Finally, there was a fifth part consisting of questions that aimed to evaluate the overall experience of the participants within the virtual environment. This part was developed for the needs of the research to evaluate participants' beliefs regarding the virtual students and their stories; the use of VR as a means of practical training; their interaction with the virtual space through eyes gaze; the sound; the design of the virtual environment and the overall VR experience.

8.7 The sample

The snowball sampling technique was considered the most suitable method to use during the current experiment, as it was highly effective during the earlier stages of the research. The snowball sampling technique is presented in chapter 3 (section 3.9).

8.8 The procedure

The experiment was conducted from May to June 2019 in Greece and Cyprus. Related to the experiments conducted in Greece, the target group were mostly university students and potential teachers, but also active teachers. Initially, the research participants were approached, using the snowball sampling technique, and once identified the meeting place for conducting the experiment was arranged. The experiments lasted one week, and each day one-hour appointments were booked for each participant, to have the necessary time for explaining the procedure and also manage possible problems that could arise (e.g. sickness) during the VR experience.

Regarding the experiments that were conducted in Cyprus, the target group consisted of active teachers but also students' future teachers. The sample was approached using the snowball sample technique and among others, teachers from two schools expressed the interest to participate. Initially, a letter was sent to the director of the school, explaining the purpose and objective of the current research, providing information about the researcher, and asking permission to conduct the experiments. After permission was obtained, the meeting place was arranged based on teachers' needs. Hence, it was the experiments involving active teachers that took place within the school area in a dedicated quiet area of the school. Each participant had at his/her disposal approximately 20-40 minutes based on their availability and schedule.

At the beginning of the process, both in Greece and Cyprus, the participants were informed about the objective of the research and they were given a consent form (appendix D-8-5 for the Greek version and appendix D-8-6 for the English version), to be further informed about the research and consent to participate. As the experiment was recorded by video and photographs it was essential to obtain participants' permission and for this reason, all that information was included in the consent form. After obtaining participant's agreement to participate in the research the pre-questionnaire was administered for completion to record participants' personal data, their emotional status before the VR intervention, and their belief related to their empathy skills. After completing the questionnaire, information was provided to the participants along with instructions on how to use and interact with the virtual world and the virtual students. After the VR experience, a short interview was conducted to identify the participant's reaction towards the VR intervention, and then the post-questionnaire was administered.

8.9 Quantitative Data Analysis

8.9.1 The sample – Descriptive statistics

In total 69 participants took part in the experiments (N=69). The participants were divided into three groups, each consisting of 23 participants (table 8-5). The participants of the three groups experienced different perspectives within the virtual world:

1. Teacher perspective
2. Teacher-Student with a prosthetic leg

3. Teacher-Student Refugee-Student prosthetic leg

Table 8-5: Distribution of population based on groups

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Teacher perspective	23	33.3	33.3	33.3
	Teacher-Student with prosthetic leg	23	33.3	33.3	66.7
	Teacher-Student Refugee-Student prosthetic leg	23	33.3	33.3	100.0
	Total	69	100.0	100.0	

Of the 69 participants, 49 (71%) were women, 19 (27.5%) were men and one participant did not wish to answer (table 8-6).

Table 8-6: Distribution of population-based on gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	19	27.5	27.5	27.5
	Female	49	71.0	71.0	98.6
	Do not wish to answer	1	1.4	1.4	100.0
	Total	69	100.0	100.0	

The participants were given the opportunity to choose their gender within the virtual world. Table 8-7 presents participants' gender choices within the virtual world (see also figure 8-30). Out of the 69 participants, 47 (68.1%) had chosen the female virtual character, while 22 (31.9%) participants had chosen the male virtual character.

Table 8-7: Distribution of population-based on gender choice in the VR environment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	47	68.1	68.1	68.1
	Male	22	31.9	31.9	100.0
	Total	69	100.0	100.0	

Crosstabulation was used to examine the relationship between participants' gender and the choice of their virtual character. The results indicate that gender affected

participants' choice of the virtual character as most of the participants had chosen virtual characters of the same gender (table 8-8).

Table 8-8: Gender Choice in VR and Gender Crosstabulation

			Gender			Total
			Male	Female	Do not wish to answer	
Gender Choice in VR	Female	Count	4	43	0	47
		Gender Choice in VR	8.5%	91.5%	0.0%	100.0%
	Male	Count	15	6	1	22
		Gender Choice in VR	68.2%	27.3%	4.5%	100.0%
Total		Count	19	49	1	69
		Gender Choice in VR	27.5%	71.0%	1.4%	100.0%

Moreover, the Chi-Square Test of Independence was used to test for an association between gender and virtual avatar gender choice. The null hypothesis (H_{null}) and the alternative hypothesis (H_{alt}) of the Chi-Square Test of Independence can be expressed in the following way:

H_{null}: Gender is not associated with Gender choice in the virtual environment

H_{alt}: Gender is associated with Gender choice in the virtual environment

Table 8-9 summarizes the distribution of the two variables. The value of the test statistic is 30.216 and the p-value of the test is p=0.000. Since the p-value is less than our chosen significance level $\alpha = 0.05$, we can reject the null hypothesis, and conclude that there is an association between gender and gender choice in the virtual environment.

Table 8-9: Chi-Square Tests examining the association between gender and virtual avatar gender choice

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	30.216[a]	2	.000

Likelihood Ratio	30.396	2	.000
Linear-by-Linear Association	20.234	1	.000
N of Valid Cases	69		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is .32.

Table 8-10 presents the data related to the participants' countries. 38 (55.1%) participants were from Cyprus and 31 (44.9%) were from Greece.

Table 8-10: Distribution of population-based on country

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Cyprus	38	55.1	55.1	55.1
	Greece	31	44.9	44.9	100.0
Total		69	100.0	100.0	

Table 8-11 presents the distribution of the population based on age. The mean age of the participants was from 30-39 years (M=3.015) with a standard deviation of 1.399.

Table 8-11: Distribution of population-based on age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-24	14	20.3	20.3	20.3
	25-29	11	15.9	15.9	36.2
	30-39	17	24.6	24.6	60.9
	40-49	14	20.3	20.3	81.2
	50-59	13	18.8	18.8	100.0
	Total	69	100.0	100.0	

Table 8-12 presents the distribution of the population based on employment status. Half of the participants are in-service teachers (56.5%), 5.8% are both in-service teachers and university students, 34.8% are university students and potential educators and 2.9% are trainers. Moreover, as far as in-service teachers are concerned, half of them (46.4%) serve in secondary education, 5.8% serve in primary education, 8.7% serve in Higher education and 2.9% serve in the private sector.

Table 8-12: Distribution of population-based on employment status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	In-service teacher	39	56.5	56.5	56.5
	University Student	24	34.8	34.8	91.3
	Trainer	2	2.9	2.9	94.2
	In-service teacher and University student	4	5.8	5.8	100.0
	Total	69	100.0	100.0	

In case you are in-service teacher state the level of education in which you serve:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary education	4	5.8	9.1	9.1
	Secondary education	32	46.4	72.7	81.8
	Higher education	6	8.7	13.6	95.5
	Private sector	2	2.9	4.5	100.0
	Total	44	63.8	100.0	
Missing	Not in-service teachers	25	36.2		
Total		69	100.0		

The mean years of teaching experience for active teachers are M=13.73 with a standard deviation of 8.442 (table 8-13). The minimum years of experience are 1 year, and the maximum is 30 years of teaching experience (table 8-14 and figure 8-30).

Table 8-13: Distribution of population-based on years of teaching experience

Mean	N	Std. Deviation	Minimum	Maximum	Range
13.7273	44	8.44232	1.00	30.00	29.00

Table 8-14: Distribution of the sample based on the years of teaching experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	2	2.9	4.5	4.5
	2.00	4	5.8	9.1	13.6
	3.00	1	1.4	2.3	15.9
	4.00	1	1.4	2.3	18.2
	8.00	3	4.3	6.8	25.0
	9.00	1	1.4	2.3	27.3
	10.00	8	11.6	18.2	45.5
	12.00	3	4.3	6.8	52.3
	13.00	3	4.3	6.8	59.1
	15.00	2	2.9	4.5	63.6
	16.00	2	2.9	4.5	68.2
	19.00	2	2.9	4.5	72.7
	20.00	2	2.9	4.5	77.3
	21.00	1	1.4	2.3	79.5
	22.00	1	1.4	2.3	81.8
	23.00	2	2.9	4.5	86.4
	26.00	2	2.9	4.5	90.9
	29.00	2	2.9	4.5	95.5
	30.00	2	2.9	4.5	100.0
	Total	44	63.8	100.0	
Missing	Not in-service teachers	25	36.2		
Total		69	100.0		

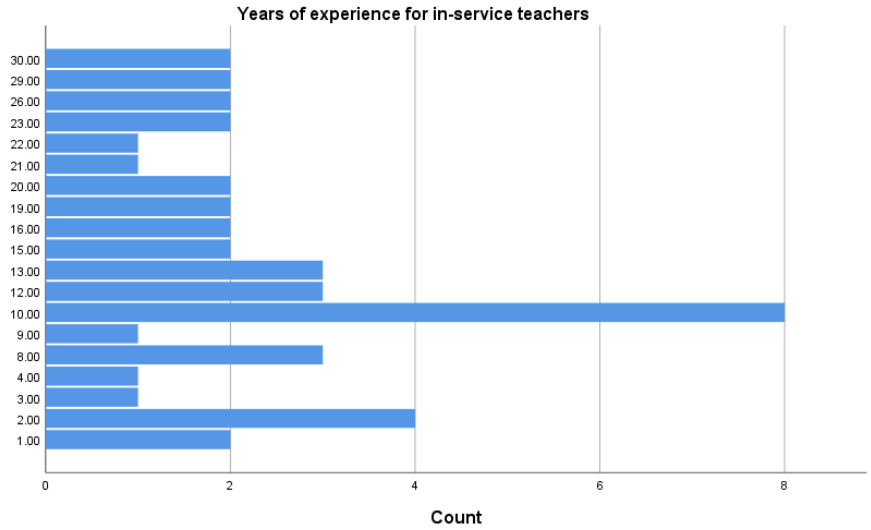


Figure 8-30: Years of experience for in-service teachers

Regarding students' level of studies, 21.7% are master students, 35.7% are undergraduate students and 4.3% are Ph.D. candidates (table 8-15). Moreover, the vast majority of the student participants study at the Department of Communication Media and Culture (29%), while some of the participants study at the Department of Civil Engineering (1.4%), Mechanical engineering (1.4%), Multimedia and Graphics Arts (7.2%), and Public History (1.4%) (table 8-16).

Table 8-15: Distribution of student population based on the level of studies

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Master	15	21.7	53.6	53.6
	Undergraduate	10	14.5	35.7	89.3
	PhD candidate	3	4.3	10.7	100.0
	Total	28	40.6	100.0	
Missing	System	41	59.4		
Total		69	100.0		

Table 8-16: Distribution of student population based on department

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		41	59.4	59.4	59.4
	Department of Civil Engineering	1	1.4	1.4	60.9
	Department of Communication Media and Culture	20	29.0	29.0	89.9
	Mechanical engineering	1	1.4	1.4	91.3
	Multimedia and Graphics Arts	5	7.2	7.2	98.6
	Public History	1	1.4	1.4	100.0
Total		69	100.0	100.0	

Regarding participant's experience using VR the mean of experience is M=2.04 with a standard deviation of 1.143 (table 8-17). Half of the participants (46.4%) have no experience using VR, 27.5% have moderate experience, 15.9% have a little experience, 7.2% have much experience and 2.9% are very experienced (table 8-18).

Table 8-17: Mean score for participants' experience in using VR environments

Mean	N	Std. Deviation	Minimum	Maximum	Range
2.0435	69	1.14320	Not at all	Very much	4.00

Table 8-18: Distribution of population regarding experience in using VR environments

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	32	46.4	46.4	46.4
	A little	11	15.9	15.9	62.3
	Moderately	19	27.5	27.5	89.9
	Much	5	7.2	7.2	97.1
	Very much	2	2.9	2.9	100.0
Total		69	100.0	100.0	

8.9.2 Questionnaire Reliability Analysis

8.9.2.1 Emotions

8.9.2.1.1 Pre-emotional scale

Reliability analysis was conducted on the variables of the pre-emotion scale. According to the results (table 8-19), the overall alpha is 0.845>0.7 indicating high reliability of the variables. The values of Cronbach's alpha if item deleted, reflected a small change in Cronbach's alpha if emotion 'downhearted' is deleted. However, as Cronbach's alpha is already high the item was not deleted.

Table 8-19: Reliability analysis for pre-emotional scale

Cronbach's Alpha	N of Items
,845	17

8.9.2.1.2 Post-emotional scale

According to the results of reliability analysis on the variables of the post-emotion scale (table 8-20) the overall alpha is 0.881>0.7 indicating high reliability of the variables. The results regarding the values of Cronbach's alpha if item deleted do not indicate significant differences if items were deleted.

Table 8-20: Reliability analysis for post-emotional scale

Cronbach's Alpha	N of Items
,881	17

8.9.2.2 Empathy

8.9.2.2.1 Pre-empathy scale

Reliability analysis was conducted on the variables of the pre-empathy scale. According to the results (table 8-21), the overall alpha is 0.735>0.7 indicating the reliability of the variables. The results indicate very small changes in Cronbach's alpha if items of the scale are deleted, thus the variables were not deleted.

Table 8-21: Reliability analysis for pre-empathy scale

Cronbach's Alpha	N of Items
,735	15

8.9.2.2.2 Post-empathy scale

Reliability analysis was conducted on the variables of the post-empathy scale. According to the results (table 8-22), the overall alpha is 0.794>0.7 indicating the reliability of the variables. The results indicate very small changes in Cronbach's alpha if items of the scale are deleted, thus the variables were not deleted.

Table 8-22: Reliability analysis for post-empathy scale

Cronbach's Alpha	N of Items
,770	15

8.9.2.3 Presence Scale

Reliability analysis was conducted on the variables of the presence scale. According to the results (table 8-23), the overall alpha is 0.794>0.7 indicating high reliability of the variables.

Table 8-23: Reliability analysis for presence scale

Cronbach's Alpha	N of Items
,894	6

8.9.2.4 Embodiment Scale

Reliability analysis was conducted on the variables of the embodiment scale. According to the results (table 8-24), the overall alpha is 0.781>0.7 indicating the reliability of the variables.

Table 8-24: Reliability analysis for embodiment scale

Cronbach's Alpha	N of Items
.781	6

8.9.3 Analysis of Emotion Scale

This section presents the analysis of the results concerning the emotional scale items. The analysis of the emotion scale includes the following tests (figure 8-31):

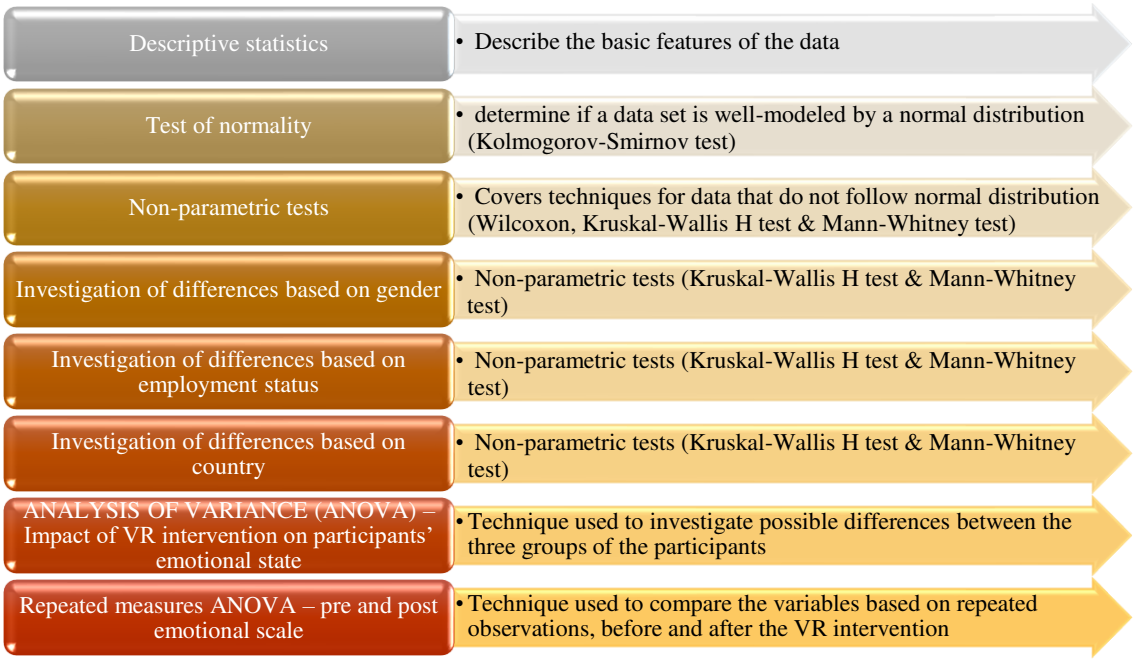


Figure 8-31: Tests carried out regarding the quantitative analysis of the emotion scale items

8.9.4 The Likert scale and reverse coding

Before the presentation of the results, it is considered appropriate to present the Likert scale being used in the Emotional Scale and then present also the reverse scoring, as many of the items were negative words that need to be reversed within SPSS. The following 5-point Likert scale was used:

Which, for the reverse-scored items becomes:

8.9.4.1 Pre-emotional scale – descriptive statistics

Table 8-25 presents the distribution of the sample regarding the pre-emotional scale, including the central tendency (Mean-M), the smallest (Minimum) and larger (Maximum) values and dispersion around the mean (Standard Deviation-SD). The frequency table for each pre-emotional scale item is presented in appendix D-8-7. The means and standard deviations for all pre-emotional scale items are as follows. Afraid: M=4.30, SD=0.86; Interested: M=3.99, SD=0.88; Active: M=3.61, SD=0.91; Nervous: M=3.78, SD=1.24; Inspired: M=3.28, SD=0.10; Sad: M=4.35, SD=0.94; Upset: M=4.41, SD=0.86; Calm: M=3.41, SD=1.22; Confident: M=3.33, SD=0.95; Tired: M=3.02, SD=1.27; Timid: M=4.61, SD=0.77; Excited: M=3.64, SD=1.07; Strong: M=3.64, SD=0.89; Alert: M=3.58; SD=0.96; Downhearted: M=4.23, SD=0.96; Relaxed: M=2.54, SD=1.27; Determined: M=3.65, SD=0.94; Concentrated: M=3.68, SD=0.80. The minimum value for the variables interested, nervous, inspired, sad, calm, tired, excited, strong, alert, downhearted, relaxed and determined was 1, while the minimum value for the variables afraid, active, upset, confident, ashamed and concentrated was 2. The maximum value for all the pre-emotional scale variables was 5.

Table 8-25: Descriptive statistics of pre-emotional scale

	N	Minimum	Maximum	Mean (M)	Std. Deviation (SD)
Pre-Afraid (Reversed)	69	2.00	5.00	4.3043	.86270
Pre-Interested	69	1.00	5.00	3.9855	.88272
Pre-Active	69	2.00	5.00	3.6087	.91100
Pre-Nervous (Reversed)	69	1.00	5.00	3.7826	1.23514
Pre-Inspired	69	1.00	5.00	3.2754	.99829
Pre-Sad (Reversed)	69	1.00	5.00	4.3478	.93661
Pre-Upset (Reversed)	69	2.00	5.00	4.4058	.86294

Pre-Calm	69	1.00	5.00	3.4058	1.21654
Pre-Confident	69	2.00	5.00	3.3333	.94972
Pre-Tired (Reversed)	69	1.00	5.00	3.0145	1.26599
Pre-Ashamed (Reversed)	69	2.00	5.00	4.6087	.77112
Pre-Excited	69	1.00	5.00	3.6377	1.07061
Pre-Strong	69	1.00	5.00	3.4493	.89994
Pre-Alert	69	1.00	5.00	3.5797	.96109
Pre-Downhearted (Reversed)	69	1.00	5.00	4.2319	.95709
Pre-Relaxed	69	1.00	5.00	2.5362	1.26700
Pre-Determined	69	1.00	5.00	3.6522	.93661
Pre-Concentrated	69	2.00	5.00	3.6812	.79507
Valid N	69				

8.9.4.2 Post-Emotional Scale – Descriptive Statistics

Table 8-26 presents the distribution of the sample regarding the post-emotional scale (after the use of VR), including the central tendency (Mean-M), the smallest (Minimum) and larger (Maximum) values and dispersion around the mean (Standard Deviation-SD). The frequency table for each post-emotional scale item is presented in appendix D-8-8. The means and standard deviations for all post-emotional scale items are as follows. Afraid: M=4.35, SD=0.87; Interested: M=4.35, SD=0.70; Active: M=3.94, SD=0.89; Nervous: M=4.00, SD=1.04; Inspired: M=3.73, SD=0.92; Sad: M=3.86, SD=1.08; Upset: M=4.03, SD=0.99; Calm: M=3.59, SD=1.02; Confident: M=3.70, SD=0.99; Tired: M=3.54, SD=1.24; Timid: M=4.41, SD=0.98; Excited: M=3.83, SD=1.07; Strong: M=3.68, SD=0.88; Alert: M=3.75; SD=1.02; Downhearted: M=4.15, SD=1.06; Relaxed: M=2.71, SD=1.19; Determined: M=3.87, SD=0.86; Concentrated: M=4.10, SD=0.77.

Table 8-26: Descriptive statistics of post-emotional scale

	N	Minimum	Maximum	Mean	Std. Deviation
Post-Afraid (Reversed)	69	1.00	5.00	4.3478	.87155
Post-Interested	69	3.00	5.00	4.3478	.70348

Post-Active	69	1.00	5.00	3.9420	.88922
Post-Nervous (Reversed)	69	2.00	5.00	4.0000	1.04319
Post-Inspired	69	1.00	5.00	3.7246	.92170
Post-Sad (Reversed)	69	1.00	5.00	3.8551	1.07478
Post-Upset (Reversed)	69	1.00	5.00	4.0290	.98475
Post-Calm	69	1.00	5.00	3.5942	1.01921
Post-Confident	69	1.00	5.00	3.6957	.98972
Post-Tired (Reversed)	69	1.00	5.00	3.5362	1.24357
Post-Ashamed (Reversed)	69	1.00	5.00	4.4058	.97496
Post-Excited	69	1.00	5.00	3.8261	1.05658
Post-Strong	69	1.00	5.00	3.6812	.88272
Post-Alert	69	1.00	5.00	3.7536	1.02046
Post-Downhearted (Reversed)	69	1.00	5.00	4.1449	1.06101
Post-Relaxed	69	1.00	5.00	2.7101	1.18943
Post-Determined	69	1.00	5.00	3.8696	.85600
Post-Concentrated	69	2.00	5.00	4.1014	.76974
Valid N (listwise)	69				

8.9.4.3 Pre and Post-Emotional Scale – Test of Normality

A Kolmogorov-Smirnov test indicated that both the pre-emotional (table 8-27) and the post-emotional scale (table 8-28) do not follow a normal distribution, as $p = 0.000 < 0.05$ for all scale items. Thus, non-parametric tests were used.

Table 8-27: One sample Kolmogorov-Smirnov Test (pre-emotional scale)

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Pre-Afraid (Reversed)	.297	69	.000
Pre- Interested	.275	69	.000
Pre- Active	.246	69	.000
Pre-Nervous (Reversed)	.215	69	.000

Pre-Inspired	.215	69	.000
Pre-Sad (Reversed)	.351	69	.000
Pre-Upset (Reversed)	.349	69	.000
Pre-Calm	.253	69	.000
Pre-Confident	.202	69	.000
Pre-Tired (Reversed)	.171	69	.000
Pre-Ashamed (Reversed)	.462	69	.000
Pre-Excited	.256	69	.000
Pre-Strong	.227	69	.000
Pre-Alert	.263	69	.000
Pre-Downhearted (Reversed)	.296	69	.000
Pre-Relaxed	.171	69	.000
Pre-Determined	.225	69	.000
Pre-Concentrated	.279	69	.000
a. Lilliefors Significance Correction			

Table 8-28: One sample Kolmogorov-Smirnov Test (post-emotional scale)

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Post-Afraid (Reversed)	.324	69	.000
Post-Interested	.301	69	.000
Post-Active	.236	69	.000
Post-Nervous (Reversed)	.266	69	.000
Post-Inspired	.299	69	.000
Post-Sad (Reversed)	.220	69	.000
Post-Upset (Reversed)	.229	69	.000
Post- Calm	.234	69	.000
Post-Confident	.258	69	.000
Post-Tired (Reversed)	.182	69	.000

Post-Ashamed (Reversed)	.381	69	.000
Post- Excited	.247	69	.000
Post- Strong	.279	69	.000
Post- Alert	.291	69	.000
Post-Downhearted (Reversed)	.283	69	.000
Post- Relaxed	.174	69	.000
Post- Determined	.227	69	.000
Post- Concentrated	.288	69	.000
a. Lilliefors Significance Correction			

8.9.4.4 Emotional differences – Non- parametric tests

Research Question: Did the use of VR affected participants' emotions and mood states?

A Wilcoxon signed-rank test showed that the use of VR elicited a statistically significant change in many emotions (table 8-29). A Wilcoxon signed rank test showed that there were significant differences between scores given for the variables: interested ($Z = -4.000$, $p<0.000$); active ($Z = -2.921$, $p<0.003$); inspired ($Z = -3.306$, $p<0.001$); sad ($Z = -2.835$, $p<0.005$); upset ($Z = -2.432$, $p<0.015$); confident ($Z = -3.221$, $p<0.001$); tired ($Z = -3.545$, $p<0.000$); determined ($Z = -2.190$, $p<0.029$) and concentrated ($Z = -3.858$, $p<0.000$). The Ranks table also provides some interesting data on the comparison of participants' Before (Pre) and After (Post) Emotions and Mood States Scores (Appendix D-8-9).

Table 8-29: Wilcoxon Signed Ranks Test

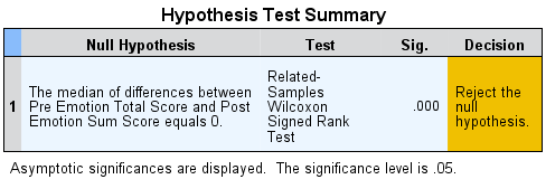
	Z	Asymp. Sig. (2-tailed)
Post-Afraid (Reversed) – Pre- Afraid (Reversed)	-.493[b]	.622
Post-Interested - Pre-Interested	-4.000[b]	.000
Post-Active - Pre-Active	-2.921[b]	.003
Post-Nervous (Reversed) – Pre-Nervous (Reversed)	-1.072[b]	.284
Post-Inspired - Pre-Inspired	-3.306[b]	.001
Post-Sad (Reversed) - Pre-Sad (Reversed)	-2.835[c]	.005

Post-Upset (Reversed) - Pre-Upset (Reversed)	-2.432[c]	.015
Post-Calm - Pre-Calm	-1.193[b]	.233
Post-Confident - Pre-Confident	-3.221[b]	.001
Post-Tired (Reversed) - Pre-Tired (Reversed)	-3.545[b]	.000
Post-Ashamed (Reversed) - Pre-Ashamed (Reversed)	-1.475[c]	.140
Post-Excited - Pre-Excited	-1.346[b]	.178
Post-Strong - Pre-Strong	-2.514[b]	.012
Post-Alert - Pre-Alert	-1.627[b]	.104
Post-Downhearted (Reversed) - Pre- Downhearted (Reversed)	-.244[c]	.807
Post-Relaxed - Pre-Relaxed	-1.240[b]	.215
Post-Determined – Pre-Determined	-2.190[b]	.029
Post-Concentrated - Pre-Concentrated	-3.858[b]	.000

b. Based on negative ranks.

c. Based on positive ranks.

The output (figure 8-32) shows that there is significant evidence of a difference between the scores for the emotional variables before and after the use of the VR.



Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between Pre Emotion Total Score and Post Emotion Sum Score equals 0.	Related-Samples Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Figure 8-32: Wilcoxon signed-rank test for pre and post-emotional scale

The results indicate a positive impact of the VR intervention on participants' emotions and mood states. The graph in figure 8-33 describes the difference related to participants' interest before and after the use of VR. The results revealed a difference in the mean score of the variable after the use of the VR indicating that the participants found the VR experience interesting.

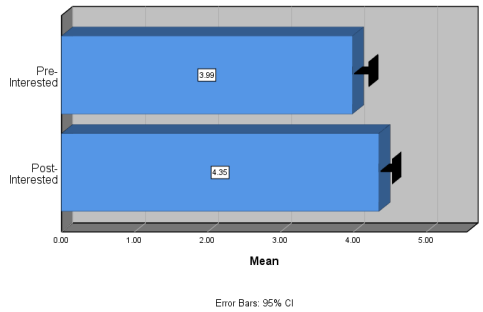


Figure 8-33: Participant's interest before and after the use of VR

According to the data, the participants felt to be in a more active state after the VR experience (figure 8-34), which could be the result of their active participation in the virtual world.

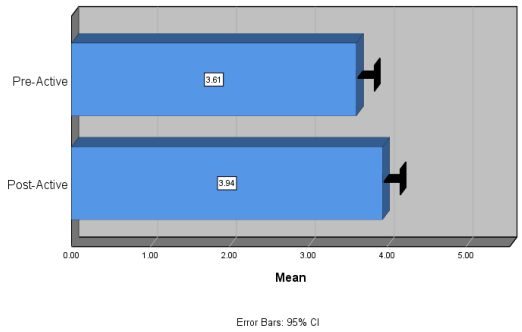


Figure 8-34: VR impact on participant's active state

The VR experience was an inspiring training approach as participants' scores regarding their inspiration raised after their experience (figure 8-35).

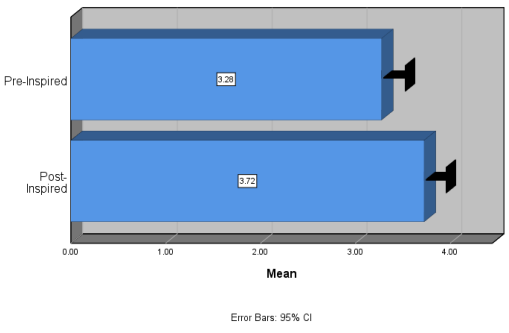


Figure 8-35: VR experience inspired the participants

The VR experience also increased participants' confidence (figure 8-36).

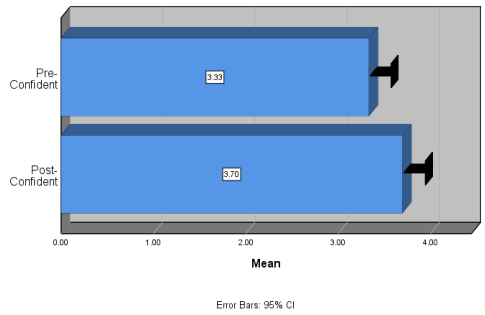


Figure 8-36: Positive impact of the VR experience on participant's confidence

Moreover, after their training within the virtual world, the participants felt stronger (figure 8-37).

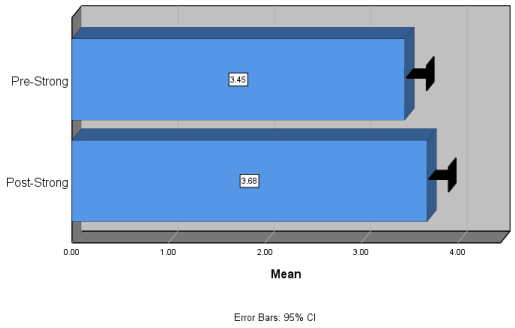


Figure 8-37: Participant's felt stronger after the use of VR

The results indicate that participants' determination was also slightly increased after their virtual experience (figure 8-38).

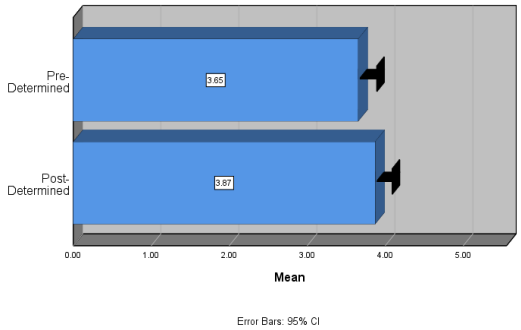


Figure 8-38: VR impact on participants' determination

Participants' concentration levels were also increased after the use of the virtual environment (figure 8-39).

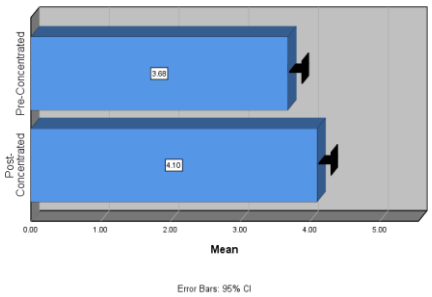


Figure 8-39: VR impact on participants' concentration

The results indicate that the VR experience also affected negatively the participants increasing their sadness after their experience as the mean score after the use of the VR tended from moderately to a little (M=4.35), while before the experiment the mean score tended from not at all to a little (M=3.88) (figure 8-40). It should be noted that sadness is a reversed variable. This is probably related to the scenario and the fact that they experienced problematic situations such as a prosthetic part on their virtual body.

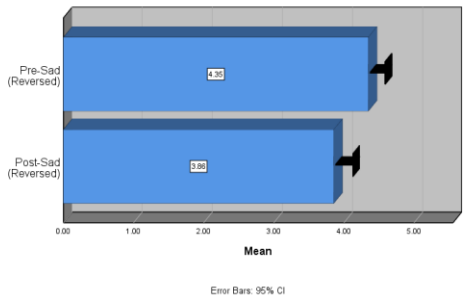


Figure 8-40: VR experience raised participants' sadness

After the use of the VR, the participants were slightly more upset (figure 8-41). It should be noted that upset is a reversed variable.

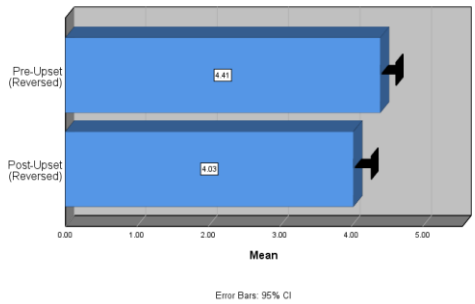


Figure 8-41: VR experience slightly upset the participants

Before the use of the virtual environment, the participants felt more tired than after the experience as their scores before the experiment tended towards moderately (M=3.01), while after the use of VR tended from moderately to a little (M=3.54) (figure 8-42). It should be noted that this is a reversed variable.

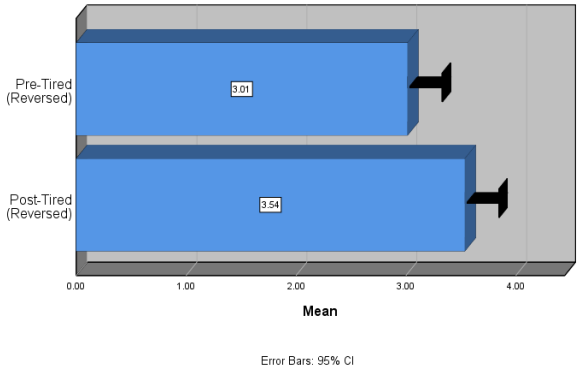


Figure 8-42: The VR experience decreased participants fatigue

8.9.4.5 Impact of VR use on participants' emotional state (ANOVA)

One of the most significant research questions of the current research was the following:

Research question: To what extent did the virtual reality intervention affected participants' emotional state?

Pre-emotional state test for equality of means

One-Way ANOVA ("analysis of variance") was used to compare the means of the three groups (1) Teacher perspective, 2) Teacher-Student with a prosthetic leg and 3) Teacher-Student Refugee-Student prosthetic leg), to investigate whether emotions before the use of VR were similar between the three groups. The descriptive statistics table (table 8-30) provides some very useful descriptive statistics, including the mean, standard deviation, and 95% confidence intervals for the dependent variable (Pre-Emotion average score) for each separate group, as well as when all groups are combined (Total).

Table 8-30: Descriptive statistics for the dependent variable pre-emotion average score and the three groups of participants.

Pre-Emotion Average Score								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Teacher perspective	23	2.8671	.27613	.05758	2.7477	2.9866	2.28	3.28
Teacher-Student with prosthetic leg	23	2.9058	.40286	.08400	2.7316	3.0800	2.22	3.50
Teacher-Student Refugee-Student prosthetic leg	23	2.8019	.46717	.09741	2.5999	3.0040	1.61	3.78
Total	69	2.8583	.38685	.04657	2.7654	2.9512	1.61	3.78

In order to use ANOVA, part of the process involves checking to make sure that the data can be analyzed using this method. The hypotheses of interest are as follows:

H_{null}: The means are all equal, thus ANOVA can be used.

H_{alt}: The means are not equal.

Levene's Test indicated that the groups we are comparing all have similar population variances as Sig. > 0.05 that is needed for an ANOVA (table 8-31).

Table 8-31: Test of Homogeneity of Variances

Pre-Emotion Average Score			
Levene Statistic	df1	df2	Sig.
1,950	2	66	,150

From the output of the ANOVA analysis, we can see that the significance value is 0.661, which is over 0.05. and, therefore, there is no statistically significant difference in the mean scores of the emotional scale for all the three groups (table 8-32).

Table 8-32: ANOVA analysis for the pre-emotion average score among the three groups

ANOVA					
Pre-Emotion Average Score					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.127	2	.063	.416	**.661**
Within Groups	10.049	66	.152		
Total	10.176	68			

The data were analyzed using repeated-measures ANOVA, as the measurements related to participants' emotions and mood states were repeated over time (after the use of VR), to measure possible changes. Thus, the independent variable is time and there were two-time points, one after the use of the VR and one after its use (figure 8-43).

Figure 8-43: Measurement of emotions and mood states over two time points

8.9.4.6 Repeated Measures ANOVA

Repeated measures are obtained when we measure the same variable repeatedly, for example, at different time points. A Repeated Measures ANOVA was used as the emotional variables were measured over two-time points, one measurement before and one after the use of VR, to compare the mean differences between the three groups: (1)Teacher perspective, 2)Teacher-Student with a prosthetic leg and 3)Teacher-Student refugee-Student prosthetic leg).

Table 8-33, Within-Subjects Factors present the groups of our independent variable and labels the time points 1 and 2. The dependent variable is referring to the fact that dependent variable emotions were measured at each of these time points.

Table 8-33: Within-Subjects Factors Table

Within-Subjects Factors	
Measure:	MEASURE_1
Time	Dependent variable
1	Pre-emotion mean
2	Post-emotion mean

Table 8-34, Between-subjects factor consists of conditions and more specifically the three different groups of participants that experienced three different perspectives within VR.

Table 8-34: Between-subjects factor conditions

Between-Subjects Factors			
		Value Label	N
Group	1.00	Teacher perspective	23
	2.00	Teacher-Student with a prosthetic leg	23
	3.00	Teacher-Student Refugee-Student prosthetic leg	23

Table 8-35 provides important descriptive statistics for this analysis related to pre and post emotions' measurements to all three groups.

Table 8-35: Descriptive statistics

	Group	Mean	Std. Deviation	N
Pre-Emotion Average Score	Teacher perspective	2,8671	,27613	23
	Teacher-Student with prosthetic leg	2,9058	,40286	23
	Teacher-Student Refugee-Student prosthetic leg	2,8019	,46717	23
	Total	2,8583	,38685	69
Post-Emotion Average Score	Teacher perspective	3,7945	,62458	23
	Teacher-Student with a prosthetic leg	3,8063	,72225	23

	Teacher-Student Refugee-Student prosthetic leg	3,6482	,65113	23
	Total	3,7497	,66135	69

Box’s Test of Equality of Covariance Matrices determines whether the data violate the assumption of homogeneity of variance-covariance matrices. If the Sig. value is larger than 0.001, then the assumption is not violated. According to table 8-36, Sig. value is 0.364, thus we assume homogenous covariance structures.

Table 8-36: Box's Test of Equality of Covariance Matrices

Box's Test of Equality of Covariance Matrices[a]	
Box's M	6.854
F	1.092
df1	6
df2	108564.923
Sig.	.364

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + Group

Within Subjects Design: Time

The multivariate tests table 8-37 displays four tests of significance that will indicate whether there are statistically significant differences related to the effect of ‘time’ on the dependent variable and the three different groups. There are four different approaches to choose from (Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root). Pillai's trace is also used quite often because of its powerfulness and robustness. It should be noted that when referring to ‘time’ we refer to the modification in the mean values of the emotional scale between the time before and the time after the use of VR. Between these two times of filling in the questionnaire, the VR intervention was mediated (the introduction and use of the respondents in the VR environment). As far as time is concerned, Multivariate tests indicate a significant change in participants' emotions and mood states before and after the VR intervention, Pillai's Trace=0.75, F(1, 66)=198,7, p=0.000. The importance of the impact of VR on participants’ emotions and

mood states can be evaluated using the effect size statistic provided by Partial Eta Squared (η2). The value is 0.75, indicating that 75% of the variance in perceived emotional scores is explained by the VR intervention. Moreover, according to the results no statistically significant difference was found between the three groups, Pillai's Trace=0.004, F(2, 66)=0.142, p=0.87. Thus, the results indicate that VR intervention had a statistically significant effect on participants' emotions and mood states, independently to the group that they belonged to.

Table 8-37: Multivariate Tests

Multivariate Tests[c]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
time	**Pillai's Trace**	**,751**	**198,703[a]**	**1,000**	**66,000**	**,000**	**,751**
	Wilks' Lambda	,249	198,703[a]	1,000	66,000	,000	,751
	Hotelling's Trace	3,011	198,703[a]	1,000	66,000	,000	,751
	Roy's Largest Root	3,011	198,703[a]	1,000	66,000	,000	,751
time * Group	Pillai's Trace	,004	,142[a]	2,000	66,000	,868	,004
	Wilks' Lambda	,996	,142[a]	2,000	66,000	,868	,004
	Hotelling's Trace	,004	,142[a]	2,000	66,000	,868	,004
	Roy's Largest Root	,004	,142[a]	2,000	66,000	,868	,004

a. Exact statistic

b. Computed using alpha = ,05

c. Design: Intercept + Group

Within Subjects Design: time

For the current data, sphericity is not an issue because there are only 2 levels of repeated measures (before and after the VR intervention). The significance of Mauchly's test (table 8-38) shows a dot and no significant value. The repeated-measures variable has only two levels then sphericity is met, the estimates of sphericity are 1 (perfect

sphericity), the chi-square is zero and has no degrees of freedom and so a p-value can't be computed. At least three conditions are needed for sphericity to be an issue.

Table 8-38: Mauchly's Test of Sphericity

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Time	1.000	.000	0	.	1.000	1.000	1.000

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + Group

Within Subjects Design: Time

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

The Tests of Within-Subjects Effects table indicate the overall significant difference in the main effect of the 'time' factor and the 'time-groups' interaction. Since our data seem spherical, Greenhouse-Geisser, Huynh-Feldt, and Lower bound results are ignored in table 8-39 below and the results denoted as "Sphericity Assumed" are interpreted. According to the results, the significance of F is .000<.05 (partial eta squared=.75). Therefore, it can be concluded that *there was a significant difference in participants' emotions and mood states after the VR intervention. However, related to the effect of time and group no statistically significant difference was found, indicating that the VR intervention affected participants' emotions and mood states indifferent to the group to which they belonged (p=.868)*.

Table 8-39: Tests of Within-Subjects Effects

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared

time	**Sphericity Assumed**	**27,412**	**1**	**27,412**	**198,703**	**,000**	**,751**
	Greenhouse-Geisser	27,412	1,000	27,412	198,703	,000	,751
	Huynh-Feldt	27,412	1,000	27,412	198,703	,000	,751
	Lower-bound	27,412	1,000	27,412	198,703	,000	,751
time * Group	Sphericity Assumed	,039	2	,020	,142	,868	,004
	Greenhouse-Geisser	,039	2,000	,020	,142	,868	,004
	Huynh-Feldt	,039	2,000	,020	,142	,868	,004
	Lower-bound	,039	2,000	,020	,142	,868	,004
Error(time)	Sphericity Assumed	9,105	66	,138			
	Greenhouse-Geisser	9,105	66,000	,138			
	Huynh-Feldt	9,105	66,000	,138			
	Lower-bound	9,105	66,000	,138			

a. Computed using alpha = ,05

The results of Levene's test of equality of error variances (table 8-40) indicate that we have not violated the assumption for either of our dependent variables (p=.150, p=.908).

Table 8-40: Levene's Test of Equality of Error Variances

Levene's Test of Equality of Error Variances[a]					
		Levene Statistic	df1	df2	Sig.
Pre-Emotion Average Score	Based on Mean	1.950	2	66	**.150**
Post-Emotion Average Score	Based on Mean	.097	2	66	**.908**

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Group

Within Subjects Design: Time

The Profile Analysis (table 8-41) does not indicate significant differences between the three different groups as p=.619>.001. We can conclude that the differences in participants' emotions and mood states do not differ among the three groups.

Table 8-41: Tests of Between-Subjects Effects

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	1506.449	1	1506.449	3278.139	.000	.980
Group	.444	2	.222	.483	.619	.014
Error	30.330	66	.460			

The profile plot shows the significant differences in participants' emotions and mood states after the VR intervention (figure 8-44).

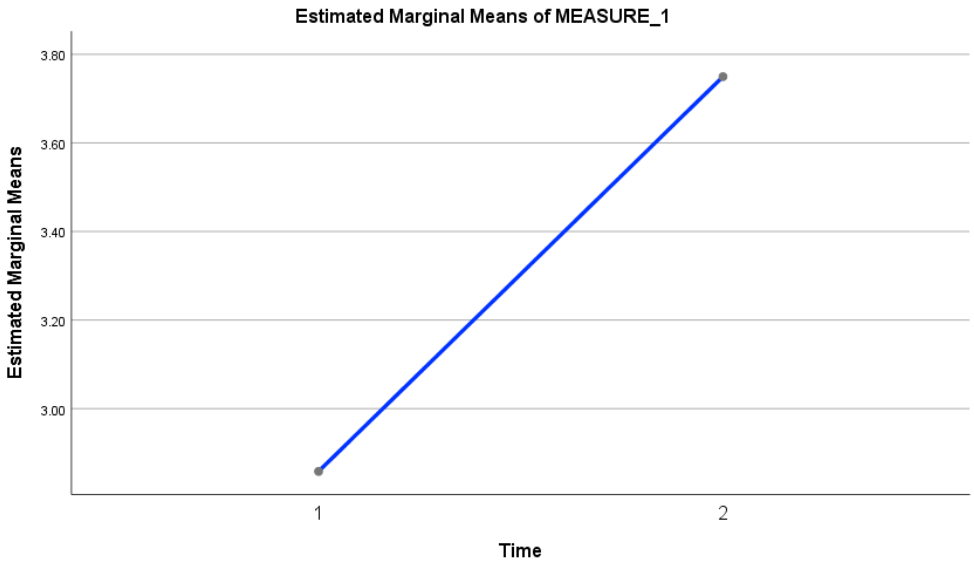


Figure 8-44: Differences in emotional variables over the two-time points measurements

The profile plot shows that emotions scores increased for all three groups between the two points in time (figure 8-45).

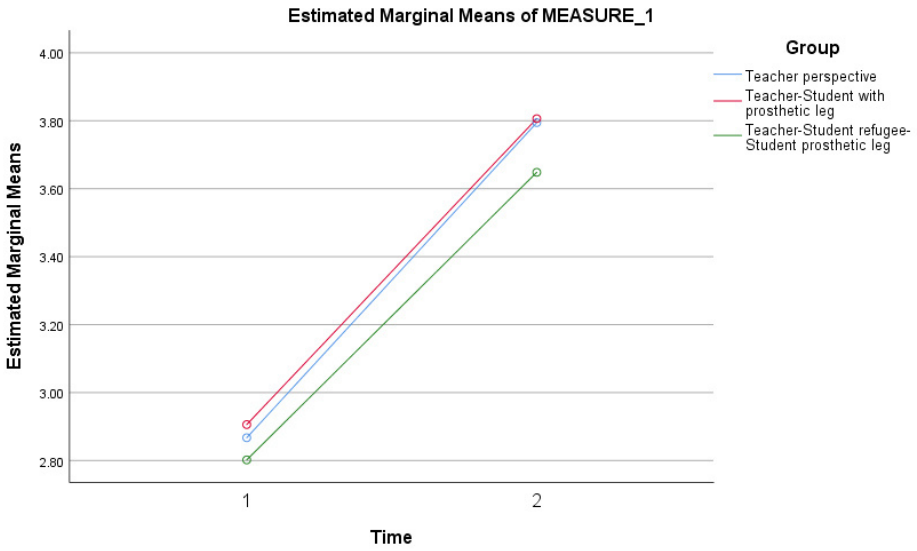


Figure 8-45: Differences in emotional variables over the two-time points measurements related to the three groups

According to Table 8-42, the means scores of emotional scale variables increased in all three groups between the two points in time when respondents completed the questionnaire, pre-intervention, and post-intervention.

Table 8-42: Mean score differences related to emotions among the three groups pre and post the intervention

Group * Time

Measure: MEASURE_1

Group	Time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Teacher perspective	1	2.867	.081	2.705	3.030
	2	3.794	.139	3.517	4.072
Teacher-Student with prosthetic leg	1	2.906	.081	2.743	3.068
	2	3.806	.139	3.529	4.084
Teacher-Student Refugee-Student prosthetic leg	1	2.802	.081	2.639	2.964
	2	3.648	.139	3.370	3.926

Pairwise comparison results are presented in table 8-44 and refer to the multiple comparisons of mean scores for all three groups on the dependent variable of emotions with the post hoc criterion of Bonferroni. Table 8-43 displays the difference between group means, the standard error, the significance value, and a confidence interval for the difference between means. By looking at the table it can be concluded that emotions' means scores are increased from time point 1-I (before VR intervention) to time point 2-J (after VR intervention) for all three groups. For the teacher perspective, the mean difference (I-J) before and after the use of VR is -0.927. Moreover, the mean difference after (2) minus the mean score before (1) is positive (0.927), thus, the means score after the VR intervention is higher than the means score before the use of VR. The same applies to the rest of the groups. Hence, all three groups mean scores of emotional variables before the VR intervention is lower compared to the means scores after the use of VR. Thus, the VR intervention was effective raising means scores of emotional variables.

Table 8-43: Pairwise Comparisons with post hoc criterion of Bonferroni

Pairwise Comparisons

Measure: MEASURE_1

Group	(I) Time	(J) Time	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
						Lower Bound	Upper Bound
Teacher perspective	1	2	-.927*	.110	.000	-1.156	-.699
	2	1	.927*	.110	.000	.699	1.156
Teacher-Student with prosthetic leg	1	2	-.901*	.116	.000	-1.140	-.661
	2	1	.901*	.116	.000	.661	1.140
Teacher-Student Refugee-Student prosthetic leg	1	2	-.846*	.102	.000	-1.059	-.634
	2	1	.846*	.102	.000	.634	1.059

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

As far as time alone is concerned (time refers to the time points before and after the VR intervention), without considering the groups, we can conclude that the emotional variables increased significantly after the VR intervention (table 8-44). From table 8-44 it can be noticed that the difference between the two means before and after (Mean Difference (IJ)) is negative (= -0.891) which means that the mean at time point 1 (before) minus the mean at time point 2 (after) is lower. So at time point 2 (filling in the questionnaire after the VR intervention) there is a higher average of emotional scores.

Table 8-44: Pairwise Comparisons related to time

Pairwise Comparisons

Measure: MEASURE_1

(I) Time	(J) Time	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-.891*	.063	.000	-1.018	-.765
2	1	.891*	.063	.000	.765	1.018

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Table 8-45 also confirms that there are no statistically significant differences between the three groups related to emotions means differences before and after the VR intervention (p=1.000 for all groups). Thus, to conclude the VR intervention affected and increased emotions and mood states to the participants of all three groups, but no statistically significant difference is found within the three groups regarding emotions' means scores. Hence, none of the groups compared to the rest develops higher means scores.

Table 8-45: Pairwise Comparisons of means between the three groups

Pairwise Comparisons

Measure: MEASURE_1

time	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
						Lower Bound	Upper Bound
1	Teacher perspective	Teacher-Student with prosthetic leg	-,039	,115	1,000	-,321	,244
		Teacher-Student Refugee-Student prosthetic leg	,065	,115	1,000	-,217	,348
	Teacher-Student with prosthetic leg	Teacher perspective	,039	,115	1,000	-,244	,321
		Teacher-Student Refugee-Student prosthetic leg	,104	,115	1,000	-,179	,387
	Teacher-Student Refugee-Student prosthetic leg	Teacher perspective	-,065	,115	1,000	-,348	,217
		Teacher-Student with prosthetic leg	-,104	,115	1,000	-,387	,179
2	Teacher perspective	Teacher-Student with prosthetic leg	-,012	,197	1,000	-,495	,471
		Teacher-Student Refugee-Student prosthetic leg	,146	,197	1,000	-,337	,630
	Teacher-Student with prosthetic leg	Teacher perspective	,012	,197	1,000	-,471	,495
		Teacher-Student Refugee-Student prosthetic leg	,158	,197	1,000	-,325	,641
	Teacher-Student Refugee-Student prosthetic leg	Teacher perspective	-,146	,197	1,000	-,630	,337
		Teacher-Student with prosthetic leg	-,158	,197	1,000	-,641	,325

Based on estimated marginal means

a. Adjustment for multiple comparisons: Bonferroni.

To conclude, the results concerning the emotion scale identified significant changes to participants' emotions after the VR intervention. After the VR experience, the participants felt more active, strong, and inspired. Moreover, the experience increased their interest, confidence, determination, and concentration. On the other hand, the VR intervention also affected negatively the participants as they felt sadder, probably due to the cases experienced, they were more upset and tired. Another significant outcome of the analysis is that emotions scores increased for all three groups between the two points in time (before and after the VR intervention) regardless of the group that they belonged to.

8.9.5 Analysis of Empathy Scale

This section presents the analysis of the results concerning the empathy scale items. The analysis of the empathy scale includes the following tests (figure 8-46):

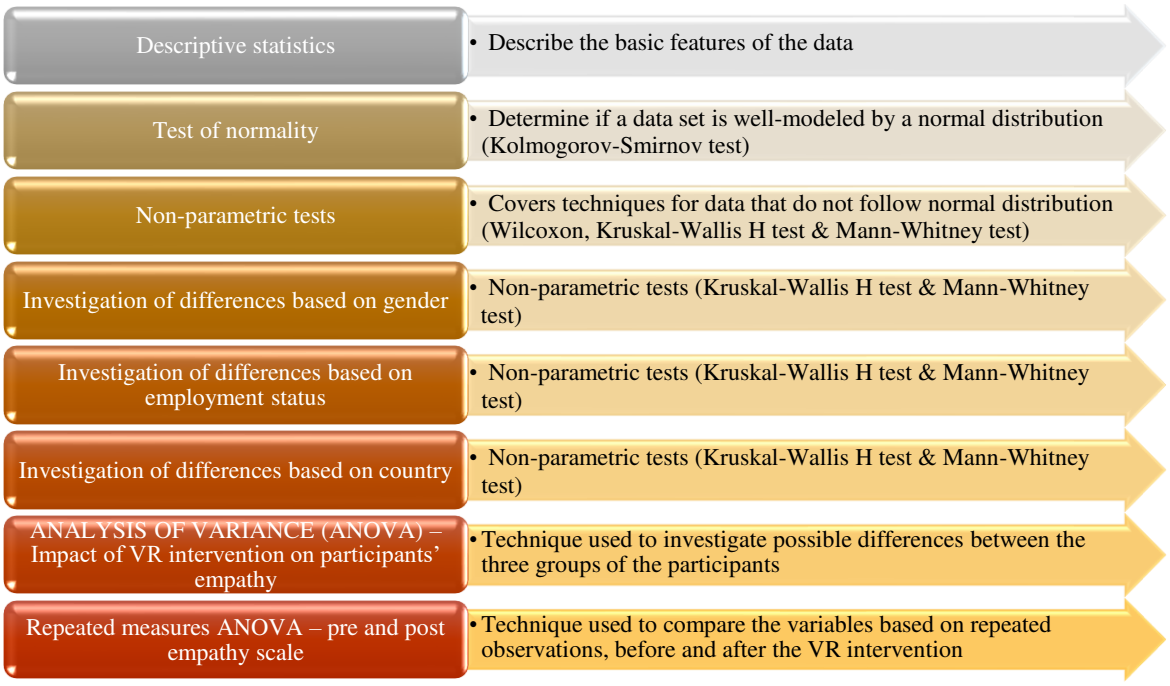


Figure 8-46: Tests carried out regarding the analysis of the empathy data

8.9.5.1 The Likert scale and reverse coding

Before the presentation of the results, it is considered appropriate to present the Likert scale being used in the Empathy Scale and then present also the reverse scoring, as many of the items were negative and had to be reversed within SPSS.

The following 5-point Likert scale was used:

Which, for the reverse-scored items becomes:

8.9.5.2 Pre-Empathy Scale – Descriptive Statistics

Table 8-46 presents the distribution of the sample regarding the pre-empathy scale, including the central tendency (Mean-M), the smallest (Minimum), and larger (Maximum) values and dispersion around the mean (Standard Deviation-SD). The frequency table for each pre-empathy scale item is presented in appendix D-8-13.

Table 8-46: Descriptive statistics for pre-empathy scale items

	N	Minimum	Maximum	Mean	Std. Deviation
1. I sometimes find no difficult to see things from the “other guy’s person’s” point of view. (Reversed)	69	1.00	5.00	3.7246	.95308
2. I try to look at everybody’s side of a problem before making a decision.	69	2.00	5.00	4.0580	.85550

3. I sometimes try to understand others better by imagining how things look from their perspective.	69	1.00	5.00	3.8551	.82739
4. If I am sure I am right about something, I listen to other people's arguments. (Reversed)	69	1.00	5.00	3.6377	1.01418
5. I believe that there are two sides to every situation and try to look at them both.	69	2.00	5.00	3.8986	.85997
6. When I am upset at someone, I usually try to "put myself in his shoes" for a while.	69	1.00	5.00	3.1884	.98929
7. Before criticizing somebody, I try to imagine how I would feel if I were in their place.	68	1.00	5.00	3.6176	.96242
8. I often feel very sorry for other people when they are having problems. (Reversed)	69	1.00	5.00	4.0000	1.15045
9. Other people's misfortunes usually disturb me a great deal. (Reversed)	69	1.00	5.00	4.1739	1.22422
10. When I see someone being treated unfairly, I often feel pity very much for them. (Reversed)	69	1.00	5.00	4.3478	1.08229
11. I am often quite touched by things that I see happen.	69	1.00	5.00	3.8696	1.08347
12. I would describe myself as a pretty soft-hearted person.	69	1.00	5.00	3.9420	.93752
13. I do not feel sympathy for people who cause their own serious illnesses. (Reversed)	69	1.00	5.00	4.2029	.99380
14. I am really interested in how other people feel. (Reversed)	69	3.00	5.00	4.5797	.71550
15. When I see someone being taken advantage of, I feel kind of protective towards him\her.	69	1.00	5.00	4.0725	1.15452
Valid N (listwise)	68				

8.9.5.3 Post-Empathy Scale – Descriptive Statistics

Table 8-47 presents the distribution of the sample regarding the post-empathy scale, including the central tendency (Mean-M), the smallest (Minimum), and larger

(Maximum) values and dispersion around the mean (Standard Deviation-SD). The frequency table for each post-empathy scale item is presented in appendix D-8-14.

Table 8-47: Descriptive statistics for post-empathy scale items

	N	Minimum	Maximum	Mean	Std. Deviation
1. I sometimes find no difficult to see things from the "other guy's person's" point of view. (Reversed)	69	1.00	5.00	3.7971	1.03724
2. I try to look at everybody's side of a problem before making a decision.	69	2.00	5.00	4.2174	.70439
3. I sometimes try to understand others better by imagining how things look from their perspective.	69	2.00	5.00	4.1884	.71281
4. If I am sure I am right about something, I listen to other people's arguments. (Reversed)	69	1.00	5.00	3.7971	1.10586
5. I believe that there are two sides to every situation and try to look at them both.	69	1.00	5.00	4.1304	.82092
6. When I am upset at someone, I usually try to "put myself in his shoes" for a while.	69	1.00	5.00	3.4783	1.00891
7. Before criticizing somebody, I try to imagine how I would feel if I were in their place.	69	2.00	5.00	4.0000	.82248
8. I often feel very sorry for other people when they are having problems. (Reversed)	69	1.00	5.00	4.2464	1.07657
9. Other people's misfortunes usually disturb me a great deal. (Reversed)	69	1.00	5.00	4.5072	.90136
10. When I see someone being treated unfairly, I often feel pity very much for them. (Reversed)	69	1.00	5.00	4.2754	1.21127
11. I am often quite touched by things that I see happen.	69	1.00	5.00	4.0290	.85700
12. I would describe myself as a pretty soft-hearted person.	69	2.00	5.00	4.0725	.81021
13. I do not feel sympathy for people who cause their own serious illnesses. (Reversed)	69	2.00	5.00	4.5217	.69892

14. I am really interested in how other people feel. (Reversed)	69	1.00	5.00	4.6232	.72965
15. When I see someone being taken advantage of, I feel kind of protective towards him\her.	69	2.00	5.00	4.4058	.87982
Valid N (listwise)	69				

8.9.5.4 Pre and Post-Emotional Scale – Test of Normality

A Kolmogorov-Smirnov test indicated that both the pre-empathy (table 8-48) and the post-empathy scale (table 8-49) do not follow a normal distribution, as $p = 0.000 < 0.05$ for all scale items. Thus, non-parametric tests were used.

Table 8-48: One sample Kolmogorov-Smirnov Test (pre-empathy scale)

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
1. I sometimes find no difficult to see things from the "other guy's person's" point of view. (Reversed)	.276	68	.000	.864	68	.000
2. I try to look at everybody's side of a problem before making a decision.	.259	68	.000	.833	68	.000
3. I sometimes try to understand others better by imagining how things look from their perspective.	.276	68	.000	.847	68	.000
4. If I am sure I am right about something, I listen to other people's arguments. (Reversed)	.215	68	.000	.886	68	.000
5. I believe that there are two sides to every situation and try to look at them both.	.246	68	.000	.860	68	.000
6. When I am upset at someone, I usually try to "put myself in his shoes" for a while.	.223	68	.000	.878	68	.000
7. Before criticizing somebody, I try to imagine how I would feel if I were in their place.	.301	68	.000	.843	68	.000
8. I often feel very sorry for other people when they are having problems. (Reversed)	.276	68	.000	.802	68	.000

9. Other people's misfortunes usually disturb me a great deal. (Reversed)	.370	68	.000	.707	68	.000
10. When I see someone being treated unfairly, I often feel pity very much for them. (Reversed)	.376	68	.000	.661	68	.000
11. I am often quite touched by things that I see happen.	.254	68	.000	.844	68	.000
12. I would describe myself as a pretty soft-hearted person.	.275	68	.000	.843	68	.000
13. I do not feel sympathy for people who cause their own serious illnesses. (Reversed)	.306	68	.000	.778	68	.000
14. I am really interested in how other people feel. (Reversed)	.429	68	.000	.613	68	.000
15. When I see someone being taken advantage of, I feel kind of protective towards him\her.	.266	68	.000	.752	68	.000
a. Lilliefors Significance Correction						

Table 8-49: One sample Kolmogorov-Smirnov Test (post-empathy scale)

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
1. I sometimes find no difficult to see things from the "other guy's person's" point of view. (Reversed)	.230	69	.000	.860	69	.000
2. I try to look at everybody's side of a problem before making a decision.	.259	69	.000	.798	69	.000
3. I sometimes try to understand others better by imagining how things look from their perspective.	.256	69	.000	.805	69	.000
4. If I am sure I am right about something, I listen to other people's arguments. (Reversed)	.210	69	.000	.861	69	.000
5. I believe that there are two sides to every situation and try to look at them both.	.263	69	.000	.804	69	.000
6. When I am upset at someone, I usually try to "put myself in his shoes" for a while.	.292	69	.000	.867	69	.000

7. Before criticizing somebody, I try to imagine how I would feel if I were in their place.	.312	69	.000	.806	69	.000
8. I often feel very sorry for other people when they are having problems. (Reversed)	.309	69	.000	.715	69	.000
9. Other people's misfortunes usually disturb me a great deal. (Reversed)	.389	69	.000	.602	69	.000
10. When I see someone being treated unfairly, I often feel pity very much for them. (Reversed)	.348	69	.000	.636	69	.000
11. I am often quite touched by things that I see happen.	.298	69	.000	.811	69	.000
12. I would describe myself as a pretty soft-hearted person.	.290	69	.000	.808	69	.000
13. I do not feel sympathy for people who cause their own serious illnesses. (Reversed)	.376	69	.000	.689	69	.000
14. I am really interested in how other people feel. (Reversed)	.422	69	.000	.571	69	.000
15. When I see someone being taken advantage of, I feel kind of protective towards him\her.	.359	69	.000	.695	69	.000
a. Lilliefors Significance Correction						

8.9.5.5 Empathy differences – Non- parametric tests

A Wilcoxon signed-rank test showed that the use of VR elicited a statistically significant change in many empathy items (table 8-50). The Ranks table also provides some interesting data on the comparison of participants' Before (Pre) and After (Post) Empathy Scores (Appendix D-8-15). A Wilcoxon signed rank test showed that there were significant differences between scores given for the variables: 3) I sometimes try to understand other's better by imagining how things look from their perspective ($Z = -3.130$, $p<0.002$); 5) I believe that there are two sides to every situation and try to look at them both ($Z = -2.425$, $p<0.015$); 7) Before criticizing somebody, I try to imagine how I would feel if I were in their place ($Z = -3.090$, $p<0.002$); 8) I often feel very sorry for other people when they are having problems (Reversed) ($Z = -1.962$, $p<0.050$); 9) Other people's misfortunes usually disturb me a great deal (Reversed) ($Z = -2.294$, $p<0.022$); 13) I do not feel sympathy for people who cause their own serious illnesses (Reversed)

(Z = -3.157, p<0.002) and 15) When I see someone being taken advantage of, I feel kind of protective towards him\her (Z = -2.549, p<0.011).

Table 8-50: Wilcoxon Signed Ranks Test for Empathy items

	Z	Asymp. Sig. (2-tailed)
1. I sometimes find no difficult to see things from the "other guy's person's" point of view. (Reversed) - 1. I sometimes find no difficult to see things from the "other guy's person's" point of view. (Reversed)	-.893[b]	.372
2. I try to look at everybody's side of a problem before making a decision. - 2. I try to look at everybody's side of a problem before making a decision.	-1.633[b]	.103
3. I sometimes try to understand others better by imagining how things look from their perspective. - 3. I sometimes try to understand others better by imagining how things look from their perspective.	-3.130[b]	**.002**
4. If I am sure I am right about something, I listen to other people's arguments. (Reversed) - 4. If I am sure I am right about something, I listen to other people's arguments. (Reversed)	-1.549[b]	.121
5. I believe that there are two sides to every situation and try to look at them both. - 5. I believe that there are two sides to every situation and try to look at them both.	-2.425[b]	**.015**
6. When I am upset at someone, I usually try to "put myself in his shoes" for a while. - 6. When I am upset at someone, I usually try to "put myself in his shoes" for a while.	-1.954[b]	.051
7. Before criticizing somebody, I try to imagine how I would feel if I were in their place. - 7. Before criticizing somebody, I try to imagine how I would feel if I were in their place.	-3.090[b]	**.002**
8. I often feel very sorry for other people when they are having problems. (Reversed) - 8. I often feel very sorry for other people when they are having problems. (Reversed)	-1.962[b]	**.050**
9. Other people's misfortunes usually disturb me a great deal. (Reversed) - 9. Other people's misfortunes usually disturb me a great deal. (Reversed)	-2.294[b]	**.022**
10. When I see someone being treated unfairly, I often feel pity very much for them. (Reversed) - 10. When I see someone being treated unfairly, I often feel pity very much for them. (Reversed)	-.346[c]	.729

11. I am often quite touched by things that I see happen. - 11. I am often quite touched by things that I see happen.	-1.393[b]	.164
12. I would describe myself as a pretty soft-hearted person. - 12. I would describe myself as a pretty soft-hearted person.	-1.446[b]	.148
13. I do not feel sympathy for people who cause their own serious illnesses. (Reversed) - 13. I do not feel sympathy for people who cause their own serious illnesses. (Reversed)	-3.157[b]	**.002**
14. I am really interested in how other people feel. (Reversed) - 14. I am really interested in how other people feel. (Reversed)	-.931[b]	.352
15. When I see someone being taken advantage of, I feel kind of protective towards him\her. - 15. When I see someone being taken advantage of, I feel kind of protective towards him\her.	-2.549[b]	**.011**

b. Based on negative ranks.

c. Based on positive ranks.

The output (figure 8-47) shows that there is significant evidence of a difference between the scores for the empathy variables before and after the use of the VR.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between pre_Empathy Sum Score and Post Empathy Sum Score equals 0.	Related-Samples Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Figure 8-47: Wilcoxon signed-rank test for pre and post-empathy scale

The results indicate a positive impact of the VR intervention on participants' empathic skills. The graphical representations in figures 7-48 to 7-54 present the differences in means score related to the items that Wilcoxon signed-rank test indicated to have statistically significant differences in table 8-50.

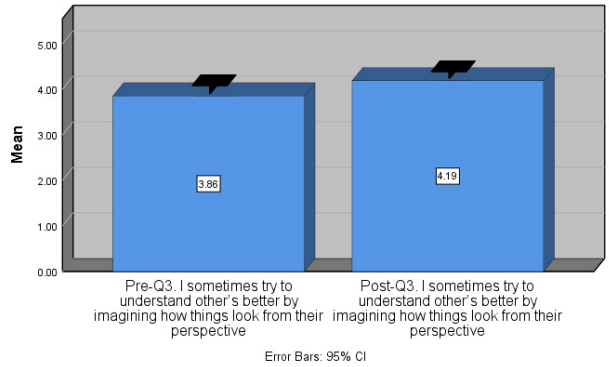


Figure 8-48: Differences in mean scores related to Q3 'I sometimes try to understand others better by imagining how things look from their perspective'.

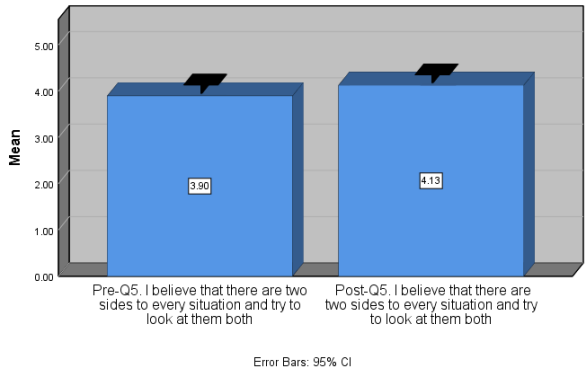


Figure 8-49: Differences in mean scores related to Q5 'I believe that there are two sides to every situation and try to look at them both'.

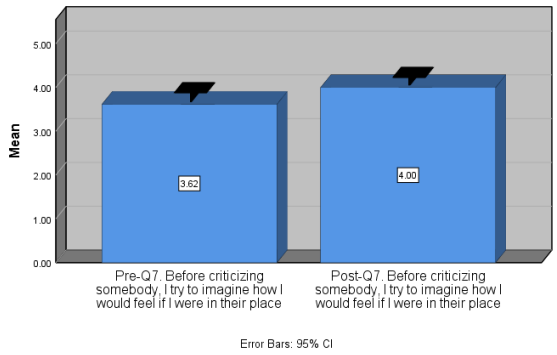


Figure 8-50: Differences in mean scores related to Q7 'Before criticizing somebody, I try to imagine how I would feel if I were in their place'

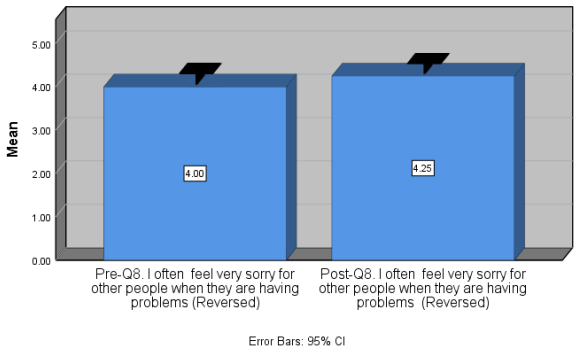


Figure 8-51: Differences in mean scores related to Q8 'I often feel very sorry for other people when they are having problems'.

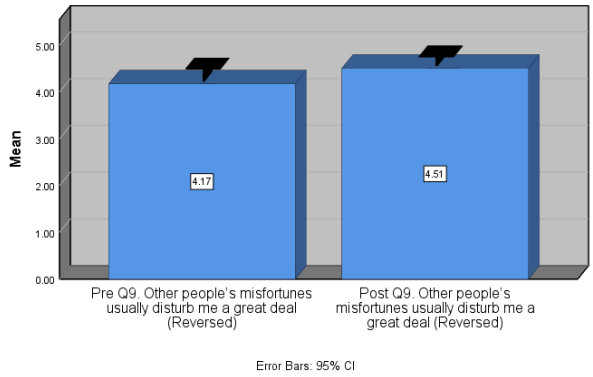


Figure 8-52: Differences in mean scores related to Q9 'Other people's misfortunes usually disturb me a great deal'.

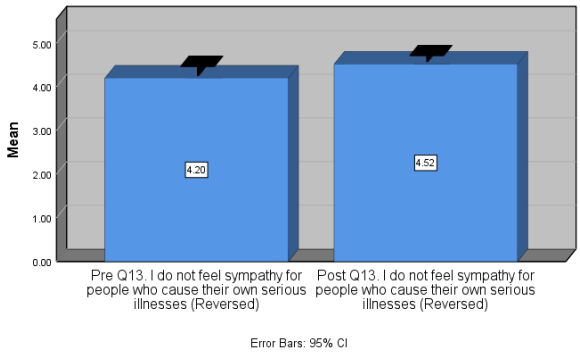


Figure 8-53: Differences in mean scores related to Q13 '. I do not feel sympathy for people who cause their own serious illnesses'.

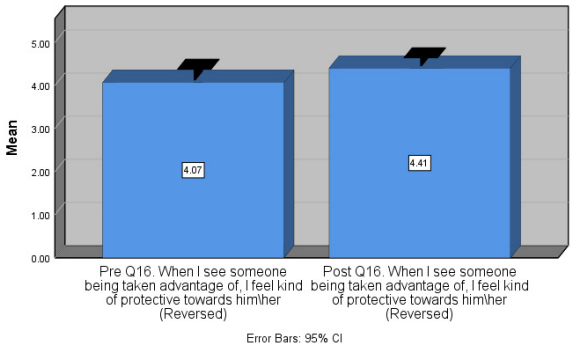


Figure 8-54: Differences in mean scores related to Q15 'When I see someone being taken advantage of, I feel kind of protective towards him\her'.

8.9.5.6 Impact of VR intervention on participants' empathic skills (ANOVA)

One of the most significant research questions of the current research was the following:

Research question: *To what extent did the virtual reality intervention affected participants' Empathy skills?*

8.9.5.6.1 Pre empathy state test for equality of means

One-Way ANOVA was used to compare the means of the three groups (1) Teacher perspective, 2) Teacher-Student with a prosthetic leg and 3) Teacher-Student Refugee-Student prosthetic leg), to investigate whether empathy skills before the use of VR were similar between the three groups. The descriptive statistics table (table 8-51 provides some very useful descriptive statistics, including the mean, standard deviation, and 95% confidence intervals for the dependent variable (Pre-Emotion average score) for each separate group, as well as when all groups are combined (Total).

Table 8-51: Descriptive statistics for the dependent variable pre-empathy average score and the three groups of participants.

Pre-Emotion Average Score							
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	Minimum	Maximum
					Lower Bound / Upper Bound		

Teacher perspective	23	2.8671	.27613	.05758	2.7477	2.9866	2.28	3.28
Teacher-Student with prosthetic leg	23	2.9058	.40286	.08400	2.7316	3.0800	2.22	3.50
Teacher-Student Refugee-Student prosthetic leg	23	2.8019	.46717	.09741	2.5999	3.0040	1.61	3.78
Total	69	2.8583	.38685	.04657	2.7654	2.9512	1.61	3.78

In order to use ANOVA, part of the process involves checking to make sure that the data can be analyzed using this method. The hypotheses of interest are as follows:

H_{null}: The means are all equal, thus ANOVA can be used.

H_{alt}: The means are not equal.

Levene's Test indicated that the groups we are comparing all have similar population variances as Sig. > 0.05 that is needed for an ANOVA (table 8-52). Thus, we accept the null hypothesis.

Table 8-52: Test of Homogeneity of Variances

Test of Homogeneity of Variances			
Pre-Empathy Average Score			
Levene Statistic	df1	df2	Sig.
.127	2	66	.881

From the output of the ANOVA analysis, we can see that the significance value is 0.221, which is over 0.05. and, therefore, there is no statistically significant difference in the mean scores of the emotional scale for all the three groups (table 8-53).

Table 8-53: Output of the ANOVA analysis for the pre-empathy average score among the three groups

ANOVA					
Pre-Empathy Average Score					
	Sum of Squares	df	Mean Square	F	Sig.

Between Groups	.600	2	.300	1.521	.226
Within Groups	13.026	66	.197		
Total	13.626	68			

The data were analyzed using repeated-measures ANOVA, as the measurements related to participants' empathy skills were repeated over time (after the use of VR), to measure possible changes. Thus, the independent variable is time and there were two-time points, one after the use of the VR and one after its use.

The means for pre-empathy scores for all three groups are visualized in the profile plot (figure 8-55).

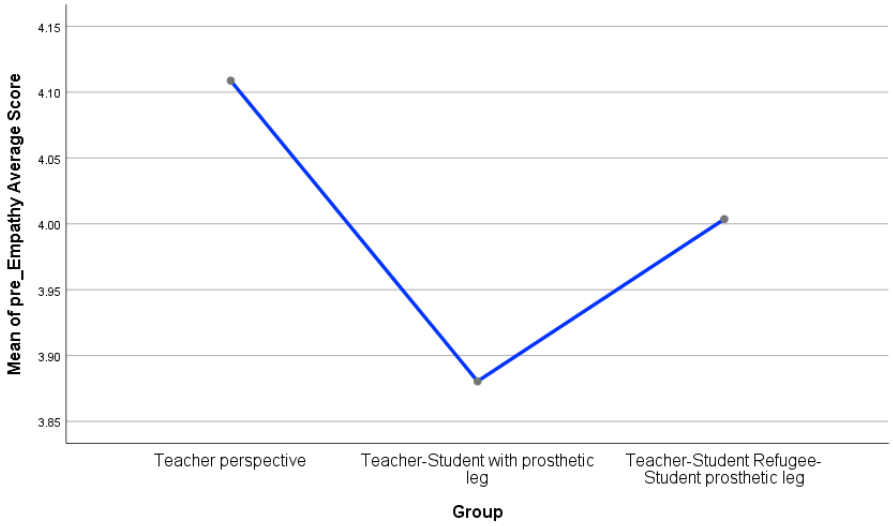


Figure 8-55: Means for pre-empathy scores for the three groups

8.9.5.6.2 Repeated Measures ANOVA

Repeated measures are obtained when we measure the same variable repeatedly, for example, at different time points. A Repeated Measures ANOVA was used as the emotional variables were measured over two-time points, one measurement before and one after the use of VR, to compare the mean differences between the three groups ((1)Teacher perspective, 2)Teacher-Student with a prosthetic leg and 3)Teacher-Student refugee-Student prosthetic leg).

Table 8-54, Within-Subjects Factors present the groups of our independent variable and labels the time points 1 and 2. The dependent variable is referring to the fact that dependent variable empathy was measured at each of these time points.

Table 8-54: Within-Subjects Factors Table

Within-Subjects Factors	
Measure: MEASURE_1	
time	Dependent Variable
1	Pre-Empathy Mean
2	Post-Empathy Mean

Table 8-55, Between-subjects factor consists of conditions and more specifically the three different groups of participants that experienced three different perspectives within VR.

Table 8-55: Between-subjects factor conditions

Between-Subjects Factors			
		Value Label	N
Group	1.00	Teacher perspective	23
	2.00	Teacher-Student with a prosthetic leg	23
	3.00	Teacher-Student Refugee-Student prosthetic leg	23

Table 8-56 provides important descriptive statistics for this analysis related to pre and post empathy's measurements to all three groups.

Table 8-56: Descriptive statistics

Descriptive Statistics				
	Group	Mean	Std. Deviation	N
Pre-Empathy Average Score	Teacher perspective	4.1087	.45470	23
	Teacher-Student with prosthetic leg	3.8804	.47333	23
	Teacher-Student Refugee-Student prosthetic leg	4.0036	.40161	23
	Total	3.9976	.44765	69
Post- Empathy Average Score	Teacher perspective	4.1929	.45184	23
	Teacher-Student with a prosthetic leg	4.1114	.51778	23

	Teacher-Student Refugee-Student prosthetic leg	4.2473	.35779	23
	Total	4.1839	.44426	69

Box's Test of Equality of Covariance Matrices determines whether the data violate the assumption of homogeneity of variance-covariance matrices. If the Sig. value is larger than 0.001, then the assumption is not violated. According to table 8-57, Sig. value is 0.314, thus we assume homogenous covariance structures.

Table 8-57: Box's Test of Equality of Covariance Matrices

Box's Test of Equality of Covariance Matrices[a]	
Box's M	7.404
F	1.180
df1	6
df2	108564.923
Sig.	.314

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + Group

Within Subjects Design: time

The multivariate tests table 8-58 displays four tests of significance that will indicate whether there are statistically significant differences related to the effect of 'time' on the dependent variable and the three different groups. Between these two times of filling in the questionnaire, the VR intervention was mediated (the introduction and use of the respondents in the VR environment). As far as time is concerned, Multivariate tests indicate a significant change in participant's empathy skills before and after the VR intervention, Pillai's Trace=0.26, F(1, 66)=23.66, p=0.000. The importance of the impact of VR on participants' empathy can be evaluated using the effect size statistic provided by Partial Eta Squared (η2). The value is 0.26, indicating that 26% of the variance in perceived empathy scores is explained by the VR intervention. Moreover, according to the results no statistically significant difference was found between the three groups, Pillai's Trace=0.051, F(2, 66)=1.78, p=0.176. Thus, the results indicate

that VR intervention had a statistically significant effect on participants' empathy, independently to the group that they belonged to.

Table 8-58: Multivariate Tests

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Time	Pillai's Trace	.264	23.661[b]	1.000	66.000	.000	,264
	Wilks' Lambda	.736	23.661[b]	1.000	66.000	.000	,264
	Hotelling's Trace	.359	23.661[b]	1.000	66.000	.000	,264
	Roy's Largest Root	.359	23.661[b]	1.000	66.000	.000	,264
Time * Group	Pillai's Trace	.051	1.784[b]	2.000	66.000	.176	,051
	Wilks' Lambda	.949	1.784[b]	2.000	66.000	.176	,051
	Hotelling's Trace	.054	1.784[b]	2.000	66.000	.176	,051
	Roy's Largest Root	.054	1.784[b]	2.000	66.000	.176	,051

a. Design: Intercept + Group

Within Subjects Design: Time

b. Exact statistic

For the current data, sphericity is not an issue because there are only 2 levels of repeated measures (before and after the VR intervention). The significance of Mauchly's test (table 8-59) shows a dot and no significant value. The repeated-measures variable has only two levels then sphericity is met, the estimates of sphericity are 1 (perfect sphericity), the chi-square is zero and has no degrees of freedom and so a p-value can't be computed. At least three conditions are needed for sphericity to be an issue.

Table 8-59: Mauchly's Test of Sphericity

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Time	1.000	.000	0	.	1.000	1.000	1.000

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + Group

Within Subjects Design: Time

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

The Tests of Within-Subjects Effects table indicate the overall significant difference in the main effect of the 'time' factor and the 'time-groups' interaction. Since our data seem spherical, Greenhouse-Geisser, Huynh-Feldt, and Lower bound results are ignored in table 8-60 below and the results denoted as 'Sphericity Assumed' are interpreted. According to the results, the significance of F is .000<.05 (partial eta squared=.26). Therefore, it can be concluded that there was a significant difference in participants' empathy scores after the VR intervention. However, related to the effect of time and group no statistically significant difference was found, indicating that the VR intervention affected participants' empathy indifferent to the group to which they belonged (p=.176).

Table 8-60: Tests of Within-Subjects Effects

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	**1.197**	**1**	**1.197**	**23.661**	**.000**	**,264**

	Greenhouse-Geisser	1.197	1.000	1.197	23.661	.000	,264
	Huynh-Feldt	1.197	1.000	1.197	23.661	.000	,264
	Lower-bound	1.197	1.000	1.197	23.661	.000	,264
Time * Group	Sphericity Assumed	.181	2	.090	1.784	.176	,051
	Greenhouse-Geisser	.181	2.000	.090	1.784	.176	,051
	Huynh-Feldt	.181	2.000	.090	1.784	.176	,051
	Lower-bound	.181	2.000	.090	1.784	.176	,051
Error (Time)	Sphericity Assumed	3.340	66	.051			
	Greenhouse-Geisser	3.340	66.000	.051			
	Huynh-Feldt	3.340	66.000	.051			
	Lower-bound	3.340	66.000	.051			

The results of Levene's test of equality of error variances (table 8-61) indicate that we have not violated the assumption for either of our dependent variables (p=.881, p=.508).

Table 8-61: Levene's Test of Equality of Error Variances

Levene's Test of Equality of Error Variances[a]				
	F	df1	df2	Sig.
Pre-Empathy Average Score	,127	2	66	,881
Post-Empathy Average Score	,685	2	66	,508

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Group

Within Subjects Design: time

The Profile Analysis (table 8-62) does not indicate significant differences between the three different groups as p=.405>.001. We can conclude that the differences in participants' empathy scores do not differ among the three groups.

Table 8-62: Tests of Between-Subjects Effects

Tests of Between-Subjects Effects						
Measure: MEASURE_1						
Transformed Variable: Average						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	2309.303	1	2309.303	6657.968	.000	,990
Group	.635	2	.317	.915	.405	,027
Error	22.892	66	.347			

According to Table 8-63, the means scores of empathy scale items increased in all three groups between the two points in time when respondents completed the questionnaire, pre-intervention, and post-intervention.

Table 8-63: Mean score differences related to empathy among the three groups pre and post the intervention

3. Group * Time					
Measure: MEASURE_1					
Group	Time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Teacher perspective	1	4.109	.093	3.924	4.294
	2	4.193	.093	4.007	4.379
Teacher-Student with prosthetic leg	1	3.880	.093	3.695	4.065
	2	4.111	.093	3.925	4.298
Teacher-Student Refugee-Student prosthetic leg	1	4.004	.093	3.819	4.189
	2	4.247	.093	4.061	4.434

Pairwise comparison results are presented in table 8-64 and refer to the multiple comparisons of mean scores for all three groups on the dependent variable of emotions with the post hoc criterion of Bonferroni. Table 8-64 displays the difference between group means, the standard error, the significance value, and a confidence interval for the difference between means. By looking at the table it can be concluded that *empathy's*

means scores are increased significantly from time point 1-I (before VR intervention) to time point 2-J (after VR intervention) for two of the three groups, and particularly for the groups: 2) Teacher-Student with a prosthetic leg and 3) Teacher-Student Refugee-Student prosthetic leg. For the teacher perspective, the change in empathy is not statistically significant as the p-value is > 0.05. For groups 2 and 3, the mean difference (I-J) before and after the use of VR is negative (-0.231 and -0.244 respectively). Moreover, the mean difference after (2) minus the mean score before (1) is positive (0.231 and 0.244), thus, the means scores after the VR intervention are higher than the mean scores before the VR intervention. *Hence, for groups 2) Teacher-Student with a prosthetic leg and 3) Teacher-Student Refugee-Student prosthetic leg, mean scores of empathy variables before the VR intervention are lower compared to the mean scores after. Thus, the VR intervention was effective in raising mean scores of empathy variables* (table 8-63).

Table 8-64: Pairwise Comparisons with post hoc criterion of Bonferroni

Pairwise Comparisons

Measure:MEASURE_1

Group	(I) time	(J) time	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
						Lower Bound	Upper Bound
Teacher perspective	1	2	-.084	.066	.209	-.217	.048
	2	1	.084	.066	.209	-.048	.217
Teacher-Student with prosthetic leg	1	2	-.231*	.066	.001	-.363	-.099
	2	1	.231*	.066	.001	.099	.363
Teacher-Student Refugee-Student prosthetic leg	1	2	-.244*	.066	.000	-.376	-.111
	2	1	.244*	.066	.000	.111	.376

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

As far as time alone is concerned (time refers to the time points before and after the VR intervention), without considering the groups, we can conclude that the empathy variables increased significantly after the VR intervention (table 8-65). From table 8-65 it can be noticed that the difference between the two means before and after (Mean Difference (IJ)) is negative (= -0.186) which means that the mean at time point 1 (before) minus the mean at time point 2 (after) is lower. So at time point 2 (filling in the questionnaire after the VR intervention) there is a higher average of empathy scores.

Table 8-65: Pairwise Comparisons related to time

Pairwise Comparisons

Measure: MEASURE_1

(I) Time	(J) Time	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-.186*	.038	.000	-.263	-.110
2	1	.186*	.038	.000	.110	.263

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

The profile plot shows the increase in empathy scores for all three groups between the two points in time (figure 8-56).

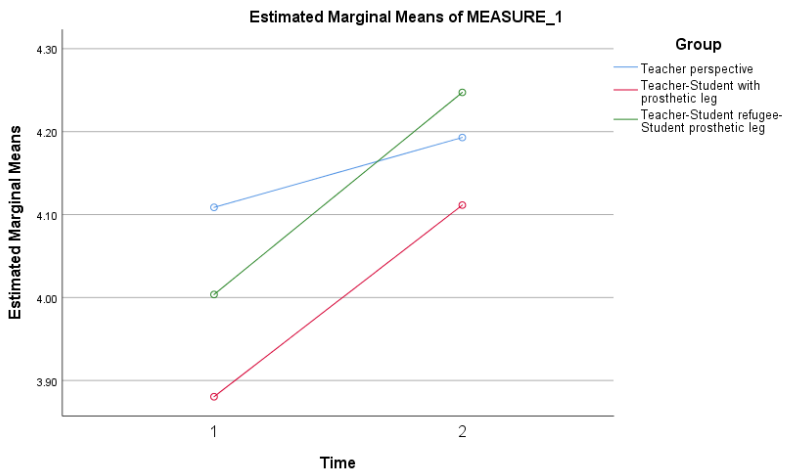


Figure 8-56: Differences in empathy variables over the two-time points measurements related to the three groups

To sum up, the VR intervention elicited statistically significant changes in many empathy items. Another significant outcome was that empathy means scores increased significantly for two of the three groups, and particularly for the groups: 2) Teacher-Student with a prosthetic leg and 3) Teacher-Student Refugee-Student prosthetic leg. For the teacher perspective, the change in empathy is not statistically significant indicating that perspective-taking has a strong impact on the VR experience and cultivation of empathy skills.

8.9.6 Analysis of Sense of presence scale

Research question: *To what extent did participants feel present in the virtual environment?*

This section presents the analysis of the results concerning the sense of presence. The analysis includes the following tests (figure 8-57):

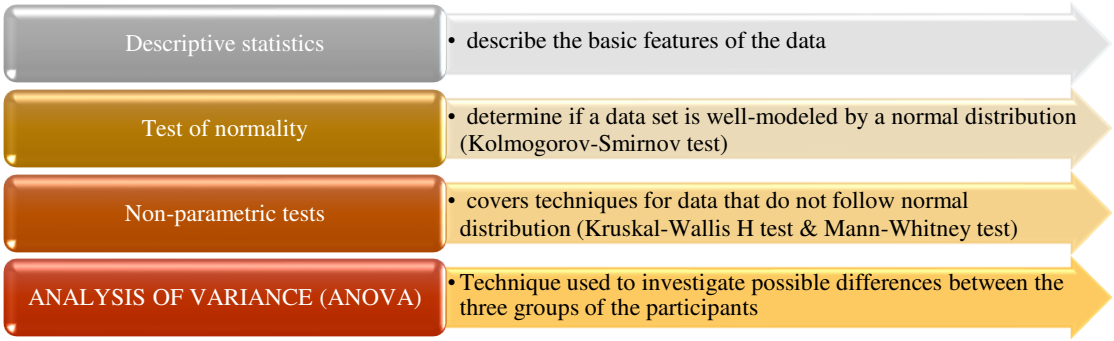


Figure 8-57: Tests carried out regarding the analysis of the presence scale

8.9.6.1 Presence Scale - Descriptive statistics

The presence scale was a 7-point Likert scale and each item had its own scale point. Table 8-66 presents the minimum, maximum, mean scores, and standards deviation for all the items of the presence scale. The results indicate a high sense of presence as for all the scale items the mean score is high. On average the participants seem to have the sense of 'being there' to the virtual classroom with a mean score of 5.54 (SD= 1.26). Moreover, the participants' felt during the VR experience that the virtual classroom was a reality for them, with a mean score of 5.17 (SD= 1.36). The participants perceived the virtual classroom as an environment that they visited and not as images that they saw, with a mean score of 5.06 (SD= 1.55). According to the results, during the VR

experience, the participants felt the sense of being within the virtual classroom environment rather than being elsewhere, with a mean score of 5.33 (SD= 1.42). Additionally, the participants thought of the virtual classroom as a place in a way similar to other places that they had visited, with a mean score of 5.04 (SD= 1.53). Furthermore, during the experience, the participants felt as if they were really standing in a classroom environment, with a mean score of 5.00 (SD= 1.50). The frequency tables for presence scale items are presented in appendix D-8-19.

Table 8-66: Descriptive statistics of Presence Scale

	N	Minimum	Maximum	Mean	Std. Deviation
1. Please rate your sense of being in the virtual environment, on a scale of 1 to 7, where 7 represents your normal experience of being in a place. I had a sense of "being there" in the virtual classroom ...	69	1.00	7.00	5.5362	1.25534
2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?	69	1.00	7.00	5.1739	1.36076
3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?	69	1.00	7.00	5.0580	1.55189
4. During the time of the experience, which was the strongest, on the whole, your sense of being in the virtual classroom environment or of being elsewhere?	69	1.00	7.00	5.3333	1.42113
5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?	69	1.00	7.00	5.0435	1.52850
6. During the time of your experience, did you often think to yourself that you were actually in the classroom environment?	69	1.00	7.00	5.0000	1.49509

Valid N (listwise)	69

8.9.6.2 Presence Scale - Test of Normality

A Kolmogorov-Smirnov test indicated that presence scale (table 8-67) do not follow normal distribution, as $p = 0.000 < 0.05$ for all scale items. Thus, non-parametric tests were used.

Table 8-67: One sample Kolmogorov-Smirnov Test for Presence Scale

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
1. Please rate your sense of being in the virtual environment, on a scale of 1 to 7, where 7 represents your normal experience of being in a place. I had a sense of "being there" in the virtual classroom ...	.209	69	.000	.846	69	.000
2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?	.192	69	.000	.900	69	.000
3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?	.210	69	.000	.897	69	.000
4. During the time of the experience, which was the strongest, on the whole, your sense of being in the virtual classroom environment or of being elsewhere?	.217	69	.000	.876	69	.000
5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?	.170	69	.000	.915	69	.000
6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?	.210	69	.000	.911	69	.000

a. Lilliefors Significance Correction

8.9.6.3 Presence differences – Non- parametric tests

Research question: *To what extend did the different perspectives affected participants' sense of presence?*

The Kruskal-Wallis H test nonparametric test is used to determine if there are statistically significant differences between the three groups related to the presence scale items. A Kruskal-Wallis H test (table 8-68 and figure 8-58) showed that there was a statistically significant difference in presence scores between the three groups only for one of the items '4. During the time of the experience, which was the strongest, on the whole, your sense of being in the virtual classroom environment or of being elsewhere?', $\chi 2(2) = 6.406$, $p = 0.041$, with a mean rank group score of 27.63 for group 1 – Teacher perspective, 35.26 for group 2 – Teacher-Student with prosthetic leg perspective and 42.11 for group 3 – Teacher- Student Refugee-Student prosthetic leg. The mean scores table for all items is presented in appendix D-8-20.

Table 8-68: Kruskal-Wallis H test for Presence scale

	Kruskal-Wallis H	df	Asymp. Sig.
1. Please rate your sense of being in the virtual environment, on a scale of 1 to 7, where 7 represents your normal experience of being in a place. I had a sense of "being there" in the virtual classroom ...	3.269	2	.195
2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?	1.096	2	.578
3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?	1.936	2	.380
4. During the time of the experience, which was the strongest, on the whole, your sense of being in the virtual classroom environment or of being elsewhere?	6.406	2	**.041**
5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?	2.343	2	.310
6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?	1.228	2	.541

Grouping Variable: Group

The Kruskal-Wallis H test revealed a statistically significant difference in presence scores between the 3 groups. As the groups are 3, the Mann-Whitney U test was used to compare the 3 groups. Mann-Whitney U test results revealed that only for group 3 - Teacher- Student Refugee-Student prosthetic leg the sense of being in the virtual classroom environment was statistically significantly higher than group 1 - Teacher perspective (U = 151, p = .010) (table 8-69). The output presented in figure 8-58 clearly states that the distributions are being compared, that the p-value is 0.041, and that the null hypothesis of equal distributions has been rejected. The mean for group 3- Teacher-Student Refugee-Student prosthetic leg is considerably higher than for group 1 – Teacher perspective (table 8-70).

Table 8-69: Mann-Whitney U test comparison between groups 1 and 3

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
Q4. During the time of the experience, which was the strongest, on the whole, your sense of being in the virtual classroom environment or of being elsewhere?	151.500	427.500	-2.568	.010

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of 4.During the time of the experience, which was the strongest on the whole, your sense of being in the virtual classroom environment or of being elsewhere? is the same across categories of Group.	Independent-Samples Kruskal-Wallis Test	.041	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Figure 8-58: Kruskal-Wallis H test Hypothesis test summary

Table 8-70: Mean scores for the 3 groups for Q4 of presence scale

Q4. During the time of the experience, which was the strongest, on the whole, your sense of being in the virtual classroom environment or of being elsewhere?			
Group	Mean	N	Std. Deviation
Teacher perspective	4.8696	23	1.35862
Teacher-Student with a prosthetic leg	5.2609	23	1.62976
Teacher-Student Refugee-Student prosthetic leg	5.8696	23	1.09977
Total	5.3333	69	1.42113

8.9.6.4 Presence and group differences - ANOVA

One-Way ANOVA was used to compare the means of the three groups (1) Teacher perspective, 2) Teacher-Student with a prosthetic leg and 3) Teacher-Student Refugee-Student prosthetic leg), to investigate whether presence was similar between the three groups. The descriptive statistics table (table 8-71) provides some very useful descriptive statistics, including the mean, standard deviation, and 95% confidence intervals for the dependent variable for each separate group, as well as when all groups are combined (Total).

Table 8-71: Descriptive statistics for presence average score and the three groups of participants

Presence Average Score								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Teacher perspective	23	4.9130	1.18478	.24704	4.4007	5.4254	2.00	7.00
Teacher-Student with prosthetic leg	23	5.1304	1.29583	.27020	4.5701	5.6908	1.33	6.83

Teacher-Student Refugee-Student prosthetic leg	23	5.5290	.94502	.19705	5.1203	5.9376	4.17	7.00
Total	69	5.1908	1.16291	.14000	4.9115	5.4702	1.33	7.00

In order to use ANOVA, part of the process involves checking to make sure that the data can be analyzed using this method. The hypotheses of interest are as follows:

H_{null}: The means are all equal, thus ANOVA can be used.

H_{alt}: The means are not equal.

Levene's Test indicated that the groups we are comparing all have similar population variances as Sig. > 0.05 that is needed for an ANOVA (table 8-72). Thus, we accept the null hypothesis.

Table 8-72: Test of Homogeneity of Variances

Test of Homogeneity of Variances			
Presence Average Score			
Levene Statistic	df1	df2	Sig.
,168	2	66	,845

From the output of the ANOVA analysis, we can see that the significance value is 0.192, which is over 0.05, therefore, there is no statistically significant difference in the mean score of the presence scale for all the three groups (table 8-73).

Table 8-73: Output of the ANOVA analysis for the pre-empathy average score among the three groups

ANOVA					
Presence Average Score					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.489	2	2.244	1.693	.192
Within Groups	87.471	66	1.325		
Total	91.960	68			

To summarize, the results indicate that the participants felt a strong sense of presence in the virtual classroom space. Moreover, the results did not reveal statistically significant differences between the three groups. Even though the participants of the group that experienced only teachers' perspective and remained less time that the participants of the rest of the groups, they also felt as being part of the virtual classroom.

8.9.7 Analysis of Embodiment Scale

This section presents the analysis of the results concerning the embodiment scale. The analysis includes the following tests (figure 8-59):

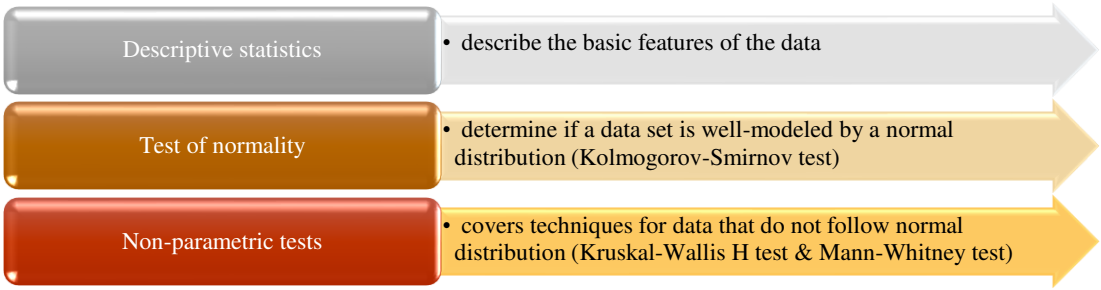


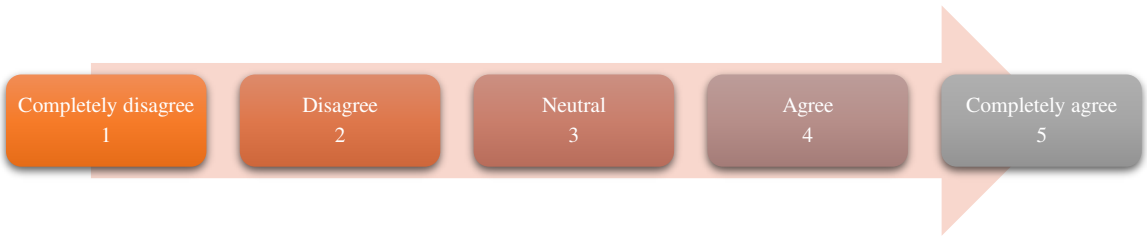
Figure 8-59: Tests carried out regarding the analysis of the presence scale

Research question: *To what extent did the virtual environment affect participants' sense of embodiment?*

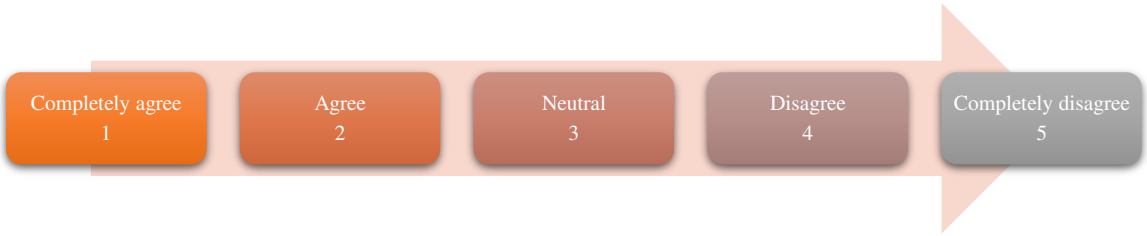
8.9.7.1 The Likert scale and reverse coding

Before the presentation of the results, it is considered appropriate to present the Likert scale being used in the Embodiment Scale and then present also the reverse scoring, as one of the items was negative and had to be reversed within SPSS.

The following 5-point Likert scale was used:



Which, for the reverse-scored items becomes:



8.9.7.2 Embodiment scale – descriptive statistics

Table 8-74 presents the minimum, maximum, mean scores, and standards deviation for all the items of the presence scale. The results indicate a medium sense of embodiment as the participants tended to be neutral to all embodiment items. The participants were neutral related to their sense that the virtual body they saw in the mirror was theirs, with a mean score of 3.35 (SD=1.04). This could be justified by the fact that they did not spend much time in the mirror scene and did not follow most of the times the instructions provided by the application that aimed to familiarize them with their virtual body. Thus, the participants tended to score from neutral to agree related to the sensation that the virtual body was theirs, with a mean score of 3.54 (SD=1.07). Additionally, the participants had a neutral sense of body ownership, with a mean score of 3.45 (SD=1.12). Moreover, the participants tended to be neutral related to controlling the avatar as if it was their own body, with a mean score of 3.32 (SD=1.01). Furthermore, the participants tended to be neutral regarding the movements of the virtual body according to their own movement, with a mean score of 3.30 (SD=1.30). The frequency tables for all embodiment items along with the graphic representations are presented in appendix D-8-21.

Table 8-74: Descriptive statistics of Embodiment Scale

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.	69	1.00	5.00	3.3478	1.04073
2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.	69	1.00	5.00	3.5362	1.06522

3. I felt that the virtual body was mine. (Reversed)	69	1.00	5.00	3.4493	1.11851
4. During the experiment, there were moments when I felt I had more than one body.	69	1.00	5.00	2.7246	1.30479
5. I felt that I controlled the avatar as if it were my body.	69	1.00	5.00	3.3188	1.00722
6. The virtual body moved according to my movements.	69	1.00	5.00	3.3043	1.29824
Valid N (listwise)	69				

8.9.7.3 Embodiment Scale - Test of Normality

A Kolmogorov-Smirnov test indicated that embodiment scale (table 8-75) do not follow normal distribution, as $p = 0.000 < 0.05$ for all scale items. Thus, non-parametric tests were used.

Table 8-75: One sample Kolmogorov-Smirnov Test for Embodiment Scale

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.	.256	69	.000	.888	69	.000
2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.	.277	69	.000	.876	69	.000
3. I felt that the virtual body was mine. (Reversed)	.268	69	.000	.880	69	.000
4. During the experiment, there were moments when I felt I had more than one body.	.213	69	.000	.871	69	.000
5. I felt that I controlled the avatar as if it were my body.	.272	69	.000	.873	69	.000
6. The virtual body moved according to my movements.	.211	69	.000	.894	69	.000
a. Lilliefors Significance Correction						

8.9.7.4 Embodiment differences – Non- parametric tests

Research question: *To what extend did the different perspectives affected participants' sense of embodiment?*

The Kruskal-Wallis H test nonparametric test is used to determine if there are statistically significant differences between the three groups related to the embodiment scale items. A Kruskal-Wallis H test (table 8-76) showed that there was a statistically significant difference in embodiment scores between the three groups only for one of the items "1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine', $\chi 2(2) = 7.760$, $p = 0.021$, with a mean rank group score of 26.00 for group 1 – Teacher perspective, 38.74 for group 2 – Teacher-Student with prosthetic leg perspective and 40.26 for group 3 – Teacher- Student Refugee-Student prosthetic leg. The mean scores for all items are presented in appendix D-8-21.

Table 8-76: Kruskal-Wallis H test for Embodiment scale

	Kruskal-Wallis H	df	Asymp. Sig.
1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.	7.760	2	**.021**
2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.	4.458	2	.108
3. I felt that the virtual body was mine. (Reversed)	.997	2	.608
4. During the experiment, there were moments when I felt I had more than one body.	5.395	2	.067
5. I felt that I controlled the avatar as if it were my body.	1.933	2	.380
6. The virtual body moved according to my movements.	.267	2	.875
Grouping Variable: Group			

The Kruskal-Wallis H test revealed a statistically significant difference in embodiment scores between the 3 groups. As the groups are 3, the Mann-Whitney U test was used to compare the 3 groups. Mann-Whitney U test results revealed that for group 2/Teacher-Student prosthetic leg the sense of embodiment was statistically significantly higher than group 1/Teacher perspective ($U = 167$, $p = .026$) (table 8-77). Moreover, Mann-

Whitney U test results revealed that for group 3/Teacher- Student Refugee-Student prosthetic leg the sense of embodiment was statistically significantly higher than group 1/Teacher perspective (U = 155, p = .012) (table 8-78). The output presented in figure 8-60 clearly states that the distributions are being compared, that the p-value is 0.021, and that the null hypothesis of equal distributions has been rejected. The mean scores for groups 3 and 2 are considerably higher than for group 1 (table 8-79 and figures 8-60 and 8-61) that can be explained from the fact that participants of groups 2 and 3 experience different perspectives and changed avatar bodied during the VR experience.

Table 8-77: Mann-Whitney U test comparison between groups 1 and 2

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.	167.000	443.000	-2.223	.026
Grouping Variable: Group				

Table 8-78: Mann-Whitney U test comparison between groups 1 and 3

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.	155.000	431.000	-2.516	.012
Grouping Variable: Group				

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of 1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine. is the same across categories of Group.	Independent-Samples Kruskal-Wallis Test	.021	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Figure 8-60: Kruskal-Wallis H test Hypothesis test summary

Table 8-79: Mean scores for the 3 groups for Q1 of embodiment scale

Q1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.			
Group	Mean	N	Std. Deviation
Teacher perspective	2.8696	23	1.09977
Teacher-Student with prosthetic leg	3.5652	23	.94514
Teacher-Student Refugee-Student prosthetic leg	3.6087	23	.94094
Total	3.3478	69	1.04073

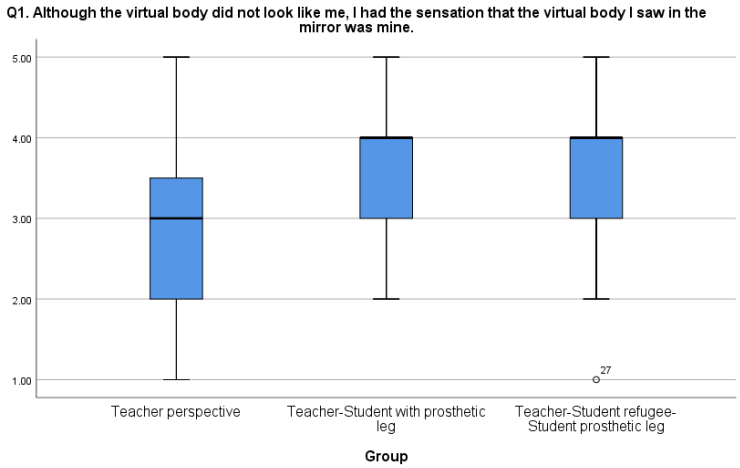


Figure 8-61: Mean score differences between the 3 groups related to Q4 of Presence scale

In conclusion, the results indicate low levels of sense of embodiment as the participants tended to score neutral to all embodiment items. It should be noted, that the low sense of embodiment could be related to the fact that the participants did not spend much time in the mirror scene that aimed to familiarize the users with their virtual body. The duration of time remaining in the mirror scene was at the participant's disposal, while instructions were provided by the researcher. Moreover, the participants were encouraged to remain in the scene and become familiar with their avatar. However, the participants seemed indifferent about the mirror scene, while they needed a lot of encouragement to look down and explore their virtual body, others remained completely static without even moving their head around and many selected to just move forwards remains a few seconds in the mirror scene. The target audience is teachers were not familiar with the sense of embodiment. This fact in combination with their limited time in the mirror scene and their unwillingness to become familiar with their virtual body

could be the explanation for the research outcomes related to the low levels of embodiment.

8.9.8 Part V – Overall evaluation of the VR application and experience

This section presents the analysis of the results concerning part IV of the questionnaire that had to do with the overall satisfaction of the users with the VR experience. The analysis includes the following tests (figure 8-62):

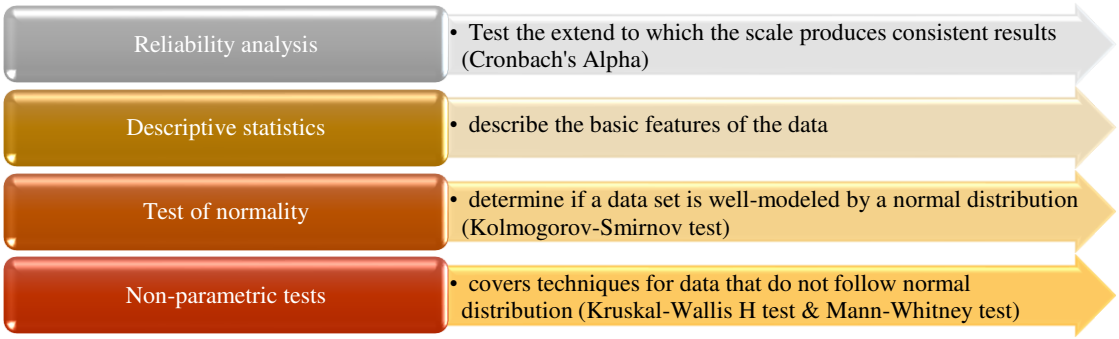


Figure 8-62: Tests carried out regarding the analysis of Part IV

8.9.8.1 Reliability analysis

Reliability analysis was conducted on the variables of part IV that had to do with the overall evaluation of the VR application and users' experience. According to the results (table 8-80), the overall alpha is 0.780>0.7 indicating high reliability of the variables.

Table 8-80: Reliability analysis for Part IV

Cronbach's Alpha	N of Items
.780	17

8.9.8.2 Descriptive statistics

Table 8-81 presents the distribution of the sample regarding the overall evaluation of the VR application, including the central tendency (Mean-M), the smallest (Minimum), and larger (Maximum) values and dispersion around the mean (Standard Deviation-SD). The results indicate that the participants were worried when virtual students narrated their stories (M=4.26, SD=0.68). However, according to the results, the participants did not see the need to understand the problems of the virtual students (M=4.42, SD=0.78),

and they did not seem to show much interest or concern regarding the problem(s) they experienced as they tended to score neutral (M=3.32, SD=1.38). Moreover, the participants tended to agree that they felt emotionally attached to their virtual character (M=3.65, SD=0.94). Nevertheless, the results indicate that the participants tried to understand the problem(s) that they were facing (M=4.17, SD=1.03), while they tried to put themselves in the position of the virtual character to empathize with his problem (M=4.15, SD=0.79). As far as participants' ability to see things from the virtual character's perspective, according to the results the participants tended to be from neutral to agree (M=3.74, SD=1.15). The frequency tables for the first seven items of Part V are presented in appendix D-8-23.

Table 8-81: Items of section I of Part IV

	N	Minimum	Maximum	Mean	Std. Deviation
1. I was worried when the virtual students narrated their stories.	69	2.00	5.00	4.2609	.67850
2. I see the need to understand the virtual students' problems. (Reversed)	69	1.00	5.00	4.4203	.77471
3. I felt emotionally attached to my own virtual character/representation.	69	1.00	5.00	3.6522	.93661
4. I showed much interest or concern regarding the problem(s) I experienced. (Reversed)	69	1.00	5.00	3.3188	1.37726
5. I made an effort to understand the problem(s) I was facing. (Reversed)	69	1.00	5.00	4.1739	1.02837
6. I tried to put myself in the position of the virtual character in an effort to empathize with his problem.	69	2.00	5.00	4.1449	.79104
7. It was easy for me to see things from the virtual character's perspective. (Reversed)	69	1.00	5.00	3.7391	1.14599
Valid N (listwise)	69				

According to table 8-82, the results indicate that participants found the virtual environment suitable as part of their practical training (M=4.19, SD=0.77). The participants found the eye-tracking interaction easy in use (M=4.46, SD=0.78), while they would not prefer to interact via using a hand-held controller (M=2.37, SD=1.21). The participants were satisfied with the quality of the sound (M=3.87, SD=0.95) as they tended to score well. Furthermore, the participants found the VR user-friendly (M=4.62, SD=0.55) and satisfactorily realistic (M=3.81, SD=0.79). The frequency tables for the six items are presented in appendix D-8-24.

Table 8-82: Items of section II of Part V

	N	Minimum	Maximum	Mean	Std. Deviation
1. The virtual environment seemed suitable for practical training.	69	1.00	5.00	4.1884	.77223
2. Eye-tracking interaction was particularly easy.	69	2.00	5.00	4.4638	.77800
3. I would prefer to interact within the virtual world via a hand-held controller.	69	1.00	5.00	2.3623	1.21233
4. Sound quality was	69	1.00	5.00	3.8696	.95352
5. The school classroom virtual (reality) simulation was satisfactorily realistic.	69	2.00	5.00	3.8116	.79104
6. I found virtual reality user-friendly.	69	3.00	5.00	4.6232	.54507
Valid N (listwise)	69				

During the VR training, the participants experienced two different classroom environments: 1) VR with classroom environment with the realistic appearance that was used during participants' training and familiarization with the virtual world and 2) a fantastic environment within which the participants experienced the main scenario. The participants were asked to choose the most favorite between the two environments. The results indicate that the vast majority of the participants (78%) preferred the fantastic classroom environment (see table 8-83 and figure 8-63).

Table 8-83: Participants' preference between real-life based VR environment and fantastic classroom environment

The following figures depict two of the virtual spaces that you have encountered during your experience. Please select the one you liked the most.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	VR with Realistic Appearance	15	21.7	21.7	21.7
	Fantastic classroom environment	54	78.3	78.3	100.0
	Total	69	100.0	100.0	

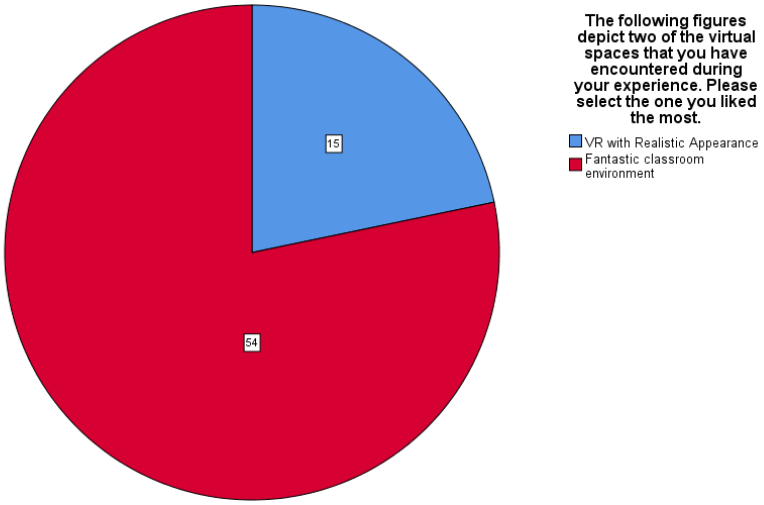


Figure 8-63: Participants' preference between real-life based VR environment and fantastic classroom environment

The results (table 8-84) indicate that the use of VR can facilitate the increase of empathy (M=4.45, SD=0.63). Additionally, most of the participants believe that VR can easier cultivate empathy than conventional traditional learning, as VR offers the opportunity to experience a situation from someone else's point of view for the users (M=4.22, SD=0.91).

Table 8-84: Cultivation of empathy via the use of VR

	N	Minimum	Maximum	Mean	Std. Deviation
1. The use of virtual reality may facilitate an increase in empathy.	69	3.00	5.00	4.4493	.63097
2. Virtual reality can easier cultivate empathy than conventional traditional learning, as virtual reality offers the opportunity to experience a situation from someone else's point of view for the users.	69	1.00	5.00	4.2174	.90537
Valid N (listwise)	69				

The participants were asked to choose from a 7-point Likert scale between training in a real-life environment (one edge of the Likert scale) and in a 3D virtual environment (the other edge of the Likert scale). The results indicate (table 8-85 and figure 8-64) that the majority of the participants lean towards training via using VR (M=4.74, SD=2.04) as most of them scored from undecided to the virtual classroom environment.

Table 8-85: Real-life classroom environment vs 3D virtual classroom environment

	N	Minimum	Maximum	Mean	Std. Deviation
If you could choose between conducting an educational activity in a real-life classroom environment and in a 3D virtual classroom environment, which would you choose?	69	1.00	7.00	4.7391	2.04114
Valid N (listwise)	69				

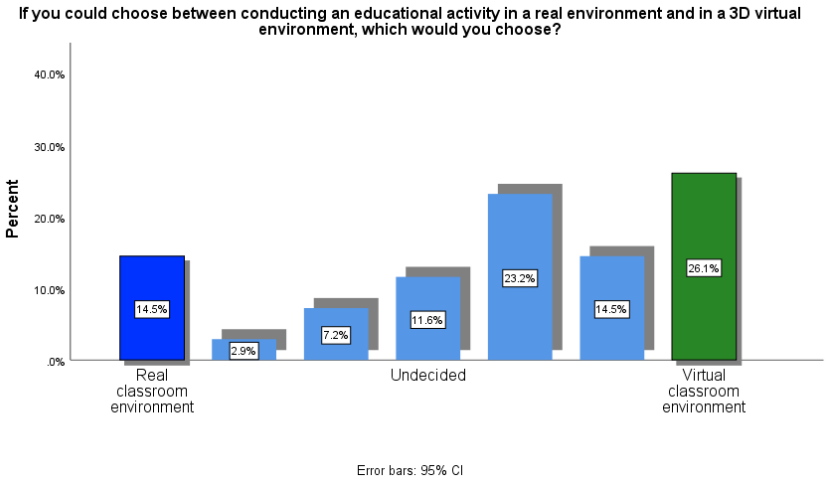


Figure 8-64: Participants' beliefs towards real-life classroom environment and 3D virtual classroom environment training

Moreover, the results indicate that the participants found the virtual training activity very pleasant as the vast majority scored from excellent to exceptional in the 7-point Likert scale (table 8-86). None of the participants scored towards the negative edge of the scale (figure 8-65).

Table 8-86: Overall user's VR training experience

	N	Minimum	Maximum	Mean	Std. Deviation
Overall, how pleasant would you characterize the virtual training activity?	69	4.00	7.00	6.1739	.96948
Valid N (listwise)	69				

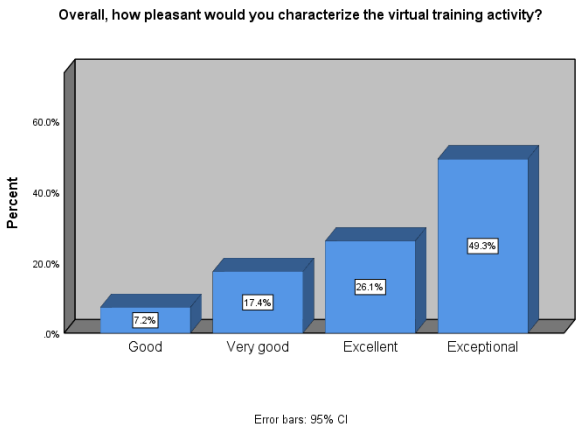


Figure 8-65: Overall satisfaction with the VR experience

8.9.8.3 Part V - Test of Normality and Non-parametric tests

A Kolmogorov-Smirnov test indicated that the sample did not follow a normal distribution, as $p = 0.000 < 0.05$ for all scale items (appendix D-8-25). Thus, non-parametric tests were used.

A Kruskal-Wallis H test revealed a statistically significant difference between the three groups for two items of the scale (table 8-87): 1) eye-tracking interaction and 2) satisfaction of the realism of the virtual classroom.

Table 8-87: Kruskal-Wallis H test to identify differences between the three groups

	Kruskal-Wallis H	df	Asymp. Sig.
I was worried when the virtual students narrated their stories.	.588	2	.745
I see the need to understand the virtual students' problems. (Reversed)	.689	2	.709
I felt emotionally attached to my own virtual character/representation.	2.111	2	.348
I showed much interest or concern regarding the problem(s) I experienced. (Reversed)	.024	2	.988
I made an effort to understand the problem I was facing. (Reversed)	.843	2	.656
I tried to put myself in the position of the virtual character in an effort to empathize with his problem.	1.098	2	.578
It was easy for me to see things from the virtual character's perspective. (Reversed)	5.636	2	.060
The virtual environment seemed suitable for practical training.	3.613	2	.164
Eye-tracking interaction was particularly easy.	6.352	2	.042
I would prefer to interact within the virtual world via a hand-held controller.	3.910	2	.142
The school classroom virtual (reality) simulation was satisfactorily realistic.	6.111	2	.047
I found virtual reality user-friendly.	2.725	2	.256
Sound quality was	.312	2	.856
The use of virtual reality may facilitate an increase in empathy.	.449	2	.799

Virtual reality can easier cultivate empathy than conventional traditional learning, as virtual reality offers the opportunity to experience a situation from someone else's point of view for the users.	1.312	2	.519
If you could choose between conducting an educational activity in a real environment and in a 3D virtual environment, which would you choose?	.370	2	.831
Overall, how pleasant would you characterize the virtual training activity?	1.184	2	.553

a. Kruskal Wallis Test

b. Grouping Variable: Group

According to Mann-Whitney test output, groups 2 (Teacher-Student with a prosthetic leg) found eye-tracking interaction easier than group 1 (Teacher perspective), (group 1 mean rank=4.04, group 2 mean rank=4.74), Z=-2.340, p=0.019 (table 8-88). Moreover, group 2 found the school classroom VR simulation more satisfactorily realistic than group 1, (group 1 mean rank=3.48, group 2 mean rank=4.00), Z=-2.142, p=0.032 (table 8-88).

Table 8-88: Mann-Whitney test for group differences regarding items of Part V

	Eye-tracking interaction was particularly easy.	The school classroom virtual (reality) simulation was satisfactorily realistic.
Mann-Whitney U	171.500	173.500
Wilcoxon W	447.500	449.500
Z	-2.340	-2.142
Asymp. Sig. (2-tailed)	.019	.032

a. Grouping Variable: Group

Mann-Whitney test also revealed a statistically significant difference between groups 3 (Teacher-Student Refugee-Student prosthetic leg) and group 1 (Teacher perspective) regarding the school classroom VR simulation. It seems that the participants of group 3 found the VR simulation more satisfactorily realistic than group 1, (group 1 mean rank=3.48, group 3 mean rank=3.96), Z=-2.110, p=0.035 (table 8-89).

Table 8-89: Mann-Whitney test for group differences regarding items of Part V

	2. Eye-tracking interaction was particularly easy.	5. The school classroom virtual (reality) simulation was satisfactorily realistic.
Mann-Whitney U	194.000	175.500
Wilcoxon W	470.000	451.500
Z	-1.716	-2.110
Asymp. Sig. (2-tailed)	.086	**.035**
a. Grouping Variable: Group		

A Kruskal-Wallis H test revealed a statistically significant difference between the genders for one item of the scale that is the use of the hand-held controller to interact within the virtual space. It seems that women would prefer to interact within the virtual world via a hand-held controller more than men (women mean rank=2.60, men mean rank=1.68), Z=-2.779, p=0.005 (table 8-90).

Table 8-90: Mann-Whitney test for gender differences regarding the use of the hand-held controller

	I would prefer to interact within the virtual world via a hand-held controller.
Mann-Whitney U	269.000
Wilcoxon W	459.000
Z	-2.779
Asymp. Sig. (2-tailed)	**.005**
a. Grouping Variable: 2. Gender	

No statistically significant differences were found related to participants' employment status and country. However, it should be noted that in terms of the country for one item a statistically significant difference was found. It seems that Cypriot participants tend to prefer more the use of a hand-held controller for interaction with the virtual world than the Greek participants (Greek participants mean rank=2.74, Cypriot participants mean rank=2.05) Z=-2.282, p=0.013.

To sum up, the participants indicated that VR is a suitable tool for practical training. Moreover, it seems that the vast majority of the participants preferred eye-tracking

interaction than a traditional hand-held controller. Additionally, the results revealed that the VR tool was user-friendly, and realistic enough. Regarding the virtual classroom environment, the participants preferred the imaginary setting over the real-life based. Equally important, is that the participants felt that a VR based approach can better enhance empathy skills compared to traditional training, due to the opportunity to change perspective and virtual bodies. Overall, the results indicated that the participants preferred to be trained via VR compared to traditional approaches.

8.9.9 Participant's choices related to the stories narrated by the virtual students

The participants had the opportunity to listen to five different stories, each related to a different virtual student and problematic situation. The participants had the opportunity to hear the stories in whatever order they wanted, listen to all of them, or make a choice. The results indicate (table 8-91 and figure 8-66) that most of the participants (34.8%) selected Joy's story as the first story to listen, followed by Bahar (29%), Ioanna (15.9%), Despina (13%) and Eleni (7.2%). It seems that the participants did not choose to begin listening to stories of avatars that reflected a problematic situation to their body, as Eleni with the prosthetic leg, or Despina with signs of anorexia.

Table 8-91: Participants' selection of 1st story to listen

		Cases	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Joy	Student Refugee	24	34.8	34.8	34.8
	Bahar	Muslim student	20	29.0	29.0	63.8
	Eleni	Prosthetic leg	5	7.2	7.2	71.0
	Ioanna	Burn injuries	11	15.9	15.9	87.0
	Despina	Anorexia	9	13.0	13.0	100.0
	Total		69	100.0	100.0	

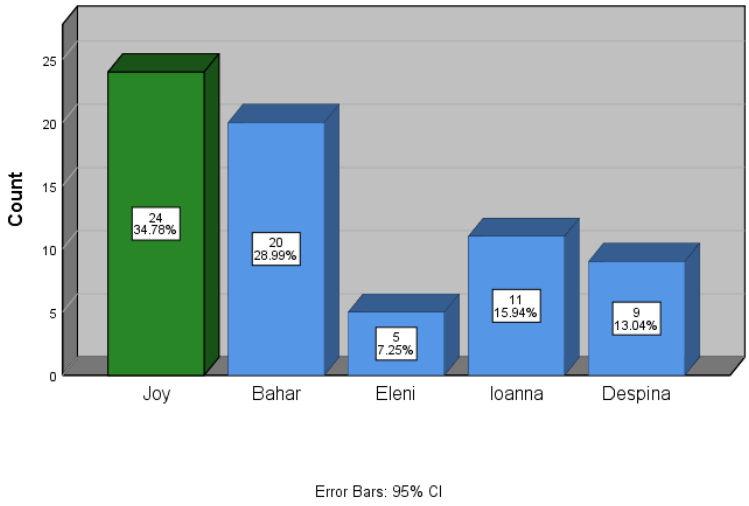


Figure 8-66: Participants' selection of 1st story to listen

As the second story to listen many of the participants (34.8%) had chosen Bahar's story, followed by Eleni's story (23.2%), Ioanna (17.4%), Despina (11.6%) and Joy (13%) (table 8-92 and figure 8-67).

Table 8-92: Participants' selection of 2nd story to listen

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Joy	9	13.0	13.0	13.0
	Bahar	24	34.8	34.8	47.8
	Eleni	16	23.2	23.2	71.0
	Ioanna	12	17.4	17.4	88.4
	Despina	8	11.6	11.6	100.0
	Total	69	100.0	100.0	

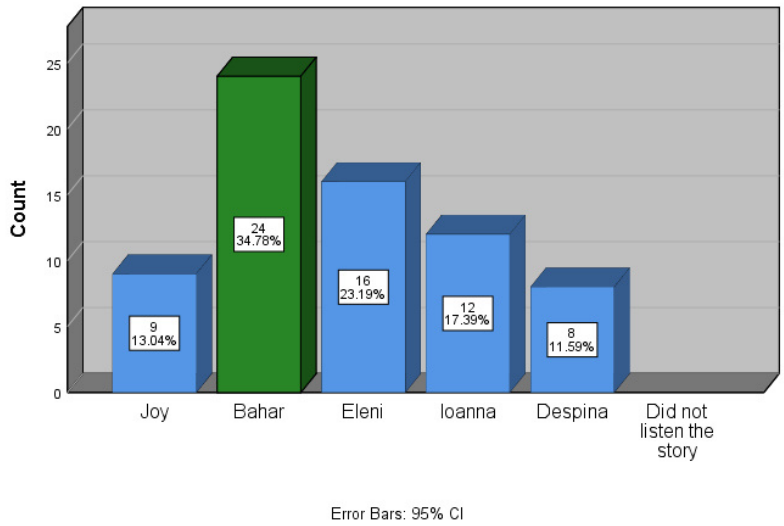


Figure 8-67: Participants' selection of 2nd story to listen

More than half of the participants (58%) listened to Eleni's story as their third choice, while one of the participants chose to listen only two of the five stories and terminated the application (table 8-93 and figure 8-68).

Table 8-93: Participants' selection of 3rd story to listen

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Joy	6	8.7	8.7	8.7
	Bahar	8	11.6	11.6	20.3
	Eleni	40	58.0	58.0	78.3
	Ioanna	8	11.6	11.6	89.9
	Despina	6	8.7	8.7	98.6
	Did not listen the story	1	1.4	1.4	100.0
	Total	69	100.0	100.0	

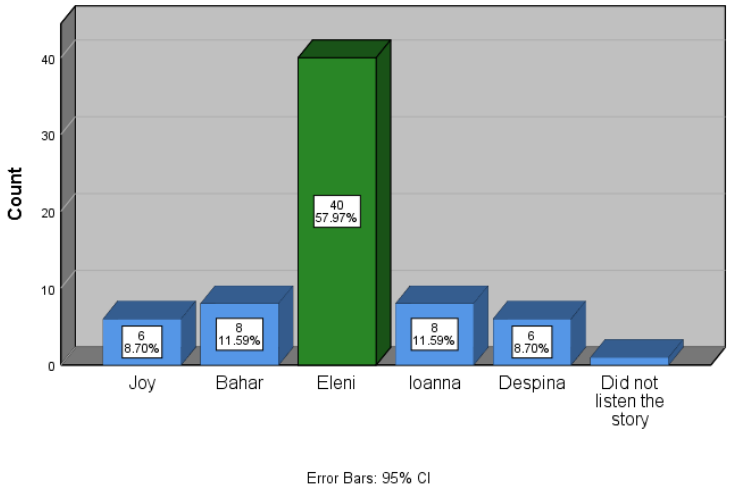


Figure 8-68: Participants' selection of 3rd story to listen

Nearly half of the participants (46.4%) listened to Ioanna's story as their fourth choice, while three of the participants chose to listen only three of the five stories and terminated the application (table 8-94 and figure 8-69).

Table 8-94: Participants' selection of 4th story to listen

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Joy	7	10.1	10.1	10.1
	Bahar	15	21.7	21.7	31.9
	Eleni	3	4.3	4.3	36.2
	Ioanna	32	46.4	46.4	82.6
	Despina	9	13.0	13.0	95.7
	Did not listen the story	3	4.3	4.3	100.0
	Total	69	100.0	100.0	

Half of the participants (49.3%) listened to Despina's story as their final choice, while five of the participants chose to listen only four of the five stories and terminated the application (table 8-95 and figure 8-70).

Crosstabulation and non-parametric tests did not reveal any statistically significant differences between the three groups, the gender, the country, or the employment status of the participants.

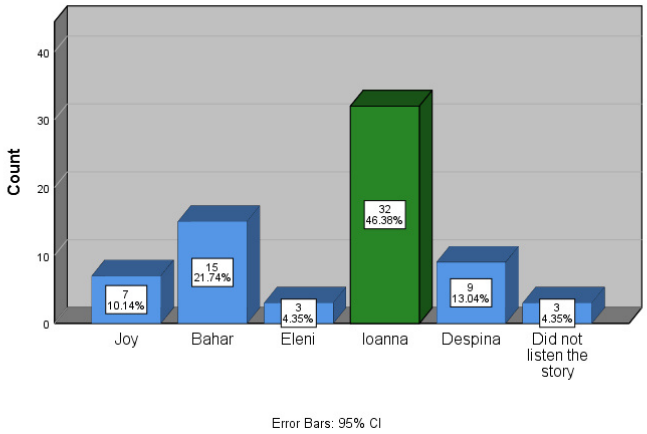


Figure 8-69: Participants' selection of 4th story to listen

Table 8-95: Participants' selection of 5th story to listen

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Joy	19	27.5	27.5	27.5
	Bahar	2	2.9	2.9	30.4
	Eleni	4	5.8	5.8	36.2
	Ioanna	5	7.2	7.2	43.5
	Despina	34	49.3	49.3	92.8
	Did not listen the story	5	7.2	7.2	100.0
	Total	69	100.0	100.0	

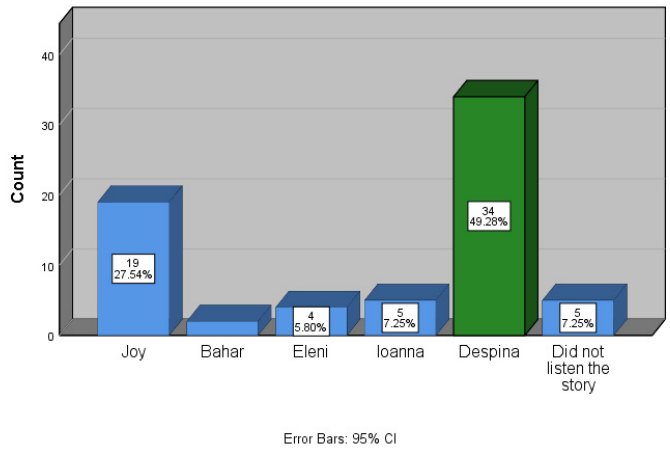


Figure 8-70: Participants' selection of 5th story to listen

In conclusion, the results indicate that most of the participants choose to begin listening to the stories of Joy-student refugee and Bahar-Muslim students. It seems that they avoided choosing at first visually impaired student avatars such as Eleni-student with a prosthetic leg, Ioanna-student with burn injuries, and Despina-student facing anorexia. There is a possibility that the visually impaired virtual students frightened them and as the participants were also unfamiliar with VR experiences, they had chosen to start from cases that they thought were simpler. On the other hand, it is possible that the participants have chosen the cases in order, starting from Joy and then Bahar, who was sitting next to the avatar of Joy.

8.9.10 Participants' advice to the virtual students

The participants had the opportunity to give their advice to their virtual students. However, the results indicate that the vast majority of the participants did not want to give any advice or suggestion to the virtual students. More particularly, according to tables from 8-96 to 7-100 over 70% of the participants chose not to give any advice to none of the five virtual students. The graphical representations (figures 8-71 to 8-75) present the high percentage of participants that chose not to provide any advice to the virtual students.

Table 8-96: Participant's advice given to the 1st selected virtual student

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Joy	7	10.1	10.1	10.1
	Bahar	7	10.1	10.1	20.3
	Ioanna	3	4.3	4.3	24.6
	Despina	2	2.9	2.9	27.5
	Did not gave advice	50	72.5	72.5	100.0
	Total	69	100.0	100.0	

Table 8-97: Participant's advice given to the 2nd selected virtual student

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Joy	2	2.9	2.9	2.9
	Bahar	7	10.1	10.1	13.0

	Eleni	6	8.7	8.7	21.7
	Ioanna	2	2.9	2.9	24.6
	Despina	1	1.4	1.4	26.1
	Did not gave advice	51	73.9	73.9	100.0
	Total	69	100.0	100.0	

Table 8-98: Participant's advice given to the 3rd selected virtual student

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Joy	3	4.3	4.3	4.3
	Bahar	1	1.4	1.4	5.8
	Eleni	8	11.6	11.6	17.4
	Ioanna	2	2.9	2.9	20.3
	Despina	1	1.4	1.4	21.7
	Did not gave advice	54	78.3	78.3	100.0
	Total	69	100.0	100.0	

Table 8-99: Participant's advice given to the 4th selected virtual student

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Joy	1	1.4	1.4	1.4
	Bahar	1	1.4	1.4	2.9
	Ioanna	8	11.6	11.6	14.5
	Despina	1	1.4	1.4	15.9
	Did not gave advice	58	84.1	84.1	100.0
	Total	69	100.0	100.0	

Table 8-100: Participant's advice given to the 5th selected virtual student

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Eleni	1	1.4	1.4	1.4
	Despina	7	10.1	10.1	11.6
	Did not gave advice	61	88.4	88.4	100.0

Total	69	100.0	100.0	

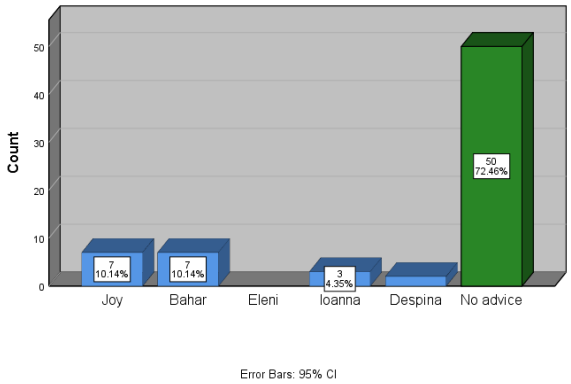


Figure 8-71: Participant's advice given to the 1st selected virtual student

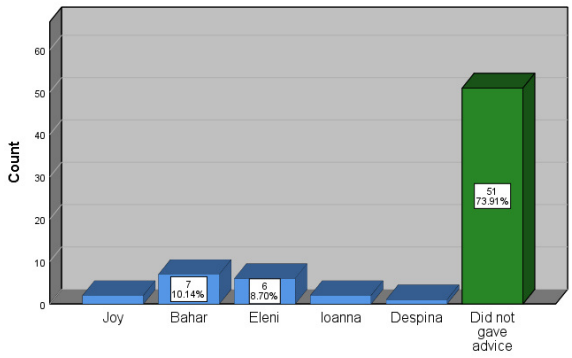


Figure 8-72: Participant's advice given to the 2nd selected virtual student

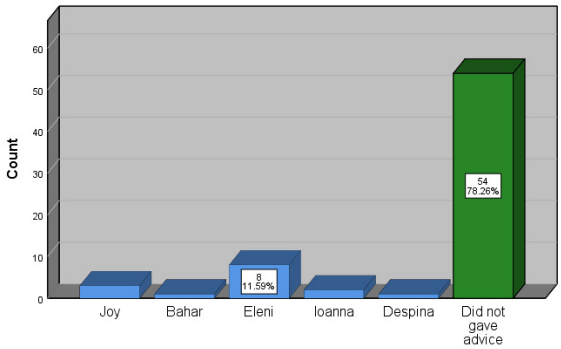


Figure 8-73: Participant's advice given to the 3rd selected virtual student

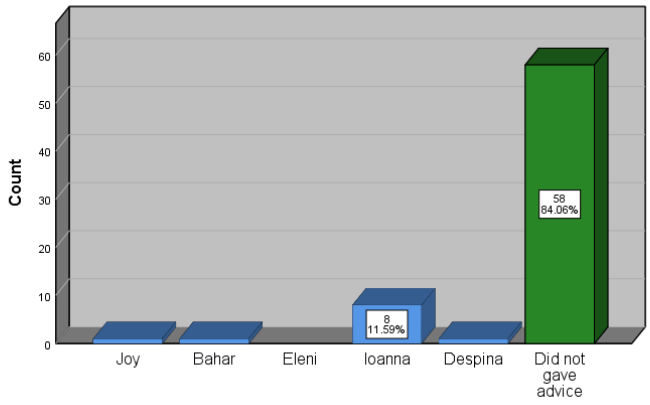


Figure 8-74: Participant's advice given to the 4th selected virtual student

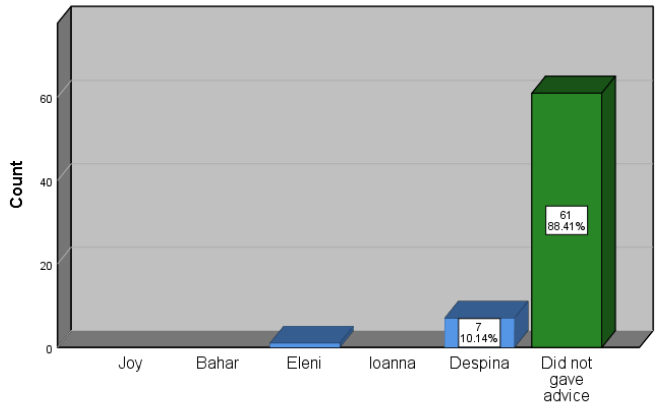


Figure 8-75: Participant's advice given to the 5th selected virtual student

Crosstabulation and non-parametric tests did not reveal any statistically significant differences between the three groups, the gender, the country, or the employment status of the participants regarding counseling the students.

To conclude, the participants had the opportunity to provide advice to their virtual students. Yet, most of the participants choose instead of speaking, to listen only to the advice provided by the system. A possible reason for that might be the fact that their answers were recorded, to create a pool of good practices that could be used for the future development of the application. Moreover, another problem for the participants was the presence of the researcher in the room. This made them feel uncomfortable because they felt that their conversation with the virtual student was not private. It was

well explained to the participants that there is no right and wrong advice, but the recording aimed to gather data that can be implemented in the application in future use. Moreover, the recording at the future could be used as part of the training, so that the mentor can hear the advice provided by the trainee for reflection purposes, and thus at this point, there was also the need to test if the recording worked appropriately. Undoubtedly, the fact that the presence of the researcher made the participants highly anxious and nervous as far as providing advice is concerned is understandable, yet as teachers, they face serious cases and with students with whom they are unfamiliar and they must be able to respond effectively to any problematic situation that might arise. Hence, their unwillingness to provide and advice due to the presence of the experiment moderator seemed an excuse and fear of being judged for the advice provided. This particular outcome is quite interesting and at the same time indicates that teachers still need a lot of practical training, as they have a lot of fear that they need to overcome. The possibility of facing a serious incident is daily, and they will not always be prepared for it. Providing advice without being ready is definitely a challenge, yet a reality.

8.9.11 Minutes in VR

Regarding the time the participants remained in the virtual space, there are differentiations. According to table 8-101, the minimum time the participants remained was 9 minutes, and the maximum time 23 minutes. The mean time was M=14.2 minutes (SD=3.36). Table 8-102 present analytically the time within the virtual space for all the participants.

Table 8-101: Mean time the participants remained within the virtual space

	N	Minimum	Maximum	Mean	Std. Deviation
Minutes in VR	69	9.00	23.00	14.2609	3.36352
Valid N (listwise)	69				

Table 8-102: Time within the virtual space for all the participants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	9.00	5	7.2	7.2	7.2
	10.00	6	8.7	8.7	15.9

11.00	5	7.2	7.2	23.2
12.00	6	8.7	8.7	31.9
13.00	5	7.2	7.2	39.1
14.00	10	14.5	14.5	53.6
15.00	11	15.9	15.9	69.6
16.00	6	8.7	8.7	78.3
17.00	4	5.8	5.8	84.1
18.00	4	5.8	5.8	89.9
19.00	2	2.9	2.9	92.8
20.00	1	1.4	1.4	94.2
21.00	1	1.4	1.4	95.7
22.00	2	2.9	2.9	98.6
23.00	1	1.4	1.4	100.0
Total	69	100.0	100.0	

A comparison between the three groups revealed statistically significant differences as presented in table 8-103 and figures 8-76 and 8-77. The participants of group 1 (Teacher perspective) remained lower time within the VR environment than the participants of the other two groups (mean score for group 1: M=11.9, SD=0.56, mean score for group 2: M=14.6, SD=0.58, mean score for group 3: M=16.3, SD=3.19).

Table 8-103: Mean score differences related to the time spend in VR per group

Minutes in VR					
Group	Mean	N	Std. Deviation	Minimum	Maximum
Teacher perspective	11.9130	23	2.66139	9.00	18.00
Teacher-Student with prosthetic leg	14.6087	23	2.75910	11.00	22.00
Teacher-Student Refugee-Student prosthetic leg	16.2609	23	3.19399	10.00	23.00
Total	14.2609	69	3.36352	9.00	23.00

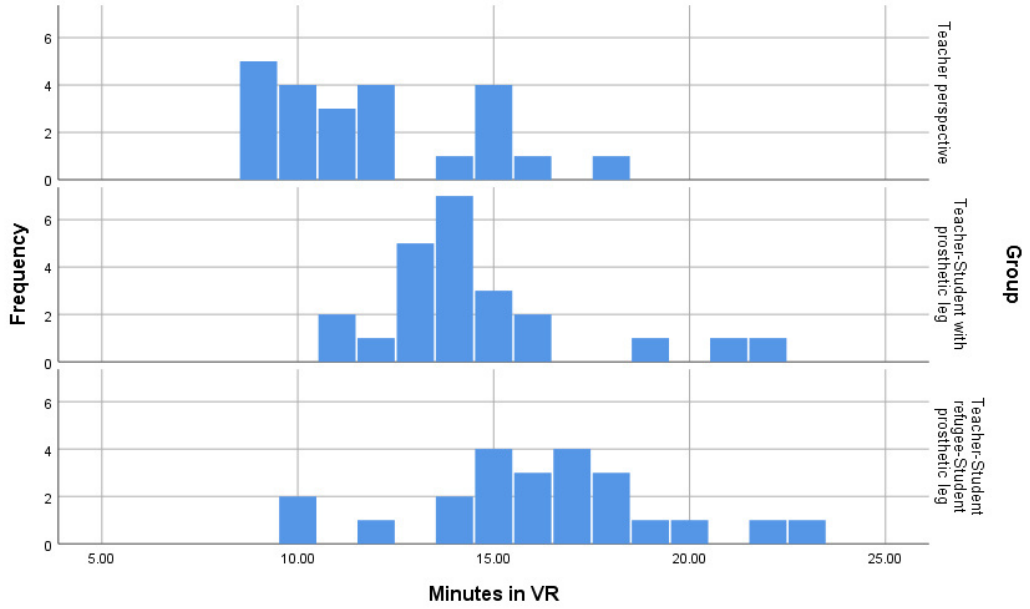


Figure 8-76: Differences between the three groups related to the time spend within VR

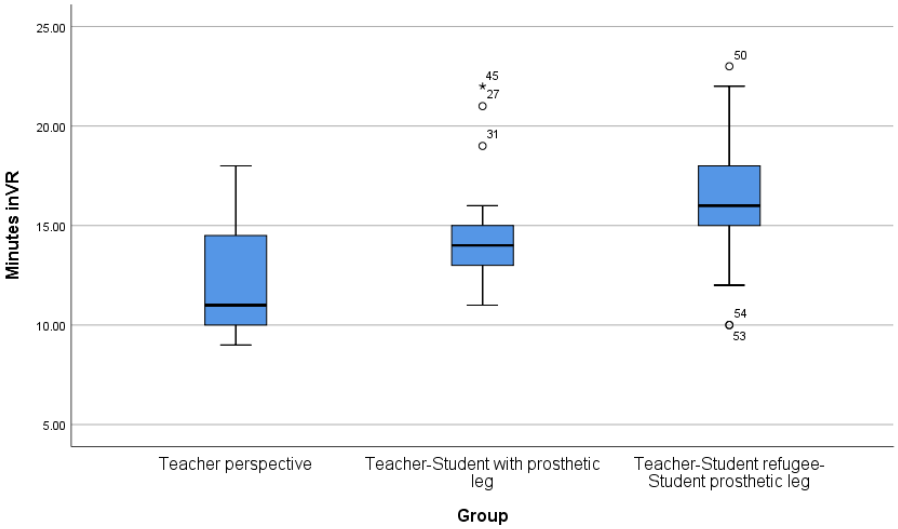


Figure 8-77: Differences between the three groups related to the time spend within VR

A Kolmogorov-Smirnov test indicates that the two groups do not follow a normal distribution, D(23)=0.18, p=0.045 and D(23)=0.24, p=0.001 (table 8-104). As only one of the groups follows a normal distribution, non-parametric tests were used for the comparison of the three groups related to the time spent within the VR environment.

Table 8-104: Normality tests for the three groups regarding time spend in VR

Tests of Normality

	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Minutes in VR	Teacher perspective	.183	23	.045	.891	23	.017
	Teacher-Student with prosthetic leg	.239	23	.001	.835	23	.001
	Teacher-Student Refugee-Student prosthetic leg	.129	23	.200*	.963	23	.521

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

A Kruskal-Wallis H test showed that there was a statistically significant difference in time within VR score between the three groups, $\chi^2(2) = 20.738$, p = 0.000 (table 8-105), with a mean rank pain score of 21.11 for Group 1, 36.04 for Group 2 and 47.85 for Group 3 (table 8-106). It seems that the participants of the third group remained more time within the VR environment. This could be explained by the fact that the participants of this group could experience three different perspectives, that the teacher, of the student Refugee and that of the student with the prosthetic leg. The same applies to group 2, as the participants were able to experience two different perspectives. On the contrary, the participants of the first group experienced only one perspective, thus their time within the virtual space was clearly less.

Table 8-105: Kruskal-Wallis H test to investigate the difference between the three groups related to time in VR

	Minutes in VR
Kruskal-Wallis H	20.738
df	2
Asymp. Sig.	.000

a. Kruskal Wallis Test

b. Grouping Variable: Group

Table 8-106: Mean rank for each group

Ranks			
	Group	N	Mean Rank
Minutes in VR	Group 1: Teacher perspective	23	21.11
	Group 2: Teacher-Student with a prosthetic leg	23	36.04
	Group 3: Teacher-Student Refugee-Student prosthetic leg	23	47.85
	Total	69	

8.9.12 Analysis of Correlations Between Variables

Correlation analysis is used to investigate possible relationships between the variables of the different scales. More particularly, the aim of using this method is to identify if there are possible connections between emotion variables; empathy variables; emotion and empathy variables; emotion and presence scale; emotion and embodiment scale; empathy and presence scale; empathy and embodiment scale; and part IV that had to do with user's overall experience with all the scales.

The bivariate Pearson Correlation was used to measure the strength and direction of linear relationships between pairs of variables. Correlations estimate the strength of the linear relationship between two variables and range from -1.0 (perfect negative correlation) to 1.0 (perfect positive correlation). The closer correlation coefficients get to -1.0 or 1.0, the stronger the correlation is.

The null hypothesis (H_{null}) and the alternative hypothesis (H_{alt}) of the significance test for correlation are the following:

H_{null}: $\rho = 0$ (the population correlation coefficient is 0; there is no significant relationship)

H_{alt}: $\rho \neq 0$ (the population correlation coefficient is not 0; there is a statistically significant relationship)

Hinkle et al. (2003), define correlations into five categories presented in table 8-107:

Table 8-107: Correlations categorization according to Hinkle et al. (2003)

.90 to 1.00 (−.90 to −1.00)	Very high correlation
.70 to .90 (−.70 to −.90)	High correlation
.50 to .70 (−.50 to −.70)	Moderate correlation
.30 to .50 (−.30 to −.50)	Low correlation
.00 to .30 (.00 to −.30)	Negligible correlation

IBM SPSS[10] define correlations into three main categories presented in table 8-108:

Table 8-108: Correlations categorization according to IBM SPSS

.6666 to 1.00 (−.6666 to − 1.00)	Strong correlation
.3333 to .66660 (−.3333 to −.6666)	Medium correlation
.00 to .3333 (.00 to −.3333)	Weak correlation

According to the results that are organized based on IBM SPSS categorization, the following correlations were found:

- positive high and moderate correlations between the variables provision of advice to the virtual students (appendix D-8-26). It seems that participants who decided to provide advice to the first virtual student they choose to listen, were more likely to provide advice to the rest of the virtual students;
- strong and moderate correlations between the items of the pre-emotional scale (appendix D-8-27);
- strong and moderate correlations between the items of the post-emotional scale (appendix D-8-28);
- strong and moderate correlations between the items of the presence scale (appendix D-8-29);
- strong, moderate and weak correlations between the items of the embodiment scale (appendix D-8-30);

[10] Further information can be found in the following link https://www.ibm.com/support/knowledgecenter/en/SS3RA7_15.0.0/com.ibm.spss.modeler.help/statistics_correlationlabels.htm

- medium correlations between variables of the pre-emotional scale and variables of the post-emotional scale (appendix D-8-31);
- moderate correlations between items of the pre-empathy scale (appendix D-8-32);
- moderate correlations between the variables of post-empathy scale (appendix D-8-33);
- moderate correlations were identified between items of the presence and the embodiment scale (appendix D-8-34);
- moderate and weak correlations between the variables of Part IV items that referred to the user's overall VR experience (appendix D-8-35);
- moderate correlations between the variables of Part IV and the variables of the post-emotional scale (appendix D-8-36);
- moderate and weak correlations were identified between variables of Part IV and variables of the post-empathy scale (appendix D-3-37);
- moderated and weak correlations between variables of Part IV and variables of the presence scale (appendix D-3-38);
- moderate and weak correlations between variables of Part IV and variables of the embodiment scale (appendix D-8-39).
- No statistically significant correlations were found between post-empathy and presence scale.
- No statistically significant correlations were found between post-empathy and presence scale, apart from one weak correlation.
- No statistically significant correlations were identified between the variables of the presence scale and the variables of the post-emotional scale.
- No statistically significant correlations were identified between the variables of the embodiment scale and the variables of the post-emotional scale.
- No statistically significant correlations were found between post-empathy and embodiment scale, apart from a weak correlation.
- No statistically significant correlations were found between post-empathy and presence scale.

All correlations found have been categorized as strong, moderate, and low and are presented as a whole and in detail in appendix D-840.

8.10 Qualitative input from the participants

After the end of the experiments, 32 of the participants gave a 3-5-minute interview and provided significant feedback that indicates the positive impact of the VR environment and the potential and added value of such a training tool for teachers. Although during the experiments qualitative data, in the form of interviews, was collected, the data was not analyzed in detail. For the needs of the current research, the qualitative input was used mainly to reinforce the findings derived from the quantitative data, rather than deriving conclusions. As part of the future work qualitative analysis of the collected data will be conducted as a means of further exploring the effect of VR-based teacher training.

The main points and comments from participants' interviews are presented in table 8-109. In total, the participants found the VR experience interesting and a completely new approach. Those who experienced only the perspective of the teacher reported that they felt like observers and would like to be able to experience also the perspective of the student. The participants also stated that perspective taking helped them enter somebody else's shoes and understand the problem, while it seems that the disorder with the prosthetic leg stressed them and touched them.

Table 8-109: Participant's comments and suggestions

Participant 1	Felt like an observer as experienced only teacher's perspective Would like to see the scenario from the perspective of the student The VR experience elicited strong emotions *'I felt that this meeting was really happening, and I was present'* (participant's comment)
Participant 2	VR experience elicited high levels of stress to the participant due to the problematic cases and the participant did not select to hear all student's stories Interesting experience *'I felt that I succeeded… 'Such an environment could become an educational tool because it brings you to confront situations that in real life we tend to avoid…My virtual environment reminded me of my classroom, it was familiar and made me feel comfortable in it'* (participant's comment)
Participant 3	Extremely interesting experience *'The stories touched me as I have been bullied as a student… 'This the tool can be used for teacher training'* (participant's comment)

Participant 4	*'The VR environment is very nicely designed, thoughtful. It was an interesting experience that motivated me to go deeper into VR technology…it is a tool that can be used to cultivate empathy better than traditional teaching approaches…it helped me enter the other's position. It can also be used in elementary schools to increase student's interest'* (participant's comment)
Participant 5	Quite interesting
Participant 6	*'I would like more of the scenario. A great experience…I would like more interaction with virtual students. It can help in cultivating empathy by entering somebody else's position'* (participant's comment)
Participant 7	*One of the cases had happened to me and I was very upset…it put you in another person's position either you want it or not…the combination of technology and traditional education will be the ideal as we must take advantage of technology and all its benefits'* (participant's comment) Felt like an observer as experienced only teacher's perspective
Participant 8	Interesting Recorded voices and not from computer
Participant 9	*'Very nice tool…I am interested in using such an approach to cultivate empathy in my students, as I had an autistic student and I needed to cultivate empathy in the rest of the classroom'* (participant's comment)
Participant 10	*This was the first time I had a VR experience and it was really nice…changing perspectives was very important, as I understood that what I said as an educator was something that anyone would say, so I had to deal with problems otherwise…I was surprised when I changed body and felt more active'* (participant's comment)
Participant 11	*'Very interesting and I liked perspective taking'* (participant's comment)
Participant 12	*A very interesting experience…when I entered the student's body with the prosthetic leg, I was shaking mine to make sure it was in place. I felt uncomfortable in the position of the teacher because my education did not seem to be enough to advise the students. Swapping bodies can help cultivate empathy.* (participant's comment) More interaction between the user and the avatar you have to make the problem more intense *'The girl who had trouble walking, it would help if you could see a bit of her daily routine and when the scenario ends everyone leaves she could walk slowly'* (participant's comment)
Participant 13	*'I was literally in the other's position and I felt like the other when I changed body…Not all problems would have the same impact on me…I don't consider appearance problems important…the scenario with the prosthetic leg was the most frightening'* (participant's comment)

Participant 14	*'Interesting…I felt more comfortable in the position of trainer…In the position of the person with the prosthetic leg, I felt uncomfortable…It was very important to see the problem through the eyes of a person with a disability'* (participant's comment)
Participant 15	*'Very unprecedented experience…I wanted more interaction…I saw the students as an observer in the teacher's position, but when I changed perspective there was a difference'* (participant's comment)
Participant 16	*It was nice…mixed emotions…I was not sure that the advice I gave was the right one…the transition to the other's position was very real even though at first as a teacher I didn't think it could be so plausible…the transition from the teacher's body to the student's problem position helped a lot especially with the prosthetic leg, which I saw my virtual body as the student…the cases were very realistic'* (participant's comment)
Participant 17	*'Beautiful experience…changing body helped me see the problem..the change of perspective makes you see things differently'* (participant's comment)
Participant 18	*'Very nice…I looked down and felt like I had her body…I admired the way she presented herself…as a trainer, I felt like an observer…this tool can help a lot in cultivating empathy…the problem is presented in a way that you can understand and coincide with the virtual student… It shows you both the problem and the acceptance, keeping subtle balances that help you coincide and not only see the negative side of the problem'* (participant's comment)
Participant 19	*'I coincided more with the female student with the prosthetic leg than with the foreign student…I would like to have more equipment and be able to see the prosthetic leg to understand the problem..it helps as a tool for cultivating empathy'* (participant's comment)
Participant 20	*'Very nice…it can cultivate empathy and feel like someone else…virtual reality has more to do with a traditional role-playing game…One of my children has hearing loss and is wearing a headset. This causes teasing. The teacher could not grasp the problem and help the child adjust to the headset…disabilities should also be included in the scenarios e.g. autism'* (participant's comment)
Participant 21	*'The environment was familiar…the advice given by the virtual teacher is very well worked…we can get ideas as teachers…I made a great effort to understand the problem of virtual students'* (participant's comment)
Participant 22	*'Very nice… I would prefer giving advice at the end, after seeing the scenario, seeing the teacher's side, then seeing the pupil's perspective, and then returning to the teacher's position to give the advice…I would like equipment to feel the prosthetic leg…there could be times when students' experimentation with a video can be shown, for example, to make the problem more comprehensible'* (participant's comment)
Participant 23	*I felt sad, I didn't want to see all the stories…virtual reality may help one see the problem but it depends on the perspective'* (participant's comment)

Participant 24	*'Great experience…I have a child with severe intellectual disability and I find that such a tool can help one get into another's position…more cases of autism, down syndrome, and other disabilities…incidents that are difficult for the trainer and a stomach punch…the teacher should be able to write their experience somewhere, with the aim of becoming an educational scenario…special education needs to be addressed as teachers are not well trained'* (participant's comment)
Participant 25	*'Great job and experience…you literally step into the other's shoes…it is a very powerful experience…it is worth getting into schools as teacher's training tool'* (participant's comment)
Participant 26	*'Very good…changing perspectives helped me understand the problem'* (participant's comment)
Participant 27	*'Changing bodies and perspective helped me to get into the other's position virtually…the teacher's advice is about the same and should be differentiated, for example, the anorexic student should be given the advice to give her a boost'* (participant's comment)
Participant 28	*'Interesting enough…if I could look beyond the teacher's perspective and also experience the student's perspective it might help'* (participant's comment)
Participant 29	*'Very nice and from a technical point, the colors were great…changing the perspective helped me get into the other's position and when all your classmates were looking at you it was easier to grasp the problem'* (participant's comment)
Participant 30	*'It was very good…I would like to get into the position of the students…it can help cultivate empathy'* (participant's comment)
Participant 31	*'The scenarios were not pleasant…changing the perspective helped me understand the difference'* (participant's comment)
Participant 32	*'Nice experience, something new and interesting…I tried to understand what the student was feeling…It can help cultivate empathy'* (participant's comment)

8.11 Conclusions

In this chapter, the experimental set up of the third experiment was presented along with the aims of the research and the research questions. The scenario, the application development, and the research tools used were explained in detail during the first part of the chapter. In the second part of the chapter, the main findings regarding the research questions were analyzed. The general conclusions based on the findings are the following:

RQ 1. To what extent did the VR intervention affect participants' emotional state?

The results indicate that the VR intervention had an impact on participants emotions' and mood states. More particularly, the VR experience increased participants' interest and inspiration, while it made them feel more active, confident, determined, and concentrated. On the other hand, the participants also felt more tired, sad, and upset, and the use of the VR application.

RQ 2. To what extent did the VR intervention affect participants' empathy?

According to the results, the VR intervention elicited a statistically significant change in many empathy items. It seems that the VR experience increased participants' ability to understand others better by imagining how things look from their perspective. Moreover, the participants' scores were increased regarding their ability to identify that there are two sides to every situation and try to look at them both. After the VR intervention participants' score was increased regarding their ability to try to imagine how they would feel if they were in their place of someone else before criticizing him/her. After the VR experience, the participants tended to feel sorry at higher levels for other people when they are having problems. Additionally, the participants tended to score higher regarding their sympathy for people who cause their own serious illnesses and felt more protective towards someone being taken advantage of.

RQ 3. To what extent did participants feel present in the virtual environment?

High levels of presence were identified, which means that the participants felt present within the virtual classroom space. The results of the current research verified the results of the initial experiment previously described in chapter 6. During this initial evaluation where an EEG device was also used along with questionnaires, the results indicated the accomplishment of a sense of presence. Based on the results of the initial evaluation the same virtual classroom space was used for this final experiment. At this stage and as the aim of the research is the design of a system easy in use within the school environment, no EEG devices were used as the previous experiment proved the sense of presence in the space. However, to investigate whether the results of this experiment will confirm the results of the previous one, sense of presence was investigated through questionnaire use and the results indicated that once more the participants had the sense of actually being there in a scene of the virtual classroom. Achieving high levels of sense of presence is of paramount importance as participants' belief that they are part of the virtual environment, allows them to react as if they were

in the real world, making VR a unique and powerful tool at their disposal for their practical training.

RQ 4. To what extent did the virtual environment affect participants' sense of embodiment?

The results indicate medium levels of sense of embodiment as the participants tended to score neutral to all embodiment items. This could be explained by the fact that there was no use of equipment such as Kinect that could allow the virtual avatar to follow the movements of participants' bodies. At this stage, the current research aims to develop a tool that could be used for teacher training within the school environment. Thus, the equipment used had to remain limited only to the necessary VR equipment. Moreover, a training tool for a target group like teachers must be flexible and easily transferable, thus, having also equipment as Kinect was difficult to move around the schools.

RQ 5. To what extend did the different perspectives affected participants' emotions?

ANOVA outputs indicate that the VR intervention had a statistically significant effect on participants' emotions and mood states between the two times in time (before and after the VR intervention), independently to the group to which they belonged to.

RQ 6. To what extend did the different perspectives affected participants' empathy?

ANOVA repeated measures revealed that perspective-taking had an impact on the cultivation of empathy skills. Empathy means scores are increased significantly for two of the three groups, and particularly for the groups: 2) Teacher-Student with a prosthetic leg and 3) Teacher-Student Refugee-Student prosthetic leg. For the teacher perspective, the change in empathy is not statistically significant. It seems that the participants who experienced only the teacher's perspective felt more than observers of the stories/cases. Moreover, the lack of body change did not allow them to experience problems through the eyes of virtual students.

RQ 7. To what extend did the different perspectives affected participants' sense of presence?

The results did not reveal statistically significant differences between the three groups. Even though the participants of the group that experienced only teachers' perspective and remained less time that the participants of the rest of the groups, they also felt as being part of the virtual classroom space.

RQ 8. To what extend did the different perspectives affected participants' sense of embodiment?

Participants' perspective-taking affected participants' sense of embodiment. Nonparametric tests revealed a statistically significant difference in embodiment scores between the 3 groups. For group 2- Teacher-Student prosthetic leg, the sense of embodiment was statistically significantly higher than group 1 - Teacher perspective. Moreover, for group 3 - Teacher- Student Refugee-Student prosthetic leg the sense of embodiment was statistically significantly higher than group 1 - Teacher perspective. Thus, the change of virtual bodies and the experience of the problems via another perspective affected the participant's sense of embodiment.

Furthermore, the outputs of the research revealed that:

- The participants preferred eye-tracking interaction instead of the hand-held controller.
- The participants found the virtual environment suitable for practical training.
- The participants preferred a more fantastic virtual environment than real-life based.
- The participants preferred to start listening to stories of virtual students that had no external appearance problems (e.g. prosthetic leg, burn injuries).
- Most of the participants did not provide virtual students with any advice.
- Several correlations (strong, moderate, weak) were identified among the various scales.

9 Conclusions

This chapter presents the conclusions derived from the finding of the current research. Moreover, the chapter presents the contribution of the research and the limitations that were encountered during the process. Furthermore, the current research led to results that posed new research challenges and questions for the future that are presented in the chapter.

9.1 Introduction

The rapid technological advancements of last years shaped the future of education. Educational technology initiated a transformational change in the education sector and posed new challenges without precedent. Lately, new technologies like VR, augmented reality (AR), machine learning, serious gaming, entered the classroom remodeling it, and promoting new technology-based approaches. In this new context, the traditional role of the teacher inevitably changed, while technology forces teachers to become designers and developers of technology-based training resources to promote personalized learning for every student along with the overall quality of education.

Without a doubt, the needs of the 21st-century classroom have changed, and the role of the teacher needs to be in line with today's classroom needs. From a unique source of knowledge, the 21st-century teacher has become the facilitator of knowledge, the creator of innovative classroom environments, in which each student that has different learning needs can conquer individually and acquire the skills, competences, and knowledge necessary for a sustainable and prosperous future in a global society and labor market.

Despite the extreme changes and challenges, teachers still hold the key position within the educational system as not only they encourage learning, but they constitute the most important role-models for the students, with a significant impact on their personal and academic development. Teaching is one of the most important professions and teachers hold the key for student's successful performance not only within the school but also in life. Hence, the improvement of the teaching profession has become a priority across all European countries but also globally. Investment in teacher education is preserved of paramount importance to upgrade their skills, strengthen the teaching profession, and promote their continuous professional development.

Lately, many efforts have been made to implement innovative technology-driven approaches in education, particularly to enhance students' development. As far as teacher education is concerned, in the last few years, there are some attempts to implement more innovative and technology-based methods, including serious gaming (Foley & McAllister, 2005; Sotiriou & Stavroulia, 2015; Stavroulia, 2015; Stavroulia et al., 2016), desktop VR (Dieker et al., 2007; Dieker et al., 2008; Zibit & Gibson, 2005; Gibson & Halverson, 2004) and augmented reality (AR) (Lee, 2012; Salmi et al., 2012), however, the use of those means remains extremely limited. Moreover, many existing applications are desktop-based and do not provide highly immersive and engaging experiences for teachers.

To address today's needs and promote the professional development of teachers via technology-based methods, the current research proposes an innovative VR-based framework for teacher education. This need arose from the lack of practical training during initial teacher education (ITE) but also the various life-long training programs that are mostly theoretical. Teachers struggle for practical training and for the acquisition of the skills and competences that today's digital and multicultural classrooms demand, yet they feel that their needs are not taken into consideration when the various training programs are being designed.

The current research aims to provide an innovative VR training tool that can address this gap between theory and practice and can provide teachers (both in-service and pre-service) the safe training space that they need to maximize their skills and competences. Within a virtual classroom space, teachers can understand the culture of the teaching profession, the nature of teaching and learning, and can confront various student problems and challenges. VR can provide a safe space for experiential training, minimizing the potential risk to real students, while at the same time the knowledge and skills gained within the virtual context can be applied in the real classroom. Additionally, the development of 'extreme' scenarios could allow teachers to be trained via simulated stressful conditions that would be difficult to simulate in a real classroom setting.

The proposed VR training tool benefiting from modern technological advancements in the field of VR, used high-quality HMDs, as far as the VR equipment is concerned, to provide the users a highly immersive, engaging, and motivating virtual experience. The

innovation of the proposed VR tool lies in the fact that it used VR equipment and goes beyond providing a desktop experience as a few attempts so far in the field of teacher education. Moreover, this is the first time that the problem of inadequate practical training in teacher education has been addressed via a VR based methodology, while the implementation of the VR application followed a full designed cycle, a five-phase process with the active involvement of the target group.

Equally important, the development of the VR application is linked to both strong theoretical foundations in education derived from the documented literature and real teachers' problems based on extensive literature analysis and survey. During the whole research process, from the very beginning to the very end, there were strong communication and collaboration channels with education experts (teachers, counselors, and school psychologists), resulting in the development of a VR tool from teachers for teachers. The active involvement of the target group maximized the added value of the proposed VR tool as the tool meets the real and everyday classroom needs of teachers. From the early stages, it became clear that co-designing with the target group was a one-way process, otherwise, there was the risk of providing a training tool with no added value and thus indifferent for teachers.

Today's teachers must be prepared for tomorrow's challenges. Teachers should not be afraid of change but be open to the implementation of new, innovative technology-based tools. VR-based approaches can be used to train the trainer teachers, providing them with the necessary knowledge, skills, and competences to deliver effective training to others.

9.2 Reflections with regards to the research questions

This research aimed to investigate the potential of using modern and innovative technology-based approaches and more particularly VR to promote the professional development of teachers and address the lack of practical training.

The main research question that constitutes the fundamental core of this thesis research project is the following:

> *RQ. Can a virtual reality-based learning paradigm be used for the professional development of teachers?*

To address the core research question and investigate the potential of using a VR-based framework as part of teacher education and training, a multiphase design (MD) model was used consisting of five phases. The first stage of the work involved extensive literature research regarding the problems and the challenges in teacher education that revealed the lack of practical training as a major issue for in-service and pre-service teachers. This training gap was confirmed with a focus group and a survey that took place, revealing problems and challenges that teachers face in their everyday life and identifying thematic areas of paramount importance for teacher training. The data gathered during this first phase of the research formed the basis for the design of the training scenarios that represented modern problems and challenges maximizing also the added value and the impact of the tool.

At a second stage, the identification of the targeted skills and competences was also of paramount importance as the prototype application cannot address all the skills and competences described in well-established competence models. Once more, based on the suggestions made by the target audience, empathy was selected as the key competence to address, and VR is one of the most suitable means to enhance empathy skills. Student diversity was indicated to be a major challenge for today's teachers, who must promote the successful performance of the classroom but also of each student individually. In-service teachers stated how important it is to be able to enter the position of the student and suggested that this must be the first step for every teacher. Understanding the students and the problems that they face is the only way to implement the appropriate teaching strategies in the classroom, in which 'every child matters' and has equal opportunities in knowledge.

The third stage concerned the development of the training scenarios (phase III). In total, three scenarios were designed, developed, and evaluated. The scenario concerned multiculturalism, substance use, diversity, and student disorders (prosthetic leg, anorexia, skin disorders, external appearance issues-burn injuries). All the cases were based on real-life incidents coming both from the literature and from suggestions of education experts and school psychologists. All the scenarios were developed within the VR application (phase IV) in close collaboration with the target population who provided continuous feedback. For example, based on feedback from teachers it was

determined that a more fantastic rather than a replica of the real classroom VR environment was more suited for the VR-based training tool.

Finalizing the VR application was a long process of designing, evaluating, and modifying. Through constant evaluations (phase V), feedback of paramount importance was gathered by education experts leading to a VR prototype application with added value and a positive impact on the users. Three experiments were conducted aiming to investigate specific parameters that were significant for the design of the VR training tool.

The first experiment aimed to investigate the VR training space versus traditional teaching within the real physical space in terms of effectiveness. Additionally, the experiment aimed to investigate possible differences between the two virtual worlds that were designed (fantastic vs real-life based) and also explore the levels of presence that is essential for providing the user an immersive experience. Moreover, the experiments aimed to measure participants' emotional reactions, along with their empathy and reflection skills. Apart from the use of a questionnaire as an instrument to gather the data, an EEG device was also used to measure the levels of presence for more reliable results.

The outcomes of the research revealed that virtual training prevailed in physical space training, indicating the high value of using VR-based approaches in teacher practice. The results indicate that VR can be a cost-effective and alternative way to traditional role-playing games for teacher training. Moreover, VR can address practical drawbacks of the role-playing method during the training sessions, such as the ability to enter the another persons' body and experience a situation through his/her eyes, feeling uncomfortable in roleplay situations, or teachers' lack of feedback and experience with particular student cases. Additionally, VR-based approaches could save time as organizing a role-playing training activity is time-consuming, while it also demands many people-acting as actors depending on the scenario. The experience gained through this research journey indicates that teachers are a difficult target group to reach due to their schedule, while time is precious for their daily routine. Role-playing activities are difficult to implement for constant training, hence, VR can provide an alternative training paradigm for constant training and in line with teachers' schedules.

Moreover, the sense of presence was achieved and was confirmed both from the questionnaire and the EEG results. What is more, there were indications that the group trained in the fantastic classroom space were more immersed, however, this difference was not statistically significant. Nevertheless, the EEG results revealed differences for the group trained in the fantastic classroom space regarding the occipital lobe, which is the visual processing center of the brain. It seems that the fantastic design of the virtual classroom activated participants' visual attention mechanisms as they were within an unfamiliar world that they needed to explore and process. Hence, according to the current research and target audience, there are indications that the exact visual realism might be less important for providing an immersive experience to teachers and deliver high-quality VR-based teacher training. This result initiated another survey to determine the preferences of the target audience regarding the design of the virtual classroom and the results identified that the target population prefers to be trained in a more fantastic environment.

Furthermore, the results of the first experiment revealed that the VR intervention triggered several positive and negative emotional reactions to the participants. Empathy-skills assessment revealed the participant's empathetic respondence in all groups, with no statistically significant differences between them. Furthermore, the research outcomes revealed that although reflection was considered important for all groups, those who were trained in the physical classroom space were more neutral and undecided when compared to those trained using a VR-based tool.

The first experiment resulted in several modifications concerning the VR tool and the organization of the second experiment that aimed to investigate the levels of presence and the impact of the different perspectives (teacher/student drug user/ healthy student) that the participants experience affected their presence. Another important objective was to evaluate the impact of the VR experience on participants' emotions and empathy skills and whether the different perspectives impacted also emotions and the cultivation of empathy. The scenario of the second experiment was related to substance use in the school environment.

An EEG device was also used during the second experiment to measure the sense of presence and also investigate potential differences between the different perspectives.

Moreover, a fitness wristband was used to record the participant's heart rate providing data related to their physiological reactions during the VR intervention.

The results of the second experiment indicated as far as the questionnaire is concerned that the sense of presence was achieved. However, the EEG results revealed that levels of presence were achieved but not for all perspectives. Participants' brain waves entered the alpha state that is associated with the sense of presence only for the perspective of the students (the student-drug user and the healthy student) and not for the teacher's perspective. It seems that the perspective of the teacher made the participants feel just as observers, while in the perspective of the student made them feel like part of the problem. Hence, the outcome of the experiment was significant as perspective-taking is the key to make someone enter the shoes of someone else's problem.

Concerning the cultivation of empathy skills, the VR intervention elicited a statistically significant change for two empathy items (difficulty to relate to students going through drug problems and understanding student's drug-related problems). However, one of those two items is of paramount importance as it concerns the ability of a teacher to enter 'the shoes of the student' and experience any problem through the student's eyes. Additionally, according to the results, perspective-taking also impacted participants' empathy, as those who experience the student drug-student perspective after the VR intervention felt closer to a student facing drug-related problems. Perspective-taking and the experience of the drug-related symptoms that were described in the scenario section had an impact on the participants and helped them understand the problem via the eyes of the student.

What is more, the results revealed that the VR intervention elicited a statistically significant change in the participant's negative emotions and mood states. Before the VR experiment, the participants did not feel negative emotions, however, the VR experience had a strong impact on their negative emotions and mood states for both groups, while perspective taking did not elicit a statistically significant difference.

The results of the second experiment were of paramount importance as the outcomes regarding the impact of perspective-taking led to several modifications related to the way perspective-taking was approached for the final application and experiment. Equally important is that the sense of presence was confirmed once more and was also confirmed by the EEG device.

The results of the second experiment led to further improvements and modifications to the VR tool and the organization of the third and final experiment, which aimed to investigate the impact of the implementation of the VR tool on participants' empathy skills. The VR environment was developed with the vision to enhance participants' empathic skills by placing them 'in another person's shoes', to experience a different perspective and understand the various problems that students face. Moreover, another significant objective was the investigation of the impact of the VR system on participants' emotions and mood states. Furthermore, two more key variables under investigation were the sense of presence and embodiment as they contribute significantly to the user's experience in a virtual world. Additionally, another significant factor under investigation was perspective-taking and its impact on the aforementioned parameters. The scenario concerns five students facing a problematic situation: a student refugee; a Muslim student; a student with a prosthetic leg; a student with burned skin and a student facing anorexia.

According to the results, the most significant outcome is that the VR intervention elicited statistically significant changes in many empathy items, increasing participants' ability to understand others better by looking at things from a point of view other than our own. Moreover, the results revealed that empathy's scores were increased significantly for two of the three groups, and particularly for the groups: 2) Teacher-Student with a prosthetic leg and 3) Teacher-Student Refugee-Student prosthetic leg. For the group that experienced only the teacher's perspective, the change in empathy was not statistically significant. Hence, it seems that the participants who experienced only the teacher's perspective felt more than observers of the stories/cases. The lack of body change did not allow them to experience problems through the eyes of virtual students. On the other hand, those participants who experienced perspective-taking were able to reflect on the various cases from the students' point of view, experiencing the problematic situation through the students' eyes. This result is of paramount importance, as it confirmed previous indications from experiment two concerning empathy and perspective-taking. Undoubtedly, VR is a strong empathic means that can provide teachers a unique perspective-taking experience that '*can offer more than traditional role-playing games*' (participant's comment), or desktop VR and serious games cannot support.

The results indicated that the VR intervention had an impact on participants emotions' and mood states. More particularly, the VR experience increased positive emotions. Additionally, the VR intervention had a statistically significant impact on participants' emotions and mood states between the two times in time (before and after the VR intervention), independently to the group to which they belonged to. '*The stories touched*' (participant's comment) the participants.

High levels of presence were identified, verifying the results of the previous two experiments and particularly of the first experiments as the same virtual classroom space was used. Achieving high levels of sense of presence is of paramount importance as participants' belief that they are part of the virtual environment, allows them to react as if they were in the real world, making VR a unique and powerful tool at their disposal for their practical training.

Another significant outcome regarding the design of the VR system concerns the eye-tracking interaction instead of a hand-held controller. For the final experiment eye-tracking interaction was used and the participants found it easy and friendly in use.

In conclusion, all three experiments identified that the graphical representation of the virtual classroom space elicited the participant's sense of presence, which is a key point for the success of a VR system. Moreover, the results revealed the impact of the VR intervention on participants' emotions and mood states, which are considered to play a key role in motivation (Izard, 1991) and might also be linked to the sense of presence (Rodriquez et al., 2015). Equally important is the impact of the VR intervention on the cultivation of empathy skills. This outcome is of paramount importance, leading to the implementation of new technology and VR-based approaches in teacher education and training to promote the cultivation of empathy skills via a challenging perspective-taking approach that puts the user '*literally in the other's position feeling like the other when changing body*' (participants' comment). Furthermore, it seems that teachers do not wish to be trained in a virtual environment replica to a real classroom. Hence, the needs of the target audience must be taken into serious consideration when designing and developing a virtual world, as their needs might be different from the developer's vision.

9.3 Contributions

The current research led the foundations for teacher practical training via using immersive VR-based approaches and opened new doors for further improvements and research in the field. Moreover, the research contributed to the enhancement of the existing knowledge regarding the use of immersive VR-based approaches as part of teacher practical training. This research proposed the implementation of a novel VR training tool as a method for practical training and cultivation of teachers' empathy skills that have not been previously addressed at least to the best of our knowledge.

Equally important is that the investigation of using VR as a potential training tool revealed the positive impact of such a mean on teachers' ability to enter the perspective of the student, cultivating their empathy skills. As one of the participants mentioned the '*VR experience was really nice…changing perspectives was very important, as I understood that what I said as an educator was something that anyone would say, so I had to deal with problems otherwise…I was surprised when I changed body and felt more active*'.

Additionally, the research contributed to understanding the target audience regarding user-centered design issues. Research data revealed that teachers do not prefer to be trained in virtual environments replica of their real classrooms, yet, they also suggested after the experiments that they want to be able to intervene in the design of the virtual classroom environment within the VR application. This outcome is significant as there are serious indications that teachers need to feel that they are in control even in issues related to the design of the virtual space, which might make them feel more open towards such innovative training tools. For instance, one of the participants mentioned that although she liked more the fantastic environment, she would like to have the ability to choose both virtual classrooms (real-life and fantastic) based on her needs. Hence, the current research indicated that when designing training tools for this target audience, it is essential to take into serious consideration their beliefs and needs, otherwise, there is a risk of impacting negatively the added value of the tool under development. The level of visual realism or even the scenario alone might not be enough for a target audience as teachers, if they are not actively participated as co-designers helping the developer reflect their needs and preferences when designing and

developing the tool or application. One major lesson learned thought this research journey is that teachers are still skeptical towards technology-based approaches and it is of strategic importance to make them understand the added value of a new tool to be used by them.

This research proved that VR could provide a new paradigm in teacher education and training, supporting teachers to re-shape their perceptions and role in a modern classroom and society that are constantly and dynamically changing. Additionally, the research resulted in the development of a VR prototype training tool, that can be the first step towards the development of a large-scale VR application that can be used for the lifelong professional training of teachers, strengthening the teaching profession and the quality of education itself. Most importantly, this research pointed out that such a technology can be used to provide teachers a safe training environment for experiential learning, experimentation, and reflection, but without the risk of harming real students. The research provided evidence of the effectiveness of VR in teacher education and training, yet further research is required to determine its effectiveness and use in the field.

The most significant outcome of this research journey concerns the potential of enhancing teachers' professional development and empathy competences via perspective-taking. This research opens a new door in the acquisition of key competences including empathy via VR-based methodology, while it also posed new challenges to the existing European competence models as many of which analyzed for the current research do not include empathy as a core skill. Perspective-taking helped the participants experience a problematic situation through the eyes of the person facing the problem, increasing their empathy. As one of the participants mentioned '*changing body helped me see the problem..the change of perspective makes you see things differently*'. Perspective-taking was the key to the increase of empathy skills, as the control group who experienced only the perspective of the teacher felt like observers. As one of the participants' mentioned '*I saw the students as an observer in the teacher's position, but when I changed perspective there was a difference*'. Hence, VR leads to a more supportive training tool for teachers that can lead to more empathetic results than traditional role-playing approaches, where a teacher must act as an actor but cannot change body and must imagine somebody else's situation. VR can go a step beyond,

offering users the ability to '*literally step into the other's shoes*' enter his/her body and see the problem through his/her eyes that is '*a very powerful experience*' (participants' comment).

Last but not least, this research is a novel approach, as immersive VR applications with the use of VR headsets have not been used so far to empower the professional development of teachers, at least to the best of our knowledge. This is the first attempt to address the real need for practical training via using a VR-based framework co-designed by teachers for teachers.

9.4 Limitations

Several research limitations and challenges arose during the current research that impacted or influenced the results of the study. This research does not provide a complete picture of the use of VR-based approaches in teacher education as the main constrain is the low number of teachers participating during the experiments. Hence, the results cannot be generalized for this target population. It is significant for a research study to have a sufficient sample size of the target audience to conclude valid research results. The larger the sample size, the stronger the results will be. The small sample size indicated the potential of using a VR-based training approach, yet the results cannot be generalized.

This main constrain is strongly related to the target audience itself, as teachers are a difficult sample to approach due to the tight schedule but also due to their unwillingness to participate in the research and devote time out of their working hours. Additionally, many of in-service and experienced teachers considered the research as an excuse to evaluate them, their teaching practice and skills, and although the researcher explained in-details the objective of the research as part of a Ph.D. research study, many of them remained skeptical during the VR tool evaluation process, which could have resulted in participants that did not provide their true beliefs and opinions when answering questionnaires. However, the problem was addressed by the researcher by providing once more details about the aims of the research assuring teachers that their skills are not under evaluation. The best way to approach the target population and overcome the problem was to use snowball sampling techniques. The snowball sampling technique was used to approach teachers from the researcher's friendly and family-friendly

environment, who then were used as informants indicating other individuals in the same group who were also used as informants. This technique allows the establishment of trust between the researcher and the target audience and increased the number of participants especially during the third experiment. Approaching teachers for the network of the researcher resulted in the first actively involved teachers. Then, those teachers inspired and motivated by the proposed work reached other teachers and communities of teachers via their networks.

Approaching the sample was certainly a challenge, especially during the first two experiments that were conducted with the use of EEG devices. Because of the use of the EEG devices the experiments had to be conducted in a space determined by the researcher, which means that the teachers had to visit the space after working hours. This was a challenge as the experiment took place in Geneva and teachers had to be motivated and paid to come to the location pointed out by the researcher. This resulted in the participation of researchers and trainers from the University of Geneva, who possed university teaching experience. Moreover, during the first experiment with the use of the Biosemi active two 64 channel EEG that required the use of gel to the hair, it was extremely difficult to approach women to participant due to the inconvenience caused by the application on the gel.

Using EEG devices was definitely a challenge during the first and second experiment, as combining an EEG device with the VR headset was difficult. In the first case, as Biosemi required the connection of 64 electrodes, the vast majority of the participants had to hold VIVE without wearing it as it caused disconnection of the signal. In the second case, it was easier to combine EMOTIV EPOC with Oculus Rift after removing the earphones of the HMD. Undoubtedly, using EEG was challenging, however, it was also essential and provided significant feedback related to the designed VR environments, the levels of presence, the importance of perspective-taking, and the potential of VR use when compared to traditional physical training approaches. As the VR tool was designed and developed from scratch, EEG information was a necessity to define whether the VR tool was in the right direction. During the last experiment, no EEG or equipment was used apart from the Oculus Rift VR headset, as the aim was to evaluate an easy in use VR system with no devices that would make it difficult for the life of the participants. Moreover, the vision is to provide teacher education an easy in

use and low-cost tool that teachers could use it for training purposes anywhere and anytime, without having to use additional complex devices. Nevertheless, using an EEG instrument provides significant information posing new challenges related to whether its use is essential to determine a new VR tool under development, especially for training purposes.

The lack of prior research studies on the topic of immersive VR approaches to teacher education and training was another challenge, as there were a few research studies to form the basis of the literature review and provide the framework for understanding the problem under investigation. However, investigating the use of VR-based methods in teacher education was a multi-complex problem to address, since apart from the challenge of developing the VR tool from scratch, the pedagogical aspects, the problems, and needs of teacher education had also to be addressed to provide a tool with added value for the target audience.

Furthermore, another limitation was the language, as the VR tool had to be in the Greek language. As a result, it was not possible to test the tool in other European countries and investigate its impact maximining the significance of the tool. This, however, is one of the future plans, as the scenario will be translated in English to test in other educational contexts across Europe.

To conclude, several limitations occurred during the current research as it happens to every research. However, it should be noted that the researcher made all the actions necessary to address and overcome the challenges that arose minimizing their impact in the research process.

9.5 Future work

The results of the research revealed the potential of using VR in teacher training and the positive impact in the professional development of teachers. The current research and the VR prototype application could form the basis for the development of a large-scale dynamic VR training tool that in the long-term could be implemented as part of teacher practice from ITE to life-long training. The results and participants' comments after the VR implementation identified the added value of the VR tool for all teachers. Equally important is that the participating teachers in the experiments suggested the further

development of the tool and gave significant feedback that will form the basis for future modifications and research in the field.

Developing new scenarios is a future priority, as it seems that teachers seek training regarding more difficult student cases, particularly regarding students with special learning needs including autism or Down syndrome. However, teachers also suggested other problems such as hearing disorders, but autism was suggested by several participants. Another important outcome from the discussions with the participants is the ability for teachers to provide feedback for the scenarios. This is of paramount importance as the main aim of the current research was the development of a VR dynamic training tool. Hence, in the long-term, the aim is to connect the VR training tool with teachers, giving them the ability to provide real-life incidents that happened in the classroom, which can be transferred and developed in the virtual world as the scenario. Establishing a strong connection with teachers and constant exchange of feedback not only will result in a dynamic training tool that meets their needs, but it will also promote the sustainability and the added value of the tool in the future. Furthermore, with many experienced teachers retiring, a significant amount of experience will be lost in the near future. Thus, it is essential to gather this experience and provide a mentoring tool for future generations of teachers. In this context, the VR training tool will also provide an advanced evaluation and feedback system for the users, to promote their reflection that will increase their understanding, their knowledge and skills, and their teaching quality.

Apart from the development of new scenarios, technical modifications will also be made in the future regarding the recording of human voices, more interaction between the user and the virtual students, and the use of Artificial Intelligence (AI) in the virtual students to support conversations between users and virtual characters. Additionally, in the future users' evaluation systems and feedback will be upgraded aiming to provide also real-time advice when used in the presence of the trainer/mentor. Moreover, the recording system during the scenario that offered the possibility to the users to provide advice to the virtual students worked perfectly from a technical point, however, the users did not feel confident to give a piece of advice. More motives will be given to the users, to provide the virtual students with advice aiming to collect feedback that could serve for the exchange of good practices among teachers.

Furthermore, undoubtedly, the economic crisis does not allow most educational institutions such as schools to buy expensive VR equipment like VIVE or Oculus Rift. For this reason, the next step will be to develop the VR application in an android edition, as the only requirements are a relatively good android mobile phone and a low-cost VR headset. However, further research is essential to explore the impact of the VR application and the different VR equipment. What is more, the VR application is currently available only in Greek and will be translated in English to be tested across other European countries.

This research opened new doors for further research in the field of teacher education via using VR-based approaches. More skills and competences are to be addressed in the future along with a more in-depth analysis of the impact of the use of VR in teacher education. One thing is for sure that future steps include the active involvement of the target audience because only understanding the needs of the target population can lead to a successful and sustainable outcome that has an added value.

9.6 Concluding remarks

This dissertation presented a research journey towards the implementation of new and innovative technology-based approaches in teacher education. VR was proposed as a new teacher training paradigm that can provide teachers with highly immersive and engaging activities and scenarios that can enhance skills of paramount importance such as empathy. VR-based approaches can form a new strategy for professional development activities for teachers. When technology is carefully implemented and applications or training tools are designed and developed based on the needs of the target audience, it can support effective teaching and learning strategies. Integrating technology, such as VR, in teacher education is a one-way process imposed by the transformation and modernization of education. VR can offer the teaching profession significant advantages and unique training experiences and resources through a range of teaching and learning strategies. VR training tools like the one developed under the current project can be part of the teacher's innovative professional toolbox leading to highly qualified teachers, empowered to succeed in the global sustainability challenge.

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APPENDIX A-4-1

Letter for the school director asking for permission to conduct the focus group (in Greek)

Cyprus University of Technology
30 Archbishop Kyprianou Str.
3036 Lemesos, Cyprus
Tel.: +357 25002569, Fax: +357 25002698
E-mail: andreas.lanitis@cut.ac.cy

Λεμεσός, 1 Ιουνίου 2016

Τεχνολογικό Πανεπιστήμιο Κύπρου
Τμήμα Πολυμέσων και Γραφικών Τεχνών

Αξιότιμε/η κ. Διευθυντή/ρια,

Στα πλαίσια εκπόνησης διδακτορικής διατριβής με θέμα την χρήση τεχνολογικών μέσων για την εκπαίδευση των εκπαιδευτικών, στο τμήμα Πολυμέσων και Γραφικών Τεχνών, Τεχνολογικό Πανεπιστημίου Κύπρου, γίνεται προσπάθεια για την δημιουργία ενός καινοτόμου εκπαιδευτικού εργαλείου Εικονικής Πραγματικότητας για την περαιτέρω εκπαίδευση των εκπαιδευτικών. Για τον σχεδιασμό του εικονικού συστήματος ώστε αυτό να εξυπηρετεί πραγματικές εκπαιδευτικές ανάγκες, είναι απαραίτητη η διερεύνηση των απόψεων και εμπειριών των εκπαιδευτικών, προκειμένου να διαγνωστούν οι ανάγκες τους για θέματα επιμόρφωσης. Οι συμμετέχοντες στην διαδικασία θα κληθούν να απαντήσουν ένα ερωτηματολόγιο, με προβλεπόμενο χρόνο συμπλήρωσης τα 20-25 λεπτά. Επιπροσθέτως, όσοι από τους συμμετέχοντες επιθυμούν θα κληθούν να συμμετάσχουν σε συνέντευξη ατομική ή ομαδική από την ερευνήτρια, με προβλεπόμενο χρόνο περίπου 20-25 λεπτά. Η συμμετοχή στην έρευνα είναι εθελοντική, ενώ θα διασφαλιστεί η ανωνυμία των συμμετεχόντων και τα δεδομένα που θα συλλεχθούν θα χρησιμοποιηθούν αποκλειστικά για τις ανάγκες της έρευνας.

Παρακαλούμε όπως, επιτρέψετε τη διεκπεραίωση της έρευνας στο δικό σας σχολείο.

Με εκτίμηση,

Καλλιόπη Σταυρούλια (Διδακτορική Φοιτήτρια)
Μεταπτυχιακή Συνεργάτης, Τμήμα Πολυμέσων και Γραφικών Τεχνών
Σχολή Καλών και Εφαρμοσμένων Τεχνών

και

Ανδρέας Λανίτης (Επιβλέπων Καθηγητής)
Αναπληρωτής Καθηγητής, Τμήμα Πολυμέσων και Γραφικών Τεχνών
Σχολή Καλών και Εφαρμοσμένων Τεχνών

APPENDIX A-4-2

Letter for the school director asking for permission to conduct the focus group (in English)

Cyprus University of Technology
30 Archbishop Kyprianou Str.
3036 Lemesos, Cyprus
Tel.: +357 25002569, Fax: +357 25002698
E-mail: andreas.lanitis@cut.ac.cy

Limassol, 1 June 2016

Cyprus University of Technology
Department of Multimedia and Graphic Arts

Dear Sir / Madam,

In the framework of the Ph.D. research on the use of technological tools for teacher education, at the Department of Multimedia and Graphic Arts, at Cyprus University of Technology, we aim to develop an innovative Virtual Reality educational tool for teacher education. In order to design the virtual system to meet real educational needs, it is necessary to explore the views and experiences of teachers in order to diagnose their real training needs. Participants in the process will be asked to answer a questionnaire, with a scheduled completion time of 20-25 minutes. Additionally, those who wish to participate will be invited in an individual or group interview by the researcher, with an estimated time of approximately 20-25 minutes. Participation in the survey is voluntary and will ensure the anonymity of the participants and the data collected will be used exclusively for research purposes.

Please, allow the research to be completed in your own school.

Yours sincerely,

Kalliopi Stavroulia (PhD candidate)
Postgraduate Associate, Department of Multimedia and Graphic Arts
Department of Fine and Applied Arts

και

Andreas Lanitis (Supervisor Professor)
Associate professor, Department of Multimedia and Graphic Arts
Department of Fine and Applied Arts

APPENDIX A-4-3

Consent form (in Greek)

Ερωτηματολόγιο Εκπαιδευτικού

Έντυπο Συγκατάθεσης

Αγαπητοί εκπαιδευτικοί,

Το παρόν ερωτηματολόγιο, στα πλαίσια της διατριβής μου στο Τμήμα Πολυμέσων και Γραφικών Τεχνών στο Τεχνολογικό Πανεπιστήμιο Κύπρου, έχει ως σκοπό τη διερεύνηση των απόψεων και εμπειριών σας ως εκπαιδευτικών προκειμένου να διαγνωστούν οι ανάγκες των εκπαιδευτικών για θέματα επιμόρφωσης σχετικά με προβλήματα/διαταραχές που αντιμετωπίζουν οι μαθητές. Η εμπειρία σας στο θέμα αυτό είναι πολύτιμη για μας.

Σας διαβεβαιώνουμε, ότι η συμπλήρωση του ερωτηματολογίου είναι ανώνυμη και οι πληροφορίες που θα μας δώσετε θα είναι απολύτως εμπιστευτικές και δεν πρόκειται να χρησιμοποιηθούν για κανένα άλλο σκοπό. Η συμμετοχή σας είναι εντελώς εθελοντική. Μπορείτε να επιλέξετε να μην συμμετέχετε σε μέρος ή στο σύνολο του ερωτηματολογίου.

Σας ευχαριστούμε για την ανταπόκριση και τη συνεργασία σας.

Με εκτίμηση,

Καλλιόπη-Ευαγγελία Σταυρούλια

Διδακτορική Φοιτήτρια και Μεταπτυχιακή Συνεργάτης

Τμήμα Πολυμέσων και Γραφικών Τεχνών

Σχολή Καλών και Εφαρμοσμένων Τεχνών

Τεχνολογικό Πανεπιστήμιο Κύπρου

Για περισσότερες πληροφορίες μπορείτε να απευθυνθείτε στο Visual Media Computing Lab:

vmc@gmail.com

APPENDIX A-4-4

Consent form (in English)

Teacher Questionnaire (TQ)

Consent form

Dear teachers,

This questionnaire, in the context of my dissertation in the Department of Multimedia and Graphic Arts at the Cyprus University of Technology, aims to explore your views and experiences regarding the identification of teachers' needs for training issues related to problems / disorders of students. Your experience on this subject is valuable to us.

Please be assured that the questionnaire completion is anonymous and that the information you provide will be completely confidential and will not be used for any other purpose. Your participation is entirely voluntary. You may choose not to participate in part or in the whole questionnaire.

Thank you for your response and cooperation.

Yours sincerely,

Kalliopi-Evangelia Stavroulia

Doctoral Student and Postgraduate Associate

Department of Multimedia and Graphic Arts

School of Fine and Applied Arts

Cyprus University of Technology

For more information contact Visual Media Computing Lab: vmc@gmail.com

APPENDIX A-4-5

Teacher Questionnaire (in Greek)

Ι. ΔΗΜΟΓΡΑΦΙΚΑ ΣΤΟΙΧΕΙΑ

1. Χώρα

Κύπρος	Ελλάδα

2. Φύλο

Άνδρας	Γυναίκα

3. Ηλικία

18-24	25-29	30-39	40-49	50-59	60+

4. Εργασιακό καθεστώς

- ❑ Μόνιμος
- ❑ Συμβασιούχος
- ❑ Αναπληρωτής- Αντικαταστάτης
- ❑ Ωρομίσθιος
- ❑ Αδιόριστος
- ❑ Άλλο (παρακαλούμε προσδιορίστε) : _____

5. Έτη προϋπηρεσίας

Καθόλου	Λιγότερο από 1 έτος	1-2 έτη	3-5 έτη
6-10 έτη	11-15 έτη	16-20 έτη	Πάνω από 20 έτη

6. Πόσα χρόνια μεσολάβησαν ανάμεσα στην ημερομηνία κτήσης του πτυχίου και τον διορισμό;

Δεν είμαι διορισμένος/η	0-4 έτη	Από 5-10 έτη	Πάνω από 10 έτη

7. Ποιο είναι το πεδίο της ειδικότητας σας:

Φιλολογικά	Μαθηματικά	Φυσική	Τέχνες	Άλλο:……
Χημεία	Ξένες γλώσσες	Πληροφορική	Οικονομικά	

8. Εκπαιδευτικό επίπεδο:

- ❑ Απόφοιτος ΑΕΙ
- ❑ Κάτοχος μεταπτυχιακού τίτλου σπουδών (Master)

- ❑ Κάτοχος διδακτορικού διπλώματος
- ❑ Άλλο (παρακαλούμε προσδιορίστε) : _____

9. Βαθμίδα εκπαίδευσης στην οποία υπηρετείτε:

- ❑ Πρωτοβάθμια εκπαίδευση
- ❑ Δευτεροβάθμια εκπαίδευση
- ❑ Τριτοβάθμια εκπαίδευση
- ❑ Επαγγελματική εκπαίδευση
- ❑ Άλλο (παρακαλούμε προσδιορίστε) : _____

10. Η πανεπιστημιακή σας εκπαίδευση περιελάβανε πρακτική άσκηση σε σχολείο;

- ❑ Ναι (συμπληρώστε την ερώτηση 11)
- ❑ Όχι

11. Πόση ήταν η διάρκεια της πρακτικής σας άσκησης;

Καθόλου πρακτική άσκηση	1 μήνα	2 μήνες
3 μήνες	Πάνω από 4 μήνες	Άλλο:

12. Προηγούμενη εμπειρία σε χρήση εφαρμογών εικονικής πραγματικότητας:

Καθόλου	Λίγο	Μέτρια	Πολύ	Πάρα πολύ

ΙΙ. ΕΠΑΓΓΕΛΜΑΤΙΚΗ ΕΞΕΛΙΞΗ

13. Πόσα περίπου επιμορφωτικά προγράμματα έχετε παρακολουθήσει την τελευταία <u>διετία</u>;

0	1	2	3	4	5	6	7	8	9	10

14. Πόσα περίπου επιμορφωτικά προγράμματα έχετε παρακολουθήσει την τελευταία <u>πενταετία</u>;

0	1	2	3	4	5	6	7	8	9	10

15. Κατά τη διάρκεια των τελευταίων 24 μηνών, συμμετείχατε σε οποιοδήποτε από τα κάτωθι είδη δραστηριοτήτων επαγγελματικής ανάπτυξης αναφορικά με προβλήματα/διαταραχές που αντιμετωπίζουν οι μαθητές, και ποια ήταν η επίδραση αυτών των δραστηριοτήτων στην ανάπτυξη σας ως εκπαιδευτικός;

	Συμμετοχή		Επίδραση				
	Ναι	*Όχι*	*Καθόλου*	*Λίγο*	*Μέτρια*	*Αρκετά*	*Πολύ*
Μαθήματα							
Εργαστήρια							
Σεμινάρια							
Εκπαιδευτικά συνέδρια							

Συμμετοχή σε δίκτυο εκπαιδευτικών με στόχο την επαγγελματική εξέλιξη των εκπαιδευτικών	
Καθοδήγηση και/ή παρατήρηση από συναδέλφου	

16. Σε ποιο βαθμό θεωρείτε ότι έχετε ανάγκη επιμόρφωσης στους κάτωθι τομείς:

	Καθόλου	*Λίγο*	*Μέτρια*	*Αρκετά*	*Πολύ*
Διαχείριση σχολικής τάξης					
Πρακτικές αξιολόγησης του μαθητή					
Γνώση και κατανόηση του γνωστικού αντικειμένου					
Δεξιότητες ΤΠΕ					
Διδασκαλία σε μαθητές με ειδικές εκπαιδευτικές ανάγκες					
Προβλήματα πειθαρχίας και συμπεριφοράς μαθητών					
Διαχείριση Πολυπολυτισμικότητας					
Εξατομικευμένο πρόγραμμα διδασκαλίας					
Προβλήματα διαταραχών των μαθητών (πχ. Προβλήματα ακοής, όρασης, λόγου κλπ.)					
Συνεργασία με τους άλλους εκπαιδευτικούς					
Χρήση της Γλώσσα του σώματος και συγκεκριμένα για:					
Τις κινήσεις και στάσεις του σώματος					
Την εξωτερική εμφάνιση					
Τον τόνος της φωνής					
Την απόσταση και επικοινωνία μέσα στην τάξη					
Την έκφραση του προσώπου					

17. Σε ποιο βαθμό αντιμετωπίζετε κατά την εκπαιδευτική διαδικασία δυσκολίες στη διαχείριση μαθητών με:

	Καθόλου	Λίγο	Μέτρια	Πολύ	Πάρα πολύ
Μαθησιακές διαταραχές (π.χ. δυσλεξία)					
Διαταραχές επικοινωνίας (π.χ. τραυλισμός)					
Διαταραχές συμπεριφοράς (π.χ. επιθετικότητα, ανυπακοή, χρήση σωματικής βίας κλπ.)					
Προβλήματα υγείας					
Προβλήματα όρασης (π.χ. μυωπία)					
Προβλήματα κίνησης (π.χ. δυσκολία στο περπάτημα)					
Προβλήματα ακοής					
Διαταραχή Ελλειμματικής Προσοχής και Υπερκινητικότητας ΔΕΠ-Υ					
Άλλο (παρακαλούμε προσδιορίστε): _					

18. Είστε σε θέση να εντοπίσετε τους μαθητές/ριες της τάξης σας που πιθανόν να αντιμετωπίζουν προβλήματα και ήπιες μορφές διαταραχών, με βάση τις υπάρχουσες γνώσεις σας;

Καθόλου	Λίγο	Μέτρια	Πολύ	Πάρα πολύ

19. Έχετε ανάγκη από επιπλέον επιμόρφωση μέσω <u>θεωρητικής προσέγγισης</u> προκειμένου να αναγνωρίζετε τυχόν προβλήματα και διαταραχές που αντιμετωπίζουν οι μαθητές σας;

Καθόλου	Λίγο	Μέτρια	Πολύ	Πάρα πολύ

20. Έχετε ανάγκη από επιπλέον επιμόρφωση μέσω <u>πρακτικής άσκησης</u> προκειμένου να αναγνωρίζετε τυχόν προβλήματα και διαταραχές που αντιμετωπίζουν οι μαθητές σας;

Καθόλου	Λίγο	Μέτρια	Πολύ	Πάρα πολύ

21. Σε ποιο βαθμό θεωρείτε ότι <u>λάβατε εκπαίδευση/κατάρτιση</u> για την εκπαίδευση μαθητών με:

	Καθόλου	*Λίγο*	*Μέτρια*	*Πολύ*	*Πάρα πολύ*
Μαθησιακές διαταραχές					
Διαταραχές επικοινωνίας					

Διαταραχές συμπεριφοράς
Προβλήματα υγείας
Προβλήματα όρασης
Προβλήματα κίνησης
Προβλήματα ακοής
ΔΕΠ-Υ

22. Σε ποιο βαθμό θεωρείτε ότι <u>είστε σε θέση να εντοπίσετε</u> τους μαθητές/ριες της τάξης σας που πιθανόν να αντιμετωπίζουν:

	Καθόλου	*Λίγο*	*Μέτρια*	*Πολύ*	*Πάρα πολύ*
Μαθησιακές διαταραχές					
Διαταραχές επικοινωνία					
Διαταραχές συμπεριφοράς					
Προβλήματα υγείας					
Προβλήματα όρασης					
Προβλήματα κίνησης					
Προβλήματα ακοής					
ΔΕΠ-Υ					

23. Σε ποιο βαθμό θεωρείτε ότι έχετε ανάγκη από επιπλέον <u>επιμόρφωση μέσω πρακτικής άσκησης</u> σε θέματα:

	Καθόλου	*Λίγο*	*Μέτρια*	*Πολύ*	*Πάρα πολύ*
Μαθησιακών διαταραχών					
Διαταραχών επικοινωνίας					
Διαταραχών συμπεριφοράς					
Προβλημάτων υγείας					
Προβλημάτων όρασης					
Προβλημάτων κίνησης					
Προβλημάτων ακοής					
ΔΕΠ-Υ					

24. Τι πιστεύετε πως χρειάζεται ένας εκπαιδευτικός για τις θεματικές που αναφέρονται στην ερώτηση 23;

	Δεν γνωρίζω	*Καθόλου*	*Λίγο*	*Μέτρια*	*Πολύ*	*Πάρα πολύ*
Κατάλληλο εκπαιδευτικό υλικό						
Πρακτική άσκηση μέσα στην τάξη						
Πρακτική άσκηση μέσω νέων τεχνολογιών όπως είναι η εικονική πραγματικότητα στα πλαίσια μιας εικονικής τάξης						

25. Σε ποιο βαθμό θεωρείτε ότι οι <u>μαθητές</u> χρίζουν περαιτέρω εκπαίδευση προκειμένου να εξασφαλίζεται η σωστή επικοινωνία και συμπεριφορά τους αναφορικά με συμμαθητές τους που τυχόν αντιμετωπίζουν διαταραχές όπως:

	Καθόλου	*Λίγο*	*Μέτρια*	*Πολύ*	*Πάρα πολύ*
Μαθησιακές διαταραχές					
Διαταραχές επικοινωνίας					
Διαταραχές συμπεριφοράς					
Προβλήματα υγείας					
Προβλήματα όρασης					
Προβλήματα κίνησης					
Προβλήματα ακοή					
ΔΕΠ-Υ					

26. Χώρος για παρατηρήσεις και συμπληρωματικές παρατηρήσεις:

Σας ευχαριστούμε για τον πολύτιμο χρόνο που διαθέσατε για τη συμπλήρωση του ερωτηματολογίου και για τη συμμετοχή σας στην έρευνα.

APPENDIX A-4-6

Teacher Questionnaire (in English)

I. Demographic Data

---

1. Country

Cyprus	Greece

2. Gender

Male	Female

3. Age

18-24	25-29	30-39	40-49	50-59	60+

4. Employment status

- ❑ Permanent
- ❑ Contract
- ❑ Associate
- ❑ Hourly
- ❑ Not appointed
- ❑ Other (please specify): _____

5. Teaching experience

Not at all	Less than 1 year	1-2 years	3-5 years
6-10 years	11-15 years	16-20 years	+20 years

6. How many years have passed for your appointment after your degree graduation?

Not appointed	0-4 years	Από 5-10 years	Over 10 years

7. Teaching specialty:

Literature	Mathematics	Physics	Art	Other:
Chemistry	Foreign languages	Informatics	Economics	

8. Level of education you have completed:

- ❑ Bachelor's degree
- ❑ Master's degree
- ❑ Doctoral degree
- ❑ Other (please specify): _____

9. Grade in which you currently teach:

- ❑ Primary education
- ❑ Secondary education
- ❑ Higher education
- ❑ Vocational education
- ❑ Other (please specify): _____

10. Did your formal education include classroom practice in school?

- ❑ Yes (got to question 11)
- ❑ No

11. How long did your classroom practicum last?

No practice at all	1 month	2 months
3 months	Over 4 months	Other:

12. Experience in using virtual reality learning environments:

Not at all	A little	Moderately	Much	Very much

II. PROFESSIONAL DEVELOPMENT

13. How many training programs have you attended the last <u>two</u> years?

0	1	2	3	4	5	6	7	8	9	10

14. How many training programs have you attended the last <u>five</u> years?

0	1	2	3	4	5	6	7	8	9	10

15. During the last 24 months, did you participate in any of the following kinds of professional development activities, and what was the impact of these activities on your development as a teacher?

	Participation		Impact				
	Yes	*No*	*Not at all*	*A little*	*Moderately*	*Much*	*Very much*
Courses							
Workshops							
Seminars							
Educational conference							
Participation in a network of teachers formed specifically for the professional development of teachers							

Mentoring and/or peer observation	

16. To what extent do you consider yourself in need of training in the following areas:

	Not at all	*A little*	*Moderately*	*Much*	*Very much*
Classroom management					
Student assessment					
Knowledge and understanding of subject field					
ICT skills					
Teaching students with special learning needs					
Student discipline and behavior problems					
Classroom diversity					
Individualized teaching and learning					
Student disorders (e.g. hearing, vision, speech, etc.)					
Collaboration with colleagues					
Body language issues and particularly:					
Body language and movement					
External appearance					
Voice tone					
Distance and communication within the classroom					
Facial expressions					

17. To what extent do you experience difficulties in managing students with:

	Not at all	*A little*	*Moderately*	*Much*	*Very much*
Learning difficulties (e.g. dyslexia)					
Communication disorders (e.g. stutter)					
Behavioral disorders (e.g. aggression, disobedience, use of physical violence, etc.)					
Health disorders					
Vision disorders (e.g. myopia)					

Movement disorders	
Hearing disorders	
Attention Deficit Disorder and Hyperactivity Disorder ADHD	
Other (please specify): _	

18. Are you able to detect students in your class who are likely to experience problems and mild forms of disorders, based on your existing knowledge?

Not at all	A little	Moderately	Much	Very much

19. Do you need further training through a <u>theoretical approach</u> in order to identify any problems and disorders that your students face?

Not at all	A little	Moderately	Much	Very much

20. Do you need additional training through <u>practice</u> to recognize any problems and disorders your students face?

Not at all	A little	Moderately	Much	Very much

21. To what extend do you believe that you received training for students facing:

	Not at all	*A little*	*Moderately*	*Much*	*Very much*
Learning difficulties					
Communication disorders					
Behavioral disorders					
Health disorders					
Vision disorders					
Movement disorders					
Hearing disorders					
Attention Deficit Disorder and Hyperactivity Disorder ADHD					

22. To what extent do you believe that you are able to identify students who may be experiencing:

	Not at all	*A little*	*Moderately*	*Much*	*Very much*
Learning difficulties					
Communication disorders					
Behavioral disorders					
Health disorders					
Vision disorders					
Movement disorders					
Hearing disorders					
Attention Deficit Disorder and Hyperactivity Disorder ADHD					

23. To what extent do you consider yourself in need of additional training in the following thematic areas:

	Not at all	*A little*	*Moderately*	*Much*	*Very much*
Learning difficulties					
Communication disorders					
Behavioral disorders					
Health disorders					
Vision disorders					
Movement disorders					
Hearing disorders					
Attention Deficit Disorder and Hyperactivity Disorder ADHD					

24. What do you think is a teacher needs for the thematic areas mentioned in question 23?

	I do not know	*Not at all*	*A little*	*Moderately*	*Much*	*Very much*
Suitable training material						
Practical training within the classroom						
Practical training through new technologies such as virtual reality within a virtual classroom						

25. To what extent do you believe that the students need further training in order to ensure their proper communication and behaviour with their classmates who might experience disorders such as:

	Not at all	*A little*	*Moderately*	*Much*	*Very much*
Learning difficulties					
Communication disorders					
Behavioral disorders					
Health disorders					
Vision disorders					
Movement disorders					
Hearing disorders					
Attention Deficit Disorder and Hyperactivity Disorder ADHD					

26. Additional comments:

Thank you for your valuable time in completing this questionnaire and for your participation in the survey.

APPENDIX A-4-7

Participants' evaluation of the impact of professional development activities on their professional development

			Frequency	Percent	Valid Percent	Cumulative Percent
Courses	Participation	Yes	25	30.1	30.1	30.1
		No	28	33.7	33.7	63.9
		Missing	30	36.1	36.1	100.0
		Total	83	100.0	100.0	
	Impact	Not at all	21	25.3	25.3	25.3
		A little	4	4.8	4.8	30.1
		Moderately	6	7.2	7.2	37.3
		Much	9	10.8	10.8	48.2
		Very much	6	7.2	7.2	55.4
		Missing	37	44.6	44.6	100.0
		Total	83	100.0	100.0	
Workshops	Participation	Yes	17	20.5	20.5	20.5
		No	35	42.2	42.2	62.7
		Missing	31	37.3	37.3	100.0
		Total	83	100.0	100.0	
	Impact	Not at all	22	26.5	26.5	26.5
		A little	1	1.2	1.2	27.7
		Moderately	6	7.2	7.2	34.9
		Much	7	8.4	8.4	43.4
		Very much	3	3.6	3.6	47.0
		Missing	44	53.0	53.0	100.0
		Total	83	100.0	100.0	
Seminars	Participation	Yes	49	59.0	59.0	59.0

		No	15	18.1	18.1	77.1
		Missing	19	22.9	22.9	100.0
		Total	83	100.0	100.0	
	Impact	Not at all	22	26.5	26.5	26.5
		A little	1	1.2	1.2	27.7
		Moderately	6	7.2	7.2	34.9
		Much	7	8.4	8.4	43.4
		Very much	3	3.6	3.6	47.0
		Missing	44	53.0	53.0	100.0
		Total	83	100.0	100.0	
Educational Conferences	Participation	Yes	26	31.3	31.3	31.3
		No	29	34.9	34.9	66.3
		Missing	28	33.7	33.7	100.0
		Total	83	100.0	100.0	
	Impact	Not at all	22	26.5	26.5	26.5
		A little	1	1.2	1.2	27.7
		Moderately	4	4.8	4.8	32.5
		Much	15	18.1	18.1	50.6
		Very much	4	4.8	4.8	55.4
		Missing	37	44.6	44.6	100.0
		Total	83	100.0	100.0	
Participation in network of teachers	Participation	Yes	22	26.5	26.5	26.5
		No	29	34.9	34.9	61.4
		Missing	32	38.6	38.6	100.0
		Total	83	100.0	100.0	
	Impact	Not at all	24	28.9	28.9	28.9
		A little	1	1.2	1.2	30.1
		Moderately	6	7.2	7.2	37.3
		Much	12	14.5	14.5	51.8

		Very much	3	3.6	3.6	55.4
		Missing	37	44.6	44.6	100.0
		Total	83	100.0	100.0	
Mentoring and/or peer observation	Participation	Yes	29	34.9	34.9	34.9
		No	27	32.5	32.5	67.5
		Missing	27	32.5	32.5	100.0
		Total	83	100.0	100.0	
	Impact	Not at all	17	20.5	20.5	20.5
		A little	1	1.2	1.2	21.7
		Moderately	5	6.0	6.0	27.7
		Much	15	18.1	18.1	45.8
		Very much	9	10.8	10.8	56.6
		Missing	36	43.4	43.4	100.0
		Total	83	100.0	100.0	

APPENDIX A-4-8

Descriptive statistics presenting participants evaluation regarding the most important thematic areas for training

		Frequency	Percent	Valid Percent	Cumulative Percent
Classroom management	Not at all	9	10.8	10.8	10.8
	A little	17	20.5	20.5	31.3
	Moderately	13	15.7	15.7	47.0
	Much	17	20.5	20.5	67.5
	Very much	11	13.3	13.3	80.7
	Missing	16	19.3	19.3	100.0
	Total	83	100.0	100.0	
Student assessment	Not at all	6	7.2	7.2	7.2
	A little	13	15.7	15.7	22.9
	Moderately	23	27.7	27.7	50.6
	Much	12	14.5	14.5	65.1
	Very much	12	14.5	14.5	79.5
	Missing	17	20.5	20.5	100.0
	Total	83	100.0	100.0	
Knowledge and understanding of subject field	Not at all	20	24.1	24.1	24.1
	A little	23	27.7	27.7	51.8
	Moderately	8	9.6	9.6	61.4
	Much	11	13.3	13.3	74.7
	Very much	4	4.8	4.8	79.5
	Missing	17	20.5	20.5	100.0
	Total	83	100.0	100.0	
ICT skills	Not at all	9	10.8	10.8	10.8
	A little	19	22.9	22.9	33.7

	Moderately	14	16.9	16.9	50.6
	Much	17	20.5	20.5	71.1
	Very much	8	9.6	9.6	80.7
	Missing	16	19.3	19.3	100.0
	Total	83	100.0	100.0	
Teaching students with special learning needs	Not at all	3	3.6	3.6	3.6
	A little	1	1.2	1.2	4.8
	Moderately	7	8.4	8.4	13.3
	Much	32	38.6	38.6	51.8
	Very much	25	30.1	30.1	81.9
	Missing	15	18.1	18.1	100.0
	Total	83	100.0	100.0	
Student discipline and behaviour problems	Not at all	5	6.0	6.0	6.0
	A little	12	14.5	14.5	20.5
	Moderately	14	16.9	16.9	37.3
	Much	18	21.7	21.7	59.0
	Very much	18	21.7	21.7	80.7
	Missing	16	19.3	19.3	100.0
	Total	83	100.0	100.0	
Classroom diversity	Not at all	5	6.0	6.0	6.0
	A little	18	21.7	21.7	27.7
	Moderately	14	16.9	16.9	44.6
	Much	20	24.1	24.1	68.7
	Very much	11	13.3	13.3	81.9
	Missing	15	18.1	18.1	100.0
	Total	83	100.0	100.0	
Approaches to individualized learning	Not at all	8	9.6	9.6	9.6
	A little	13	15.7	15.7	25.3
	Moderately	17	20.5	20.5	45.8

	Much	20	24.1	24.1	69.9
	Very much	9	10.8	10.8	80.7
	Missing	16	19.3	19.3	100.0
	Total	83	100.0	100.0	
Student disorders (e.g. hearing, vision, speech, etc.)	Not at all	2	2.4	2.4	2.4
	A little	10	12.0	12.0	14.5
	Moderately	10	12.0	12.0	26.5
	Much	21	25.3	25.3	51.8
	Very much	24	28.9	28.9	80.7
	Missing	16	19.3	19.3	100.0
	Total	83	100.0	100.0	
Collaboration with colleagues	Not at all	12	14.5	14.5	14.5
	A little	18	21.7	21.7	36.1
	Moderately	17	20.5	20.5	56.6
	Much	9	10.8	10.8	67.5
	Very much	10	12.0	12.0	79.5
	Missing	17	20.5	20.5	100.0
	Total	83	100.0	100.0	
Body movements	Not at all	11	13.3	13.3	13.3
	A little	14	16.9	16.9	30.1
	Moderately	15	18.1	18.1	48.2
	Much	15	18.1	18.1	66.3
	Very much	11	13.3	13.3	79.5
	Missing	17	20.5	20.5	100.0
	Total	83	100.0	100.0	
External appearance	Not at all	19	22.9	22.9	22.9
	A little	19	22.9	22.9	45.8
	Moderately	16	19.3	19.3	65.1
	Much	5	6.0	6.0	71.1

	Very much	7	8.4	8.4	79.5
	Missing	17	20.5	20.5	100.0
	Total	83	100.0	100.0	
Voice tone	Not at all	14	16.9	16.9	16.9
	A little	18	21.7	21.7	38.6
	Moderately	19	22.9	22.9	61.4
	Much	8	9.6	9.6	71.1
	Very much	8	9.6	9.6	80.7
	Missing	16	19.3	19.3	100.0
	Total	83	100.0	100.0	
Communication within the classroom	Not at all	13	15.7	15.7	15.7
	A little	15	18.1	18.1	33.7
	Moderately	14	16.9	16.9	50.6
	Much	13	15.7	15.7	66.3
	Very much	11	13.3	13.3	79.5
	Missing	17	20.5	20.5	100.0
	Total	83	100.0	100.0	
Facial expressions	Not at all	13	15.7	15.7	15.7
	A little	22	26.5	26.5	42.2
	Moderately	13	15.7	15.7	57.8
	Much	9	10.8	10.8	68.7
	Very much	10	12.0	12.0	80.7
	Missing	16	19.3	19.3	100.0
	Total	83	100.0	100.0	

APPENDIX A-4-9

Descriptive statistics presenting participants evaluation regarding managing students that face several disorders.

		Frequency	Percent	Valid Percent	Cumulative Percent
Learning difficulties (e.g. dyslexia)	Not at all	4	4.8	6.1	6.1
	A little	15	18.1	22.7	28.8
	Moderately	28	33.7	42.4	71.2
	Much	15	18.1	22.7	93.9
	Very much	4	4.8	6.1	100.0
	Total	66	79.5	100.0	
	Missing	17	20.5		
	Total	83	100.0		
Communication disorders (e.g. stutter)	Not at all	12	14.5	18.5	18.5
	A little	23	27.7	35.4	53.8
	Moderately	23	27.7	35.4	89.2
	Much	4	4.8	6.2	95.4
	Very much	3	3.6	4.6	100.0
	Total	65	78.3	100.0	
	Missing	18	21.7		
	Total	83	100.0		
Behavioral disorders (e.g. aggression, disobedience, use of physical violence, etc.)	Not at all	6	7.2	9.1	9.1
	A little	11	13.3	16.7	25.8
	Moderately	22	26.5	33.3	59.1
	Much	17	20.5	25.8	84.8
	Very much	10	12.0	15.2	100.0
	Total	66	79.5	100.0	
	Missing	17	20.5		

	Total	83	100.0		
Health disorders	Not at all	12	14.5	18.5	18.5
	A little	26	31.3	40.0	58.5
	Moderately	16	19.3	24.6	83.1
	Much	9	10.8	13.8	96.9
	Very much	2	2.4	3.1	100.0
	Total	65	78.3	100.0	
	Missing	18	21.7		
	Total	83	100.0		
Vision disorders (e.g. myopia)	Not at all	17	20.5	26.2	26.2
	A little	27	32.5	41.5	67.7
	Moderately	11	13.3	16.9	84.6
	Much	7	8.4	10.8	95.4
	Very much	3	3.6	4.6	100.0
	Total	65	78.3	100.0	
	Missing	18	21.7		
	Total	83	100.0		
Movement disorders	Not at all	22	26.5	33.8	33.8
	A little	24	28.9	36.9	70.8
	Moderately	13	15.7	20.0	90.8
	Much	5	6.0	7.7	98.5
	Very much	1	1.2	1.5	100.0
	Total	65	78.3	100.0	
	Missing	18	21.7		
	Total	83	100.0		
Hearing disorders	Not at all	5	6.0	7.9	7.9
	A little	15	18.1	23.8	31.7
	Moderately	14	16.9	22.2	54.0
	Much	18	21.7	28.6	82.5

	Very much	11	13.3	17.5	100.0
	Total	63	75.9	100.0	
	Missing	20	24.1		
	Total	83	100.0		
Attention Deficit Disorder and Hyperactivity Disorder ADHD	Not at all	3	3.6	4.8	4.8
	A little	7	8.4	11.1	15.9
	Moderately	15	18.1	23.8	39.7
	Much	20	24.1	31.7	71.4
	Very much	18	21.7	28.6	100.0
	Total	63	75.9	100.0	
	Missing	20	24.1		
	Total	83	100.0		

APPENDIX A-4-10

Descriptive statistics of questions 18, 19 and 20

	N	Mean	Std. Deviation
Q18. Do you need additional training through practice to recognize any problems and disorders your students face?	65	3.6154	1.16850
Q19. Are you able to detect students of your class who are likely to experience problems and mild forms of disorders, based on your existing knowledge?	65	3.4615	.90272
Q20. Do you need further training through a theoretical approach in order to identify any problems and disorders that your students face?	65	3.1385	1.18423
Valid N (listwise)	65		

Q18. Are you able to detect students of your class who are likely to experience problems and mild forms of disorders, based on your existing knowledge?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	1	1.2	1.5	1.5
	A little	5	6.0	7.7	9.2
	Moderately	32	38.6	49.2	58.5
	Much	17	20.5	26.2	84.6
	Very much	10	12.0	15.4	100.0
	Total	65	78.3	100.0	
	Missing	18	21.7		
Total		83	100.0		

Q19. Do you need further training through a theoretical approach in order to identify any problems and disorders that your students face?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	5	6.0	7.7	7.7
	A little	16	19.3	24.6	32.3
	Moderately	19	22.9	29.2	61.5
	Much	15	18.1	23.1	84.6
	Very much	10	12.0	15.4	100.0
	Total	65	78.3	100.0	
	Missing	18	21.7		
Total		83	100.0		

Q20. Do you need additional training through practice to recognize any problems and disorders your students face?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	3	3.6	4.6	4.6
	A little	10	12.0	15.4	20.0
	Moderately	13	15.7	20.0	40.0
	Much	22	26.5	33.8	73.8
	Very much	17	20.5	26.2	100.0
	Total	65	78.3	100.0	
	Missing	18	21.7		
Total		83	100.0		

APPENDIX A-4-11

Descriptive statistics concerning participants' evaluation of their training related to dealing with specific student's disorders

		Frequency	Percent	Valid Percent	Cumulative Percent
Learning difficulties	Not at all	16	19.3	24.6	24.6
	A little	18	21.7	27.7	52.3
	Moderately	18	21.7	27.7	80.0
	Much	7	8.4	10.8	90.8
	Very much	6	7.2	9.2	100.0
	Total	65	78.3	100.0	
	Missing	18	21.7		
	Total	83	100.0		
Communication disorders	Not at all	19	22.9	29.2	29.2
	A little	22	26.5	33.8	63.1
	Moderately	16	19.3	24.6	87.7
	Much	6	7.2	9.2	96.9
	Very much	2	2.4	3.1	100.0
	Total	65	78.3	100.0	
	Missing	18	21.7		
	Total	83	100.0		
Behavioral disorders	Not at all	19	22.9	29.2	29.2
	A little	15	18.1	23.1	52.3
	Moderately	22	26.5	33.8	86.2
	Much	7	8.4	10.8	96.9
	Very much	2	2.4	3.1	100.0
	Total	65	78.3	100.0	
	Missing	18	21.7		

	Total	83	100.0		
Health disorders	Not at all	34	41.0	53.1	53.1
	A little	14	16.9	21.9	75.0
	Moderately	11	13.3	17.2	92.2
	Much	4	4.8	6.3	98.4
	Very much	1	1.2	1.6	100.0
	Total	64	77.1	100.0	
	Missing	19	22.9		
	Total	83	100.0		
Vision disorders	Not at all	36	43.4	57.1	57.1
	A little	14	16.9	22.2	79.4
	Moderately	5	6.0	7.9	87.3
	Much	5	6.0	7.9	95.2
	Very much	3	3.6	4.8	100.0
	Total	63	75.9	100.0	
	Missing	20	24.1		
	Total	83	100.0		
Movement disorders	Not at all	34	41.0	53.1	53.1
	A little	17	20.5	26.6	79.7
	Moderately	8	9.6	12.5	92.2
	Much	3	3.6	4.7	96.9
	Very much	2	2.4	3.1	100.0
	Total	64	77.1	100.0	
	Missing	19	22.9		
	Total	83	100.0		
Hearing disorders	Not at all	33	39.8	51.6	51.6
	A little	19	22.9	29.7	81.3
	Moderately	4	4.8	6.3	87.5
	Much	6	7.2	9.4	96.9

	Very much	2	2.4	3.1	100.0
	Total	64	77.1	100.0	
	Missing	19	22.9		
	Total	83	100.0		
Attention Deficit Disorder and Hyperactivity Disorder ADHD	Not at all	15	18.1	23.1	23.1
	A little	22	26.5	33.8	56.9
	Moderately	18	21.7	27.7	84.6
	Much	6	7.2	9.2	93.8
	Very much	4	4.8	6.2	100.0
	Total	65	78.3	100.0	
	Missing	18	21.7		
	Total	83	100.0		

APPENDIX A-4-12

Descriptive statistics concerning participants' self-evaluation regarding their ability to identify students dealing with disorders

		Frequency	Percent	Valid Percent	Cumulative Percent
Learning difficulties	Not at all	1	1.2	1.5	1.5
	A little	4	4.8	6.2	7.7
	Moderately	24	28.9	36.9	44.6
	Much	26	31.3	40.0	84.6
	Very much	10	12.0	15.4	100.0
	Total	65	78.3	100.0	
	Missing	18	21.7		
	Total	83	100.0		
Communication disorders	Not at all	1	1.2	1.5	1.5
	A little	4	4.8	6.2	7.7
	Moderately	23	27.7	35.4	43.1
	Much	27	32.5	41.5	84.6
	Very much	10	12.0	15.4	100.0
	Total	65	78.3	100.0	
	Missing	18	21.7		
	Total	83	100.0		
Behavioral disorders	Not at all	1	1.2	1.5	1.5
	A little	2	2.4	3.1	4.6
	Moderately	19	22.9	29.2	33.8
	Much	33	39.8	50.8	84.6
	Very much	10	12.0	15.4	100.0
	Total	65	78.3	100.0	
	Missing	18	21.7		

	Total	83	100.0		
Health disorders	Not at all	4	4.8	6.3	6.3
	A little	14	16.9	21.9	28.1
	Moderately	31	37.3	48.4	76.6
	Much	10	12.0	15.6	92.2
	Very much	5	6.0	7.8	100.0
	Total	64	77.1	100.0	
	Missing	19	22.9		
	Total	83	100.0		
Vision disorders	Not at all	5	6.0	7.8	7.8
	A little	8	9.6	12.5	20.3
	Moderately	20	24.1	31.3	51.6
	Much	17	20.5	26.6	78.1
	Very much	14	16.9	21.9	100.0
	Total	64	77.1	100.0	
	Missing	19	22.9		
	Total	83	100.0		
Movement disorders	Not at all	4	4.8	6.3	6.3
	A little	7	8.4	10.9	17.2
	Moderately	11	13.3	17.2	34.4
	Much	23	27.7	35.9	70.3
	Very much	19	22.9	29.7	100.0
	Total	64	77.1	100.0	
	Missing	19	22.9		
	Total	83	100.0		
Hearing disorders	Not at all	5	6.0	7.8	7.8
	A little	8	9.6	12.5	20.3
	Moderately	18	21.7	28.1	48.4
	Much	19	22.9	29.7	78.1

	Very much	14	16.9	21.9	100.0
	Total	64	77.1	100.0	
	Missing	19	22.9		
	Total	83	100.0		
Attention Deficit Disorder and Hyperactivity Disorder ADHD	Not at all	3	3.6	4.6	4.6
	A little	6	7.2	9.2	13.8
	Moderately	20	24.1	30.8	44.6
	Much	27	32.5	41.5	86.2
	Very much	9	10.8	13.8	100.0
	Total	65	78.3	100.0	
	Missing	18	21.7		
	Total	83	100.0		

APPENDIX A-4-13

Participant's perceptions regarding additional training related to student's disorders

		Frequency	Percent	Valid Percent	Cumulative Percent
Learning difficulties	Not at all	3	3.6	4.7	4.7
	A little	5	6.0	7.8	12.5
	Moderately	21	25.3	32.8	45.3
	Much	20	24.1	31.3	76.6
	Very much	15	18.1	23.4	100.0
	Total	64	77.1	100.0	
	Missing	19	22.9		
	Total	83	100.0		
Communication disorders	Not at all	2	2.4	3.2	3.2
	A little	6	7.2	9.5	12.7
	Moderately	21	25.3	33.3	46.0
	Much	23	27.7	36.5	82.5
	Very much	11	13.3	17.5	100.0
	Total	63	75.9	100.0	
	Missing	20	24.1		
	Total	83	100.0		
Behavioral disorders	Not at all	2	2.4	3.1	3.1
	A little	7	8.4	10.9	14.1
	Moderately	17	20.5	26.6	40.6
	Much	21	25.3	32.8	73.4
	Very much	17	20.5	26.6	100.0
	Total	64	77.1	100.0	
	Missing	19	22.9		

	Total	83	100.0		
Health disorders	Not at all	4	4.8	6.3	6.3
	A little	10	12.0	15.9	22.2
	Moderately	17	20.5	27.0	49.2
	Much	20	24.1	31.7	81.0
	Very much	12	14.5	19.0	100.0
	Total	63	75.9	100.0	
	Missing	20	24.1		
	Total	83	100.0		
Vision disorders	Not at all	5	6.0	7.9	7.9
	A little	16	19.3	25.4	33.3
	Moderately	14	16.9	22.2	55.6
	Much	16	19.3	25.4	81.0
	Very much	12	14.5	19.0	100.0
	Total	63	75.9	100.0	
	Missing	20	24.1		
	Total	83	100.0		
Movement disorders	Not at all	4	4.8	6.5	6.5
	A little	14	16.9	22.6	29.0
	Moderately	18	21.7	29.0	58.1
	Much	16	19.3	25.8	83.9
	Very much	10	12.0	16.1	100.0
	Total	62	74.7	100.0	
	Missing	21	25.3		
	Total	83	100.0		
Hearing disorders	Not at all	5	6.0	7.9	7.9
	A little	15	18.1	23.8	31.7
	Moderately	14	16.9	22.2	54.0
	Much	18	21.7	28.6	82.5

	Very much	11	13.3	17.5	100.0
	Total	63	75.9	100.0	
	Missing	20	24.1		
	Total	83	100.0		
Attention Deficit Disorder and Hyperactivity Disorder ADHD	Not at all	3	3.6	4.8	4.8
	A little	7	8.4	11.1	15.9
	Moderately	15	18.1	23.8	39.7
	Much	20	24.1	31.7	71.4
	Very much	18	21.7	28.6	100.0
	Total	63	75.9	100.0	
	Missing	20	24.1		
	Total	83	100.0		

APPENDIX A-4-14

Participant's perceptions regarding student's training

		Frequency	Percent	Valid Percent	Cumulative Percent
Learning difficulties	A little	2	2.4	3.1	3.1
	Moderately	10	12.0	15.6	18.8
	Much	30	36.1	46.9	65.6
	Very much	22	26.5	34.4	100.0
	Total	64	77.1	100.0	
	Missing	19	22.9		
	Total	83	100.0		
Communication disorders	A little	3	3.6	4.8	4.8
	Moderately	10	12.0	15.9	20.6
	Much	28	33.7	44.4	65.1
	Very much	22	26.5	34.9	100.0
	Total	63	75.9	100.0	
	Missing	20	24.1		
	Total	83	100.0		
Behavioral disorders	A little	4	4.8	6.3	6.3
	Moderately	6	7.2	9.4	15.6
	Much	29	34.9	45.3	60.9
	Very much	25	30.1	39.1	100.0
	Total	64	77.1	100.0	
	Missing	19	22.9		
	Total	83	100.0		
Health disorders	A little	2	2.4	3.2	3.2
	Moderately	17	20.5	27.0	30.2

	Much	25	30.1	39.7	69.8
	Very much	19	22.9	30.2	100.0
	Total	63	75.9	100.0	
	Missing	20	24.1		
	Total	83	100.0		
Vision disorders	A little	6	7.2	9.8	9.8
	Moderately	14	16.9	23.0	32.8
	Much	25	30.1	41.0	73.8
	Very much	16	19.3	26.2	100.0
	Total	61	73.5	100.0	
	Missing	22	26.5		
	Total	83	100.0		
Movement disorders	A little	5	6.0	7.8	7.8
	Moderately	14	16.9	21.9	29.7
	Much	28	33.7	43.8	73.4
	Very much	17	20.5	26.6	100.0
	Total	64	77.1	100.0	
	Missing	19	22.9		
	Total	83	100.0		
Hearing disorders	A little	4	4.8	6.3	6.3
	Moderately	14	16.9	22.2	28.6
	Much	28	33.7	44.4	73.0
	Very much	17	20.5	27.0	100.0
	Total	63	75.9	100.0	
	Missing	20	24.1		
	Total	83	100.0		
Attention Deficit Disorder and Hyperactivity Disorder ADHD	A little	2	2.4	3.2	3.2
	Moderately	6	7.2	9.7	12.9
	Much	33	39.8	53.2	66.1

	Very much	21	25.3	33.9	100.0
	Total	62	74.7	100.0	
	Missing	21	25.3		
	Total	83	100.0		

APPENDIX B-6-1

Questionnaire administered to the groups that used the VR application

PART I. DEMOGRAPHIC DATA

27. Country

Switzerland	Cyprus	Other:

28. Gender

Male	Female

29. Age

18-24	25-29	30-39	40-49	50-59	60+

30. Teaching experience:

Not at all	First time	1-2 years	3-5 years
6-10 years	11-15 years	16-20 years	Over 20 years

31. Level of education in which you serve:

- ❑ Primary Education
- ❑ Secondary Education
- ❑ Higher Education
- ❑ Vocational Education
- ❑ Other: ……

32. Experience in using Virtual Reality environments:

Not at all	A little	Moderately	Much	Very much

PART II

1. ***What was your perspective onto the virtual world? (In the case of changing perspectives, please describe the one most frequently used.)***

- ❑ "Through the eyes of my own character", so called first-person perspective
- ❑ "Behind/above my character", so called third-person perspective

2. ***Now you'll see some statements about experiences. Please indicate, whether or not each statement applies to your experience. There are no right or wrong answers, only your opinion counts. You will notice that some questions are very similar to each other. This is necessary for statistical reasons. And please remember: Answer all these questions only referring to this one experience.***

	-3	-2	-1	0	+1	+2	+3
1. How aware were you of the real world surrounding while navigating in the virtual world? (i.e. sounds, room temperature, other people, etc.)?	*Extremely aware*			*Moderately aware*			*Not aware at all*
2. How real did the virtual world seem to you?	*Completely real*						*Not real at all*
3. I had a sense of acting in the virtual space, rather than operating something from outside.	*Fully disagree*						*Fully agree*
4. How much did your experience in the virtual environment seem consistent with your real-world experience?	*Not consistent*						*Very consistent*
5. How real did the virtual world seem to you?	*About as real as an imagined world*						*Indistinguishable from the real world*
6. I did not feel present in the virtual space.	*Did not feel*						*Felt present*
7. I was not aware of my real environment.	*Fully disagree*						*Fully agree*
8. In the computer-generated world, I had a sense of 'being there'	*Not at all*						*Very much*
9. Somehow, I felt that the virtual world surrounded me.	*Fully disagree*						*Fully agree*
10. I felt present in the virtual space.	*Fully disagree*						*Fully agree*
11. I still paid attention to the real environment.	*Fully disagree*						*Fully agree*

12. The virtual world seemed more realistic than the real world.	*Fully disagree*	*Fully agree*
13. I felt like I was just perceiving pictures.	*Fully disagree*	*Fully agree*
14. I was completely captivated by the virtual world.	*Fully disagree*	*Fully agree*

PART III

Evaluate the following comments about teachers' abilities by placing an "X" in the appropriate box of the 6-point scale.
Use the following scale to record your answers:

0	*1*	*2*	*3*	*4*	*5*
Not at all	*Strongly disagree*	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*

	0	*1*	*2*	*3*	*4*	*5*
1. A teacher should be able to predict the feelings of his/her students						
2. A teacher should be able to spot when a student is feeling awkward or uncomfortable.						
3. A teacher should try to look at every student's side of a disagreement before making a decision.						
4. A teacher should try to understand the students better, by imagining how things look from their perspective.						
5. Teachers sometimes find it difficult to see things from the student's point of view.						
6. Teachers often get emotionally involved with the students' problems.						
7. A teacher should try to imagine how he/she would feel in the students' situation.						
8. Teachers should not be really interested in how students feel.						
9. A teacher should be upset when his/her students are being treated disrespectfully.						
10. A teacher should feel supportive of students of other racial and ethnic groups.						
11. It is difficult for a teacher to put himself/herself in the position of someone who is racially and/or ethnically different.						

PART IV

Evaluate the following comments about teachers' reflective abilities by placing an "X" in the appropriate box of the 6-point scale.
Use the following scale to record your answers:

0	*1*	*2*	*3*	*4*	*5*
Not at all	*Strongly disagree*	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*

	0	*1*	*2*	*3*	*4*	*5*
1. Teachers should spend time in self-reflection.						
2. This experience within the VR environment regarding multiculturalism and bullying can challenge some of teachers' firmly held ideas.						
3. A teacher should not really be interested in analyzing students' needs.						
4. The use of this VR experience, can change the way teachers will attend to the needs of the students.						
5. This VR experience, can help teachers change the way they will react on disruptive behavior among my students.						
6. This VR experience, can help teachers discover faults in their teaching style or in their interaction with students that he/she previously believed to be right.						
7. Because of this VR experience, teachers will try more frequently to enter their students' position.						
8. Because of this VR experience, teachers will support more students of other racial and ethnic groups.						

PART V

This following scale consists of several words and phrases that describe different feelings and emotions. Indicate to what extent you had any of those feelings during the VR experience. Use the following scale to record your answers:

0	*1*	*2*	*3*	*4*	*5*
Not at all	*Low*	*A little*	*Moderately*	*Very*	*Extremely*

	0	*1*	*2*	*3*	*4*	*5*
1. Excited						
2. Stressed						
3. Active						
4. Fatigue						

5. Upset
6. Confident
7. Afraid
8. Inspired
9. Joyful
10. Nervous
11. Sad
12. Satisfied

Thank you very much for your participation!

APPENDIX B-6-2

Questionnaire administered to the group that was trained in the physical classroom

PART I. DEMOGRAPHIC DATA

1. Country

Switzerland	Cyprus	Other:

2. Gender

Male	Female

3. Age

18-24	25-29	30-39	40-49	50-59	60+

4. Teaching experience:

Not at all	First time	1-2 years	3-5 years
6-10 years	1-15 years	6-20 years	Over 20 years

5. Level of education in which you serve:

- ❑ Primary Education
- ❑ Secondary Education
- ❑ Higher Education
- ❑ Vocational Education
- ❑ Other: ……

6. Experience in using Virtual Reality environments:

Not at all	A little	Moderately	Much	Very much

PART III

Evaluate the following comments about teachers' abilities by placing an "X" in the appropriate box of the 6-point scale.
Use the following scale to record your answers:

0	*1*	*2*	*3*	*4*	*5*
Not at all	*Strongly disagree*	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*

	0	1	2	3	4	5
1. A teacher should be able to predict the feelings of his/her students						
2. A teacher should be able to spot when a student is feeling awkward or uncomfortable.						
3. A teacher should try to look at every student's side of a disagreement before making a decision.						
4. A teacher should try to understand the students better, by imagining how things look from their perspective.						
5. Teachers sometimes find it difficult to see things from the student's point of view.						
6. Teachers often get emotionally involved with the students' problems.						
7. A teacher should try to imagine how he/she would feel in the students' situation.						
8. Teachers should not be really interested in how students feel.						
9. A teacher should be upset when his/her students are being treated disrespectfully.						
10. A teacher should feel supportive of students of other racial and ethnic groups.						
11. It is difficult for a teacher to put himself/herself in the position of someone who is racially and/or ethnically different.						

PART IV

Evaluate the following comments about teachers' reflective abilities by placing an "X" in the appropriate box of the 6-point scale.
Use the following scale to record your answers:

0	*1*	*2*	*3*	*4*	*5*
Not at all	*Strongly disagree*	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*

	0	1	2	3	4	5
1. Teachers should spend time in self-reflection.						
2. This experience within the physical classroom environment regarding multiculturalism and bullying can challenge some of teachers' firmly held ideas.						
3. A teacher should not really be interested in analyzing students' needs.						
4. The use of this training experience, can change the way teachers will attend to the needs of the students.						
5. This training experience, can help teachers change the way they will react on disruptive behavior among my students.						

6. This training experience, can help teachers discover faults in their teaching style or in their interaction with students that he/she previously believed to be right.
7. Because of this training experience, teachers will try more frequently to enter their students' position.
8. Because of this training experience, teachers will support more students of other racial and ethnic groups.

PART V

This following scale consists of several words and phrases that describe different feelings and emotions. Indicate to what extent you had any of those feelings during the VR experience. Use the following scale to record your answers:

0	*1*	*2*	*3*	*4*	*5*
Not at all	*Low*	*A little*	*Moderately*	*Very*	*Extremely*

	0	*1*	*2*	*3*	*4*	*5*
1. Excited						
2. Stressed						
3. Active						
4. Fatigue						
5. Upset						
6. Confident						
7. Afraid						
8. Inspired						
9. Joyful						
10. Nervous						
11. Sad						
12. Satisfied						

Thank you very much for your participation!

APPENDIX B-6-3

Consent form for pilot test investigation

Consent Form

Dear participant,

You will be asked to interact with a Virtual Reality environment, developed in the context of my dissertation in the Department of Multimedia and Graphic Arts, Cyprus University of Technology, for helping teachers practice their skills. You are expected to participate for approximately 10 minutes and then you will be asked to evaluate your experience. Your experience on this subject is valuable to us.

Please be assured that the questionnaire completion is anonymous and that the information you provide will be completely confidential and will not be used for any other purpose. Your participation is entirely voluntary. You can choose not to participate in part, or all the testing of the Virtual Reality environment and you can withdraw at any time without giving a reason.

Thank you for your response and cooperation.

Yours Sincerely,

Kalliopi-Evangelia Stavroulia

Doctoral Student and Postgraduate Associate

Department of Multimedia and Graphic Arts

School of Fine and Applied Arts

Cyprus University of Technology

For more information, please contact the Visual Media Computing Lab: vmc@gmail.com

APPENDIX B-6-4

Descriptive statistics for the items of the presence scale

8. In the computer-generated world, I had a sense of 'being there'. (General item)

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	-1.0	2	18.2	18.2
		1.0	2	18.2	36.4
		2.0	6	54.5	90.9
		3 (Extremely)	1	9.1	100.0
		Total	11	100.0	
VI.group	Valid	-3 (Not at all)	1	9.1	9.1
		-2.0	1	9.1	18.2
		-1.0	1	9.1	27.3
		.0	1	9.1	36.4
		1.0	3	27.3	63.6
		2.0	3	27.3	90.9
		3 (Extremely)	1	9.1	100.0
		Total	11	100.0	

9. Somehow, I felt that the virtual world surrounded me. (SP1)

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	-3 (Not at all)	1	9.1	9.1
		-2.00	2	18.2	27.3
		-1.00	1	9.1	36.4
		1.00	2	18.2	54.5
		2.00	3	27.3	81.8
		3 (Extremely)	2	18.2	100.0
		Total	11	100.0	
VI.group	Valid	-3 (Not at all)	1	9.1	9.1

		-2.00	1	9.1	18.2
		.00	2	18.2	36.4
		1.00	4	36.4	72.7
		2.00	3	27.3	100.0
		Total	11	100.0	

13. I felt like I was just perceiving pictures. (SP2)

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	.00	1	9.1	9.1
		2.00	3	27.3	36.4
		3.00	2	18.2	54.5
		4.00	1	9.1	63.6
		5.00	4	36.4	100.0
		Total	11	100.0	
VI.group	Valid	1.00	3	27.3	27.3
		2.00	1	9.1	36.4
		4.00	1	9.1	45.5
		5.00	3	27.3	72.7
		6.00	3	27.3	100.0
		Total	11	100.0	

6. I did not feel present in the virtual space. (SP3)

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	-2.00	4	36.4	36.4
		-1.00	2	18.2	54.5
		1.00	3	27.3	81.8
		2.00	2	18.2	100.0
		Total	11	100.0	
VI.group	Valid	-3 (Not at all)	3	27.3	27.3
		-2.00	3	27.3	54.5

		-1.00	3	27.3	81.8
		.00	1	9.1	90.9
		2.00	1	9.1	100.0
		Total	11	100.0	

3. I had a sense of acting in the virtual space, rather than operating something from outside. (SP4)

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	-3 (Not at all)	1	9.1	9.1
		-2.00	2	18.2	27.3
		-1.00	3	27.3	54.5
		.00	4	36.4	90.9
		1.00	1	9.1	100.0
		Total	11	100.0	
VI.group	Valid	-3 (Not at all)	1	9.1	9.1
		-2.00	2	18.2	27.3
		-1.00	1	9.1	36.4
		.00	3	27.3	63.6
		1.00	4	36.4	100.0
		Total	11	100.0	

10. I felt present in the virtual space. (SP5)

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	-3 (Not at all)	1	9.1	9.1
		-2.00	1	9.1	18.2
		.00	1	9.1	27.3
		1.00	3	27.3	54.5
		2.00	5	45.5	100.0
		Total	11	100.0	
VI.group	Valid	-3 (Not at all)	1	9.1	9.1

		-2.00	1	9.1	18.2
		.00	3	27.3	45.5
		1.00	2	18.2	63.6
		2.00	3	27.3	90.9
		3 (Extremely)	1	9.1	100.0
		Total	11	100.0	

1. How aware were you of the real world surrounding while navigating in the virtual world? (i.e. sounds, room temperature, other people, etc.)? (INV)

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	-3 (Not at all)	1	9.1	9.1
		-2.00	3	27.3	36.4
		1.00	4	36.4	72.7
		2.00	3	27.3	100.0
		Total	11	100.0	
VI.group	Valid	-3 (Not at all)	3	27.3	27.3
		-2.00	3	27.3	54.5
		.00	2	18.2	72.7
		2.00	2	18.2	90.9
		3 (Extremely)	1	9.1	100.0
		Total	11	100.0	

11. I still paid attention to the real environment. (INV)

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	1.00	3	27.3	27.3
		2.00	4	36.4	63.6
		4.00	2	18.2	81.8
		5.00	2	18.2	100.0
		Total	11	100.0	
VI.group	Valid	1.00	2	18.2	18.2
		5.00	5	45.5	63.6

		6.00	4	36.4	100.0
		Total	11	100.0	

7. I was not aware of my real environment. (INV)

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	-2.00	5	45.5	45.5
		-1.00	2	18.2	63.6
		1.00	3	27.3	90.9
		3 (Extremely)	1	9.1	100.0
		Total	11	100.0	
VI.group	Valid	-3 (Not at all)	1	9.1	9.1
		-2.00	2	18.2	27.3
		.00	1	9.1	36.4
		2.00	6	54.5	90.9
		3 (Extremely)	1	9.1	100.0
		Total	11	100.0	

14. I was completely captivated by the virtual world. (INV)

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	-2.00	2	18.2	18.2
		-1.00	4	36.4	54.5
		.00	2	18.2	72.7
		1.00	2	18.2	90.9
		2.00	1	9.1	100.0
		Total	11	100.0	
VI.group	Valid	-2.00	3	27.3	27.3
		-1.00	2	18.2	45.5
		.00	1	9.1	54.5
		1.00	1	9.1	63.6
		2.00	3	27.3	90.9

		3 (Extremely)	1	9.1	100.0
		Total	11	100.0	

5. How real did the virtual world seem to you? (REAL)

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	1.00	1	9.1	9.1
		2.00	2	18.2	27.3
		3.00	1	9.1	36.4
		4.00	4	36.4	72.7
		5.00	1	9.1	81.8
		6.00	2	18.2	100.0
		Total	11	100.0	
VI.group	Valid	1.00	2	18.2	18.2
		2.00	2	18.2	36.4
		3.00	3	27.3	63.6
		4.00	1	9.1	72.7
		5.00	3	27.3	100.0
		Total	11	100.0	

4. How much did your experience in the virtual environment seem consistent with your real-world experience? (REAL)

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	-2.00	2	18.2	18.2
		-1.00	4	36.4	54.5
		.00	1	9.1	63.6
		1.00	1	9.1	72.7
		2.00	3	27.3	100.0
		Total	11	100.0	
VI.group	Valid	-2.00	2	18.2	18.2
		-1.00	1	9.1	27.3

		.00	3	27.3	54.5
		1.00	3	27.3	81.8
		2.00	2	18.2	100.0
		Total	11	100.0	

2. How real did the virtual world seem to you? (REAL)

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	-3 (Not at all)	2	18.2	18.2
		-2.00	3	27.3	45.5
		-1.00	1	9.1	54.5
		.00	2	18.2	72.7
		1.00	2	18.2	90.9
		2.00	1	9.1	100.0
		Total	11	100.0	
VI.group	Valid	-3 (Not at all)	1	9.1	9.1
		-2.00	2	18.2	27.3
		-1.00	1	9.1	36.4
		.00	1	9.1	45.5
		1.00	4	36.4	81.8
		2.00	2	18.2	100.0
		Total	11	100.0	

12. The virtual world seemed more realistic than the real world. (REAL)

GROUP			Frequency	Percent	Cumulative Percent
VR.group	Valid	-3 (Not at all)	8	72.7	72.7
		-2.00	2	18.2	90.9
		1.00	1	9.1	100.0
		Total	11	100.0	
VI.group	Valid	-3 (Not at all)	4	36.4	36.4

	-2.00	3	27.3	63.6
	-1.00	2	18.2	81.8
	.00	1	9.1	90.9
	1.00	1	9.1	100.0
	Total	11	100.0	

APPENDIX B-6-5

Descriptive statistics for the items of the empathy scale

1. A teacher should be able to predict the feelings of his/her students

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	2 (Disagree)	2	18.2	18.2	18.2
		4 (Agree)	9	81.8	81.8	100.0
		Total	11	100.0	100.0	
VI.group	Valid	0 (No opinion)	1	9.1	9.1	9.1
		4 (Agree)	7	63.6	63.6	72.7
		5 (Strongly agree)	3	27.3	27.3	100.0
		Total	11	100.0	100.0	
PS.group	Valid	2 (Disagree)	1	9.1	9.1	9.1
		4 (Agree)	7	63.6	63.6	72.7
		5 (Strongly agree)	3	27.3	27.3	100.0
		Total	11	100.0	100.0	

2. A teacher should be able to spot when a student is feeling awkward or uncomfortable.

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	4 (Agree)	7	63.6	63.6	63.6
		5 (Strongly agree)	4	36.4	36.4	100.0
		Total	11	100.0	100.0	
VI.group	Valid	4 (Agree)	4	36.4	36.4	36.4
		5 (Strongly agree)	7	63.6	63.6	100.0
		Total	11	100.0	100.0	
PS.group	Valid	4 (Agree)	9	81.8	81.8	81.8
		5 (Strongly agree)	2	18.2	18.2	100.0
		Total	11	100.0	100.0	

3. A teacher should try to look at every student's side of a disagreement before making a decision.

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	4 (Agree)	8	72.7	72.7	72.7
		5 (Strongly agree)	3	27.3	27.3	100.0
		Total	11	100.0	100.0	
VI.group	Valid	3 (Neither Agree nor Disagree)	3	27.3	27.3	27.3
		4 (Agree)	4	36.4	36.4	63.6
		5 (Strongly agree)	4	36.4	36.4	100.0
		Total	11	100.0	100.0	
PS.group	Valid	3 (Neither Agree nor Disagree)	1	9.1	9.1	9.1
		4 (Agree)	7	63.6	63.6	72.7
		5 (Strongly agree)	3	27.3	27.3	100.0
		Total	11	100.0	100.0	

4. A teacher should try to understand the students better, by imagining how things look from their perspective.

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	4 (Agree)	8	72.7	72.7	72.7
		5 (Strongly agree)	3	27.3	27.3	100.0
		Total	11	100.0	100.0	
VI.group	Valid	4 (Agree)	4	36.4	36.4	36.4
		5 (Strongly agree)	7	63.6	63.6	100.0
		Total	11	100.0	100.0	
PS.group	Valid	3 (Neither Agree nor Disagree)	1	9.1	9.1	9.1
		4 (Agree)	6	54.5	54.5	63.6
		5 (Strongly agree)	4	36.4	36.4	100.0

		Total	11	100.0	100.0	

5. Teachers sometimes find it difficult to see things from the student's point of view.

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	0 (No opinion)	1	9.1	9.1	9.1
		2 (Disagree)	1	9.1	9.1	18.2
		4 (Agree)	8	72.7	72.7	90.9
		5 (Strongly agree)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
VI.group	Valid	0 (No opinion)	1	9.1	9.1	9.1
		3 (Neither Agree nor Disagree)	1	9.1	9.1	18.2
		4 (Agree)	5	45.5	45.5	63.6
		5 (Strongly agree)	4	36.4	36.4	100.0
		Total	11	100.0	100.0	
PS.group	Valid	2 (Disagree)	1	9.1	9.1	9.1
		4 (Agree)	7	63.6	63.6	72.7
		5 (Strongly agree)	3	27.3	27.3	100.0
		Total	11	100.0	100.0	

6. Teachers often get emotionally involved with the students' problems.

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	0 (No opinion)	1	9.1	9.1	9.1
		2 (Disagree)	3	27.3	27.3	36.4
		3 (Neither Agree nor Disagree)	4	36.4	36.4	72.7
		4 (Agree)	2	18.2	18.2	90.9
		5 (Strongly agree)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
VI.group	Valid	0(No opinion)	1	9.1	9.1	9.1

		1 (Strongly disagree)	1	9.1	9.1	18.2
		3 (Neither Agree nor Disagree)	4	36.4	36.4	54.5
		4 (Agree)	3	27.3	27.3	81.8
		5 (Strongly agree)	2	18.2	18.2	100.0
		Total	11	100.0	100.0	
PS.group	Valid	1 (Strongly disagree)	2	18.2	18.2	18.2
		2 (Disagree)	1	9.1	9.1	27.3
		3 (Neither Agree nor Disagree)	3	27.3	27.3	54.5
		4 (Agree)	4	36.4	36.4	90.9
		5 (Strongly agree)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	

7. A teacher should try to imagine how he/she would feel in the students' situation.

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	2 (Disagree)	1	9.1	9.1	9.1
		4 (Agree)	7	63.6	63.6	72.7
		5 (Strongly agree)	3	27.3	27.3	100.0
		Total	11	100.0	100.0	
VI.group	Valid	3 (Neither Agree nor Disagree)	2	18.2	18.2	18.2
		4 (Agree)	4	36.4	36.4	54.5
		5 (Strongly agree)	5	45.5	45.5	100.0
		Total	11	100.0	100.0	
PS.group	Valid	4 (Agree)	9	81.8	81.8	81.8
		5 (Strongly agree)	2	18.2	18.2	100.0
		Total	11	100.0	100.0	

10. A teacher should feel supportive of students of other racial and ethnic groups.

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	3 (Neither Agree nor Disagree)	3	27.3	27.3	27.3
		4 (Agree)	4	36.4	36.4	63.6
		5 (Strongly agree)	4	36.4	36.4	100.0
		Total	11	100.0	100.0	
VI.group	Valid	3 (Neither Agree nor Disagree)	1	9.1	9.1	9.1
		4 (Agree)	5	45.5	45.5	54.5
		5 (Strongly agree)	5	45.5	45.5	100.0
		Total	11	100.0	100.0	
PS.group	Valid	2 (Disagree)	1	9.1	9.1	9.1
		4 (Agree)	9	81.8	81.8	90.9
		5 (Strongly agree)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	

11. It is difficult for a teacher to put himself/herself in the position of someone who is racially and/or ethnically different.

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	0 (No opinion)	1	9.1	9.1	9.1
		2 (Disagree)	4	36.4	36.4	45.5
		3 (Neither Agree nor Disagree)	4	36.4	36.4	81.8
		4 (Agree)	2	18.2	18.2	100.0
		Total	11	100.0	100.0	
VI.group	Valid	0 (No opinion)	1	9.1	9.1	9.1
		1(Strongly disagree)	2	18.2	18.2	27.3
		2 (Disagree)	1	9.1	9.1	36.4
		3 (Neither Agree nor Disagree)	3	27.3	27.3	63.6

		4 (Agree)	4	36.4	36.4	100.0
		Total	11	100.0	100.0	
PS.group	Valid	2 (Disagree)	2	18.2	18.2	18.2
		4 (Agree)	8	72.7	72.7	90.9
		5 (Strongly agree)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	

APPENDIX B-6-6

Descriptive statistics for the items of the reflection scale

1. Teachers should spend time in self-reflection.

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	3 (Neither agree nor disagree)	1	9.1	9.1	9.1
		4 (Agree)	10	90.9	90.9	100.0
		Total	11	100.0	100.0	
VI.group	Valid	3 (Neither agree nor disagree)	1	9.1	9.1	9.1
		4 (Agree)	5	45.5	45.5	54.5
		5 (Strongly agree)	5	45.5	45.5	100.0
		Total	11	100.0	100.0	
PS.group	Valid	4 (Agree)	7	63.6	63.6	63.6
		5 (Strongly agree)	4	36.4	36.4	100.0
		Total	11	100.0	100.0	

2. This experience within the VR environment regarding multiculturalism and bullying can challenge some of teachers' firmly held ideas.

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	1 (Strongly disagree)	1	9.1	9.1	9.1
		2 (Disagree)	2	18.2	18.2	27.3
		3 (Neither agree nor disagree)	2	18.2	18.2	45.5
		4 (Agree)	6	54.5	54.5	100.0

		Total	11	100.0	100.0	
VI.group	Valid	1 (Strongly disagree)	1	9.1	9.1	9.1
		3 (Neither agree nor disagree)	4	36.4	36.4	45.5
		4(Agree)	3	27.3	27.3	72.7
		5(Strongly agree)	3	27.3	27.3	100.0
		Total	11	100.0	100.0	
PS.group	Valid	2(Disagree)	1	9.1	9.1	9.1
		3(Neither agree nor disagree)	3	27.3	27.3	36.4
		4(Agree)	5	45.5	45.5	81.8
		5(Strongly agree)	2	18.2	18.2	100.0
		Total	11	100.0	100.0	

3. A teacher should not really be interested in analyzing students' needs.

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	2(Disagree)	1	9.1	9.1	9.1
		3(Neither agree nor disagree)	2	18.2	18.2	27.3
		4(Agree)	8	72.7	72.7	100.0
		Total	11	100.0	100.0	
VI.group	Valid	3(Neither agree nor disagree)	3	27.3	27.3	27.3
		4(Agree)	7	63.6	63.6	90.9

		5(Strongly agree)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
PS.group	Valid	3(Neither agree nor disagree)	2	18.2	18.2	18.2
		4(Agree)	9	81.8	81.8	100.0
		Total	11	100.0	100.0	

4. The use of this VR experience, can change the way teachers will attend to the needs of the students.

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	2(Disagree)	3	27.3	27.3	27.3
		3(Neither agree nor disagree)	3	27.3	27.3	54.5
		4(Agree)	5	45.5	45.5	100.0
		Total	11	100.0	100.0	
VI.group	Valid	1(Strongly disagree)	1	9.1	9.1	9.1
		3(Neither agree nor disagree)	2	18.2	18.2	27.3
		4(Agree)	6	54.5	54.5	81.8
		5(Strongly agree)	2	18.2	18.2	100.0
		Total	11	100.0	100.0	
PS.group	Valid	2(Disagree)	1	9.1	9.1	9.1
		3(Neither agree nor disagree)	5	45.5	45.5	54.5
		4(Agree)	4	36.4	36.4	90.9

		5(Strongly agree)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	

5. This VR experience, can help teachers change the way they will react on disruptive behavior among my students.

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	2(Disagree)	3	27.3	27.3	27.3
		3(Neither agree nor disagree)	2	18.2	18.2	45.5
		4(Agree)	5	45.5	45.5	90.9
		5(Strongly agree)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
VI.group	Valid	1(Strongly disagree)	1	9.1	9.1	9.1
		3(Neither agree nor disagree)	2	18.2	18.2	27.3
		4(Agree)	5	45.5	45.5	72.7
		5(Strongly agree)	3	27.3	27.3	100.0
		Total	11	100.0	100.0	
PS.group	Valid	3(Neither agree nor disagree)	5	45.5	45.5	45.5
		4(Agree)	5	45.5	45.5	90.9
		5(Strongly agree)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	

6. This VR experience, can help teachers discover faults in their teaching style or in their interaction with students that he/she previously believed to be right.

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	2(Disagree)	3	27.3	27.3	27.3
		3(Neither agree nor disagree)	3	27.3	27.3	54.5
		4(Agree)	4	36.4	36.4	90.9
		5(Strongly agree)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
VI.group	Valid	1(Strongly disagree)	1	9.1	9.1	9.1
		3(Neither agree nor disagree)	3	27.3	27.3	36.4
		4(Agree)	3	27.3	27.3	63.6
		5(Strongly agree)	4	36.4	36.4	100.0
		Total	11	100.0	100.0	
PS.group	Valid	3(Neither agree nor disagree)	2	18.2	18.2	18.2
		4(Agree)	8	72.7	72.7	90.9
		5(Strongly agree)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	

7. Because of this VR experience, teachers will try more frequently to enter their students' position.

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	0(Not at all)	1	9.1	9.1	9.1
		3(Neither agree nor disagree)	4	36.4	36.4	45.5
		4(Agree)	5	45.5	45.5	90.9

		5(Strongly agree)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
VI.group	Valid	1(Strongly disagree)	1	9.1	9.1	9.1
		3(Neither agree nor disagree)	3	27.3	27.3	36.4
		4(Agree)	5	45.5	45.5	81.8
		5(Strongly agree)	2	18.2	18.2	100.0
		Total	11	100.0	100.0	
PS.group	Valid	2(Disagree)	1	9.1	9.1	9.1
		3(Neither agree nor disagree)	4	36.4	36.4	45.5
		4(Agree)	5	45.5	45.5	90.9
		5(Strongly agree)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	

8. Because of this VR experience, teachers will support more students of other racial and ethnic groups.

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	0(Not at all)	1	9.1	9.1	9.1
		2(Disagree)	2	18.2	18.2	27.3
		3(Neither agree nor disagree)	4	36.4	36.4	63.6
		4(Agree)	3	27.3	27.3	90.9
		5(Strongly agree)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
VI.group	Valid	1(Strongly disagree)	1	9.1	9.1	9.1

		3(Neither agree nor disagree)	3	27.3	27.3	36.4
		4(Agree)	4	36.4	36.4	72.7
		5(Strongly agree)	3	27.3	27.3	100.0
		Total	11	100.0	100.0	
PS.group	Valid	2(Disagree)	1	9.1	9.1	9.1
		3(Neither agree nor disagree)	4	36.4	36.4	45.5
		4(Agree)	5	45.5	45.5	90.9
		5(Strongly agree)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	

APPENDIX B-6-7

Descriptive statistics for the items of the emotions scale

1. Excited

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	1(Low)	5	45.5	45.5	45.5
		2(A little)	4	36.4	36.4	81.8
		3(Moderately)	1	9.1	9.1	90.9
		4(Very)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
VI.group	Valid	0(Not at all)	3	27.3	27.3	27.3
		2(A little)	3	27.3	27.3	54.5
		3(Moderately)	2	18.2	18.2	72.7
		4(Very)	3	27.3	27.3	100.0
		Total	11	100.0	100.0	
PS.group	Valid	0(Not at all)	2	18.2	18.2	18.2
		1(Low)	4	36.4	36.4	54.5
		2(A little)	2	18.2	18.2	72.7
		3(Moderately)	3	27.3	27.3	100.0
		Total	11	100.0	100.0	

2. Stressed (Reversed)

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	2(A little)	1	9.1	9.1	9.1
		3(Moderately)	4	36.4	36.4	45.5
		4(Very)	1	9.1	9.1	54.5
		5(Extremely)	5	45.5	45.5	100.0
		Total	11	100.0	100.0	

VI.group	Valid	2(A little)	1	9.1	9.1	9.1
		3(Moderately)	1	9.1	9.1	18.2
		4(Very)	5	45.5	45.5	63.6
		5(Extremely)	4	36.4	36.4	100.0
		Total	11	100.0	100.0	
PS.group	Valid	3(Moderately)	2	18.2	18.2	18.2
		4(Very)	3	27.3	27.3	45.5
		5(Extremely)	6	54.5	54.5	100.0
		Total	11	100.0	100.0	

3. Active

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	0(Not at all)	2	18.2	18.2	18.2
		1(Low)	4	36.4	36.4	54.5
		2(A little)	3	27.3	27.3	81.8
		3(Moderately)	1	9.1	9.1	90.9
		4(Very)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
VI.group	Valid	0(Not at all)	1	9.1	9.1	9.1
		1(Low)	4	36.4	36.4	45.5
		3(Moderately)	6	54.5	54.5	100.0
		Total	11	100.0	100.0	
PS.group	Valid	0(Not at all)	1	9.1	9.1	9.1
		1(Low)	6	54.5	54.5	63.6
		2(A little)	2	18.2	18.2	81.8
		3(Moderately)	2	18.2	18.2	100.0
		Total	11	100.0	100.0	

4. Fatigue (Reversed)

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	3(Moderately)	2	18.2	18.2	18.2
		4(Very)	1	9.1	9.1	27.3
		5(Extremely)	8	72.7	72.7	100.0
		Total	11	100.0	100.0	
VI.group	Valid	3(Moderately)	3	27.3	27.3	27.3
		4(Very)	3	27.3	27.3	54.5
		5(Extremely)	5	45.5	45.5	100.0
		Total	11	100.0	100.0	
PS.group	Valid	3(Moderately)	1	9.1	9.1	9.1
		4(Very)	1	9.1	9.1	18.2
		5(Extremely)	9	81.8	81.8	100.0
		Total	11	100.0	100.0	

5. Upset (Reversed)

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	1(Low)	1	9.1	9.1	9.1
		2(A little)	2	18.2	18.2	27.3
		3(Moderately)	3	27.3	27.3	54.5
		5(Extremely)	5	45.5	45.5	100.0
		Total	11	100.0	100.0	
VI.group	Valid	1(Low)	1	9.1	9.1	9.1
		2(A little)	2	18.2	18.2	27.3
		3(Moderately)	3	27.3	27.3	54.5
		4(Very)	2	18.2	18.2	72.7
		5(Extremely)	3	27.3	27.3	100.0
		Total	11	100.0	100.0	
PS.group	Valid	3(Moderately)	2	18.2	18.2	18.2

		4(Very)	1	9.1	9.1	27.3
		5(Extremely)	8	72.7	72.7	100.0
		Total	11	100.0	100.0	

6. Confident

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	1(Low)	3	27.3	27.3	27.3
		2(A little)	2	18.2	18.2	45.5
		3(Moderately)	2	18.2	18.2	63.6
		4(Very)	4	36.4	36.4	100.0
		Total	11	100.0	100.0	
VI.group	Valid	0(Not at all)	1	9.1	9.1	9.1
		1(Low)	2	18.2	18.2	27.3
		2(A little)	1	9.1	9.1	36.4
		3(Moderately)	4	36.4	36.4	72.7
		4(Very)	2	18.2	18.2	90.9
		5(Extremely)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
PS.group	Valid	0(Not at all)	1	9.1	9.1	9.1
		1(Low)	2	18.2	18.2	27.3
		2(A little)	3	27.3	27.3	54.5
		3(Moderately)	3	27.3	27.3	81.8
		4(Very)	2	18.2	18.2	100.0
		Total	11	100.0	100.0	

7. Afraid (Reversed)

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	2(A little)	1	9.1	9.1	9.1
		3(Moderately)	1	9.1	9.1	18.2

		4(Very)	2	18.2	18.2	36.4
		5(Extremely)	7	63.6	63.6	100.0
		Total	11	100.0	100.0	
VI.group	Valid	3(Moderately)	1	9.1	9.1	9.1
		4(Very)	3	27.3	27.3	36.4
		5(Extremely)	7	63.6	63.6	100.0
		Total	11	100.0	100.0	
PS.group	Valid	4(Very)	1	9.1	9.1	9.1
		5(Extremely)	10	90.9	90.9	100.0
		Total	11	100.0	100.0	

8. Inspired

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	0(Not at all)	4	36.4	36.4	36.4
		1(Low)	1	9.1	9.1	45.5
		3(Moderately)	5	45.5	45.5	90.9
		5(Extremely)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
VI.group	Valid	0(Not at all)	1	9.1	9.1	9.1
		1(Low)	3	27.3	27.3	36.4
		2(A little)	3	27.3	27.3	63.6
		3(Moderately)	1	9.1	9.1	72.7
		4(Very)	3	27.3	27.3	100.0
		Total	11	100.0	100.0	
PS.group	Valid	0(Not at all)	2	18.2	18.2	18.2
		1(Low)	2	18.2	18.2	36.4
		2(A little)	3	27.3	27.3	63.6
		3(Moderately)	3	27.3	27.3	90.9
		4(Very)	1	9.1	9.1	100.0

		Total	11	100.0	100.0	

9. Joyful

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	0(Not at all)	3	27.3	27.3	27.3
		1(Low)	3	27.3	27.3	54.5
		2(A little)	2	18.2	18.2	72.7
		3(Moderately)	2	18.2	18.2	90.9
		5(Extremely)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
VI.group	Valid	0(Not at all)	4	36.4	36.4	36.4
		1(Low)	2	18.2	18.2	54.5
		2(A little)	1	9.1	9.1	63.6
		3(Moderately)	1	9.1	9.1	72.7
		4(Very)	3	27.3	27.3	100.0
		Total	11	100.0	100.0	
PS.group	Valid	0(Not at all)	1	9.1	9.1	9.1
		1(Low)	3	27.3	27.3	36.4
		2(A little)	4	36.4	36.4	72.7
		3(Moderately)	2	18.2	18.2	90.9
		4(Very)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	

10. Nervous (Reversed)

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	2(A little)	1	9.1	9.1	9.1
		3(Moderately)	3	27.3	27.3	36.4
		4(Very)	4	36.4	36.4	72.7
		5(Extremely)	3	27.3	27.3	100.0

		Total	11	100.0	100.0	
VI.group	Valid	2(A little)	1	9.1	9.1	9.1
		3(Moderately)	1	9.1	9.1	18.2
		4(Very)	3	27.3	27.3	45.5
		5(Extremely)	6	54.5	54.5	100.0
		Total	11	100.0	100.0	
PS.group	Valid	4(Very)	3	27.3	27.3	27.3
		5(Extremely)	8	72.7	72.7	100.0
		Total	11	100.0	100.0	

11. Sad (Reversed)

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent
VR.group	Valid	1(Low)	1	9.1	9.1	9.1
		2(A little)	2	18.2	18.2	27.3
		3(Moderately)	3	27.3	27.3	54.5
		5(Extremely)	5	45.5	45.5	100.0
		Total	11	100.0	100.0	
VI.group	Valid	2(A little)	1	9.1	9.1	9.1
		3(Moderately)	3	27.3	27.3	36.4
		4(Very)	3	27.3	27.3	63.6
		5(Extremely)	4	36.4	36.4	100.0
		Total	11	100.0	100.0	
PS.group	Valid	3(Moderately)	1	9.1	9.1	9.1
		4(Very)	1	9.1	9.1	18.2
		5(Extremely)	9	81.8	81.8	100.0
		Total	11	100.0	100.0	

12. Satisfied

GROUP			Frequency	Percent	Valid Percent	Cumulative Percent

VR.group	Valid	0(Not at all)	4	36.4	36.4	36.4
		1(Low)	1	9.1	9.1	45.5
		2(A little)	1	9.1	9.1	54.5
		3(Moderately)	4	36.4	36.4	90.9
		4(Very)	1	9.1	9.1	100.0
		Total	11	100.0	100.0	
VI.group	Valid	0(Not at all)	3	27.3	27.3	27.3
		1(Low)	2	18.2	18.2	45.5
		2(A little)	2	18.2	18.2	63.6
		4(Very)	4	36.4	36.4	100.0
		Total	11	100.0	100.0	
PS.group	Valid	0(Not at all)	2	18.2	18.2	18.2
		1(Low)	2	18.2	18.2	36.4
		2(A little)	3	27.3	27.3	63.6
		3(Moderately)	4	36.4	36.4	100.0
		Total	11	100.0	100.0	

APPENDIX B-6-8

Correlations regarding presence scale items

As the data did not follow the normal distribution, Spearman's rank-order correlation was run to determine whether there is a relationship between the items of presence scale for the two groups that used the virtual reality system and experience in using VR. The results indicate that there is a moderate, positive correlation between the variable ‘experience in using virtual reality environments’ and the variable 6 ‘I did not feel present in the virtual space’ (rs= .446, n=22, p= .038< .05). Thus, large values of experience in the use of VR are associated with large values of presence in the virtual space.

The test of correlation also reported a moderate, negative correlation between the variable ‘perspective onto the virtual world’ and the variable 8 ‘In the computer-generated world, I had a sense of ‘being there’’ (rs= -.544, n=22, p= .009< .01). Thus, the perspective onto the virtual world is negatively associated with the sense of being there in the virtual world. Moreover, according to the results, there is also a moderate, negative correlation between the variable ‘perspective onto the virtual world?’ and the variable 9 ‘Somehow, I felt that the virtual world surrounded me’ (rs= .481, n=22, p= .024< .05). Thus, the perspective onto the virtual world is negatively associated with the level the participants felt that the virtual world surrounded them.

Moreover, the results revealed significant correlations among the presence scale items. There is a strong positive correlation between the variable 8 ‘sense of ‘being there’ in the VR environment’ and the variable 9 ‘Somehow, I felt that the virtual world surrounded me’ (rs=.698, n=22, p= .000< .01). Thus, large values of sense of ‘being there’ are associated with large values of sense of physical presence in the virtual space. Moreover, variable 8 is moderately correlated with variable 3 ‘I had a sense of acting in the virtual space, rather than operating something from outside’ (rs=.582, n=22, p= .004< .01). There was significant evidence of a very strongly correlation between variable 8 and variable 10 ‘I felt present in the virtual space’ (rs=.882, n=22, p= .000< .01). There was also evidence that the sense of ‘being there’ is moderately correlated with variable 7 ‘I was not aware of my real environment’ (rs=.499, n=22, p= .018< .05), to variable 14 ‘I was completely captivated by the virtual world’ (rs=.566, n=22, p= .006< .01) and to variable 2 ‘How real did the virtual world seem to you?’ (rs=.531, n=22, p= .011< .05), while there is also a moderately negative correlation to variable 5 ‘How real did the virtual world seem to you?’ (rs=-.591, n=22, p= .004< .01). Furthermore, there is evidence of a strong correlation between the sense of ‘being there’ and variable 4 ‘How much did your experience in the virtual environment seem consistent with your real-world experience?’ (rs=.725, n=22, p= .000< .01).

The results also revealed a moderate correlation between variable 9 ‘Somehow, I felt that the virtual world surrounded me’ and variable 13 ‘I felt like I was just perceiving pictures’ (rs=.490, n=22, p= .021< .05), variable 3 ‘I had a sense of acting in the virtual space, rather than operating something from outside’ (rs=.518, n=22, p= .013< .05), variable 14 ‘I was completely captivated by the virtual world’ (rs=.575, n=22, p= .005< .01), variable 4 ‘How much did your experience in the virtual environment seem consistent with your real-world experience?’ (rs=.581, n=22, p= .005< .01) and variable 2 ‘How real did the virtual world seem to you?’ (rs=.511, n=22, p= .015< .05). There was also an evidence for a strong correlation between variable 9 and variable 10 ‘I felt present in the virtual space’ (rs=.714, n=22, p= .000< .01), while there was also indication for a negative moderate correlation between variable 9 and variable 5 ‘How real did the virtual world seem to you?’ (rs=-.535, n=22, p= .010< .05).

Some moderate correlations exist between variable 13 ‘I felt like I was just perceiving pictures’ and variables 11 ‘I still paid attention to the real environment’ (rs=.559, n=22, p= .007< .01) and 14 ‘I was completely captivated by the virtual world’ (rs=.683, n=22, p= .000< .01).

A strong negative correlation exists between variable 6 ‘I did not feel present in the virtual space’ and variable 11 ‘I still paid attention to the real environment’ (rs=-.605, n=22, p= .003< .01).

The results indicate a strong correlation between variable 3 ‘I had a sense of acting in the virtual space, rather than operating something from outside’ and variables 10 ‘I felt present in the virtual space’ (rs=.720, n=22, p= .000< .01) and 7 ‘I was not aware of my real environment’ (rs=.688, n=22, p= .000< .01). Moreover, there are indications for a moderate correlation between variable 3 and variables 11 ‘I still paid attention to the real environment’ (rs=.464, n=22, p= .030< .05) and 4 ‘How much did your experience in the virtual environment seem consistent with your real-world experience?’ (rs=.503, n=22, p= .017< .05).

According to the results there are evidence that variable 10 ‘I felt present in the virtual space’ is moderately correlated with variables 7 ‘I was not aware of my real environment’ (rs=.504, n=22, p= .017< .05), 14 ‘I was completely captivated by the virtual world’ (rs=.430, n=22, p= .046< .05), 4 ‘How much did your experience in the virtual environment seem consistent with your real-world experience?’ (rs=.594, n=22, p= .004< .01) and 2 ‘How real did the virtual world seem to you?’ (rs=.509, n=22, p= .015< .05), while there is a moderately negative correlation to variable 5 ‘How real did the virtual world seem to you?’ (rs=-.526, n=22, p= .012< .05).

A strong negative correlation exists between variable 1 ‘How aware were you of the real world surrounding while navigating in the virtual world? (i.e. sounds, room temperature, other people,

etc.)?' and variable 11 'I still paid attention to the real environment' (rs=-.609, n=22, p= .003< .01), while there is also a moderately negative correlation between variable 1 and variable 7 'I was not aware of my real environment' (rs=-.481, n=22, p= .023< .05).

There are evidence of a moderate correlation between variable 11 'I still paid attention to the real environment' and variables 7 'I was not aware of my real environment' (rs=.662, n=22, p= .001< .01), 14 'I was completely captivated by the virtual world' (rs=.588, n=22, p= .004< .01), 2 'How real did the virtual world seem to you?' (rs=.565, n=22, p= .006< .01) and 12 'The virtual world seemed more realistic than the real world' (rs=.435, n=22, p= .043< .05), while there is a moderate negative correlation between variable 11 and variable 5 'How real did the virtual world seem to you?' (rs=-.583, n=22, p= .004< .01).

Moderate positive correlations also exist between variable 7 'I was not aware of my real environment' and variables 14 'I was completely captivated by the virtual world' (rs=.519, n=22, p= .013< .05) and 2 'How real did the virtual world seem to you?' (rs=.513, n=22, p= .015< .05), while there is a moderate negative correlation between variables 7 and 5 'How real did the virtual world seem to you?' (rs=-.466, n=22, p= .029< .05).

There are indications that there is a strong positive correlation between variable 14 'I was completely captivated by the virtual world' and variables 4 'How much did your experience in the virtual environment seem consistent with your real-world experience?' (rs=.705, n=22, p= .000< .01) and 2 'How real did the virtual world seem to you?' (rs=.605, n=22, p= .003< .01), while there is a strong negative correlation between variable 14 and variable 5 'How real did the virtual world seem to you?' (rs=-.655, n=22, p= .001< .01).

There was significant evidence for very strong negative correlation between variable 5 'How real did the virtual world seem to you?' (real/not real) and variables 2 'How real did the virtual world seem to you?' (imagined/real) (rs=-.961, n=22, p= .003< .01) and 4 'How much did your experience in the virtual environment seem consistent with your real-world experience?' (rs=-.870, n=22, p= .000< .01), while there is also a strong negative correlation between variable 5 and variable 12 'The virtual world seemed more realistic than the real world' (rs=-.679, n=22, p= .001< .01).

Finally, there are indications for a strong positive correlation between variable 4 'How much did your experience in the virtual environment seem consistent with your real-world experience?' and variable 2 'How real did the virtual world seem to you?' (rs=.818, n=22, p= .000< .01), while there are also some indications for a moderate positive correlation between variable 4 and variable 12 'The virtual world seemed more realistic than the real world' (rs=.433, n=22, p= .044< .05).

			Experience in using Virtual Reality environments
Spearman's rho	Experience in using Virtual Reality environments	Correlation Coefficient	1.000
		Sig. (2-tailed)	.
		N	22
	How long did you interact with the virtual world (in minutes)?	Correlation Coefficient	.229
		Sig. (2-tailed)	.304
		N	22
	What was your perspective onto the virtual world?	Correlation Coefficient	-.356
		Sig. (2-tailed)	.104
		N	22
	8. In the computer-generated world, I had a sense of 'being there'	Correlation Coefficient	.218
		Sig. (2-tailed)	.329
		N	22
	9. Somehow, I felt that the virtual world surrounded me.	Correlation Coefficient	.112
		Sig. (2-tailed)	.621
		N	22
	13. I felt like I was just perceiving pictures.	Correlation Coefficient	.078
		Sig. (2-tailed)	.729
		N	22
	6. I did not feel present in the virtual space.	Correlation Coefficient	**.446***
		Sig. (2-tailed)	.038
		N	22

3. I had a sense of acting in the virtual space, rather than operating something from outside.	Correlation Coefficient	-.019
	Sig. (2-tailed)	.932
	N	22
10. I felt present in the virtual space.	Correlation Coefficient	.200
	Sig. (2-tailed)	.372
	N	22
1. How aware were you of the real world surrounding while navigating in the virtual world? (i.e. sounds, room temperature, other people, etc.)?	Correlation Coefficient	.152
	Sig. (2-tailed)	.500
	N	22
11. I still paid attention to the real environment.	Correlation Coefficient	-.094
	Sig. (2-tailed)	.679
	N	22
7. I was not aware of my real environment.	Correlation Coefficient	-.038
	Sig. (2-tailed)	.868
	N	22
14. I was completely captivated by the virtual world.	Correlation Coefficient	.246
	Sig. (2-tailed)	.271
	N	22
5. How real did the virtual world seem to you?	Correlation Coefficient	-.360
	Sig. (2-tailed)	.100
	N	22
	Correlation Coefficient	.250

	4. How much did your experience in the virtual environment seem consistent with your real-world experience?	Sig. (2-tailed)	.262
		N	22
	2. How real did the virtual world seem to you?	Correlation Coefficient	.287
		Sig. (2-tailed)	.195
		N	22
	12. The virtual world seemed more realistic than the real world.	Correlation Coefficient	.226
		Sig. (2-tailed)	.311
		N	22

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

			What was your perspective onto the virtual world?
Spearman's rho	What was your perspective onto the virtual world?	Correlation Coefficient	1.000
		Sig. (2-tailed)	.
		N	22
	8. In the computer-generated world, I had a sense of 'being there'	Correlation Coefficient	**-.544****
		Sig. (2-tailed)	.009
		N	22
	9. Somehow, I felt that the virtual world surrounded me.	Correlation Coefficient	**-.481***
		Sig. (2-tailed)	.024
		N	22
	13. I felt like I was just perceiving pictures.	Correlation Coefficient	.009

	Sig. (2-tailed)	.969
	N	22
6. I did not feel present in the virtual space.	Correlation Coefficient	-.044
	Sig. (2-tailed)	.846
	N	22
3. I had a sense of acting in the virtual space, rather than operating something from outside.	Correlation Coefficient	-.378
	Sig. (2-tailed)	.083
	N	22
10. I felt present in the virtual space.	Correlation Coefficient	**-.592****
	Sig. (2-tailed)	.004
	N	22
1. How aware were you of the real world surrounding while navigating in the virtual world? (i.e. sounds, room temperature, other people, etc.)?	Correlation Coefficient	-.201
	Sig. (2-tailed)	.370
	N	22
11. I still paid attention to the real environment.	Correlation Coefficient	.062
	Sig. (2-tailed)	.786
	N	22
7. I was not aware of my real environment.	Correlation Coefficient	-.053
	Sig. (2-tailed)	.816
	N	22
14. I was completely captivated by the virtual world.	Correlation Coefficient	-.087
	Sig. (2-tailed)	.699
	N	22

5. How real did the virtual world seem to you?	Correlation Coefficient	.347
	Sig. (2-tailed)	.113
	N	22
4. How much did your experience in the virtual environment seem consistent with your real-world experience?	Correlation Coefficient	-.393
	Sig. (2-tailed)	.071
	N	22
2. How real did the virtual world seem to you?	Correlation Coefficient	-.314
	Sig. (2-tailed)	.155
	N	22
12. The virtual world seemed more realistic than the real world.	Correlation Coefficient	-.245
	Sig. (2-tailed)	.273
	N	22

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

			8. In the computer-generated world, I had a sense of 'being there'	9. Somehow, I felt that the virtual world surrounded me.	13. I felt like I was just perceiving pictures.	6. I did not feel present in the virtual space.	3. I had a sense of acting in the virtual space, rather than operating something from outside.	10. I felt present in the virtual space.	1. How aware were you of the real world surrounding while navigating in the virtual world? (i.e. sounds, room temperature, other people, etc.)?	11. I still paid attention to the real environment.	7. I was not aware of my real environment.	14. I was completely captivated by the virtual world.	5. How real did the virtual world seem to you?	4. How much did your experience in the virtual environment seem consistent with your real-world experience?	2. How real did the virtual world seem to you?	12. The virtual world seemed more realistic than the real world.
Spearman's rho	8. In the computer-generated world, I had a sense of 'being there'	Correlation Coefficient	1.000													
		Sig. (2-tailed)	.													
		N	22													
	9. Somehow, I felt that the virtual world surrounded me.	Correlation Coefficient	**.698****	1.000												
		Sig. (2-tailed)	.000	.												
		N	22	22												
	13. I felt like I was just perceiving pictures.	Correlation Coefficient	.233	**.490***	1.000											
		Sig. (2-tailed)	.296	.021	.											
		N	22	22	22											
	6. I did not feel present in the virtual space.	Correlation Coefficient	-.369	-.409	-.351	1.000										
		Sig. (2-tailed)	.091	.059	.110	.										
		N	22	22	22	22										

3. I had a sense of acting in the virtual space, rather than operating something from outside.	Correlation Coefficient	**.582****	**.518***	.314	-.338	1.000									
	Sig. (2-tailed)	.004	.013	.154	.124	.									
	N	22	22	22	22	22									
10. I felt present in the virtual space.	Correlation Coefficient	**.882****	**.714****	.297	-.422	**.720****	1.000								
	Sig. (2-tailed)	.000	.000	.179	.051	.000	.								
	N	22	22	22	22	22	22								
1. How aware were you of the real world surrounding while navigating in the virtual world? (i.e. sounds, room temperature, other people, etc.)?	Correlation Coefficient	-.126	-.125	-.026	.387	-.289	-.071	1.000							
	Sig. (2-tailed)	.576	.578	.909	.075	.193	.753	.							
	N	22	22	22	22	22	22	22							
11. I still paid attention to the real environment.	Correlation Coefficient	.284	.342	**.559****	**-.605****	**.464***	.377	**-.609****	1.000						
	Sig. (2-tailed)	.201	.119	.007	.003	.030	.084	.003	.						
	N	22	22	22	22	22	22	22	22						

7. I was not aware of my real environment.	Correlation Coefficient	**.499***	.393	.317	-.348	**.688****	**.504***	**-.481***	**.662****	1.000					
	Sig. (2-tailed)	.018	.071	.151	.113	.000	.017	.023	.001	.					
	N	22	22	22	22	22	22	22	22	22					
14. I was completely captivated by the virtual world.	Correlation Coefficient	**.566****	**.575****	**.683****	-.315	.390	**.430***	-.353	**.588****	**.519***	1.000				
	Sig. (2-tailed)	.006	.005	.000	.154	.073	.046	.107	.004	.013	.				
	N	22	22	22	22	22	22	22	22	22	22				
5. How real did the virtual world seem to you?	Correlation Coefficient	**-.591****	**-.535***	-.339	.334	-.381	**-.526***	.373	**-.583****	**-.466***	**-.655****	1.000			
	Sig. (2-tailed)	.004	.010	.123	.129	.081	.012	.088	.004	.029	.001	.			
	N	22	22	22	22	22	22	22	22	22	22	22			
4. How much did your experience in the virtual environment seem consistent with your real-world experience?	Correlation Coefficient	**.725****	**.581****	.337	-.300	**.503***	**.594****	-.211	.407	.400	**.705****	**-.870****	1.000		
	Sig. (2-tailed)	.000	.005	.126	.175	.017	.004	.347	.060	.065	.000	.000	.		
	N	22	22	22	22	22	22	22	22	22	22	22	22	22	22

2. How real did the virtual world seem to you?	Correlation Coefficient	**.531***	**.511***	.311	-.286	.386	**.509***	-.341	**.565****	**.513***	**.605****	**-.961****	**.818****	1.000	.715**
	Sig. (2-tailed)	.011	.015	.159	.197	.076	.015	.120	.006	.015	.003	.000	.000	.	.000
	N	22	22	22	22	22	22	22	22	22	22	22	22	22	22
12. The virtual world seemed more realistic than the real world.	Correlation Coefficient	.151	.294	.185	-.183	.241	.234	-.422	**.435***	.289	.267	**-.679****	**.433***	.715**	1.000
	Sig. (2-tailed)	.501	.184	.410	.415	.281	.294	.050	.043	.193	.230	.001	.044	.000	.
	N	22	22	22	22	22	22	22	22	22	22	22	22	22	22

APPENDIX B-6-9

Correlations between empathy scale items

The results indicate several low and moderate correlations among the items of empathy scale. There is a low positive correlation between the item ‘1. A teacher should be able to predict the feelings of his/her students’ and the item ‘2. A teacher should be able to spot when a student is feeling awkward or uncomfortable’ (rs=.374, n=33, p= .032< .05). Another low positive correlation exists between the item ‘1. A teacher should be able to predict the feelings of his/her students’ and the item ‘3. A teacher should try to look at every student’s side of a disagreement before making a decision’ (rs=.427, n=33, p= .013< .05). Additionally, there is a moderate positive correlation between the item ‘1. A teacher should be able to predict the feelings of his/her students’ and the item ‘6. Teachers often get emotionally involved with the students’ problems’ (rs=.555, n=33, p= .001< .01).

Another low positive correlation was revealed between the item ‘2. A teacher should be able to spot when a student is feeling awkward or uncomfortable’ and the item ‘3. A teacher should try to look at every student’s side of a disagreement before making a decision’ (rs=.483, n=33, p= .004< .01). Additionally, there is a low positive correlation between item ‘2. A teacher should be able to spot when a student is feeling awkward or uncomfortable’ and the item ‘4. A teacher should try to understand the students better, by imagining how things look from their perspective’ (rs=.444, n=33, p= .0010).

The results revealed a low positive correlation between the item ‘3. A teacher should try to look at every student’s side of a disagreement before making a decision’ and the item ‘5. Teachers sometimes find it difficult to see things from the student’s point of view’ (rs=.383, n=33, p= .028<0.05). Moreover, there is a low positive correlation ‘3. A teacher should try to look at every student’s side of a disagreement before making a decision’ and the item ‘6. Teachers often get emotionally involved with the students’ problems’ (rs=.478, n=33, p= .005<0.01).

Another low positive correlation exists between the item ‘4. A teacher should try to understand the students better, by imagining how things look from their perspective’ and the item ‘5. Teachers sometimes find it difficult to see things from the student’s point of view’ (rs=.374, n=33, p= .032<0.05). Moreover, there is a low positive correlation between item ‘4. A teacher should try to understand the students better, by imagining how things look from their perspective’ and the item ‘7. A teacher should try to imagine how he/she would feel in the students’ situation’ (rs=.411, n=33, p= .018<0.05).

There are indications of a low positive correlation between the item ‘5. Teachers sometimes find it difficult to see things from the student’s point of view’ and the item ‘6. Teachers often get emotionally involved with the students’ problems’ (r_s=.394, n=33, p= .023<0.05). What it more, there is a moderate positive correlation between the item ‘5. Teachers sometimes find it difficult to see things from the student’s point of view’ and the item ‘11. It is difficult for a teacher to put himself/herself in the position of someone who is racially and/or ethnically different’ (r_s=.501, n=33, p= .003<0.01).

Furthermore, there is a low positive correlation between the item ‘10. A teacher should feel supportive of students of other racial and ethnic groups’ and the item ‘11. It is difficult for a teacher to put himself/herself in the position of someone who is racially and/or ethnically different’ (r_s=.351, n=33, p= .045<0.05).

Correlations

			1. A teacher should be able to predict the feelings of his/her students	2. A teacher should be able to spot when a student is feeling awkward or uncomfortable.	3. A teacher should try to look at every student's side of a disagreement before making a decision.	4. A teacher should try to understand the students better, by imagining how things look from their perspective.	5. Teachers sometimes find it difficult to see things from the student's point of view.	6. Teachers often get emotionally involved with the students' problems.	7. A teacher should try to imagine how he/she would feel in the students' situation.	10. A teacher should feel supportive of students of other racial and ethnic groups.	11. It is difficult for a teacher to put himself/herself in the position of someone who is racially and/or ethnically different.
Spearman's rho	1. A teacher should be able to predict the feelings of his/her students	Correlation Coefficient	1.000								
		Sig. (2-tailed)	.								
		N	33								
	2. A teacher should be able to spot when a student is feeling awkward or uncomfortable.	Correlation Coefficient	.374*	1.000							
		Sig. (2-tailed)	.032	.							
		N	33	33							
	3. A teacher should try to look at every student's side of a disagreement before making a decision.	Correlation Coefficient	.427*	.483**	1.000						
		Sig. (2-tailed)	.013	.004	.						
		N	33	33	33						
	4. A teacher should try to understand the students better, by imagining how things look from their perspective.	Correlation Coefficient	.224	.444**	.265	1.000					
		Sig. (2-tailed)	.210	.010	.135	.					
		N	33	33	33	33					
	5. Teachers sometimes find it difficult to see things from the student's point of view.	Correlation Coefficient	.167	.104	.383*	.374*	1.000				
		Sig. (2-tailed)	.353	.563	.028	.032	.				
		N	33	33	33	33	33				
	6. Teachers often get emotionally involved with the students' problems.	Correlation Coefficient	.555**	.218	.478**	.052	.394*	1.000			
		Sig. (2-tailed)	.001	.222	.005	.773	.023	.			
		N	33	33	33	33	33	33			
	7. A teacher should try to imagine how he/she would feel in the students' situation.	Correlation Coefficient	.180	.056	.234	.411*	.039	.016	1.000		
		Sig. (2-tailed)	.316	.755	.190	.018	.828	.930	.		
		N	33	33	33	33	33	33	33		
	10. A teacher should feel supportive of students of other racial and ethnic groups.	Correlation Coefficient	.304	.315	.394*	.324	.284	.237	.313	1.000	
		Sig. (2-tailed)	.085	.074	.023	.066	.109	.185	.077	.	
		N	33	33	33	33	33	33	33	33	
	11. It is difficult for a teacher to put himself/herself in the position of someone who is racially and/or ethnically different.	Correlation Coefficient	.333	-.048	.104	.311	.501**	.088	.102	.351*	1.000
		Sig. (2-tailed)	.058	.791	.564	.078	.003	.625	.572	.045	.
		N	33	33	33	33	33	33	33	33	33

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

APPENDIX B-6-10

Correlations between reflection scale items

The results indicate several correlations among the items of reflection scale. The item ‘2. This experience within the VR environment regarding multiculturalism and bullying can challenge some of teachers’ firmly held ideas’ is positively low correlated with the items ‘4. The use of this VR experience can change the way teachers will attend to the needs of the students’ (rs=.374, n=33, p= .032<0.05); ‘5. This VR experience can help teachers change the way they will react on disruptive behavior among my students’ (rs=.446, n=33, p= .007<0.01); ‘6. This VR experience can help teachers discover faults in their teaching style or in their interaction with students that he/she previously believed to be right’ (rs=.449, n=33, p= .009<0.01); ‘7. Because of this VR experience, teachers will try more frequently to enter their students’ position’ (rs=.424, n=33, p= .014<0.05) and ‘8. Because of this VR experience, teachers will support more students of other racial and ethnic groups’ (rs=.493, n=33, p= .003<0.01).

According to the results there is a positive low correlation between the item ‘3. A teacher should not really be interested in analyzing students’ needs’ and the items ‘5. This VR experience can help teachers change the way they will react on disruptive behavior among my students’ (rs=.417, n=33, p= .016<0.05) and ‘6. This VR experience can help teachers discover faults in their teaching style or in their interaction with students that he/she previously believed to be right’ (rs=.357, n=33, p= .032<0.05).

Moreover, there is a positive low correlation between item ‘4. The use of this VR experience can change the way teachers will attend to the needs of the students’ and items ‘5. This VR experience can help teachers change the way they will react to disruptive behavior among my students’ (rs=.384, n=33, p= .027<0.05) and ‘7. Because of this VR experience, teachers will try more frequently to enter their students’ position’ (rs=.476, n=33, p= .005<0.01). Additionally, there is a positive moderate correlation between item ‘4. The use of this VR experience can change the way teachers will attend to the needs of the students’ and item ‘8. Because of this VR experience, teachers will support more students of other racial and ethnic groups’ (rs=.524, n=33, p= .002<0.01).

The results indicate a strong positive correlation between the item ‘5. This VR experience can help teachers change the way they will react to disruptive behavior among my students’ and the item ‘6. This VR experience can help teachers discover faults in their teaching style or in their interaction with students that he/she previously believed to be right’ (rs=.445, n=33, p= .009<0.01). Moreover, there is a low positive correlation between item ‘5. This VR experience

can help teachers change the way they will react to disruptive behavior among my students' and item '8. Because of this VR experience, teachers will support more students of other racial and ethnic groups' (rs=.370, n=33, p= .034<0.05).

Furthermore, there is a low positive correlation between item '7. Because of this VR experience, teachers will try more frequently to enter their students' position' and item '8. Because of this VR experience, teachers will support more students of other racial and ethnic groups' (rs=.370, n=33, p= .034<0.05).

Correlations

			1. Teachers should spend time in self-reflection.	2. This experience within the VR environment regarding multiculturalism and bullying can challenge some of teachers' firmly held ideas.	3. A teacher should not really be interested in analyzing students' needs.	4. The use of this VR experience, can change the way teachers will attend to the needs of the students.	5. This VR experience, can help teachers change the way they will react on disruptive behavior among my students.	6. This VR experience, can help teachers discover faults in their teaching style or in their interaction with students that he/she previously believed to be right.	7. Because of this VR experience, teachers will try more frequently to enter their students' position.	8. Because of this VR experience, teachers will support more students of other racial and ethnic groups.
Spearman's rho	1. Teachers should spend time in self-reflection.	Correlation Coefficient	1.000							
		Sig. (2-tailed)	.							
		N	33							
	2. This experience within the VR environment regarding multiculturalism and bullying can challenge some of teachers' firmly held ideas.	Correlation Coefficient	.026	1.000						
		Sig. (2-tailed)	.886	.						
		N	33	33						
	3. A teacher should not really be interested in analyzing students' needs.	Correlation Coefficient	.112	.108	1.000					
		Sig. (2-tailed)	.535	.550	.					
		N	33	33	33					
	4. The use of this VR experience, can change the way teachers will attend to the needs of the students.	Correlation Coefficient	.073	.374*	.324	1.000				
		Sig. (2-tailed)	.686	.032	.066	.				
		N	33	33	33	33				
	5. This VR experience, can help teachers change the way they will react on disruptive behavior among my students.	Correlation Coefficient	.193	.464**	.417*	.384*	1.000			
		Sig. (2-tailed)	.281	.007	.016	.027	.			
		N	33	33	33	33	33			
	6. This VR experience, can help teachers discover faults in their teaching style or in their interaction with students that he/she previously believed to be right.	Correlation Coefficient	.330	.449**	.375*	.304	.830**	1.000		
		Sig. (2-tailed)	.061	.009	.032	.085	.000	.		
		N	33	33	33	33	33	33		
	7. Because of this VR experience, teachers will try more frequently to enter their students' position.	Correlation Coefficient	.000	.424*	.246	.476**	.214	.164	1.000	
		Sig. (2-tailed)	.998	.014	.168	.005	.233	.362	.	
		N	33	33	33	33	33	33	33	
	8. Because of this VR experience, teachers will support more students of other racial and ethnic groups.	Correlation Coefficient	-.008	.496**	-.067	.524**	.370*	.219	.445**	1.000
		Sig. (2-tailed)	.963	.003	.711	.002	.034	.220	.009	.
		N	33	33	33	33	33	33	33	33

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

APPENDIX B-6-11

Correlations between emotions scale items

The results revealed several correlations among the various emotional states the participants experienced. The strongest correlation exists between the states inspired and satisfied (rs=.816, n=33, p= .000<0.01). Statistically significant correlations were also identified among other emotional states. There is a positive moderate correlation between excited and satisfied (rs=.668, n=33, p= .000<0.01); joyful (rs=.579, n=33, p= .000<0.01); inspired (rs=.575, n=33, p= .000<0.01); active (rs=.556, n=33, p= .001<0.01) and confident (rs=.463, n=33, p= .007<0.01). This positive correlation indicates that those variables tend to increase together.

Low and moderate correlations were also identified among the emotional state stressed and the emotional states fatigue (rs=.409, n=33, p= .018<0.05); upset (rs=.385, n=33, p= .027<0.05); confident (rs=.386, n=33, p= .026<0.05); afraid (rs=.578, n=33, p= .000<0.01); nervous (rs=.538, n=33, p= .001<0.01) and sad (rs=.495, n=33, p= .003<0.01).

According to the results there are low and moderate positive correlations between item active and items confident (rs=.619, n=33, p= .000<0.01); inspired (rs=.644, n=33, p= .000<0.01); satisfied (rs=.548, n=33, p= .001<0.01); joyful (rs=.495, n=33, p= .003<0.01); sad (rs=.349, n=33, p= .047<0.05) and afraid (rs=.371, n=33, p= .033<0.05).

Low and moderate correlations were also identified between the item fatigue and the items sad (rs=.546, n=33, p= .001<0.01); upset (rs=.435, n=33, p= .012<0.05); afraid (rs=.410, n=33, p= .018<0.05) and nervous (rs=.365, n=33, p= .037<0.05). Moreover, there are low and moderate correlations between the item upset and the items afraid (rs=.623, n=33, p= .000<0.01); nervous (rs=.639, n=33, p= .000<0.01); sad (rs=.682, n=33, p= .000<0.01); joyful (rs=.490, n=33, p= .004<0.01) and satisfied (rs=.369, n=33, p= .035<0.05).

The results revealed that item confident is positively correlated with the items joyful (rs=.610, n=33, p= .000<0.01); afraid (rs=.461, n=33, p= .007<0.01); inspired (rs=.466, n=33, p= .006<0.01); satisfied (rs=.452, n=33, p= .008<0.01) and sad (rs=.373, n=33, p= .033<0.05).

The emotional state afraid is also positively correlated with the states nervous (rs=.564, n=33, p= .001<0.01); sad (rs=.675, n=33, p= .000<0.01) and joyful (rs=.486, n=33, p= .004<0.01).

The emotional state inspired is positively correlated with the state joyful (rs=.650, n=33, p= .000<0.01).

Moreover, there are positive moderate correlations between the item joyful and the items satisfied (rs=.775, n=33, p= .000<0.01) and sad (rs=.612, n=33, p= .000<0.01), while a positive moderate correlation was also identified with the item nervous (rs=.409, n=33, p= .018<0.05).

Another positive moderate correlation was revealed between the item nervous and the items sad (r_s=.573, n=33, p= .000<0.01) and satisfied (r_s=.522, n=33, p= .002<0.01).

Overall, regarding participants' emotions it seems that there are statistically significant correlations among the positive emotions, indicating that positive emotions tended to increase together. Moreover, there are several correlations among negative emotions, indicating that negative emotions also tended to increase together. However, the results also revealed some low and moderate correlations between positive and negative emotions.

Correlations

			1. Excited	2. Stressed	3. Active	4. Fatigue	5. Upset	6. Confident	7. Afraid	8. Inspired	9. Joyful	10. Nervous	11. Sad	12. Satisfied
Spearman's rho	1. Excited	Correlation Coefficient	1.000											
		Sig. (2-tailed)	.											
		N	33											
	2. Stressed	Correlation Coefficient	.163	1.000										
		Sig. (2-tailed)	.365	.										
		N	33	33										
	3. Active	Correlation Coefficient	.556**	.122	1.000									
		Sig. (2-tailed)	.001	.497	.									
		N	33	33	33									
	4. Fatigue	Correlation Coefficient	.094	.409*	.173	1.000								
		Sig. (2-tailed)	.603	.018	.334	.								
		N	33	33	33	33								
	5. Upset	Correlation Coefficient	.181	.385*	.322	.435*	1.000							
		Sig. (2-tailed)	.314	.027	.068	.012	.							
		N	33	33	33	33	33							
	6. Confident	Correlation Coefficient	.463**	.386*	.619**	.236	.190	1.000						
		Sig. (2-tailed)	.007	.026	.000	.186	.290	.						
		N	33	33	33	33	33	33						
	7. Afraid	Correlation Coefficient	.187	.578**	.371*	.410*	.623**	.461**	1.000					
		Sig. (2-tailed)	.297	.000	.033	.018	.000	.007	.					
		N	33	33	33	33	33	33	33					

	7. Afraid	Correlation Coefficient	.187	.578**	.371*	.410*	.623**	.461**	1.000					
		Sig. (2-tailed)	.297	.000	.033	.018	.000	.007	.					
		N	33	33	33	33	33	33	33					
	8. Inspired	Correlation Coefficient	.575**	.100	.644**	.045	.206	.466**	.128	1.000				
		Sig. (2-tailed)	.000	.579	.000	.802	.249	.006	.477	.				
		N	33	33	33	33	33	33	33	33				
	9. Joyful	Correlation Coefficient	.579**	.208	.495**	.325	.490**	.610**	.486**	.650**	1.000			
		Sig. (2-tailed)	.000	.245	.003	.065	.004	.000	.004	.000	.			
		N	33	33	33	33	33	33	33	33	33			
	10. Nervous	Correlation Coefficient	.192	.538**	.253	.365*	.639**	.172	.564**	.346*	.409*	1.000		
		Sig. (2-tailed)	.285	.001	.155	.037	.000	.338	.001	.049	.018	.		
		N	33	33	33	33	33	33	33	33	33	33		
	11. Sad	Correlation Coefficient	.300	.495**	.349*	.546**	.682**	.373*	.675**	.284	.612**	.573**	1.000	
		Sig. (2-tailed)	.090	.003	.047	.001	.000	.033	.000	.109	.000	.000	.	
		N	33	33	33	33	33	33	33	33	33	33	33	
	12. Satisfied	Correlation Coefficient	.668**	.215	.548**	.226	.369*	.452**	.338	.816**	.775**	.522**	.381*	1.000
		Sig. (2-tailed)	.000	.229	.001	.206	.035	.008	.054	.000	.000	.002	.029	.
		N	33	33	33	33	33	33	33	33	33	33	33	33

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

APPENDIX B-6-12

Questionnaire for User Virtual Reality Preferences (English Version)

Cyprus University of Technology

Questionnaire for User Virtual Reality Preferences

PART I: Background Information

1. **Country:**

Cyprus	Greece

2. **Gender**

Male	Female	Do not wish to answer

3. **Age**

18-24	25-29	30-39	40-49	50-59	60+

4. **Teaching experience (in years): ……..**
5. **Teaching speciality: …….**
6. **Are you currently employed as a teacher? ……..**
7. **State your teaching grade level: …….**

PART II: Virtual Reality

Virtual reality (VR) is an interactive computer-generated experience taking place within a simulated environment, that can be similar to the real world or it can be fantastical. A user can autonomously navigate around a VR (in the form of avatars) and interact with simulated objects and other avatars in real time at the same pace one would experience events in the real world.

8. **Experience in using virtual reality learning environments:**
   - ❑ Not at all
   - ❑ A little
   - ❑ Moderately
   - ❑ Much
   - ❑ Very much

To answer the following questions, assume that you will be provided with a VR teacher training application, to improve your skills and competencies maximizing your professional development. The following questions refer to your requirements regarding a VR application to be used for that purpose.

9. The following images represent possible virtual environments for teacher training. Please indicate your preference from 1-7 for each of the figures.

(1)

1	2	3	4	5	6	7
Absolutely inappropriate	Inappropriate	Slightly inappropriate	Neutral	Slightly appropriate	Appropriate	Absolutely appropriate

(2)

1	2	3	4	5	6	7
Absolutely inappropriate	Inappropriate	Slightly inappropriate	Neutral	Slightly appropriate	Appropriate	Absolutely appropriate

(3)

1	2	3	4	5	6	7
Absolutely inappropriate	Inappropriate	Slightly inappropriate	Neutral	Slightly appropriate	Appropriate	Absolutely appropriate

10. Additional comments regarding your preference of the above figures:

11. Please provide any additional comments regarding how a virtual environment for teacher training should be:

PART III: Themes of VR training application

12. Please indicate the level of importance from 1-5 for the following themes as part of the training scenario (1= Not important, 2= Slightly important, 3= Fairly important, 4=Important, 5=Very important)

	1	*2*	*3*	*4*	*5*
Student's vision disorders					
Student's hearing disorders					
Multicultural classroom					
Student's movement disorders					
Autism					
Attention-deficit hyperactivity disorder (ADHD)					
Behavior disorders					
Bullying incidents					
Drug related incidents					

13. Please provide any additional comments regarding a scenario theme that should be included in training via VR.

14. What kind of feedback would you expect from after a VR experience?

Good practice advice	
Performance evaluation	
No feedback	
Individual performance assessment	
Performance assessment comparatively to other users	
Other (please specify)	

PART IV: Personal experience

15. During your career as a teacher, describe an incident with the students that you would never forget.

Thank you for your time and participation!

APPENDIX B-6-13

Questionnaire for User Virtual Reality Preferences (Greek Version)

Τεχνολογικό Πανεπιστήμιο Κύπρου

Ερωτηματολόγιο Προτιμήσεων σε θέματα Εικονικής Πραγματικότητας

<u>Πρώτη Ενότητα: Δημογραφικά Στοιχεία</u>

1. **Χώρα:**

Κύπρος	Ελλάδα

2. **Φύλο**

Άνδρας	Γυναίκα	Δεν επιθυμώ να απαντήσω

3. **Ηλικία**

18-24	25-29	30-39	40-49	50-59	60+

4. **Έτη προϋπηρεσίας (σε χρόνια): ……**
5. **Ειδικότητα: …….**
6. **Εργάζεστε τη δεδομένη χρονική στιγμή ως εκπαιδευτικός;:……**
7. **Βαθμίδα εκπαίδευσης στην οποία υπηρετείτε τη δεδομένη χρονική στιγμή: ……**

<u>Δεύτερη Ενότητα : Εικονική Πραγματικότητα</u>

Η Εικονική Πραγματικότητα (ΕΠ), είναι μια διαδραστική εμπειρία που παράγεται από υπολογιστή και λαμβάνει χώρα μέσα σε ένα προσομοιωμένο περιβάλλον, που μπορεί να είναι παρόμοιο με τον πραγματικό κόσμο ή μπορεί να είναι φανταστικό. Ένας χρήστης μπορεί να περιηγηθεί αυτόνομα σε ένα περιβάλλον ΕΠ (με τη μορφή εικονικού χαρακτήρα) και να αλληλοεπιδράσει με προσομοιωμένα αντικείμενα και άλλους εικονικούς χαρακτήρες σε πραγματικό χρόνο με τον ίδιο ρυθμό που θα μπορούσε να βιώσει γεγονότα στον πραγματικό κόσμο.

8. **Προηγούμενη εμπειρία σε χρήση εφαρμογών εικονικής πραγματικότητας:**
   - ❑ Καθόλου
   - ❑ Λίγο
   - ❑ Μέτρια
   - ❑ Πολύ
   - ❑ Πάρα πολύ

Για να απαντήσετε στις παρακάτω ερωτήσεις, υποθέστε ότι θα σας δοθεί μια εφαρμογή εκπαίδευσης διδασκόντων με Εικονική Πραγματικότητα για να βελτιώσετε τις ικανότητες και τις δεξιότητες σας, μεγιστοποιώντας την επαγγελματική σας εξέλιξη. Οι ακόλουθες ερωτήσεις αφορούν τις απαιτήσεις σας σχετικά με μια εφαρμογή Εικονικής Πραγματικότητας που θα χρησιμοποιηθεί για το σκοπό αυτό.

9. Οι παρακάτω εικόνες αντιπροσωπεύουν πιθανά εικονικά περιβάλλοντα για την κατάρτιση των εκπαιδευτικών. Παρακαλείσθε να αναφέρετε την προτίμησή σας από 1-7 για κάθε μία από τις φωτογραφίες:

(1)

1	2	3	4	5	6	7
Απολύτως ακατάλληλο	Ακατάλληλο	Ελαφρώς ακατάλληλο	Ουδέτερο	Ελαφρώς κατάλληλο	Κατάλληλο	Απολύτως κατάλληλο

(2)

1	2	3	4	5	6	7
Απολύτως ακατάλληλο	Ακατάλληλο	Ελαφρώς ακατάλληλο	Ουδέτερο	Ελαφρώς κατάλληλο	Κατάλληλο	Απολύτως κατάλληλο

(3)

1	2	3	4	5	6	7
Απολύτως ακατάλληλο	Ακατάλληλο	Ελαφρώς ακατάλληλο	Ουδέτερο	Ελαφρώς κατάλληλο	Κατάλληλο	Απολύτως κατάλληλο

10. Πρόσθετες παρατηρήσεις σχετικά με την προτίμηση των παραπάνω εικόνων:

11. Παρακαλείσθε να αναφέρετε τυχόν πρόσθετα σχόλια σχετικά με το πως θα πρέπει να είναι ένα εικονικό περιβάλλον που προορίζεται για την κατάρτιση των εκπαιδευτικών:

<u>Τρίτη ενότητα: Θεματικές για εκπαίδευση με τη χρήση ΕΠ</u>

12. Παρακαλείσθε να αναφέρετε το επίπεδο σπουδαιότητας από 1-5 για τα ακόλουθα θέματα ως μέρος του σεναρίου εκπαίδευσης στο ΕΠ: (1=Δεν είναι σημαντικό, 2=Λίγο σημαντικό, 3=Αρκετά σημαντικό, 4=Σημαντικό, 5=Πολύ σημαντικό):

	1	***2***	***3***	***4***	***5***
Διαταραχές όρασης του μαθητή					
Διαταραχές ακοής του μαθητή					
Πολυπολιτισμικότητα					
Διαταραχές κίνησης του μαθητή					
Αυτισμός					
Διαταραχή Ελλειμματικής Προσοχής και Υπερκινητικότητας ΔΕΠ-Υ					
Προβλήματα συμπεριφοράς					
Περιστατικά εκφοβισμού					
Περιστατικά που σχετίζονται με τη χρήση ουσιών					

13. Παρακαλείσθε να αναφέρετε τυχόν πρόσθετα σχόλια αναφορικά με το θέμα του σεναρίου που θα πρέπει να συμπεριληφθεί στην εκπαίδευση μέσω ΕΠ.

14. Τι είδους ανατροφοδότηση θα περιμένατε μετά από μια εμπειρία ΕΠ;

Συμβουλές καλής πρακτικής	
Αξιολόγηση της απόδοσης	
Καμία ανατροφοδότηση	
Ατομική αξιολόγηση της απόδοσης	
Αξιολόγηση της απόδοσης συγκριτικά με άλλους χρήστες	
Άλλο (παρακαλώ προσδιορίστε)	

<u>Ενότητα τέταρτη: Προσωπική εμπειρία</u>

15. Κατά τη διάρκεια της καριέρας σας ως εκπαιδευτικός, περιγράψτε ένα περιστατικό με τους μαθητές που δεν θα ξεχάσετε ποτέ.

Σας ευχαριστούμε για το χρόνο σας και την συμμετοχή σας!

APPENDIX B-6-14

Informed consent (English version)

Consent Form

Dear teachers,

This questionnaire aims to explore your views on the use of Virtual Reality (VR) in teacher education and design of a VR application. Your experience on this subject is valuable to us. Please be assured that the questionnaire completion is anonymous and that the information you provide will be completely confidential and will not be used for any other purpose. Your participation is entirely voluntary.

Thank you for your response and cooperation.

Yours sincerely,

Kalliopi-Evangelia Stavroulia

Doctoral Student and Postgraduate Associate

Department of Multimedia and Graphic Arts

School of Fine and Applied Arts

Cyprus University of Technology

APPENDIX B-6-15

Informed consent (Greek version)

<u>Έντυπο Συγκατάθεσης</u>

Αγαπητοί εκπαιδευτικοί,

Το παρόν ερωτηματολόγιο έχει ως σκοπό τη διερεύνηση των απόψεων σας αναφορικά με τη χρήση της Εικονικής Πραγματικότητας (ΕΠ) στην εκπαίδευση των εκπαιδευτικών και τον σχεδιασμό μιας εφαρμογής ΕΠ. Η εμπειρία σας στο θέμα αυτό είναι πολύτιμη για μας. Σας διαβεβαιώνουμε, ότι η συμπλήρωση του ερωτηματολογίου είναι ανώνυμη και οι πληροφορίες που θα μας δώσετε θα είναι απολύτως εμπιστευτικές και δεν πρόκειται να χρησιμοποιηθούν για κανένα άλλο σκοπό. Η συμμετοχή σας είναι εντελώς εθελοντική.

Σας ευχαριστούμε για την ανταπόκριση και τη συνεργασία σας.

Με εκτίμηση,

Καλλιόπη-Ευαγγελία Σταυρούλια

Διδακτορική φοιτήτρια και μεταπτυχιακός συνεργάτης

Τμήμα Πολυμέσων και Γραφικών Τεχνών

Σχολή Καλών και Εφαρμοσμένων Τεχνών

Τεχνολογικό Πανεπιστήμιο Κύπρου

APPENDIX C-7-1

Pre-questionnaire (in Greek)

ΜΕΡΟΣ Ι

1. Χώρα

Κύπρος	Ελλάδα	Άλλο:

2. Φύλο

Άνδρας	Γυναίκα	Δεν επιθυμώ να απαντήσω

3. Ηλικία

18-24	25-29	30-39	40-49	50-59	60+

4. Διδακτική εμπειρία:

Καθόλου	<1 έτος	1-4 έτη
5-10 έτη	11-20 έτη	> 20 έτη

5. Δουλεύετε επί του παρόντος ως εκπαιδευτικός;

- ❑ Ναι
- ❑ Όχι

6. Βαθμίδα εκπαίδευσης στην οποία υπηρετείτε

- ❑ Δεν εργάζομαι την δεδομένη χρονική στιγμή ως εκπαιδευτικός
- ❑ Πρωτοβάθμια εκπαίδευση
- ❑ Δευτεροβάθμια εκπαίδευση
- ❑ Τριτοβάθμια εκπαίδευση
- ❑ Άλλο: ……

7. Ειδικότητα:

- ❑ Φιλολογία ❑ Μαθηματικά ❑ Φυσική ❑ Χημεία
- ❑ Ξένες γλώσσες ❑ Πληροφορική ❑ Οικονομικά
- ❑ Δάσκαλος/α ❑ Άλλο (παρακαλώ διευκρινίστε):……

8. Προηγούμενη εμπειρία σε χρήση εφαρμογών εικονικής πραγματικότητας:

Καθόλου	Λίγο	Μέτρια	Πολύ	Πάρα πολύ

ΜΕΡΟΣ ΙΙ

Αξιολογήστε τα ακόλουθα σχόλια σχετικά με τις ικανότητες των εκπαιδευτικών τοποθετώντας ένα "Χ" στο κατάλληλο πλαίσιο της 6βάθμιας κλίμακας. Χρησιμοποιήστε την ακόλουθη κλίμακα για να καταγράψετε τις απαντήσεις σας:
0=Καθόλου, 1=Διαφωνώ απόλυτα, 2= Διαφωνώ, 3=Ουδέτερος/η, 4=Συμφωνώ 5=Συμφωνώ απόλυτα

	0	*1*	*2*	*3*	*4*	*5*
1. Όταν βλέπω κάποιον που αντιμετωπίζει πρόβλημα χρήσης ναρκωτικών, συχνά αναρωτιέμαι γιατί έχει εμπλακεί στα ναρκωτικά και συνεχίζω να σκέφτομαι την κατάστασή του καθ' όλη τη διάρκεια της ημέρας μου.						
2. Όταν ακούω για μια κατάσταση χρήσης ναρκωτικών στις ειδήσεις, νιώθω αμέσως στεναχωρημένος.						
3. Έχω προσφερθεί να βοηθήσω εθελοντικά χρήστες που χρειάστηκαν με κάποιο τρόπο βοήθεια.						
4. Δυσκολεύομαι να διαχειριστώ μαθητές που αντιμετωπίζουν πρόβλημα ναρκωτικών.						
5. Προσπαθώ να δω τα πράγματα από την πλευρά του μαθητή.						
6. Όταν βλέπω έναν μαθητή που βρίσκεται σε κίνδυνο εξαιτίας ενός προβλήματος ναρκωτικών και δεν μπορώ να βοηθήσω, νιώθω βαθύτατα προβληματισμένος και επεξεργάζομαι την κατάσταση πολλές φορές μετά το γεγονός.						
7. Πιστεύω ότι να μπορώ να καταλάβω τα προβλήματα των μαθητών που αντιμετωπίζουν πρόβλημα ναρκωτικών με καθιστά καλύτερο εκπαιδευτικό.						
8. Αισθάνομαι λίγη συμπόνια για μαθητές που προκαλούν στον εαυτό τους σοβαρά προβλήματα υγείας, όπως αυτά που πηγάζουν από τη χρήση των ναρκωτικών.						
9. Προσπαθώ να σκέφτομαι όπως οι χρήστες ναρκωτικών για να καταλάβω το πρόβλημα τους.						
10. Είναι σημαντικό οι μαθητές μου να γνωρίζουν ότι νοιάζομαι για αυτούς.						
11. Αισθάνομαι λίγη συμπόνια για μαθητές που προκαλούν στον εαυτό τους σοβαρά προβλήματα υγείας, όπως αυτά που πηγάζουν από τη χρήση ναρκωτικών.						
12. Μερικές φορές αναρωτιέμαι πως θα ήταν να είμαι στη θέση του μαθητή μου.						
13. Μερικές φορές δεν αισθάνομαι άσχημα για τους μαθητές μου όταν έχουν προβλήματα όπως αυτά των ναρκωτικών.						
14. Μερικές φορές πιστεύω ότι είναι δύσκολο να δω τα πράγματα από τη θέση του μαθητή.						

15. Πριν κριτικάρω οποιονδήποτε μαθητή, προσπαθώ να φανταστώ πως θα ένιωθα αν ήμουν στη θέση του.

ΜΕΡΟΣ ΙΙΙ

Η παρακάτω κλίμακα αποτελείται από λέξεις που περιγράφουν διαφορετικά συναισθήματα. Διαβάστε την κάθε λέξη και τοποθετήστε ένα "Χ" στο κατάλληλο πλαίσιο της 6βάθμιας κλίμακας που περιγράφει σε πιο βαθμό αισθάνεστε το κάθε συναίσθημα αυτή τη στιγμή.. Χρησιμοποιήστε την ακόλουθη κλίμακα για να καταγράψετε τις απαντήσεις σας:
0=Καθόλου, 1=Ελάχιστα, 2= Λίγο, 3=Μέτρια, 4=Πολύ 5=Πάρα πολύ

	0	*1*	*2*	*3*	*4*	*5*
1. Φοβισμένος/η						
2. Με ενδιαφέρον						
3. Ενεργός/η						
4. Νευρικός/η						
5. Εμπνευσμένος/η						
6. Στεναχωρημένος/η						
7. Αναστατωμένος/η						
8. Ήρεμος/η						
9. Με αυτοπεποίθηση						
10. Κουρασμένος						
11. Ντροπή						
12. Νυσταγμένος/η						
13. Σε εγρήγορση						
14. Αποκαρδιωμένος/η						
15. Χαλαρός						
16. Αποφασισμένος						
17. Συγκεντρωμένος						

Σας ευχαριστούμε πολύ για την συμμετοχή σας!

APPENDIX C-7-2

Pre-questionnaire (in English)

PART I

1. Country

Cyprus	Greece	Other:

2. Gender

Male	Female	Do not wish to answer

3. Age

18-24	25-29	30-39	40-49	50-59	60+

4. Teaching experience:

Not at all	<1 year	1-4 years
5-10 years	11-20 years	> 20 years

5. Are you currently employed as a teacher?

- ❑ Yes
- ❑ No

6. Level of education in which you serve:

- ❑ I do not serve currently as a teacher
- ❑ Primary Education
- ❑ Secondary Education
- ❑ Higher Education
- ❑ Other: ……

7. Teaching specialty:

- ❑ Literature
- ❑ Mathematics
- ❑ Physics
- ❑ Chemistry
- ❑ Foreign languages
- ❑ Computer Science
- ❑ Economics
- ❑ Primary school teacher
- ❑ Other, (please specify): ……

8. Experience in using Virtual Reality environments:

Not at all	A little	Moderately	Much	Very much

PART II

Evaluate the following comments about teachers' abilities by placing an "X" in the appropriate box of the 6-point scale. Use the following scale to record your answers:
0=Not at all, 1= Strongly disagree, 2= Disagree, 3= Neither agree nor disagree y, 4=Agree 5=Strongly agree

	0	*1*	*2*	*3*	*4*	*5*
1. When I see someone who is facing drug problems, I often wonder about why they got involved with drugs and consider their situation later in the day.						
2. When I hear about a drug situation in the news, I immediately feel sad						
3. I have volunteered to assist drug users who needed help in some way.						
4. I find it difficult to relate to students going through drug problems.						
5. I try to see things from my student's points of view.						
6. When I see a student in distress because of drug problems and I am not able to help, I am deeply troubled and revisit the situation many times after the fact.						
7. I believe that understanding student's drug related problems makes me a better teacher.						
8. I have little sympathy for students who face problems such as drug use.						
9. I try to think like drug users in order to better understand them.						
10. It is important for my students to know that I care about them.						
11. I do not feel sympathy for students who cause their own serious illnesses such as drug related problems.						
12. Sometimes I wonder what it would feel like to be in my student's situation.						
13. Sometimes I don't feel very sorry for my students when they are having problems such as drug problems.						
14. I sometimes find it difficult to see things from students' point of view.						
15. Before criticizing a student, I try to imagine how I would feel if I were in their place.						

PART III

This following scale consists of several words and phrases that describe different feelings and emotions. Indicate to what extent you have any of those feelings right now. Use the following scale to record your answers:
0=Not at all, 1= Low, 2= A little, 3=moderately, 4=Very 5=Extremely

	0	*1*	*2*	*3*	*4*	*5*
1. Afraid						
2. Interested						
3. Active						
4. Nervous						
5. Inspired						
6. Sad						
7. Upset						
8. Calm						
9. Confident						
10. Tired						
11. Ashamed						
12. Sleepy						
13. Alert						
14. Downhearted						
15. Relaxed						
16. Determined						
17. Concentrating						

Thank you very much for your participation!

APPENDIX C-7-3

Post-questionnaire (in Greek)

Τεχνολογικό Πανεπιστήμιο Κύπρου

ΜΕΡΟΣ Ι

1. ***Για πόσο διάστημα θεωρείτε ότι αλληλοεπιδράσατε με το εικονικό σχολικό περιβάλλον; ……***
2. ***Ποια ήταν η προοπτική από την οποία βλέπατε μέσα στο εικονικό περιβάλλον:***

   ❑ "Μέσα από τα μάτια του δικού μου χαρακτήρα", αποκαλούμενη προοπτική πρώτου προσώπου
   ❑ "Πίσω/πάνω από τον χαρακτήρα μου", αποκαλούμενη προοπτική τρίτου προσώπου

3. ***Θα διαβάσετε κάποιες δηλώσεις σχετικά με την εμπειρία σας. Παρακαλείσθε να αναφέρετε εάν κάθε δήλωση ισχύει για την εμπειρία σας. Δεν υπάρχουν σωστές ή λανθασμένες απαντήσεις. Θα παρατηρήσετε ότι ορισμένες ερωτήσεις είναι πολύ παρόμοιες μεταξύ τους. Αυτό είναι απαραίτητο για στατιστικούς λόγους. Και θυμηθείτε: Απαντήστε σε όλα αυτά τα ερωτήματα μόνο για την εμπειρία εικονικής πραγματικότητας που είχατε.***

	-3	-2	-1	0	+1	+2	+3
1. Πόσο συναίσθηση του πραγματικού κόσμου γύρω σου είχες όσο ήσουν μέσα στο εικονικό περιβάλλον? (πχ. ήχοι, θερμοκρασία δωματίου, άλλοι άνθρωποι κλπ.).	*Πλήρη συναίσθηση*			*Μέτρια*			*Καθόλου*
2. Πόσο πραγματικό σου έμοιαζε το εικονικό σχολείο;	*Απόλυτα πραγματικό*						*Καθόλου πραγματικό*
3. Είχα την αίσθηση ότι πραγματικά δρούσα μέσα στο εικονικό σχολείο, παρά το ότι χειριζόμουν κάτι από απόσταση.	*Διαφωνώ απόλυτα*						*Συμφωνώ απόλυτα*
4. Πόσο συνάδει η εμπειρία σου στο εικονικό σχολείο με αυτή του πραγματικού σχολείου;	*Δεν συνάδει*						*Συνάδει πολύ*
5. Πόσο πραγματικό σου φάνηκε το περιβάλλον του εικονικού σχολείου;	*Τόσο αληθινό όσο ένας φαντασιακός κόσμος*						*Δεν ξεχωρίζει από τον πραγματικό κόσμο*
6. Δεν ένιωσα παρών στο εικονικό περιβάλλον.	*Δεν ένιωσα*						*Ένιωσα παρών*
7. Δεν είχα συναίσθηση του πραγματικού περιβάλλοντος γύρω μου.	*Διαφωνώ απόλυτα*						*Συμφωνώ απόλυτα*
	Καθόλου						*Πάρα πολύ*

8. Στο εικονικό σχολείο είχα την αίσθηση ότι πραγματικά βρισκόμουν εκεί.					
9. Με κάποιο τρόπο, ένιωσα ότι το περιβάλλον του εικονικού σχολείου με περιέλαβε.	*Διαφωνώ απόλυτα*				*Συμφωνώ απόλυτα*
10. Ένιωσα παρών στο εικονικό σχολείο.	*Διαφωνώ απόλυτα*				*Συμφωνώ απόλυτα*
11. Συνέχιζα να προσέχω το πραγματικό περιβάλλον γύρω μου.	*Διαφωνώ απόλυτα*				*Συμφωνώ απόλυτα*
12. Το περιβάλλον του εικονικού σχολείου έμοιαζε πιο ρεαλιστικό από αυτό του πραγματικού κόσμου.	*Διαφωνώ απόλυτα*				*Συμφωνώ απόλυτα*
13. Ένιωσα ότι απλώς έβλεπα εικόνες.	*Διαφωνώ απόλυτα*				*Συμφωνώ απόλυτα*
14. Παρασύρθηκα απόλυτα από το εικονικό περιβάλλον.	*Διαφωνώ απόλυτα*				*Συμφωνώ απόλυτα*
15. Είχα την αίσθηση ότι «βρισκόμουν εκεί» στο εικονικό περιβάλλον…	*Καθόλου*		*Ουδέτερος/η*		*Πάρα πολύ*
16. Υπήρξαν φορές κατά τη διάρκεια της εικονικής εμπειρίας μου όπου ένιωσα ότι η πραγματικότητα είναι ο χώρος του σχολείου που έβλεπα:	*Καθόλου*				*Σχεδόν σε όλη τη διάρκεια*
17. Το σχολικό περιβάλλον μοιάζει να είναι…	*Εικόνες που έβλεπα*				*Μια τοποθεσία που επισκέφθηκα*
18. Είχα μια ισχυρή αίσθηση….	*Ότι βρισκόμουν αλλού*				*Ότι βρισκόμουν στο σχολικό χώρο*
19. Νιώθω ότι ο εικονικός σχολικός χώρος μοιάζει και με άλλα μέρη που επισκέφθηκα σήμερα…	*καθόλου*				*Πάρα πολύ*
20. Κατά τη διάρκεια της εικονικής εμπειρίας αισθάνθηκα αρκετές φορές ότι όντως βρισκόμουν και στεκόμουν στο χώρο του σχολείου.	*Όχι πολύ συχνά*				*Πάρα πολύ*

	Διαφωνώ απόλυτα	*Διαφωνώ*	*Ουδέτερος/η*	*Συμφωνώ*	*Συμφωνώ απόλυτα*
21. Παρόλο που το εικονικό σώμα δεν έμοιαζε απόλυτα με εμένα, είχα την					

αίσθηση ότι το εικονικό σώμα που είδα στον καθρέπτη ήταν δικό μου.
22. Παρόλο που το εικονικό σώμα δεν έμοιαζε απόλυτα με το δικό μου, όταν το κοιτούσα είχα την αίσθηση ότι ήταν δικό μου.
23. Δεν ένιωσα ότι το εικονικό σώμα ήταν δικό μου.
24. Κατά τη διάρκεια του πειράματος υπήρξαν στιγμές όπου ένιωσα ότι είχα περισσότερα από ένα σώματα.
25. Ένιωσα ότι έλεγχα τον εικονικό χαρακτήρα σαν να ήταν το σώμα μου.
26. Το εικονικό σώμα κινούνταν ανάλογα με τις κινήσεις μου.

ΜΕΡΟΣ ΙΙ

Αξιολογήστε τα ακόλουθα σχόλια σχετικά με τις ικανότητες των εκπαιδευτικών τοποθετώντας ένα "Χ" στο κατάλληλο πλαίσιο της 6βάθμιας κλίμακας. Χρησιμοποιήστε την ακόλουθη κλίμακα για να καταγράψετε τις απαντήσεις σας:
0=Καθόλου, 1=Διαφωνώ απόλυτα, 2= Διαφωνώ, 3=Ουδέτερος/η, 4=Συμφωνώ 5=Συμφωνώ απόλυτα

	0	*1*	*2*	*3*	*4*	*5*
1. Όταν βλέπω κάποιον που αντιμετωπίζει πρόβλημα χρήσης ναρκωτικών, συχνά αναρωτιέμαι γιατί έχει εμπλακεί στα ναρκωτικά και συνεχίζω να σκέφτομαι την κατάστασή του καθ' όλη τη διάρκεια της ημέρας μου.						
2. Όταν ακούω για μια κατάσταση χρήσης ναρκωτικών στις ειδήσεις, νιώθω αμέσως στεναχωρημένος.						
3. Έχω προσφερθεί να βοηθήσω εθελοντικά χρήστες που χρειάστηκαν με κάποιο τρόπο βοήθεια.						
4. Δυσκολεύομαι να διαχειριστώ μαθητές που αντιμετωπίζουν πρόβλημα ναρκωτικών.						
5. Προσπαθώ να δω τα πράγματα από την πλευρά του μαθητή.						
6. Όταν βλέπω έναν μαθητή που βρίσκεται σε κίνδυνο εξαιτίας ενός προβλήματος ναρκωτικών και δεν μπορώ να βοηθήσω, νιώθω βαθύτατα προβληματισμένος και επεξεργάζομαι την κατάσταση πολλές φορές μετά το γεγονός.						
7. Πιστεύω ότι να μπορώ να καταλάβω τα προβλήματα των μαθητών που αντιμετωπίζουν πρόβλημα ναρκωτικών με καθιστά καλύτερο εκπαιδευτικό.						
8. Αισθάνομαι λίγη συμπόνια για μαθητές που προκαλούν στον εαυτό τους σοβαρά προβλήματα υγείας, όπως αυτά που πηγάζουν από τη χρήση των ναρκωτικών.						
9. Προσπαθώ να σκέφτομαι όπως οι χρήστες ναρκωτικών για να καταλάβω το πρόβλημα τους.						
10. Είναι σημαντικό οι μαθητές μου να γνωρίζουν ότι νοιάζομαι για αυτούς.						

11. Αισθάνομαι λίγη συμπόνια για μαθητές που προκαλούν στον εαυτό τους σοβαρά προβλήματα υγείας, όπως αυτά που πηγάζουν από τη χρήση ναρκωτικών.

12. Μερικές φορές αναρωτιέμαι πως θα ήταν να είμαι στη θέση του μαθητή μου.

13. Μερικές φορές δεν αισθάνομαι άσχημα για τους μαθητές μου όταν έχουν προβλήματα όπως αυτά των ναρκωτικών.

14. Μερικές φορές πιστεύω ότι είναι δύσκολο να δω τα πράγματα από τη θέση του μαθητή.

15. Πριν κριτικάρω οποιονδήποτε μαθητή, προσπαθώ να φανταστώ πως θα ένιωθα αν ήμουν στη θέση του.

ΜΕΡΟΣ ΙΙΙ

Η παρακάτω κλίμακα αποτελείται από λέξεις που περιγράφουν διαφορετικά συναισθήματα. Διαβάστε την κάθε λέξη και τοποθετήστε ένα "Χ" στο κατάλληλο πλαίσιο της 6βάθμιας κλίμακας που περιγράφει σε πιο βαθμό αισθάνεστε το κάθε συναίσθημα αυτή τη στιγμή.. Χρησιμοποιήστε την ακόλουθη κλίμακα για να καταγράψετε τις απαντήσεις σας:
0=Καθόλου, 1=Ελάχιστα, 2= Λίγο, 3=Μέτρια, 4=Πολύ 5=Πάρα πολύ

	0	*1*	*2*	*3*	*4*	*5*
1. Φοβισμένος/η						
2. Με ενδιαφέρον						
3. Ενεργός/η						
4. Νευρικός/η						
5. Εμπνευσμένος/η						
6. Στεναχωρημένος/η						
7. Αναστατωμένος/η						
8. Ήρεμος/η						
9. Με αυτοπεποίθηση						
10. Κουρασμένος						
11. Ντροπή						
12. Νυσταγμένος/η						
13. Σε εγρήγορση						
14. Αποκαρδιωμένος/η						
15. Χαλαρός						
16. Αποφασισμένος						
17. Συγκεντρωμένος						

Σας ευχαριστούμε πολύ για την συμμετοχή σας!

APPENDIX C-7-4

Post-questionnaire (in English)

Cyprus University of Technology

PART I

1. ***How long did you interact with the virtual school environment (min)? ……***
2. ***What was your perspective onto the virtual world? (In the case of changing perspectives, please describe the one most frequently used.)***

   ❑ "Through the eyes of my own character", so called first-person perspective
   ❑ "Behind/above my character", so called third-person perspective

3. ***Now you'll see some statements about experiences. Please indicate, whether or not each statement applies to your experience. There are no right or wrong answers, only your opinion counts. You will notice that some questions are very similar to each other. This is necessary for statistical reasons. And please remember: Answer all these questions only referring to this one experience.***

	-3	-2	-1	0	+1	+2	+3
1. How aware were you of the real world surrounding while navigating in the virtual world? (i.e. sounds, room temperature, other people, etc.)?	*Extremely aware*			*Moderately aware*			*Not aware at all*
2. How real did the virtual world seem to you?	*Completely real*						*Not real at all*
3. I had a sense of acting in the virtual space, rather than operating something from outside.	*Fully disagree*						*Fully agree*
4. How much did your experience in the virtual environment seem consistent with your real-world experience?	*Not consistent*						*Very consistent*
5. How real did the virtual world seem to you?	*About as real as an imagined world*						*Indistinguishable from the real world*
6. I did not feel present in the virtual space.	*Did not feel*						*Felt present*
7. I was not aware of my real environment.	*Fully disagree*						*Fully agree*
8. In the computer-generated world, I had a sense of 'being there'	*Not at all*						*Very much*
9. Somehow, I felt that the virtual world surrounded me.	*Fully disagree*						*Fully agree*

10. I felt present in the virtual space.	*Fully disagree*		*Fully agree*
11. I still paid attention to the real environment.	*Fully disagree*		*Fully agree*
12. The virtual world seemed more realistic than the real world.	*Fully disagree*		*Fully agree*
13. I felt like I was just perceiving pictures.	*Fully disagree*		*Fully agree*
14. I was completely captivated by the virtual world.	*Fully disagree*		*Fully agree*
15. I had a sense of "being there" in the school space:	*Not at all*	*Neutral*	*Very much*
16. There were times during the experience when the school space was the reality for me…	*At no time*		*Almost all the time*
17. The school space seems to me to be more like...	*Images that I saw*		*Somewhere that I visited*
18. I had a stronger sense of...	*Being elsewhere*		*Being in the school space*
19. I think of the school space as a place in a way similar to other places that I've been today…	*Not at all*		*Very much so*
20. During the experience, I often thought that I was really standing in the school space	*Not very often*		*Very much so*

	Completely disagree	*Disagree*	*Undecided*	*Agree*	*Completely agree*
21. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.					
22. Although the virtual body did not look like me, when I looked at my body I had the sensation that it was mine.					
23. I felt that the virtual body was not mine.					
24. During the experiment, there were moments when I felt I had more than one body.					
25. I felt that I controlled the avatar as if it were my body.					
26. The virtual body moved according to my movements.					

PART II

Evaluate the following comments about teachers' abilities by placing an "X" in the appropriate box of the 6-point scale. Use the following scale to record your answers:

0	*1*	*2*	*3*	*4*	*5*
Not at all	*Strongly disagree*	*Disagree*	*Neither agree nor disagree*	*Agree*	*Strongly agree*

	0	*1*	*2*	*3*	*4*	*5*
1. When I see someone who is facing drug problems, I often wonder about why they got involved with drugs and consider their situation later in the day.						
2. When I hear about a drug situation in the news, I immediately feel sad						
3. I have volunteered to assist drug users who needed help in some way.						
4. I find it difficult to relate to students going through drug problems.						
5. I try to see things from my student's points of view.						
6. When I see a student in distress because of drug problems and I am not able to help, I am deeply troubled and revisit the situation many times after the fact.						
7. I believe that understanding student's drug related problems make me a better teacher.						
8. I have little sympathy for students who face problems such as drug use.						
9. I try to think like drug users in order to better understand them.						
10. It is important for my students to know that I care about them.						
11. I do not feel sympathy for students who cause their own serious illnesses such as drug related problems.						
12. Sometimes I wonder what it would feel like to be in my student's situation.						
13. Sometimes I don't feel very sorry for my students when they are having problems such as drug problems.						
14. I sometimes find it difficult to see things from student's point of view.						
15. Before criticizing a student, I try to imagine how I would feel if I were in their place.						

PART III

This following scale consists of several words and phrases that describe different feelings and emotions. Indicate to what extent you have any of those feelings right now. Use the following scale to record your answers:
0=Not at all, 1= Low, 2= A little, 3=moderately, 4=Very 5=Extremely

	0	*1*	*2*	*3*	*4*	*5*
1. Afraid						
2. Interested						
3. Active						
4. Nervous						
5. Inspired						
6. Sad						
7. Upset						
8. Calm						
9. Confident						
10. Tired						
11. Ashamed						
12. Sleepy						
13. Alert						
14. Downhearted						
15. Relaxed						
16. Determined						
17. Concentrating						

Thank you very much for your participation!

APPENDIX C-7-5

Consent form (in Greek)

Έντυπο Συγκατάθεσης

Αγαπητοί συμμετέχοντες,

Καλείστε να συμμετάσχετε σε μια έρευνα που διεξάγεται από τις Καλλιόπη Σταυρούλια και Μαρία Χριστοφή, στο πλαίσιο της διδακτορικής διατριβής τους στο Τμήμα Πολυμέσων και Γραφικών Τεχνών του Τεχνολογικού Πανεπιστημίου Κύπρου. Σας ζητάμε να συμμετάσχετε στην παρούσα έρευνα γιατί ο σκοπός της είναι να βοηθήσουμε τους εκπαιδευτικούς να εξασκήσουν τις δεξιότητές τους μέσω της χρήσης ενός εκπαιδευτικού εργαλείου Εικονικής Πραγματικότητας.

Θα σας ζητηθεί να αλληλοεπιδράσετε με ένα σχολικό περιβάλλον Εικονικής Πραγματικότητας για περίπου 20 λεπτά και στη συνέχεια θα σας ζητηθεί να αξιολογήσετε την εμπειρία σας μέσω ερωτηματολογίου. Η εμπειρία σας σε αυτό το θέμα είναι πολύτιμη για εμάς. Σας διαβεβαιώνουμε, ότι η συμπλήρωση του ερωτηματολογίου είναι ανώνυμη και οι πληροφορίες που θα μας δώσετε θα είναι απολύτως εμπιστευτικές και δεν πρόκειται να χρησιμοποιηθούν για κανένα άλλο σκοπό. **Η συμμετοχή σας είναι εντελώς εθελοντική**. Μπορείτε να επιλέξετε να μην συμμετέχετε σε μέρος ή στο σύνολο του ερωτηματολογίου ή του πειράματος.

Επιπροσθέτως, ζητάμε την συγκατάθεση σας για την φωτογράφιση και την βιντεοσκόπηση του πειράματος. Η χρήση των αρχείων περιορίζεται μόνο για τους σκοπούς της έρευνας μας. Σε περίπτωση που φωτογραφίες σας ή βίντεο χρησιμοποιηθούν για εκπαιδευτικούς σκοπούς ή σε περίπτωση που τα αποτελέσματα της έρευνας δημοσιευτούν ή παρουσιαστούν σε συνέδρια, η ταυτότητά σας θα προστατεύεται και θα συγκαλύπτεται το πρόσωπο σας, ώστε να μην αποκαλυφθεί η ταυτότητά σας. Μπορείτε να αρνηθείτε να φωτογραφηθείτε και να βιντεοσκοπηθείτε. Οι ερευνήτριες μπορούν να σας προμηθεύσουν με ένα αντίγραφο του φωτογραφικού και βιντεοσκοπημένου υλικού κατόπιν αιτήσεώς σας.

Δεν υπάρχουν προβλέψιμοι κίνδυνοι που προκύπτουν από τη συμμετοχή σας στην παρούσα έρευνα. Θα σας επεξηγηθεί τι ελπίζουμε να μάθουμε από το πρόγραμμα σαν αποτέλεσμα και της δικής σας συμμετοχής.

Δεν πρέπει να συμμετάσχετε, εάν δεν επιθυμείτε ή εάν έχετε οποιουσδήποτε ενδοιασμούς αφορούν την συμμετοχή σας στο πρόγραμμα.

Είστε ελεύθεροι να αποσύρετε οποιαδήποτε στιγμή εσείς επιθυμείτε την συγκατάθεση για την συμμετοχή σας στο πρόγραμμα.

Σας ευχαριστούμε για την ανταπόκριση και τη συνεργασία σας.

Με εκτίμηση,

Καλλιόπη Σταυρούλια και Μαρία Χριστοφή

Διδακτορικές Φοιτήτριες και Συνεργάτες

Τμήμα Πολυμέσων και Γραφικών Τεχνών

Σχολή Καλών και Εφαρμοσμένων Τεχνών

Για περισσότερες πληροφορίες μπορείτε να απευθυνθείτε στο Visual Media Computing Lab: vmc@gmail.com και στο Microsoft Computer Games and Emerging Technologies Lab (GET Lab): http://getlab.org/

APPENDIX C-7-6

Consent form (in English)

Consent Form

Dear participants,

You are invited to participate in a research conducted by Kalliopi-Evangelia Stavroulia and Maria Christofi, as part of their doctoral thesis in the Department of Multimedia and Graphic Arts of the Cyprus University of Technology. We invite you to participate in this research because its purpose is to help teachers practice their skills using a Virtual Reality educational tool.

You will be asked to interact with a Virtual Reality school environment for about 20 minutes and then you will be asked to rate your experience through a questionnaire. Your experience in this matter is valuable to us. We assure you that filling out the questionnaire is anonymous and the information you provide will be completely confidential and will not be used for any other purpose. **Your participation is completely voluntary, and you may choose to withdraw at any time.**

In addition, we ask for your consent for the photography and video recording of the experiment. The use of archives is restricted to our research purposes only. If your photos or videos are used for educational purposes or if the research results are published or presented at conferences, your identity will be protected, and your face will be concealed so that your identity will not be revealed. You can refuse to be photographed and videotaped. Researchers can provide you with a copy of the photographic and video material on your request.

There are no foreseeable risks arising from your participation in this survey.

You should not participate if you do not wish or if you have any concerns about your participation in the experiment.

You are free to withdraw at any time from the experiment.

Thank you for your feedback and cooperation.

Yours sincerely,

Kalliopi-Evangelia Stavroulia & Maria Christofi

Ph.D. candidates

Department of Multimedia and Graphic Arts

School of Fine and Applied Arts

Technological University of Cyprus

For further information please contact Visual Media Computing Lab: vmc@gmail.com and Microsoft Computer Games and Emerging Technologies Lab (GET Lab): http://getlab.org/

APPENDIX C-7-7

Descriptive statistics for the items of the IPQ presence scale

Q8. In the computer-generated school, I had a sense of 'being there'.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	1	8.3	8.3	8.3
	-1	1	8.3	8.3	16.7
	0	3	25.0	25.0	41.7
	1	4	33.3	33.3	75.0
	2	1	8.3	8.3	83.3
	3 (Very much)	2	16.7	16.7	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q8. In the computer-generated school, I had a sense of 'being there'.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-1	1	7.7	7.7	7.7
	0	3	23.1	23.1	30.8
	1	2	15.4	15.4	46.2
	2	6	46.2	46.2	92.3
	3 (Very much / Πάρα πολύ)	1	7.7	7.7	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q3. In the computer-generated school, I had a sense of 'being there'.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-1	1	7.7	7.7	7.7
	0	3	23.1	23.1	30.8
	1	2	15.4	15.4	46.2

	2	6	46.2	46.2	92.3
	3 (Very much)	1	7.7	7.7	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q3. I had a sense of acting in the virtual school space, rather than operating something from outside.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3 (Fully Disagree)	2	15.4	15.4	15.4
	-2	2	15.4	15.4	30.8
	0	5	38.5	38.5	69.2
	1	1	7.7	7.7	76.9
	2	2	15.4	15.4	92.3
	3 (Fully agree)	1	7.7	7.7	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q6. I did not feel present in the virtual school space.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	1	8.3	8.3	8.3
	-1	1	8.3	8.3	16.7
	0	1	8.3	8.3	25.0
	1	4	33.3	33.3	58.3
	2	2	16.7	16.7	75.0
	3 (Felt present)	3	25.0	25.0	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q6. I did not feel present in the virtual school space.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	-3 (Did not feel present)	1	7.7	7.7	7.7
	-2	1	7.7	7.7	15.4
	-1	2	15.4	15.4	30.8
	1	2	15.4	15.4	46.2
	2	4	30.8	30.8	76.9
	3 (Felt present)	3	23.1	23.1	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q9. Somehow, I felt that the virtual school environment surrounded me.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-1	1	8.3	8.3	8.3
	0	4	33.3	33.3	41.7
	1	4	33.3	33.3	75.0
	2	1	8.3	8.3	83.3
	3 (Fully agree)	2	16.7	16.7	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q9. Somehow, I felt that the virtual school environment surrounded me.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-1	2	15.4	15.4	15.4
	0	2	15.4	15.4	30.8
	1	2	15.4	15.4	46.2
	2	5	38.5	38.5	84.6
	3 (Fully agree)	2	15.4	15.4	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q10. I felt present in the virtual school.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	1	8.3	8.3	8.3
	0	2	16.7	16.7	25.0
	1	5	41.7	41.7	66.7
	2	3	25.0	25.0	91.7
	3 (Fully agree)	1	8.3	8.3	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q10. I felt present in the virtual school.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	2	15.4	15.4	15.4
	0	2	15.4	15.4	30.8
	1	3	23.1	23.1	53.8
	2	5	38.5	38.5	92.3
	3 (Fully agree)	1	7.7	7.7	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q13. I felt like I was just perceiving pictures.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	2	16.7	16.7	16.7
	-1	4	33.3	33.3	50.0
	0	2	16.7	16.7	66.7
	1	2	16.7	16.7	83.3
	3 (Fully agree)	2	16.7	16.7	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q13. I felt like I was just perceiving pictures.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3 (Fully disagree)	2	15.4	15.4	15.4
	-2	4	30.8	30.8	46.2
	-1	3	23.1	23.1	69.2
	0	1	7.7	7.7	76.9
	1	2	15.4	15.4	92.3
	2	1	7.7	7.7	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q1. How aware were you of the real world surrounding while navigating in the virtual school? (i.e. sounds, room temperature, other people, etc.)?[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-1	3	25.0	25.0	25.0
	0 (Moderately aware)	6	50.0	50.0	75.0
	1	2	16.7	16.7	91.7
	2	1	8.3	8.3	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q1. How aware were you of the real world surrounding while navigating in the virtual school? (i.e. sounds, room temperature, other people, etc.)?[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	5	38.5	38.5	38.5
	0 (Moderately aware)	4	30.8	30.8	69.2
	1	2	15.4	15.4	84.6
	2	1	7.7	7.7	92.3
	3 (Not aware at all)	1	7.7	7.7	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q7. I was not aware of my real environment.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	1	8.3	8.3	8.3
	0	6	50.0	50.0	58.3
	1	2	16.7	16.7	75.0
	2	2	16.7	16.7	91.7
	3 (Fully agree)	1	8.3	8.3	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q7. I was not aware of my real environment.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3 (Fully disagree)	1	7.7	7.7	7.7
	-2	2	15.4	15.4	23.1
	-1	2	15.4	15.4	38.5
	0	3	23.1	23.1	61.5
	1	2	15.4	15.4	76.9
	2	1	7.7	7.7	84.6
	3 (Fully agree)	2	15.4	15.4	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q11. I still paid attention to the real environment.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3 (Fully disagree)	2	16.7	16.7	16.7
	-2	2	16.7	16.7	33.3
	-1	2	16.7	16.7	50.0
	1	3	25.0	25.0	75.0

	2	2	16.7	16.7	91.7
	3 (Fully agree)	1	8.3	8.3	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q11. I still paid attention to the real environment.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3 (Fully disagree)	2	15.4	15.4	15.4
	-2	2	15.4	15.4	30.8
	-1	2	15.4	15.4	46.2
	0	2	15.4	15.4	61.5
	1	4	30.8	30.8	92.3
	3 (Fully agree)	1	7.7	7.7	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q14. I was completely captivated by the virtual school environment.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3 (Fully disagree)	3	25.0	25.0	25.0
	-2	1	8.3	8.3	33.3
	-1	1	8.3	8.3	41.7
	0	2	16.7	16.7	58.3
	1	3	25.0	25.0	83.3
	2	1	8.3	8.3	91.7
	3 (Fully agree)	1	8.3	8.3	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q14. I was completely captivated by the virtual school environment.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	-3 (Fully disagree)	2	15.4	15.4	15.4
	-2	2	15.4	15.4	30.8
	-1	5	38.5	38.5	69.2
	1	2	15.4	15.4	84.6
	2	1	7.7	7.7	92.3
	3 (Fully agree)	1	7.7	7.7	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q2. How real did the virtual school seem to you?[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	2	16.7	16.7	16.7
	-1	5	41.7	41.7	58.3
	0 (Moderately aware)	1	8.3	8.3	66.7
	1	1	8.3	8.3	75.0
	3 (Not real at all)	3	25.0	25.0	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q2. How real did the virtual school seem to you?[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3 (Completely Real)	2	15.4	15.4	15.4
	-1	3	23.1	23.1	38.5
	0 (Moderately aware)	5	38.5	38.5	76.9
	1	3	23.1	23.1	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q4. How much did your experience in the virtual school environment seem consistent with your real-school experience?[a]

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	-3 (Not consistent)	2	16.7	16.7	16.7
	-1	3	25.0	25.0	41.7
	0	2	16.7	16.7	58.3
	1	3	25.0	25.0	83.3
	2	1	8.3	8.3	91.7
	3 (Very consistent)	1	8.3	8.3	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q4. How much did your experience in the virtual school environment seem consistent with your real-school experience?[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	3	23.1	23.1	23.1
	0	5	38.5	38.5	61.5
	1	2	15.4	15.4	76.9
	2	2	15.4	15.4	92.3
	3 (Very consistent)	1	7.7	7.7	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q5. How real did the virtual school environment seem to you?[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3 (About as real as an imagined world)	1	8.3	8.3	8.3
	-2	1	8.3	8.3	16.7
	-1	4	33.3	33.3	50.0
	0	3	25.0	25.0	75.0
	1	1	8.3	8.3	83.3
	2	2	16.7	16.7	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q5. How real did the virtual school environment seem to you?[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	1	7.7	7.7	7.7
	-1	1	7.7	7.7	15.4
	0	4	30.8	30.8	46.2
	1	4	30.8	30.8	76.9
	2	2	15.4	15.4	92.3
	3 (Indistinguishable from the real world)	1	7.7	7.7	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q12. The virtual school environment seemed more realistic than the real school environment.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3 (Fully disagree)	3	25.0	25.0	25.0
	-2	3	25.0	25.0	50.0
	-1	5	41.7	41.7	91.7
	3 (Fully agree)	1	8.3	8.3	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q12. The virtual school environment seemed more realistic than the real school environment.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3 (Fully disagree)	3	23.1	23.1	23.1
	-2	3	23.1	23.1	46.2
	-1	4	30.8	30.8	76.9
	0	1	7.7	7.7	84.6
	1	2	15.4	15.4	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

APPENDIX C-7-8

Descriptive statistics for the items of the SUS presence scale

Q15_I had a sense of "being there" in the school space[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3 (Not at all)	2	16.7	16.7	16.7
	0 (Neutral)	5	41.7	41.7	58.3
	1	2	16.7	16.7	75.0
	2	1	8.3	8.3	83.3
	3 (Very much)	2	16.7	16.7	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q15_I had a sense of "being there" in the school space[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	1	7.7	7.7	7.7
	0 (Neutral)	1	7.7	7.7	15.4
	1	4	30.8	30.8	46.2
	2	5	38.5	38.5	84.6
	3 (Very much)	2	15.4	15.4	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q16_There were times during the experience when the school space was the reality for me…[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3 (At no time)	1	8.3	8.3	8.3
	-2	1	8.3	8.3	16.7
	-1	2	16.7	16.7	33.3

	0 (Neutral)	1	8.3	8.3	41.7
	1	4	33.3	33.3	75.0
	2	1	8.3	8.3	83.3
	3 (Almost all time)	2	16.7	16.7	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q16_There were times during the experience when the school space was the reality for me…[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	1	7.7	7.7	7.7
	-1	1	7.7	7.7	15.4
	0 (Neutral)	1	7.7	7.7	23.1
	1	6	46.2	46.2	69.2
	2	3	23.1	23.1	92.3
	3 (Almost all time)	1	7.7	7.7	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q17_The school space seems to me to be more like...[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3 (Images that I saw)	2	16.7	16.7	16.7
	-1	2	16.7	16.7	33.3
	0 (Neutral)	4	33.3	33.3	66.7
	1	3	25.0	25.0	91.7
	2	1	8.3	8.3	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q17_The school space seems to me to be more like...[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-1	3	23.1	23.1	23.1
	0 (Neutral)	1	7.7	7.7	30.8
	1	6	46.2	46.2	76.9
	2	2	15.4	15.4	92.3
	3 (Somewhere that I visited)	1	7.7	7.7	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q18_I had a stronger sense of...[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3 (Being elsewhere)	1	8.3	8.3	8.3
	-1	3	25.0	25.0	33.3
	0 (Neutral)	4	33.3	33.3	66.7
	1	1	8.3	8.3	75.0
	2	3	25.0	25.0	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q18_I had a stronger sense of...[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3 (Being elsewhere)	1	7.7	7.7	7.7
	-2	1	7.7	7.7	15.4
	0 (Neutral)	4	30.8	30.8	46.2
	1	3	23.1	23.1	69.2
	2	4	30.8	30.8	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q19_I think of the virtual school space as a place in a way similar to other places that I've been today…[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3 (Not at all)	2	16.7	16.7	16.7
	-1	3	25.0	25.0	41.7
	0 (Neutral)	1	8.3	8.3	50.0
	1	3	25.0	25.0	75.0
	2	3	25.0	25.0	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q19_I think of the virtual school space as a place in a way similar to other places that I've been today…[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3 (Not at all)	3	23.1	23.1	23.1
	-2	1	7.7	7.7	30.8
	-1	2	15.4	15.4	46.2
	0 (Neutral)	4	30.8	30.8	76.9
	1	1	7.7	7.7	84.6
	2	1	7.7	7.7	92.3
	3 (Very much so)	1	7.7	7.7	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

Q20_During the experience I often thought that I was really standing in the school space[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	2	16.7	16.7	16.7
	-1	1	8.3	8.3	25.0
	0 (Neutral)	4	33.3	33.3	58.3

	1	2	16.7	16.7	75.0
	2	1	8.3	8.3	83.3
	3 (Very much so)	2	16.7	16.7	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

Q20_During the experience I often thought that I was really standing in the school space[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-1	2	15.4	15.4	15.4
	0 (Neutral)	2	15.4	15.4	30.8
	1	4	30.8	30.8	61.5
	2	2	15.4	15.4	76.9
	3 (Very much so)	3	23.1	23.1	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

APPENDIX C-7-9

Descriptive statistics for the items of the embodiment scale

1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	4	33.3	33.3	33.3
	Undecided	4	33.3	33.3	66.7
	Agree	3	25.0	25.0	91.7
	Completely agree	1	8.3	8.3	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	7.7	7.7	7.7
	Undecided	4	30.8	30.8	38.5
	Agree	6	46.2	46.2	84.6
	Completely agree	2	15.4	15.4	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

2. Although the virtual body did not look like me, when I looked at my body I had the sensation that it was mine.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely disagree	1	8.3	8.3	8.3
	Disagree	2	16.7	16.7	25.0
	Undecided	2	16.7	16.7	41.7
	Agree	7	58.3	58.3	100.0

	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

2. Although the virtual body did not look like me, when I looked at my body I had the sensation that it was mine.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	2	15.4	15.4	15.4
	Undecided	2	15.4	15.4	30.8
	Agree	7	53.8	53.8	84.6
	Completely agree	2	15.4	15.4	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

3. I felt that the virtual body was not mine.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	3	25.0	25.0	25.0
	Undecided	3	25.0	25.0	50.0
	Disagree	5	41.7	41.7	91.7
	Completely disagree	1	8.3	8.3	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

3. I felt that the virtual body was not mine.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	2	15.4	15.4	15.4
	Undecided	3	23.1	23.1	38.5
	Disagree	4	30.8	30.8	69.2
	Completely disagree	4	30.8	30.8	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

4. During the experiment there were moments when I felt I had more than one body.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely disagree	2	16.7	16.7	16.7
	Disagree	4	33.3	33.3	50.0
	Undecided	2	16.7	16.7	66.7
	Agree	4	33.3	33.3	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

4. During the experiment there were moments when I felt I had more than one body.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely disagree	4	30.8	30.8	30.8
	Disagree	2	15.4	15.4	46.2
	Undecided	2	15.4	15.4	61.5
	Agree	4	30.8	30.8	92.3
	Completely agree	1	7.7	7.7	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

5. I felt that I controlled the avatar as if it were my body.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely disagree	1	8.3	8.3	8.3
	Disagree	1	8.3	8.3	16.7
	Undecided	4	33.3	33.3	50.0
	Agree	6	50.0	50.0	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

5. I felt that I controlled the avatar as if it were my body.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely disagree	1	7.7	7.7	7.7
	Disagree	3	23.1	23.1	30.8
	Undecided	3	23.1	23.1	53.8
	Agree	5	38.5	38.5	92.3
	Completely agree	1	7.7	7.7	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

6. The virtual body moved according to my movements.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely disagree	2	16.7	16.7	16.7
	Disagree	2	16.7	16.7	33.3
	Undecided	2	16.7	16.7	50.0
	Agree	4	33.3	33.3	83.3
	Completely agree	2	16.7	16.7	100.0
	Total	12	100.0	100.0	

a. Perspective = Teacher-Student drug user

6. The virtual body moved according to my movements.[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely disagree	1	7.7	7.7	7.7
	Disagree	4	30.8	30.8	38.5
	Undecided	3	23.1	23.1	61.5
	Agree	3	23.1	23.1	84.6
	Completely agree	2	15.4	15.4	100.0
	Total	13	100.0	100.0	

a. Perspective = Teacher-healthy student

APPENDIX C-7-10

Descriptive statistics for the items of the pre-empathy scale

1. When I see someone who is facing drug problems, I often wonder about why they got involved with drugs and consider their situation later in the day.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 (No opinion)	2	8.0	8.0	8.0
	2 (Disagree)	2	8.0	8.0	16.0
	3 (Neither Agree nor Disagree)	2	8.0	8.0	24.0
	4 (Agree)	17	68.0	68.0	92.0
	5 (Strongly agree)	2	8.0	8.0	100.0
	Total	25	100.0	100.0	

2. When I hear about a drug situation in the news, I immediately feel sad.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 (Strongly disagree)	1	4.0	4.0	4.0
	2 (Disagree)	4	16.0	16.0	20.0
	3 (Neither Agree nor Disagree)	5	20.0	20.0	40.0
	4 (Agree)	13	52.0	52.0	92.0
	5 (Strongly agree)	2	8.0	8.0	100.0
	Total	25	100.0	100.0	

3. I have volunteered to assist drug users who needed help in some way.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 (No opinion)	8	32.0	32.0	32.0
	1 (Strongly disagree)	2	8.0	8.0	40.0
	2 (Disagree)	2	8.0	8.0	48.0

	3 (Neither Agree nor Disagree)	4	16.0	16.0	64.0
	4 (Agree)	8	32.0	32.0	96.0
	5 (Strongly agree)	1	4.0	4.0	100.0
	Total	25	100.0	100.0	

4. I find it difficult to relate to students going through drug problems.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 (No opinion)	3	12.0	12.0	12.0
	1 (Strongly disagree)	2	8.0	8.0	20.0
	2 (Disagree)	8	32.0	32.0	52.0
	3 (Neither Agree nor Disagree)	2	8.0	8.0	60.0
	4 (Agree)	8	32.0	32.0	92.0
	5 (Strongly agree)	2	8.0	8.0	100.0
	Total	25	100.0	100.0	

5. I try to see things from my student's points of view.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 (Disagree)	1	4.0	4.0	4.0
	3 (Neither Agree nor Disagree)	3	12.0	12.0	16.0
	4 (Agree)	12	48.0	48.0	64.0
	5 (Strongly agree)	9	36.0	36.0	100.0
	Total	25	100.0	100.0	

6. When I see a student in distress because of drug problems and I am not able to help, I am deeply troubled and revisit the situation many times after the fact.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 (Strongly disagree)	2	8.0	8.0	8.0
	2 (Disagree)	2	8.0	8.0	16.0

	3 (Neither Agree nor Disagree)	4	16.0	16.0	32.0
	4 (Agree)	13	52.0	52.0	84.0
	5 (Strongly agree)	4	16.0	16.0	100.0
	Total	25	100.0	100.0	

7. I believe that understanding student's drug related problems makes me a better teacher.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 (No opinion)	2	8.0	8.0	8.0
	3 (Neither Agree nor Disagree)	6	24.0	24.0	32.0
	4 (Agree)	12	48.0	48.0	80.0
	5 (Strongly agree)	5	20.0	20.0	100.0
	Total	25	100.0	100.0	

8. I have little sympathy for students who face problems such as drug use.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 (No opinion)	2	8.0	8.0	8.0
	1 (Strongly disagree)	3	12.0	12.0	20.0
	2 (Disagree)	8	32.0	32.0	52.0
	3 (Neither Agree nor Disagree)	3	12.0	12.0	64.0
	4 (Agree)	5	20.0	20.0	84.0
	5 (Strongly agree)	4	16.0	16.0	100.0
	Total	25	100.0	100.0	

9. I try to think like drug users in order to better understand them.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 (No opinion)	1	4.0	4.0	4.0
	1 (Strongly disagree)	2	8.0	8.0	12.0
	2 (Disagree)	3	12.0	12.0	24.0

	3 (Neither Agree nor Disagree)	6	24.0	24.0	48.0
	4 (Agree)	10	40.0	40.0	88.0
	5 (Strongly agree)	3	12.0	12.0	100.0
	Total	25	100.0	100.0	

10. It is important for my students to know that I care about them.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3 (Neither Agree nor Disagree)	1	4.0	4.0	4.0
	4 (Agree)	7	28.0	28.0	32.0
	5 (Strongly agree)	17	68.0	68.0	100.0
	Total	25	100.0	100.0	

11. I do not feel sympathy for students who cause their own serious illnesses such as drug related problems.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 (No opinion)	2	8.0	8.0	8.0
	1 (Strongly disagree)	9	36.0	36.0	44.0
	2 (Disagree)	4	16.0	16.0	60.0
	3 (Neither Agree nor Disagree)	3	12.0	12.0	72.0
	4 (Agree)	4	16.0	16.0	88.0
	5 (Strongly agree)	3	12.0	12.0	100.0
	Total	25	100.0	100.0	

12. Sometimes I wonder what it would feel like to be in my student's situation.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 (No opinion)	2	8.0	8.0	8.0
	3 (Neither Agree nor Disagree)	3	12.0	12.0	20.0
	4 (Agree)	13	52.0	52.0	72.0

	5 (Strongly agree)	7	28.0	28.0	100.0
	Total	25	100.0	100.0	

14. I sometimes find it difficult to see things from student's point of view.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 (Strongly disagree)	2	8.0	8.0	8.0
	2 (Disagree)	7	28.0	28.0	36.0
	3 (Neither Agree nor Disagree)	4	16.0	16.0	52.0
	4 (Agree)	10	40.0	40.0	92.0
	5 (Strongly agree)	2	8.0	8.0	100.0
	Total	25	100.0	100.0	

15. Before criticizing a student, I try to imagine how I would feel if I were in their place.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3 (Neither Agree nor Disagree)	4	16.0	16.0	16.0
	4 (Agree)	11	44.0	44.0	60.0
	5 (Strongly agree)	10	40.0	40.0	100.0
	Total	25	100.0	100.0	

APPENDIX C-7-11

Descriptive statistics for the items of the post-empathy scale

1. When I see someone who is facing drug problems, I often wonder about why they got involved with drugs and consider their situation later in the day.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 (No opinion)	2	8.0	8.0	8.0
	2 (Disagree)	1	4.0	4.0	12.0
	3 (Neither Agree nor Disagree)	3	12.0	12.0	24.0
	4 (Agree)	15	60.0	60.0	84.0
	5 (Strongly agree)	4	16.0	16.0	100.0
	Total	25	100.0	100.0	

2. When I hear about a drug situation in the news, I immediately feel sad.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 (Strongly disagree)	2	8.0	8.0	8.0
	2 (Disagree)	1	4.0	4.0	12.0
	3 (Neither Agree nor Disagree)	6	24.0	24.0	36.0
	4 (Agree)	14	56.0	56.0	92.0
	5 (Strongly agree)	2	8.0	8.0	100.0
	Total	25	100.0	100.0	

3. I have volunteered to assist drug users who needed help in some way.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 (No opinion)	6	24.0	24.0	24.0
	1 (Strongly disagree)	5	20.0	20.0	44.0
	2 (Disagree)	3	12.0	12.0	56.0

	3 (Neither Agree nor Disagree)	3	12.0	12.0	68.0
	4 (Agree)	7	28.0	28.0	96.0
	5 (Strongly agree)	1	4.0	4.0	100.0
	Total	25	100.0	100.0	

4. I find it difficult to relate to students going through drug problems.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 (Strongly disagree)	2	8.0	8.0	8.0
	2 (Disagree)	3	12.0	12.0	20.0
	3 (Neither Agree nor Disagree)	4	16.0	16.0	36.0
	4 (Agree)	13	52.0	52.0	88.0
	5 (Strongly agree)	3	12.0	12.0	100.0
	Total	25	100.0	100.0	

5. I try to see things from my student's points of view.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 (Disagree)	1	4.0	4.0	4.0
	3 (Neither Agree nor Disagree)	1	4.0	4.0	8.0
	4 (Agree)	17	68.0	68.0	76.0
	5 (Strongly agree)	6	24.0	24.0	100.0
	Total	25	100.0	100.0	

6. When I see a student in distress because of drug problems and I am not able to help, I am deeply troubled and revisit the situation many times after the fact.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 (Disagree)	2	8.0	8.0	8.0
	3 (Neither Agree nor Disagree)	4	16.0	16.0	24.0
	4 (Agree)	12	48.0	48.0	72.0

	5 (Strongly agree)	7	28.0	28.0	100.0
	Total	25	100.0	100.0	

7. I believe that understanding student's drug related problems makes me a better teacher.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 (Disagree)	1	4.0	4.0	4.0
	3 (Neither Agree nor Disagree)	2	8.0	8.0	12.0
	4 (Agree)	12	48.0	48.0	60.0
	5 (Strongly agree)	10	40.0	40.0	100.0
	Total	25	100.0	100.0	

8. I have little sympathy for students who face problems such as drug use.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 (No opinion)	1	4.0	4.0	4.0
	1 (Strongly disagree)	7	28.0	28.0	32.0
	2 (Disagree)	4	16.0	16.0	48.0
	3 (Neither Agree nor Disagree)	5	20.0	20.0	68.0
	4 (Agree)	3	12.0	12.0	80.0
	5 (Strongly agree)	5	20.0	20.0	100.0
	Total	25	100.0	100.0	

9. I try to think like drug users in order to better understand them.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 (Strongly disagree)	2	8.0	8.0	8.0
	2 (Disagree)	3	12.0	12.0	20.0
	3 (Neither Agree nor Disagree)	4	16.0	16.0	36.0
	4 (Agree)	11	44.0	44.0	80.0
	5 (Strongly agree)	5	20.0	20.0	100.0

	Total	25	100.0	100.0	

10. It is important for my students to know that I care about them.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4 (Agree)	11	44.0	44.0	44.0
	5 (Strongly agree)	14	56.0	56.0	100.0
	Total	25	100.0	100.0	

11. I do not feel sympathy for students who cause their own serious illnesses such as drug related problems.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 (No opinion)	2	8.0	8.0	8.0
	1 (Strongly disagree)	6	24.0	24.0	32.0
	2 (Disagree)	4	16.0	16.0	48.0
	3 (Neither Agree nor Disagree)	6	24.0	24.0	72.0
	4 (Agree)	4	16.0	16.0	88.0
	5 (Strongly agree)	3	12.0	12.0	100.0
	Total	25	100.0	100.0	

12. Sometimes I wonder what it would feel like to be in my student's situation.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 (No opinion)	1	4.0	4.0	4.0
	1 (Strongly disagree)	1	4.0	4.0	8.0
	2 (Disagree)	1	4.0	4.0	12.0
	3 (Neither Agree nor Disagree)	4	16.0	16.0	28.0
	4 (Agree)	12	48.0	48.0	76.0
	5 (Strongly agree)	6	24.0	24.0	100.0
	Total	25	100.0	100.0	

14. I sometimes find it difficult to see things from student's point of view.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 (No opinion)	1	4.0	4.0	4.0
	1 (Strongly disagree)	3	12.0	12.0	16.0
	2 (Disagree)	4	16.0	16.0	32.0
	3 (Neither Agree nor Disagree)	4	16.0	16.0	48.0
	4 (Agree)	11	44.0	44.0	92.0
	5 (Strongly agree)	2	8.0	8.0	100.0
	Total	25	100.0	100.0	

15. Before criticizing a student, I try to imagine how I would feel if I were in their place.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 (No opinion)	1	4.0	4.0	4.0
	2 (Disagree)	1	4.0	4.0	8.0
	3 (Neither Agree nor Disagree)	5	20.0	20.0	28.0
	4 (Agree)	8	32.0	32.0	60.0
	5 (Strongly agree)	10	40.0	40.0	100.0
	Total	25	100.0	100.0	

APPENDIX C-7-12

Ranks table on the comparison of participants' before (pre) and after (post) empathy scores

		N	Mean Rank	Sum of Ranks
1. When I see someone who is facing drug problems, I often wonder about why they got involved with drugs and consider their situation later in the day. (post) - 1. When I see someone who is facing drug problems, I often wonder about why they got involved with drugs and consider their situation later in the day. (pre)	Negative Ranks	4	2.63	10.50
	Positive Ranks	1	4.50	4.50
	Ties	20		
	Total	25		
2. When I hear about a drug situation in the news, I immediately feel sad. (post) - 2. When I hear about a drug situation in the news, I immediately feel sad. (pre)	Negative Ranks	5	5.40	27.00
	Positive Ranks	4	4.50	18.00
	Ties	16		
	Total	25		
3. I have volunteered to assist drug users who needed help in some way. (post) - 3. I have volunteered to assist drug users who needed help in some way. (pre)	Negative Ranks	6	6.67	40.00
	Positive Ranks	7	7.29	51.00
	Ties	12		
	Total	25		
4. I find it difficult to relate to students going through drug problems. (post) - 4. I find it difficult to relate to students going through drug problems. (pre)	Negative Ranks	12	9.00	108.00
	Positive Ranks	3	4.00	12.00
	Ties	10		
	Total	25		
5. I try to see things from my student’s points of view. (post) - 5. I try to see things from my student’s points of view. (pre)	Negative Ranks	8	9.06	72.50

	Positive Ranks	9	8.94	80.50
	Ties	8		
	Total	25		
6. When I see a student in distress because of drug problems and I am not able to help, I am deeply troubled and revisit the situation many times after the fact. (post) - 6. When I see a student in distress because of drug problems and I am not able to help, I am deeply troubled and revisit the situation many times after the fact. (pre)	Negative Ranks	10	7.55	75.50
	Positive Ranks	4	7.38	29.50
	Ties	11		
	Total	25		
7. I believe that understanding student's drug related problems makes me a better teacher. (post) - 7. I believe that understanding student's drug related problems makes me a better teacher. (pre)	Negative Ranks	9	6.44	58.00
	Positive Ranks	2	4.00	8.00
	Ties	14		
	Total	25		
8. I have little sympathy for students who face problems such as drug use. (post) - 8. I have little sympathy for students who face problems such as drug use. (pre)	Negative Ranks	7	7.71	54.00
	Positive Ranks	8	8.25	66.00
	Ties	10		
	Total	25		
9. I try to think like drug users in order to better understand them. (post) - 9. I try to think like drug users in order to better understand them. (pre)	Negative Ranks	8	6.81	54.50
	Positive Ranks	4	5.88	23.50
	Ties	13		
	Total	25		
10. It is important for my students to know that I care about them. (post) - 10. It is important for my students to know that I care about them. (pre)	Negative Ranks	2	3.50	7.00
	Positive Ranks	4	3.50	14.00

	Ties	19		
	Total	25		
11. I do not feel sympathy for students who cause their own serious illnesses such as drug related problems. (post) - 11. I do not feel sympathy for students who cause their own serious illnesses such as drug related problems. (pre)	Negative Ranks	9	10.17	91.50
	Positive Ranks	8	7.69	61.50
	Ties	8		
	Total	25		
12. Sometimes I wonder what it would feel like to be in my student's situation. (post) - 12. Sometimes I wonder what it would feel like to be in my student's situation. (pre)	Negative Ranks	5	5.30	26.50
	Positive Ranks	6	6.58	39.50
	Ties	14		
	Total	25		
14. I sometimes find it difficult to see things from student's point of view. (post) - 14. I sometimes find it difficult to see things from student's point of view. (pre)	Negative Ranks	6	6.17	37.00
	Positive Ranks	6	6.83	41.00
	Ties	13		
	Total	25		
15. Before criticizing a student, I try to imagine how I would feel if I were in their place. (post) - 15. Before criticizing a student, I try to imagine how I would feel if I were in their place. (pre)	Negative Ranks	5	7.30	36.50
	Positive Ranks	9	7.61	68.50
	Ties	11		
	Total	25		

APPENDIX C-7-13

Descriptive statistics for pre-emotions scale items

1. Afraid (pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4(Very)	1	4.0	4.0	4.0
	3(Moderately)	1	4.0	4.0	8.0
	2(A little)	1	4.0	4.0	12.0
	1(Low)	3	12.0	12.0	24.0
	0(Not at all)	19	76.0	76.0	100.0
	Total	25	100.0	100.0	

2. Interested (pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1(Low)	1	4.0	4.0	4.0
	2(A little)	5	20.0	20.0	24.0
	3(Moderately)	4	16.0	16.0	40.0
	4(Very)	9	36.0	36.0	76.0
	5(Extremely)	6	24.0	24.0	100.0
	Total	25	100.0	100.0	

3. Active (pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1(Low)	2	8.0	8.0	8.0
	2(A little)	5	20.0	20.0	28.0
	3(Moderately)	5	20.0	20.0	48.0
	4(Very)	9	36.0	36.0	84.0
	5(Extremely)	4	16.0	16.0	100.0
	Total	25	100.0	100.0	

4. Nervous (pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5(Extremely)	2	8.0	8.0	8.0

	4(Very)	3	12.0	12.0	20.0
	3(Moderately)	1	4.0	4.0	24.0
	2(A little)	3	12.0	12.0	36.0
	1(Low)	5	20.0	20.0	56.0
	0(Not at all)	11	44.0	44.0	100.0
	Total	25	100.0	100.0	

5. Inspired (pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0(Not at all)	3	12.0	12.0	12.0
	1(Low)	2	8.0	8.0	20.0
	2(A little)	4	16.0	16.0	36.0
	3(Moderately)	7	28.0	28.0	64.0
	4(Very)	6	24.0	24.0	88.0
	5(Extremely)	3	12.0	12.0	100.0
	Total	25	100.0	100.0	

6. Sad (pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5(Extremely)	1	4.0	4.0	4.0
	4(Very)	2	8.0	8.0	12.0
	3(Moderately)	2	8.0	8.0	20.0
	1(Low)	4	16.0	16.0	36.0
	0(Not at all)	16	64.0	64.0	100.0
	Total	25	100.0	100.0	

7. Upset (pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3(Moderately)	2	8.0	8.0	8.0
	2(A little)	1	4.0	4.0	12.0
	1(Low)	3	12.0	12.0	24.0
	0(Not at all)	19	76.0	76.0	100.0
	Total	25	100.0	100.0	

8. Calm (pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0(Not at all)	3	12.0	12.0	12.0
	1(Low)	3	12.0	12.0	24.0
	2(A little)	2	8.0	8.0	32.0
	3(Moderately)	6	24.0	24.0	56.0
	4(Very)	5	20.0	20.0	76.0
	5(Extremely)	6	24.0	24.0	100.0
	Total	25	100.0	100.0	

9. Confident (pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0(Not at all)	1	4.0	4.0	4.0
	1(Low)	2	8.0	8.0	12.0
	2(A little)	2	8.0	8.0	20.0
	3(Moderately)	9	36.0	36.0	56.0
	4(Very)	9	36.0	36.0	92.0
	5(Extremely)	2	8.0	8.0	100.0
	Total	25	100.0	100.0	

10. Tired (pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5(Extremely)	4	16.0	16.0	16.0
	4(Very)	5	20.0	20.0	36.0
	3(Moderately)	5	20.0	20.0	56.0
	2(A little)	3	12.0	12.0	68.0
	1(Low)	3	12.0	12.0	80.0
	0(Not at all)	5	20.0	20.0	100.0
	Total	25	100.0	100.0	

11. Ashamed (pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5(Extremely)	17	68.0	68.0	68.0

	4(Very)	3	12.0	12.0	80.0
	3(Moderately)	3	12.0	12.0	92.0
	2(A little)	1	4.0	4.0	96.0
	1(Low)	1	4.0	4.0	100.0
	Total	25	100.0	100.0	

12. Sleepy (pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4(Very)	1	4.0	4.0	4.0
	3(Moderately)	5	20.0	20.0	24.0
	2(A little)	4	16.0	16.0	40.0
	1(Low)	9	36.0	36.0	76.0
	0(Not at all)	6	24.0	24.0	100.0
	Total	25	100.0	100.0	

13. Alert (pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0(Not at all)	4	16.0	16.0	16.0
	1(Low)	5	20.0	20.0	36.0
	2(A little)	3	12.0	12.0	48.0
	3(Moderately)	6	24.0	24.0	72.0
	4(Very)	4	16.0	16.0	88.0
	5(Extremely)	3	12.0	12.0	100.0
	Total	25	100.0	100.0	

14. Downhearted (pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3(Moderately)	4	16.0	16.0	16.0
	2(A little)	2	8.0	8.0	24.0
	1(Low)	6	24.0	24.0	48.0
	0(Not at all)	13	52.0	52.0	100.0
	Total	25	100.0	100.0	

15. Relaxed (pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0(Not at all)	4	16.0	16.0	16.0
	1(Low)	3	12.0	12.0	28.0
	2(A little)	7	28.0	28.0	56.0
	3(Moderately)	2	8.0	8.0	64.0
	4(Very)	7	28.0	28.0	92.0
	5(Extremely)	2	8.0	8.0	100.0
	Total	25	100.0	100.0	

16. Determined (pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0(Not at all)	1	4.0	4.0	4.0
	2(A little)	6	24.0	24.0	28.0
	3(Moderately)	3	12.0	12.0	40.0
	4(Very)	9	36.0	36.0	76.0
	5(Extremely)	6	24.0	24.0	100.0
	Total	25	100.0	100.0	

17. Concentrating (pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0(Not at all)	1	4.0	4.0	4.0
	1(Low)	1	4.0	4.0	8.0
	2(A little)	2	8.0	8.0	16.0
	3(Moderately)	7	28.0	28.0	44.0
	4(Very)	10	40.0	40.0	84.0
	5(Extremely)	4	16.0	16.0	100.0
	Total	25	100.0	100.0	

APPENDIX C-7-14

Descriptive statistics for post-emotions scale items

1. Afraid (post)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5(Extremely)	9	36.0	36.0	36.0
	4(Very)	2	8.0	8.0	44.0
	3(Moderately)	1	4.0	4.0	48.0
	2(A little)	4	16.0	16.0	64.0
	1(Low)	4	16.0	16.0	80.0
	0(Not at all)	5	20.0	20.0	100.0
	Total	25	100.0	100.0	

2. Interested (post)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0(Not at all)	2	8.0	8.0	8.0
	1(Low)	3	12.0	12.0	20.0
	2(A little)	3	12.0	12.0	32.0
	3(Moderately)	3	12.0	12.0	44.0
	4(Very)	11	44.0	44.0	88.0
	5(Extremely)	3	12.0	12.0	100.0
	Total	25	100.0	100.0	

3. Active (post)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0(Not at all)	3	12.0	12.0	12.0
	1(Low)	3	12.0	12.0	24.0
	2(A little)	6	24.0	24.0	48.0
	3(Moderately)	5	20.0	20.0	68.0
	4(Very)	6	24.0	24.0	92.0
	5(Extremely)	2	8.0	8.0	100.0
	Total	25	100.0	100.0	

4. Nervous (post)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5(Extremely)	8	32.0	32.0	32.0
	4(Very)	2	8.0	8.0	40.0
	3(Moderately)	3	12.0	12.0	52.0
	2(A little)	3	12.0	12.0	64.0
	1(Low)	4	16.0	16.0	80.0
	0(Not at all)	5	20.0	20.0	100.0
	Total	25	100.0	100.0	

5. Inspired (post)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0(Not at all)	3	12.0	12.0	12.0
	1(Low)	3	12.0	12.0	24.0
	2(A little)	3	12.0	12.0	36.0
	3(Moderately)	7	28.0	28.0	64.0
	4(Very)	7	28.0	28.0	92.0
	5(Extremely)	2	8.0	8.0	100.0
	Total	25	100.0	100.0	

6. Sad (post)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5(Extremely)	7	28.0	28.0	28.0
	4(Very)	6	24.0	24.0	52.0
	3(Moderately)	2	8.0	8.0	60.0
	2(A little)	2	8.0	8.0	68.0
	1(Low)	3	12.0	12.0	80.0
	0(Not at all)	5	20.0	20.0	100.0
	Total	25	100.0	100.0	

7. Upset (post)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5(Extremely)	8	32.0	32.0	32.0

	4(Very)	5	20.0	20.0	52.0
	3(Moderately)	3	12.0	12.0	64.0
	2(A little)	2	8.0	8.0	72.0
	1(Low)	2	8.0	8.0	80.0
	0(Not at all)	5	20.0	20.0	100.0
	Total	25	100.0	100.0	

8. Calm (post)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0(Not at all)	2	8.0	8.0	8.0
	1(Low)	4	16.0	16.0	24.0
	2(A little)	8	32.0	32.0	56.0
	3(Moderately)	3	12.0	12.0	68.0
	4(Very)	4	16.0	16.0	84.0
	5(Extremely)	4	16.0	16.0	100.0
	Total	25	100.0	100.0	

9. Confident (post)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0(Not at all)	2	8.0	8.0	8.0
	1(Low)	4	16.0	16.0	24.0
	2(A little)	3	12.0	12.0	36.0
	3(Moderately)	5	20.0	20.0	56.0
	4(Very)	8	32.0	32.0	88.0
	5(Extremely)	3	12.0	12.0	100.0
	Total	25	100.0	100.0	

10. Tired (post)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5(Extremely)	4	16.0	16.0	16.0
	4(Very)	6	24.0	24.0	40.0
	3(Moderately)	5	20.0	20.0	60.0
	2(A little)	4	16.0	16.0	76.0

	1(Low)	6	24.0	24.0	100.0
	Total	25	100.0	100.0	

11. Ashamed (post)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5(Extremely)	8	32.0	32.0	32.0
	4(Very)	5	20.0	20.0	52.0
	3(Moderately)	1	4.0	4.0	56.0
	2(A little)	2	8.0	8.0	64.0
	0(Not at all)	9	36.0	36.0	100.0
	Total	25	100.0	100.0	

12. Sleepy (post)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5(Extremely)	8	32.0	32.0	32.0
	4(Very)	4	16.0	16.0	48.0
	3(Moderately)	5	20.0	20.0	68.0
	1(Low)	6	24.0	24.0	92.0
	0(Not at all)	2	8.0	8.0	100.0
	Total	25	100.0	100.0	

13. Alert (post)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0(Not at all)	4	16.0	16.0	16.0
	1(Low)	5	20.0	20.0	36.0
	2(A little)	2	8.0	8.0	44.0
	3(Moderately)	7	28.0	28.0	72.0
	4(Very)	5	20.0	20.0	92.0
	5(Extremely)	2	8.0	8.0	100.0
	Total	25	100.0	100.0	

14. Downhearted (post)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5(Extremely)	5	20.0	20.0	20.0

	4(Very)	6	24.0	24.0	44.0
	3(Moderately)	2	8.0	8.0	52.0
	2(A little)	5	20.0	20.0	72.0
	1(Low)	1	4.0	4.0	76.0
	0(Not at all)	6	24.0	24.0	100.0
	Total	25	100.0	100.0	

15. Relaxed (post)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0(Not at all)	5	20.0	20.0	20.0
	1(Low)	5	20.0	20.0	40.0
	2(A little)	4	16.0	16.0	56.0
	3(Moderately)	4	16.0	16.0	72.0
	4(Very)	4	16.0	16.0	88.0
	5(Extremely)	3	12.0	12.0	100.0
	Total	25	100.0	100.0	

16. Determined (post)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0(Not at all)	2	8.0	8.0	8.0
	1(Low)	3	12.0	12.0	20.0
	2(A little)	2	8.0	8.0	28.0
	3(Moderately)	6	24.0	24.0	52.0
	4(Very)	8	32.0	32.0	84.0
	5(Extremely)	4	16.0	16.0	100.0
	Total	25	100.0	100.0	

17. Concentrating (post)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0(Not at all)	1	4.0	4.0	4.0
	1(Low)	4	16.0	16.0	20.0
	2(A little)	2	8.0	8.0	28.0
	3(Moderately)	6	24.0	24.0	52.0

4(Very)	8	32.0	32.0	84.0
5(Extremely)	4	16.0	16.0	100.0
Total	25	100.0	100.0	

APPENDIX C-7-15

Mean scores for pre/post emotions scale per group

Perspective = Teacher-Student drug user

	Mean	N	Std. Deviation
1. Afraid (pre)	5.5833	12	1.16450
2. Interested (pre)	4.5833	12	1.44338
3. Active (pre)	4.0833	12	1.31137
4. Nervous (pre)	4.5833	12	1.78164
5. Inspired (pre)	3.4167	12	1.62135
6. Sad (pre)	4.9167	12	1.44338
7. Upset (pre)	5.5833	12	.90034
8. Calm (pre)	4.0000	12	1.85864
9. Confident (pre)	4.2500	12	1.13818
10. Tired (pre)	3.4167	12	1.92865
11. Ashamed (pre)	1.6667	12	.88763
12. Sleepy (pre)	4.7500	12	1.28806
13. Alert (pre)	3.4167	12	1.50504
14. Downhearted (pre)	5.2500	12	.96531
15. Relaxed (pre)	3.6667	12	1.55700
16. Determined (pre)	4.5000	12	1.38170
17. Concentrating (pre)	4.5000	12	1.16775
1. Afraid (post)	3.7500	12	2.22077
2. Interested (post)	4.0833	12	1.67649
3. Active (post)	3.2500	12	1.65831
4. Nervous (post)	3.6667	12	2.01509
5. Inspired (post)	3.7500	12	1.81534
6. Sad (post)	3.7500	12	1.91288
7. Upset (post)	3.3333	12	2.01509
8. Calm (post)	3.3333	12	1.61433

9. Confident (post)	3.6667	12	1.55700
10. Tired (post)	3.5000	12	1.73205
11. Ashamed (post)	4.0000	12	2.21565
12. Sleepy (post)	2.9167	12	2.06522
13. Alert (post)	3.0000	12	1.47710
14. Downhearted (post)	4.4167	12	1.67649
15. Relaxed (post)	3.1667	12	1.64225
16. Determined (post)	4.0833	12	1.67649
17. Concentrating (post)	4.3333	12	1.37069

Perspective = Teacher-healthy student

	Mean	N	Std. Deviation
1. Afraid (pre)	5.4615	13	.96742
2. Interested (pre)	4.5385	13	.96742
3. Active (pre)	4.5385	13	1.12660
4. Nervous (pre)	4.5385	13	1.76141
5. Inspired (pre)	4.1538	13	1.40512
6. Sad (pre)	5.2308	13	1.69085
7. Upset (pre)	5.5385	13	.96742
8. Calm (pre)	4.0000	13	1.63299
9. Confident (pre)	4.0769	13	1.32045
10. Tired (pre)	3.4615	13	1.71345
11. Ashamed (pre)	1.6154	13	1.32530
12. Sleepy (pre)	4.3846	13	1.12090
13. Alert (pre)	3.3846	13	1.85016
14. Downhearted (pre)	5.0000	13	1.29099
15. Relaxed (pre)	3.2308	13	1.69085
16. Determined (pre)	4.4615	13	1.33012
17. Concentrating (pre)	4.3846	13	1.32530
1. Afraid (post)	2.8462	13	1.86396
2. Interested (post)	4.0769	13	1.44115

3. Active (post)	3.8462	13	1.34450
4. Nervous (post)	3.0000	13	2.00000
5. Inspired (post)	3.6923	13	1.25064
6. Sad (post)	2.5385	13	1.89804
7. Upset (post)	2.6923	13	1.93152
8. Calm (post)	3.8462	13	1.51911
9. Confident (post)	4.0769	13	1.55250
10. Tired (post)	2.6923	13	1.03155
11. Ashamed (post)	2.6923	13	2.09701
12. Sleepy (post)	2.9231	13	1.60528
13. Alert (post)	3.7692	13	1.69085
14. Downhearted (post)	2.3846	13	1.55662
15. Relaxed (post)	3.3077	13	1.84321
16. Determined (post)	4.0769	13	1.44115
17. Concentrating (post)	3.9231	13	1.55250

APPENDIX D-8-1

Pre-Questionnaire – Greek version

Τεχνολογικό Πανεπιστήμιο Κύπρου

ΕΡΩΤΗΜΑΤΟΛΟΓΙΟ ΑΞΙΟΛΟΓΗΣΗΣ ΕΜΠΕΙΡΙΑΣ ΕΙΚΟΝΙΚΗΣ ΠΡΑΓΜΑΤΙΚΟΤΗΤΑΣ

No: ……..

<u>ΜΕΡΟΣ Ι: ΔΗΜΟΓΡΑΦΙΚΑ ΣΤΟΙΧΕΙΑ</u>

1. Χώρα

Κύπρος	Ελλάδα	Άλλο:

2. Γένος

Άνδρας	Γυναίκα	Δεν επιθυμώ να απαντήσω

3. Ηλικία

18-24	25-29	30-39	40-49	50-59	60+

4. πάγγελμα:

- ❑ Εν ενεργεία εκπαιδευτικός
- ❑ Φοιτητής
- ❑ Επιμορφωτής
- ❑ Άλλο: ……..

5. Εάν εργάζεστε τη δεδομένη χρονική στιγμή ως εκπαιδευτικός παρακαλώ αναφέρετε την βαθμίδα που υπηρετείτε και τα έτη προϋπηρεσίας σας:

- ❑ Βαθμίδα εκπαίδευσης: ……..
- ❑ Έτη προϋπηρεσίας (σε χρόνια): ……

6. Σε περίπτωση που είστε φοιτητής αναφέρετε το επίπεδο σπουδών και το τμήμα σας:

- ❑ Επίπεδο σπουδών:……
- ❑ Τμήμα: ……

7. Πόσο έμπειρο θεωρείς τον εαυτό σου στις τεχνολογίες εικονικής πραγματικότητας:

Καθόλου	Λίγο	Μέτρια	Πολύ	Εξαιρετικά

<u>ΜΕΡΟΣ ΙΙ: ΚΛΙΜΑΚΑ ΘΕΤΙΚΩΝ ΚΑΙ ΑΡΝΗΤΙΚΩΝ ΣΥΝΑΙΣΘΗΜΑΤΩΝ</u>

Οι ακόλουθες δηλώσεις διερευνούν τα συναισθήματα σας. Για κάθε δήλωση, προσδιορίστε πόσο καλά σας περιγράφει με την επιλογή του κατάλληλου γράμματος 1,2,3,4,5 στην κλίμακα που ακολουθεί. Όταν αποφασίσετε για την απάντηση σας συμπληρώστε το γράμμα δίπλα στη δήλωση. ΔΙΑΒΑΣΤΕ ΚΑΘΕ ΔΗΛΩΣΗ ΠΡΟΣΕΚΤΙΚΑ ΠΡΙΝ ΑΠΑΝΤΗΣΕΤΕ. Απαντήστε όσο πιο ειλικρινά μπορείτε.

Κώδικας:

1	*2*	*3*	*4*	*5*
Δεν με περιγράφει καθόλου				*Με περιγράφει υπερβολικά*

	1	**2**	**3**	**4**	**5**
1. Φοβισμένος/η					
2. Με ενδιαφέρον					
3. Δραστήριος/α					
4. Νευρικός/η					
5. Με έμπνευση					
6. Λυπημένος/η					
7. Αναστατωμένος/η					
8. Ήρεμος/η					
9. Γεμάτος αυτοπεποίθηση					
10. Κουρασμένος/η					
11. Ντροπή					
12. Ενθουσιασμένος/η					
13. Δυνατός					
14. Σε εγρήγορση					
15. Απογοητευμένος					
16. Ξεκούραστος					
17. Αποφασισμένος					
18. Συγκεντρωμένος					

ΜΕΡΟΣ ΙΙΙ: ΚΛΙΜΑΚΑ ΕΝΣΥΝΑΙΣΘΗΣΗΣ

Οι ακόλουθες δηλώσεις διερευνούν τις σκέψεις και τα συναισθήματα σας σε ποικίλες καταστάσεις. Για κάθε δήλωση, προσδιορίστε πόσο καλά σας περιγράφει με την επιλογή του κατάλληλου γράμματος 1,2,3,4,5 στην κλίμακα που ακολουθεί. Όταν αποφασίσετε για την απάντηση σας συμπληρώστε το γράμμα δίπλα στη δήλωση. ΔΙΑΒΑΣΤΕ ΚΑΘΕ ΔΗΛΩΣΗ ΠΡΟΣΕΚΤΙΚΑ ΠΡΙΝ ΑΠΑΝΤΗΣΕΤΕ. Απαντήστε όσο πιο ειλικρινά μπορείτε. Κώδικας:

1	*2*	*3*	*4*	*5*
Δεν με περιγράφει καθόλου				*Με περιγράφει υπερβολικά*

	1	*2*	*3*	*4*	*5*
1. Μερικές φορές δυσκολεύομαι να δω τα πράγματα από την πλευρά του άλλου.					
2. Σε ένα πρόβλημα προσπαθώ να εξετάζω όλες τις πλευρές πριν πάρω κάποια απόφαση.					
3. Μερικές φορές προσπαθώ να καταλάβω τους άλλους καλύτερα με το να φαντάζομαι πως βλέπουν τα πράγματα από τη δική τους σκοπιά.					
4. Εάν είμαι βέβαιος/η ότι έχω δίκιο σε κάτι, δεν χάνω το χρόνο μου ακούγοντας τα επιχειρήματα των άλλων.					
5. Πιστεύω ότι σε κάθε κατάσταση υπάρχουν δυο πλευρές και προσπαθώ να εξηγήσω και τις δύο.					
6. Όταν είμαι θυμωμένος/η με κάποιον προσπαθώ να «δω μέσα από τα μάτια του» για λίγο.					
7. Πριν κριτικάρω κάποιον προσπαθώ να φανταστώ πως θα αισθανόμουν στη θέση του.					
8. Μερικές φορές δεν αισθάνομαι πολύ συμπονετικά για τους άλλους όταν αντιμετωπίζουν προβλήματα.					
9. Οι κακοτυχίες των άλλων δεν με προβληματίζουν ιδιαίτερα.					
10. Όταν βλέπω να φέρονται σε κάποιον άδικα, δεν συμπάσχω συχνά μαζί του.					
11. Συχνά επηρεάζομαι από πράγματα που βλέπω να συμβαίνουν.					
12. Θα περιέγραφα τον εαυτό μου ως αρκετά συμπονετικό άτομο.					
13. Δεν συμπονώ τους ανθρώπους που ευθύνονται οι ίδιοι για τις σοβαρές τους ασθένειες.					
14. Δεν ενδιαφέρομαι πραγματικά για το πώς νιώθουν οι άλλοι άνθρωποι.					
15. Όταν βλέπω να εκμεταλλεύονται κάποιο άτομο, νιώθω την ανάγκη να το προστατεύσω.					

Σας ευχαριστούμε για την συμμετοχή και τον χρόνο σας!

APPENDIX D-8-2

Post-Questionnaire – Greek version

Τεχνολογικό Πανεπιστήμιο Κύπρου

No: ……..

<u>ΜΕΡΟΣ Ι</u>

Οι ακόλουθες δηλώσεις διερευνούν την εμπειρία σας στον εικονικό κόσμο. Για κάθε δήλωση, προσδιορίστε πόσο καλά περιγράφει την εμπειρία σας κατά τη χρήση του συστήματος Εικονικής Πραγματικότητας με την επιλογή του κατάλληλου γράμματος 1,2,3,4,5,6,7 στην κλίμακα που ακολουθεί. Όταν αποφασίσετε για την απάντηση σας συμπληρώστε το γράμμα δίπλα στη δήλωση. ΔΙΑΒΑΣΤΕ ΚΑΘΕ ΔΗΛΩΣΗ ΠΡΟΣΕΚΤΙΚΑ ΠΡΙΝ ΑΠΑΝΤΗΣΕΤΕ. Απαντήστε όσο πιο ειλικρινά μπορείτε.

1. Παρακαλώ βαθμολογείστε την αίσθηση του να βρίσκεστε στον εικονικό χώρο του σχολείου, σε κλίμακα από το 1 έως το 7, όπου το 7 αναπαριστά την φυσιολογική εμπειρία σας, το να βρίσκεστε σε ένα χώρο. Είχατε την αίσθηση ότι βρίσκεστε μέσα στο χώρο της σχολικής αίθουσας…

Καθόλου			*Ουδέτερος*			*Πάρα πολύ*
1	2	3	4	5	6	7

2. Σε ποιο βαθμό, κατά τη διάρκεια της εμπειρίας σας, υπήρχαν φορές οπού ο χώρος της σχολικής αίθουσας αποτέλεσε πραγματικότητα για εσάς;

Ποτέ			*Ουδέτερος*			*Πάντα*
1	2	3	4	5	6	7

3. Όταν σκέφτεστε την εμπειρία σας βλέπετε τη σχολική αίθουσα ως μια εικόνα ή σαν ένα μέρος το οποίο επισκεφτήκατε;

Εικόνες που είδα			*Ουδέτερος*			*Ένα χώρο που έχω επισκεφθεί*
1	2	3	4	5	6	7

4. Κατά τη διάρκεια της εμπειρίας σας, ποιο συναίσθημα ήταν το πιο έντονο: η αίσθηση ότι βρίσκεστε σε μια σχολική αίθουσα ή ότι βρίσκεστε κάπου αλλού;

Βρισκόμουν αλλού			*Ουδέτερος*			*Βρισκόμουν στη σχολική αίθουσα*
1	2	3	4	5	6	7

5. Εγώ σκέφτομαι το χώρο της σχολικής αίθουσας, ως ένα μέρος παρόμοιο με αυτά που έχω επισκεφθεί σήμερα:

Καθόλου			*Ουδέτερος*			*Πάρα πολύ*
1	2	3	4	5	6	7

6. Κατά τη διάρκεια της εμπειρίας σας, σκεφτόσασταν συχνά ότι βρισκόσασταν στην πραγματικότητα σε μια σχολική αίθουσα;

Όχι πολύ συχνά			*Ουδέτερος*			*Πολύ συχνά*
1	2	3	4	5	6	7

ΜΕΡΟΣ ΙΙ

Οι ακόλουθες δηλώσεις διερευνούν την εμπειρία σας στον εικονικό κόσμο. Για κάθε δήλωση, προσδιορίστε πόσο καλά περιγράφει την εμπειρία σας κατά τη χρήση του συστήματος Εικονικής Πραγματικότητας με την επιλογή του κατάλληλου γράμματος 1,2,3,4,5 στην κλίμακα που ακολουθεί. Όταν αποφασίσετε για την απάντηση σας συμπληρώστε το γράμμα δίπλα στη δήλωση. ΔΙΑΒΑΣΤΕ ΚΑΘΕ ΔΗΛΩΣΗ ΠΡΟΣΕΚΤΙΚΑ ΠΡΙΝ ΑΠΑΝΤΗΣΕΤΕ. Απαντήστε όσο πιο ειλικρινά μπορείτε.

	Διαφωνώ απόλυτα	*Διαφωνώ*	*Ουδέτερος*	*Συμφωνώ*	*Συμφωνώ απόλυτα*
1. Παρόλο που το εικονικό σώμα δεν έμοιαζε με εμένα, είχα την αίσθηση ότι το εικονικό σώμα που είδα στον καθρέφτη ήταν δικό μου.					
2. Παρόλου που το εικονικό σώμα δεν έμοιαζε με εμένα, όταν κοίταξα το σώμα μου, είχα την αίσθηση ότι ήταν δικό μου.					
3. Ένιωσα ότι το εικονικό σώμα δεν ήταν δικό μου.					
4. Κατά τη διάρκεια του πειράματος υπήρχαν στιγμές που ένιωθα ότι είχα περισσότερα από ένα σώμα.					
5. Ένιωσα ότι τον εικονικό άνθρωπο σαν να ήταν το σώμα μου					
6. Το εικονικό σώμα κινήθηκε σύμφωνα με τις κινήσεις μου.					

ΜΕΡΟΣ ΙΙΙ: ΚΛΙΜΑΚΑ ΘΕΤΙΚΩΝ ΚΑΙ ΑΡΝΗΤΙΚΩΝ ΣΥΝΑΙΣΘΗΜΑΤΩΝ

Οι ακόλουθες δηλώσεις διερευνούν τα συναισθήματα σας. Για κάθε δήλωση, προσδιορίστε πόσο καλά σας περιγράφει με την επιλογή του κατάλληλου γράμματος 1,2,3,4,5 στην κλίμακα που ακολουθεί. Όταν αποφασίσετε για την απάντηση σας συμπληρώστε το γράμμα δίπλα στη δήλωση. ΔΙΑΒΑΣΤΕ ΚΑΘΕ ΔΗΛΩΣΗ ΠΡΟΣΕΚΤΙΚΑ ΠΡΙΝ ΑΠΑΝΤΗΣΕΤΕ. Απαντήστε όσο πιο ειλικρινά μπορείτε.
Κώδικας:

1	2	3	4	5
Δεν με περιγράφει καθόλου				Με περιγράφει υπερβολικά

	1	*2*	*3*	*4*	*5*
Φοβισμένος/η					
Με ενδιαφέρον					
Δραστήριος/α					
Νευρικός/η					

Με έμπνευση	
Λυπημένος/η	
Αναστατωμένος/η	
Ήρεμος/η	
Γεμάτος αυτοπεποίθηση	
Κουρασμένος/η	
Ντροπή	
Ενθουσιασμένος/η	
Δυνατός	
Σε εγρήγορση	
Απογοητευμένος	
Ξεκούραστος	
Αποφασισμένος	
Συγκεντρωμένος	

<u>ΜΕΡΟΣ IV: ΚΛΙΜΑΚΑ ΕΝΣΥΝΑΙΣΘΗΣΗΣ</u>

Οι ακόλουθες δηλώσεις διερευνούν τις σκέψεις και τα συναισθήματα σας σε ποικίλες καταστάσεις. Για κάθε δήλωση, προσδιορίστε πόσο καλά σας περιγράφει με την επιλογή του κατάλληλου γράμματος 1,2,3,4,5 στην κλίμακα που ακολουθεί. Όταν αποφασίσετε για την απάντηση σας συμπληρώστε το γράμμα δίπλα στη δήλωση. ΔΙΑΒΑΣΤΕ ΚΑΘΕ ΔΗΛΩΣΗ ΠΡΟΣΕΚΤΙΚΑ ΠΡΙΝ ΑΠΑΝΤΗΣΕΤΕ. Απαντήστε όσο πιο ειλικρινά μπορείτε. Κώδικας:

1	2	3	4	5
Δεν με περιγράφει καθόλου				Με περιγράφει υπερβολικά

	1	*2*	*3*	*4*	*5*
Μερικές φορές δυσκολεύομαι να δω τα πράγματα από την πλευρά του άλλου.					
Σε ένα πρόβλημα προσπαθώ να εξετάζω όλες τις πλευρές πριν πάρω κάποια απόφαση.					
Μερικές φορές προσπαθώ να καταλάβω τους άλλους καλύτερα με το να φαντάζομαι πως βλέπουν τα πράγματα από τη δική τους σκοπιά.					
Εάν είμαι βέβαιος/η ότι έχω δίκιο σε κάτι, δεν χάνω το χρόνο μου ακούγοντας τα επιχειρήματα των άλλων.					
Πιστεύω ότι σε κάθε κατάσταση υπάρχουν δυο πλευρές και προσπαθώ να εξηγήσω και τις δύο.					
Όταν είμαι θυμωμένος/η με κάποιον προσπαθώ να «δω μέσα από τα μάτια του» για λίγο.					
Πριν κριτικάρω κάποιον προσπαθώ να φανταστώ πως θα αισθανόμουν στη θέση του.					
Μερικές φορές δεν αισθάνομαι πολύ συμπονετικά για τους άλλους όταν αντιμετωπίζουν προβλήματα.					
Οι κακοτυχίες των άλλων δεν με προβληματίζουν ιδιαίτερα.					
Όταν βλέπω να φέρονται σε κάποιον άδικα, δεν συμπάσχω συχνά μαζί του.					

Συχνά επηρεάζομαι από πράγματα που βλέπω να συμβαίνουν.	
Θα περιέγραφα τον εαυτό μου ως αρκετά συμπονετικό άτομο.	
Δεν συμπονώ τους ανθρώπους που ευθύνονται οι ίδιοι για τις σοβαρές τους ασθένειες.	
Δεν ενδιαφέρομαι πραγματικά για το πώς νιώθουν οι άλλοι άνθρωποι.	
Όταν βλέπω να εκμεταλλεύονται κάποιο άτομο, νιώθω την ανάγκη να το προστατεύσω.	

ΜΕΡΟΣ V

1. Κατά τη διάρκεια της εμπειρίας σας στον εικονικό κόσμο βρισκόσασταν στο σώμα:

   ☐ Του εκπαιδευτικού

   ☐ Του αλλοδαπού μαθητή

   ☐ Της μαθήτριας με το προσθετικό πόδι

2. *Οι ακόλουθες δηλώσεις διερευνούν την εμπειρία σας στον εικονικό κόσμο. Για κάθε δήλωση, προσδιορίστε πόσο καλά περιγράφει την εμπειρία σας κατά τη χρήση του συστήματος Εικονικής Πραγματικότητας με την επιλογή του κατάλληλου γράμματος 1,2,3,4,5 στην κλίμακα που ακολουθεί. Όταν αποφασίσετε για την απάντηση σας συμπληρώστε το γράμμα δίπλα στη δήλωση. ΔΙΑΒΑΣΤΕ ΚΑΘΕ ΔΗΛΩΣΗ ΠΡΟΣΕΚΤΙΚΑ ΠΡΙΝ ΑΠΑΝΤΗΣΕΤΕ. Απαντήστε όσο πιο ειλικρινά μπορείτε.*

	Διαφωνώ απόλυτα	*Διαφωνώ*	*Ουδέτερος*	*Συμφωνώ*	*Συμφωνώ απόλυτα*
Όταν οι εικονικοί μαθητές διηγήθηκαν την ιστορία τους προβληματίστηκα.					
Δεν ένιωσα ότι ήταν σημαντικό για μένα να κατανοήσω τα προβλήματα των εικονικών μαθητών.					
Ένιωσα ότι ήμουν συναισθηματικά συνδεδεμένος με τον εικονικό χαρακτήρα που βίωσα.					
Έδειξα λίγο ενδιαφέρον ή ανησυχία για το πρόβλημα/ τα προβλήματα που βίωσα.					
Έκανα ελάχιστη ή καμία προσπάθεια να καταλάβω το πρόβλημα με το οποίο αντιμετώπιζα.					
Προσπάθησα να τοποθετήσω τον εαυτό μου στη θέση του εικονικού χαρακτήρα σε μια προσπάθεια να καταλάβω το πρόβλημα.					
Ήταν δύσκολο για μένα να βλέπω τα πράγματα από την οπτική γωνία του εικονικού χαρακτήρα.					

3. *Οι ακόλουθες δηλώσεις διερευνούν την εμπειρία σας στον εικονικό κόσμο. Για κάθε δήλωση, προσδιορίστε πόσο καλά περιγράφει την εμπειρία σας κατά τη χρήση του συστήματος Εικονικής Πραγματικότητας με την επιλογή του κατάλληλου γράμματος 1,2,3,4,5 στην κλίμακα που ακολουθεί. Όταν αποφασίσετε για την απάντηση σας συμπληρώστε το γράμμα δίπλα στη δήλωση. ΔΙΑΒΑΣΤΕ ΚΑΘΕ ΔΗΛΩΣΗ ΠΡΟΣΕΚΤΙΚΑ ΠΡΙΝ ΑΠΑΝΤΗΣΕΤΕ. Απαντήστε όσο πιο ειλικρινά μπορείτε.*

	Διαφωνώ απόλυτα	*Διαφωνώ*	*Ουδέτερος*	*Συμφωνώ*	*Συμφωνώ απόλυτα*
Το (εικονικό) περιβάλλον διεξαγωγής της δραστηριότητας ήταν κατάλληλο.					
Η αλληλεπίδραση με τον εικονικό κόσμο μέσω της χρήσης των ματιών ήταν εύκολος.					
Θα προτιμούσα την αλληλεπίδραση με τον εικονικό κόσμο μέσω χειριστηρίου.					
Ο βαθμός αληθοφάνειας του περιβάλλοντος ήταν ικανοποιητικός.					
Βρήκα την εικονική πραγματικότητα εύκολη στη χρήση.					

	Πολύ κακή	*Κακή*	*Αποδεκτή*	*Καλή*	*Πολύ καλή*
Η ποιότητα του ήχου ήταν					

4. *Οι παρακάτω εικόνες αντιπροσωπεύουν τα δύο διαφορετικούς εικονικούς χώρους στους οποίους βρεθήκατε κατά τη διάρκεια της εμπειρίας σας. Παρακαλώ επιλέξτε αυτό που σας άρεσε περισσότερο.*

1) ☐

2) ☐

5. *Συνολική εμπειρία:*

	Διαφωνώ απόλυτα	*Διαφωνώ*	*Ουδέτερος*	*Συμφωνώ*	*Συμφωνώ απόλυτα*
Θεωρώ ότι η χρήση της εικονικής πραγματικότητας μπορεί να διευκολύνει την καλλιέργεια της ενσυναίσθησης					
Η εικονική πραγματικότητα είναι ένας πολύ ευκολότερος τρόπος για να καλλιεργηθεί η ενσυναίσθηση συγκριτικά με τη συνηθισμένη μάθηση και να δούμε μια κατάσταση από τη σκοπιά κάποιου άλλου.					

6. *Αν μπορούσες να επιλέξεις μεταξύ των παρακάτω περιβαλλόντων διεξαγωγής της εκπαιδευτικής δραστηριότητας:*

Πραγματικό	1	2	3	4	5	6	7	Εικονικό

7. *Συνολικά πόσο ευχάριστη θα χαρακτήριζες τη δραστηριότητα;*

1	2	3	4	5	6	7

Ανάφερε κάτι που σου έκανε εντύπωση, θετικό ή αρνητικό ή κάτι που θα ήθελες να βελτιωθεί.

Παρακαλώ καταγράψτε κάθε άλλο σχόλιο που θέλετε να κάνετε σχετικά με την εμπειρία σας.

Σας ευχαριστώ θερμά για την συμμετοχή σας!

APPENDIX D-8-3

Pre-Questionnaire – English version

VREQ – VIRTUAL REALITY EXPERIENCE QUESTIONNAIRE

No: ……..

PART I: DEMOGRAPHIC DATA

1. Country

Cyprus	Greece	Other:

2. Gender

Male	Female	Do not wish to answer

3. Age

18-24	25-29	30-39	40-49	50-59	60+

4. Employment status:

- ❑ Teacher/Educator
- ❑ University student
- ❑ Trainer
- ❑ Other: ……..

5. If you are a teacher/educator state at the moment, state the level of education in which you serve and the years of work experience:

- ❑ Level of education: …….
- ❑ Years of work experience: ……

6. If you are a student, indicate your level of study and department:

- ❑ Level of study: ……
- ❑ Department: ……

7. Experience in using Virtual Reality technology:

Not at all	A little	Moderately	Much	Very much

PART II: FEELINGS AND EMOTIONS

This following scale consists of several words and phrases that describe different feelings and emotions. Indicate to what extent you have any of those feelings now. When you decide on your answer, fill in the box next to the statement. READ ANY STATEMENT CAREFULLY BEFORE YOU ANSWER. Answer as honestly as you can.

Use the following scale to record your answers:

1	*2*	*3*	*4*	*5*
Does not describes me at all				*Describes me extremely*

	1	*2*	*3*	*4*	*5*
Afraid					
Interested					
Active					
Nervous					
Inspired					
Sad					
Upset					
Calm					
Confident					
Tired					
Ashamed					
Excited					
Strong					
Alert					
Downhearted					
Relaxed					
Determined					
Concentrating					

PART III: EMPATHY SCALE

The following statements explore your thoughts and feelings in a variety of situations. When you decide on your answer, fill in the box next to the statement. READ ANY STATEMENT CAREFULLY BEFORE YOU ANSWER. Answer as honestly as you can.

Use the following scale to record your answers:

1	*2*	*3*	*4*	*5*
Does not describes me at all				*Describes me extremely*

	1 *2* *3* *4* *5*
I sometimes find it difficult to see things from the “other guy’s person’s” point of view.	
I try to look at everybody’s side of a problem before making a decision.	
I sometimes try to understand others better by imagining how things look from their perspective.	
If I am sure I am right about something, I do not waste much time listening to other people’s arguments.	
I believe that there are two sides to every situation and try to look at them both.	
When I am upset at someone, I usually try to “put myself in his shoes” for a while.	
Before criticizing somebody, I try to imagine how I would feel if I were in their place.	
Sometimes I do not feel very sorry for other people when they are having problems.	
Other people’s misfortunes do not usually disturb me a great deal.	
When I see someone being treated unfairly, I sometimes do not feel very much pity for them.	
I am often quite touched by things that I see happen.	
I would describe myself as a pretty soft-hearted person.	
I do not feel sympathy for people who cause their own serious illnesses	
I am not really interested in how other people feel	
When I see someone being taken advantage of, I feel kind of protective towards him\her	

Thank you for your participation!

APPENDIX D-8-4

Post-Questionnaire – English version

VREQ – VIRTUAL REALITY EXPERIENCE QUESTIONNAIRE

No: ……..

PART I: PRESENCE

You'll see some statements about your experiences in the virtual world. Please indicate, whether if each statement applies to your experience while using the VR system. When you decide on your answer, fill in the box next to the statement. READ ANY STATEMENT CAREFULLY BEFORE YOU ANSWER. Answer as honestly as you can. And please remember: Answer all these questions only referring to this one experience.

1. Please rate your sense of being in the virtual environment, on a scale of 1 to 7, where 7 represents your normal experience of being in a place. I had a sense of "being there" in the virtual classroom ...

Not at all			*Neutral*			*Very much*
1	2	3	4	5	6	7

2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?

At no time			*Neutral*			*Almost all the time*
1	2	3	4	5	6	7

3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?

Images that I saw			*Neutral*			*Somewhere that I visited*
1	2	3	4	5	6	7

4. During the time of the experience, which was the strongest, on the whole, your sense of being in the virtual classroom environment or of being elsewhere?

Being elsewhere			*Neutral*			*Being in the school space*
1	2	3	4	5	6	7

5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?

Not at all			*Neutral*			*Very much so*
1	2	3	4	5	6	7

6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?

Not very often			*Neutral*			*Very much so*
1	2	3	4	5	6	7

PART II: EMBODIMENT

You'll see some statements about your experiences in the virtual world. Please indicate, whether if each statement applies to your experience while using the VR system. When you decide on your answer, fill in the box next to the statement. READ ANY STATEMENT CAREFULLY BEFORE YOU ANSWER. Answer as honestly as you can. And please remember: Answer all these questions only referring to this one experience.

	Completely disagree	*Disagree*	*Neutral*	*Agree*	*Completely agree*
Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine					
Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.					
I felt that the virtual body was not mine.					
During the experiment, there were moments when I felt I had more than one body.					
I felt that I controlled the avatar as if it were my body.					
The virtual body moved according to my movements.					

PART III: FEELINGS AND EMOTIONS

This following scale consists of several words and phrases that describe different feelings and emotions. Indicate to what extent you have any of those feelings now. When you decide on your answer, fill in the box next to the statement. READ ANY STATEMENT CAREFULLY BEFORE YOU ANSWER. Answer as honestly as you can.

Use the following scale to record your answers:

1	*2*	*3*	*4*	*5*
Does not describes me at all				*Describes me extremely*

	1	*2*	*3*	*4*	*5*
Afraid					
Interested					
Active					
Nervous					
Inspired					
Sad					
Upset					
Calm					
Confident					
Tired					
Ashamed					
Excited					
Strong					
Alert					
Downhearted					
Relaxed					
Determined					
Concentrating					

PART IV: EMPATHY SCALE

The following statements explore your thoughts and feelings in a variety of situations. When you decide on your answer, fill in the box next to the statement. READ ANY STATEMENT CAREFULLY BEFORE YOU ANSWER. Answer as honestly as you can.
Use the following scale to record your answers:

1	*2*	*3*	*4*	*5*
Does not describes me at all				*Describes me extremely*

	1	*2*	*3*	*4*	*5*
I sometimes find it difficult to see things from the "other guy's person's" point of view.					
I try to look at everybody's side of a problem before making a decision.					

I sometimes try to understand others better by imagining how things look from their perspective.
If I am sure I am right about something, I do not waste much time listening to other people's arguments.
I believe that there are two sides to every situation and try to look at them both.
When I am upset at someone, I usually try to "put myself in his shoes" for a while.
Before criticizing somebody, I try to imagine how I would feel if I were in their place.
Sometimes I do not feel very sorry for other people when they are having problems.
Other people's misfortunes do not usually disturb me a great deal.
When I see someone being treated unfairly, I sometimes do not feel very much pity for them.
I am often quite touched by things that I see happen.
I would describe myself as a pretty soft-hearted person.
I do not feel sympathy for people who cause their own serious illnesses
I am not really interested in how other people feel
When I see someone being taken advantage of, I feel kind of protective towards him\her

PART V

8. *During the VR experience, you were in the body of:*

   ☐ The teacher

   ☐ The student refugee

   ☐ The student with a prosthetic leg

9. *The following statements explore your thoughts and feelings in a variety of situations. When you decide on your answer, fill in the box next to the statement. READ ANY STATEMENT CAREFULLY BEFORE YOU ANSWER. Answer as honestly as you can.*

	Completely disagree	*Disagree*	*Neutral*	*Agree*	*Completely agree*
I was deeply troubled when virtual students narrated their stories.					
I did not see the need to understand the virtual students' problems.					
I felt emotionally attached to my own virtual character/representation.					
I showed little interest or concern regarding the problem(s) I experienced.					
I made no effort to understand the problem I was facing.					
I tried to put myself in the position of the virtual character in an effort to empathize with his problem					

It was difficult for me to see things from the virtual character's perspective.	

10. *The following statements explore your thoughts and feelings in a variety of situations. When you decide on your answer, fill in the box next to the statement. READ ANY STATEMENT CAREFULLY BEFORE YOU ANSWER. Answer as honestly as you can.*

	Completely disagree	*Disagree*	*Neutral*	*Agree*	*Completely agree*
The virtual environment seemed suitable for practical training.					
Eye-tracking interaction was particularly easy.					
I would prefer to interact within the virtual world via a hand-held controller.					
The school classroom virtual (reality) simulation was satisfactorily realistic.					
I found virtual reality user-friendly.					
	Poor	*Fair*	*Average*	*Good*	*Excellent*
Sound quality was					

11. *The figures below represent the two different virtual spaces you experienced. Please choose one option that you liked best.*

1) ☐

2) ☐

12. Overall experience:

	Completely disagree	*Disagree*	*Neutral*	*Agree*	*Completely agree*
The use of virtual reality may facilitate an increase in empathy. Virtual reality can easier cultivate empathy than conventional traditional learning, as virtual reality offers the opportunity to experience a situation from someone else's point of view for the users.					

13. If you could choose between conducting an educational activity in a real environment and in a 3D virtual environment, which would you choose?

Real	1	2	3	4	5	6	7	Virtual

14. Overall, how pleasant would you characterize the virtual training activity?

1	2	3	4	5	6	7

Please state something that impressed you, positive or negative, or something you would like to be improved.

Please state any other comments you would like to make about your experience.

Thank you very much for your participation!

APPENDIX D-8-5

Informed consent – Greek version

Αγαπητοί συμμετέχοντες,

Καλείστε να συμμετάσχετε σε μια έρευνα που διεξάγεται από την Καλλιόπη-Ευαγγελία Σταυρούλια, στο πλαίσιο εκπόνησης της διδακτορικής της διατριβής, στο Τμήμα Πολυμέσων και Γραφικών Τεχνών του Τεχνολογικού Πανεπιστημίου Κύπρου. Σας ζητάμε να συμμετάσχετε στην έρευνα, γιατί ο σκοπός της είναι να βοηθήσουμε τους εκπαιδευτικούς να εξασκήσουν τις δεξιότητες ενσυναίσθησης τους, μέσω της χρήσης ενός εκπαιδευτικού εργαλείου Εικονικής Πραγματικότητας.

Θα σας ζητηθεί να αλληλοεπιδράσετε μέσα σε ένα περιβάλλον Εικονικής Τάξης. Αναμένεται να συμμετάσχετε για περίπου 20-30 λεπτά και στη συνέχεια θα σας ζητηθεί να αξιολογήσετε την εμπειρία σας μέσω ερωτηματολογίου. Η εμπειρία σας σε αυτό το θέμα είναι πολύτιμη. Η συμπλήρωση του ερωτηματολογίου είναι ανώνυμη και οι πληροφορίες που παρέχονται είναι απολύτως εμπιστευτικές και δεν θα χρησιμοποιηθούν για κανέναν άλλο σκοπό. **Η συμμετοχή σας είναι εντελώς εθελοντική** και μπορείτε να επιλέξετε να μην συμμετάσχετε σε μέρος ή στο σύνολο του ερωτηματολογίου ή του πειράματος.

Επιπροσθέτως, ζητάμε την συγκατάθεση σας για την φωτογράφιση και βιντεοσκόπηση του πειράματος. Η χρήση των αρχείων αυτών περιορίζεται μόνο για τους σκοπούς της έρευνας μου. Σε περίπτωση που φωτογραφίες σας ή βίντεο θα χρησιμοποιηθούν για εκπαιδευτικούς σκοπούς ή σε περίπτωση που τα αποτελέσματα της έρευνας δημοσιευτούν ή παρουσιαστούν σε συνέδρια, η ταυτότητα σας θα προστατεύεται και θα συγκαλύπτεται το πρόσωπο σας, ώστε να μην αποκαλυφθεί η ταυτότητα σας. Μπορείτε να αρνηθείτε να φωτογραφηθείτε ή να βιντεοσκοπηθείτε. Μπορεί να σας δοθεί αντίγραφο του φωτογραφικού και βιντεοσκοπημένου υλικού κατόπιν αιτήσεως σας.

Δεν πρέπει να συμμετάσχετε, εάν δεν επιθυμείτε ή εάν έχετε οποιουσδήποτε ενδοιασμούς που αφορούν την συμμετοχή σας στο πρόγραμμα.

Σας ευχαριστώ για την απόκριση και τη συνεργασία σας.

Με εκτίμηση,

Καλλιόπη-Ευαγγελία Σταυρούλια

Υποψήφια Διδάκτωρ

Τμήμα Πολυμέσων και Γραφικών Τεχνών

Σχολή Καλών και Εφαρμοσμένων Τεχνών

Τεχνολογικό Πανεπιστήμιο Κύπρου

Για οποιαδήποτε περαιτέρω πληροφορία παρακαλώ επικοινωνήστε με το Εργαστήριο Υπολογιστικών Οπτικών Μέσων: vmc@gmail.com

APPENDIX D-8-6

Informed consent – English version

Dear participants,

You are invited to participate in a research conducted by Kalliopi-Evangelia Stavroulia as part of her Ph.D. thesis in the Department of Multimedia and Graphic Arts of the Cyprus University of Technology. We invite you to participate in the research because its purpose is to help teachers practice their empathy skills through the use of a Virtual Reality educational tool.

You will be prompted to interact in a Virtual Classroom environment. You are expected to participate for about 20-30 minutes and then you will be asked to rate your experience through a questionnaire. Your experience in this matter is valuable. The completion of the questionnaire is anonymous, and the information provided is completely confidential and will not be used for any other purpose. ***Your participation is completely voluntary***, and you may choose to withdraw at any timw.

Additionally, we ask for your consent for the photography and video recording of the experiment. The files will be used only for the needs of the current experiment. If your photos or videos are used for educational purposes or if the research results are published or presented at conferences, your identity will be protected, and your face will be covered so that your identity will not be revealed. You can refuse to be photographed or videotaped. You may be given a copy of the photographic and video material on request.

You should not participate if you do not wish or if you have any concerns about your participation in the program.

Thank you for your response and cooperation.

Yours sincerely,

Kalliopi-Evangelia Stavroulia

Ph.D. candidate

Department of Multimedia and Graphic Arts

School of Fine and Applied Arts

Technological University of Cyprus

For further information please contact Visual Media Computing Lab: vmc@gmail.com

APPENDIX D-8-7

Descriptive Statistics for Pre-emotional scale

Pre-Afraid (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much	4	5.8	5.8	5.8
	Moderately	6	8.7	8.7	14.5
	A little	24	34.8	34.8	49.3
	Not at all	35	50.7	50.7	100.0
	Total	69	100.0	100.0	

Pre-Interested

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	1	1.4	1.4	1.4
	A little	3	4.3	4.3	5.8
	Moderately	12	17.4	17.4	23.2
	Much	33	47.8	47.8	71.0
	Very much	20	29.0	29.0	100.0
	Total	69	100.0	100.0	

Pre-Active

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A little	9	13.0	13.0	13.0
	Moderately	20	29.0	29.0	42.0
	Much	29	42.0	42.0	84.1
	Very much	11	15.9	15.9	100.0
	Total	69	100.0	100.0	

Pre-Nervous (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very much	4	5.8	5.8	5.8
	Much	8	11.6	11.6	17.4
	Moderately	13	18.8	18.8	36.2
	A little	18	26.1	26.1	62.3
	Not at all	26	37.7	37.7	100.0

	Total	69	100.0	100.0	

Pre-Inspired

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	3	4.3	4.3	4.3
	A little	12	17.4	17.4	21.7
	Moderately	23	33.3	33.3	55.1
	Much	25	36.2	36.2	91.3
	Very much	6	8.7	8.7	100.0
	Total	69	100.0	100.0	

Pre-Sad (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very much	1	1.4	1.4	1.4
	Much	2	2.9	2.9	4.3
	Moderately	10	14.5	14.5	18.8
	A little	15	21.7	21.7	40.6
	Not at all	41	59.4	59.4	100.0
	Total	69	100.0	100.0	

Pre-Upset (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much	4	5.8	5.8	5.8
	Moderately	5	7.2	7.2	13.0
	A little	19	27.5	27.5	40.6
	Not at all	41	59.4	59.4	100.0
	Total	69	100.0	100.0	

Pre-Calm

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	5	7.2	7.2	7.2
	A little	14	20.3	20.3	27.5
	Moderately	11	15.9	15.9	43.5
	Much	26	37.7	37.7	81.2
	Very much	13	18.8	18.8	100.0
	Total	69	100.0	100.0	

Pre-Confident

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A little	15	21.7	21.7	21.7
	Moderately	24	34.8	34.8	56.5
	Much	22	31.9	31.9	88.4
	Very much	8	11.6	11.6	100.0
	Total	69	100.0	100.0	

Pre-tired (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very much	10	14.5	14.5	14.5
	Much	13	18.8	18.8	33.3
	Moderately	23	33.3	33.3	66.7
	A little	12	17.4	17.4	84.1
	Not at all	11	15.9	15.9	100.0
	Total	69	100.0	100.0	

Pre-Ashamed(Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much	1	1.4	1.4	1.4
	Moderately	9	13.0	13.0	14.5
	A little	6	8.7	8.7	23.2
	Not at all	53	76.8	76.8	100.0
	Total	69	100.0	100.0	

Pre-Excited

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	4	5.8	5.8	5.8
	A little	5	7.2	7.2	13.0
	Moderately	17	24.6	24.6	37.7
	Much	29	42.0	42.0	79.7
	Very much	14	20.3	20.3	100.0
	Total	69	100.0	100.0	

Pre-Strong

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Not at all	2	2.9	2.9	2.9
	A little	5	7.2	7.2	10.1
	Moderately	30	43.5	43.5	53.6
	Much	24	34.8	34.8	88.4
	Very much	8	11.6	11.6	100.0
	Total	69	100.0	100.0	

Pre-Alert

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	2	2.9	2.9	2.9
	A little	7	10.1	10.1	13.0
	Moderately	19	27.5	27.5	40.6
	Much	31	44.9	44.9	85.5
	Very much	10	14.5	14.5	100.0
	Total	69	100.0	100.0	

Pre-Downhearted (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very much	1	1.4	1.4	1.4
	Much	3	4.3	4.3	5.8
	Moderately	10	14.5	14.5	20.3
	A little	20	29.0	29.0	49.3
	Not at all	35	50.7	50.7	100.0
	Total	69	100.0	100.0	

Pre-Relaxed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	18	26.1	26.1	26.1
	A little	17	24.6	24.6	50.7
	Moderately	20	29.0	29.0	79.7
	Much	7	10.1	10.1	89.9
	Very much	7	10.1	10.1	100.0
	Total	69	100.0	100.0	

Pre-Determined

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Not at all	1	1.4	1.4	1.4
	A little	6	8.7	8.7	10.1
	Moderately	22	31.9	31.9	42.0
	Much	27	39.1	39.1	81.2
	Very much	13	18.8	18.8	100.0
	Total	69	100.0	100.0	

Pre-Concentrated

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A little	5	7.2	7.2	7.2
	Moderately	21	30.4	30.4	37.7
	Much	34	49.3	49.3	87.0
	Very much	9	13.0	13.0	100.0
	Total	69	100.0	100.0	

APPENDIX D-8-8

Descriptive Statistics for Post-emotional scale

Post-Afraid (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very much	1	1.4	1.4	1.4
	Much	1	1.4	1.4	2.9
	Moderately	9	13.0	13.0	15.9
	A little	20	29.0	29.0	44.9
	Not at all	38	55.1	55.1	100.0
	Total	69	100.0	100.0	

Post-Interested

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Moderately	9	13.0	13.0	13.0
	Much	27	39.1	39.1	52.2
	Very much	33	47.8	47.8	100.0
	Total	69	100.0	100.0	

Post-Active

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	1	1.4	1.4	1.4
	A little	2	2.9	2.9	4.3
	Moderately	17	24.6	24.6	29.0
	Much	29	42.0	42.0	71.0
	Very much	20	29.0	29.0	100.0
	Total	69	100.0	100.0	

Post-Nervous (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much	7	10.1	10.1	10.1
	Moderately	16	23.2	23.2	33.3
	A little	16	23.2	23.2	56.5
	Not at all	30	43.5	43.5	100.0
	Total	69	100.0	100.0	

Post-Inspired

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	1	1.4	1.4	1.4
	A little	7	10.1	10.1	11.6
	Moderately	14	20.3	20.3	31.9
	Much	35	50.7	50.7	82.6
	Very much	12	17.4	17.4	100.0
	Total	69	100.0	100.0	

Post-Sad (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very much	2	2.9	2.9	2.9
	Much	6	8.7	8.7	11.6
	Moderately	15	21.7	21.7	33.3
	A little	23	33.3	33.3	66.7
	Not at all	23	33.3	33.3	100.0
	Total	69	100.0	100.0	

Post-Upset (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much	4	5.8	5.8	5.8
	Moderately	5	7.2	7.2	13.0
	A little	19	27.5	27.5	40.6
	Not at all	41	59.4	59.4	100.0
	Total	69	100.0	100.0	

Post-Calm

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	5	7.2	7.2	7.2
	A little	14	20.3	20.3	27.5
	Moderately	11	15.9	15.9	43.5
	Much	26	37.7	37.7	81.2
	Very much	13	18.8	18.8	100.0
	Total	69	100.0	100.0	

Post-Confident

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A little	15	21.7	21.7	21.7
	Moderately	24	34.8	34.8	56.5
	Much	22	31.9	31.9	88.4
	Very much	8	11.6	11.6	100.0
	Total	69	100.0	100.0	

Post-tired (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very much	10	14.5	14.5	14.5
	Much	13	18.8	18.8	33.3
	Moderately	23	33.3	33.3	66.7
	A little	12	17.4	17.4	84.1
	Not at all	11	15.9	15.9	100.0
	Total	69	100.0	100.0	

Post-Ashamed (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much	1	1.4	1.4	1.4
	Moderately	9	13.0	13.0	14.5
	A little	6	8.7	8.7	23.2
	Not at all	53	76.8	76.8	100.0
	Total	69	100.0	100.0	

Post-Excited

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	4	5.8	5.8	5.8
	A little	5	7.2	7.2	13.0
	Moderately	17	24.6	24.6	37.7
	Much	29	42.0	42.0	79.7
	Very much	14	20.3	20.3	100.0
	Total	69	100.0	100.0	

Post-Strong

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	2	2.9	2.9	2.9

	A little	5	7.2	7.2	10.1
	Moderately	30	43.5	43.5	53.6
	Much	24	34.8	34.8	88.4
	Very much	8	11.6	11.6	100.0
	Total	69	100.0	100.0	

Post-Alert

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	2	2.9	2.9	2.9
	A little	7	10.1	10.1	13.0
	Moderately	19	27.5	27.5	40.6
	Much	31	44.9	44.9	85.5
	Very much	10	14.5	14.5	100.0
	Total	69	100.0	100.0	

Post-Downhearted (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very much	1	1.4	1.4	1.4
	Much	3	4.3	4.3	5.8
	Moderately	10	14.5	14.5	20.3
	A little	20	29.0	29.0	49.3
	Not at all	35	50.7	50.7	100.0
	Total	69	100.0	100.0	

Post-Relaxed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	18	26.1	26.1	26.1
	A little	17	24.6	24.6	50.7
	Moderately	20	29.0	29.0	79.7
	Much	7	10.1	10.1	89.9
	Very much	7	10.1	10.1	100.0
	Total	69	100.0	100.0	

Post-Determined

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	1	1.4	1.4	1.4

	A little	6	8.7	8.7	10.1
	Moderately	22	31.9	31.9	42.0
	Much	27	39.1	39.1	81.2
	Very much	13	18.8	18.8	100.0
	Total	69	100.0	100.0	

Post-Concentrated

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A little	5	7.2	7.2	7.2
	Moderately	21	30.4	30.4	37.7
	Much	34	49.3	49.3	87.0
	Very much	9	13.0	13.0	100.0
	Total	69	100.0	100.0	

APPENDIX D-8-9

Ranks table: Wilcoxon Signed-Rank Test for pre and post-emotional scale

		N	Mean Rank	Sum of Ranks
Post-Afraid (Reversed) -Pre-Afraid (Reversed)	Negative Ranks	12	16.29	195.50
	Positive Ranks	17	14.09	239.50
	Ties	40		
	Total	69		
Post-Interested - Pre-Interested	Negative Ranks	5	16.00	80.00
	Positive Ranks	28	17.18	481.00
	Ties	36		
	Total	69		
Post-Active - Pre-Active	Negative Ranks	9	13.00	117.00
	Positive Ranks	23	17.87	411.00
	Ties	37		
	Total	69		
Post-Nervous (Reversed) - Pre-Nervous (Reversed)	Negative Ranks	14	20.14	282.00
	Positive Ranks	23	18.30	421.00
	Ties	32		
	Total	69		
Post-Inspired - Pre-Inspired	Negative Ranks	9	15.89	143.00
	Positive Ranks	28	20.00	560.00
	Ties	32		
	Total	69		
Post-Sad (Reversed) - Pre-Sad (Reversed)	Negative Ranks	26	23.71	616.50
	Positive Ranks	14	14.54	203.50
	Ties	29		
	Total	69		
Post-Upset (Reversed) - Pre-Upset (Reversed)	Negative Ranks	26	18.62	484.00

	Positive Ranks	10	18.20	182.00
	Ties	33		
	Total	69		
Post-Calm - Pre-Calm	Negative Ranks	18	17.97	323.50
	Positive Ranks	22	22.57	496.50
	Ties	29		
	Total	69		
Post-Confident - Pre-Confident	Negative Ranks	10	16.50	165.00
	Positive Ranks	28	20.57	576.00
	Ties	31		
	Total	69		
Post-Tired (Reversed) - Pre-Tired (Reversed)	Negative Ranks	5	11.70	58.50
	Positive Ranks	24	15.69	376.50
	Ties	40		
	Total	69		
Post-Ashamed (Reversed) - Pre-Ashamed (Reversed)	Negative Ranks	15	11.37	170.50
	Positive Ranks	7	11.79	82.50
	Ties	47		
	Total	69		
Post-Excited - Pre-Excited	Negative Ranks	16	18.66	298.50
	Positive Ranks	23	20.93	481.50
	Ties	30		
	Total	69		
Post-Strong - Pre-Strong	Negative Ranks	8	16.44	131.50
	Positive Ranks	23	15.85	364.50
	Ties	38		
	Total	69		
Post-Alert - Pre-Alert	Negative Ranks	11	21.41	235.50
	Positive Ranks	25	17.22	430.50

	Ties	33		
	Total	69		
Post-Downhearted (Reversed) - Pre-Downhearted (Reversed)	Negative Ranks	19	18.32	348.00
	Positive Ranks	17	18.71	318.00
	Ties	33		
	Total	69		
Post-Relaxed - Pre-Relaxed	Negative Ranks	15	18.13	272.00
	Positive Ranks	22	19.59	431.00
	Ties	32		
	Total	69		
Post-Determined - Pre-Determined	Negative Ranks	9	13.61	122.50
	Positive Ranks	20	15.63	312.50
	Ties	40		
	Total	69		
Post-Concentrated - Pre-Concentrated	Negative Ranks	5	12.50	62.50
	Positive Ranks	26	16.67	433.50
	Ties	38		
	Total	69		

APPENDIX D-8-10

Wilcoxon S-R Test - Ranks table output for gender differences

	Gender	N	Mean Rank	Sum of Ranks
Pre-Afraid (Reversed)	Male	19	39.55	751.50
	Female	49	32.54	1594.50
	Total	68		
Pre-Interested	Male	19	39.97	759.50
	Female	49	32.38	1586.50
	Total	68		
Pre-Active	Male	19	31.74	603.00
	Female	49	35.57	1743.00
	Total	68		
Pre-Nervous (Reversed)	Male	19	40.13	762.50
	Female	49	32.32	1583.50
	Total	68		
Pre-Inspired	Male	19	39.55	751.50
	Female	49	32.54	1594.50
	Total	68		
Pre-Sad (Reversed)	Male	19	41.39	786.50
	Female	49	31.83	1559.50
	Total	68		
Pre-Upset (Reversed)	Male	19	41.68	792.00
	Female	49	31.71	1554.00
	Total	68		
Pre-Calm	Male	19	44.53	846.00
	Female	49	30.61	1500.00
	Total	68		
Pre-Confident	Male	19	44.16	839.00
	Female	49	30.76	1507.00

	Total	68		
Pre-Tired (Reversed)	Male	19	39.82	756.50
	Female	49	32.44	1589.50
	Total	68		
Pre-Ashamed (Reversed)	Male	19	32.16	611.00
	Female	49	35.41	1735.00
	Total	68		
Pre-Excited	Male	19	37.97	721.50
	Female	49	33.15	1624.50
	Total	68		
Pre-Strong	Male	19	40.74	774.00
	Female	49	32.08	1572.00
	Total	68		
Pre-Alert	Male	19	35.87	681.50
	Female	49	33.97	1664.50
	Total	68		
Pre-Downhearted (Reversed)	Male	19	42.82	813.50
	Female	49	31.28	1532.50
	Total	68		
Pre-Relaxed	Male	19	43.50	826.50
	Female	49	31.01	1519.50
	Total	68		
Pre-Determined	Male	19	37.03	703.50
	Female	49	33.52	1642.50
	Total	68		
Pre-Concentrated	Male	19	38.32	728.00
	Female	49	33.02	1618.00
	Total	68		

APPENDIX D-8-11

Means over all emotions Pre and Post for each gender separately

	Male			Female			Do not wish to answer		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation	Mean	N	Std. Deviation
Emotions Before (Pre) the use of VR									
Pre-Afraid (Reversed)	4.5789	19	.60698	4.2041	49	.93496	4.0000	1	.
Pre-Interested	4.1579	19	1.06787	3.8980	49	.79700	5.0000	1	.
Pre-Active	3.4737	19	.84119	3.6735	49	.94401	3.0000	1	.
Pre-Nervous (Reversed)	4.2105	19	.91766	3.6531	49	1.29986	2.0000	1	.
Pre-Sad (Reversed)	4.6842	19	.67104	4.2041	49	.99957	5.0000	1	.
Pre-Inspired	3.5263	19	.96427	3.1837	49	1.01393	3.0000	1	.
Pre-Upset (Reversed)	4.7895	19	.41885	4.3061	49	.89452	2.0000	1	.
Pre-Calm	4.0526	19	.97032	3.1837	49	1.21918	2.0000	1	.
Pre-Confident	3.8421	19	.89834	3.1429	49	.91287	3.0000	1	.
Pre-Tired (Reversed)	3.3684	19	1.16479	2.8571	49	1.29099	4.0000	1	.
Pre-Ashamed (Reversed)	4.5263	19	.77233	4.6327	49	.78246	5.0000	1	.
Pre-Emotion12_Excited	3.7895	19	1.03166	3.5510	49	1.08130	5.0000	1	.
Pre- Strong	3.6842	19	.88523	3.3673	49	.90586	3.0000	1	.
Pre- Alert	3.6316	19	.95513	3.5714	49	.97895	3.0000	1	.
Pre- Downhearted (Reversed)	4.6316	19	.68399	4.0612	49	1.00847	5.0000	1	.
Pre-Relaxed	3.1579	19	1.21395	2.3265	49	1.21429	1.0000	1	.

Pre-Determined	3.7368	19	1.04574	3.6327	49	.90586	3.0000	1	.
Pre-Concentrated	3.8421	19	.95819	3.6327	49	.72726	3.0000	1	.
Emotions After (Post) the use of VR									
Post-Afraid (Reversed)	4.4737	19	.77233	4.2857	49	.91287	5.0000	1	.
Post-Interested	4.5263	19	.69669	4.2653	49	.70046	5.0000	1	.
Post-Active	3.9474	19	.84811	3.9184	49	.90914	5.0000	1	.
Post-Nervous (Reversed)	3.9474	19	1.07877	4.0000	49	1.04083	5.0000	1	.
Post-Inspired	3.7368	19	.73349	3.6939	49	.98328	5.0000	1	.
Post- Sad (Reversed)	3.6316	19	1.06513	3.9184	49	1.07697	5.0000	1	.
Post-Upset (Reversed)	3.8947	19	.93659	4.0612	49	1.00847	5.0000	1	.
Post-Calm	3.7368	19	.93346	3.5102	49	1.04328	5.0000	1	.
Post-Confident	3.7368	19	.80568	3.6531	49	1.05180	5.0000	1	.
Post-Tired (Reversed)	3.7368	19	1.09758	3.4286	49	1.29099	5.0000	1	.
Post-Ashamed (Reversed)	4.0526	19	1.02598	4.5306	49	.93768	5.0000	1	.
Post-Excited	3.6842	19	1.29326	3.8571	49	.95743	5.0000	1	.
Post-Strong	3.6842	19	.88523	3.6735	49	.89879	4.0000	1	.
Post-Alert	3.7368	19	1.14708	3.7347	49	.97416	5.0000	1	.
Post-Downhearted (Reversed)	4.1579	19	.95819	4.1224	49	1.11117	5.0000	1	.
Post-Relaxed	3.1053	19	1.10024	2.5306	49	1.19202	4.0000	1	.
Post-Determined	3.8421	19	.76472	3.8980	49	.89547	3.0000	1	.
Post-Concentrated	4.0526	19	1.02598	4.1224	49	.66560	4.0000	1	.

APPENDIX D-8-12

Means over all emotions Pre and Post for the groups: active teachers and university students.

	Active teacher			University Student		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation
Pre-emotional scale						
Pre-Afraid (Reversed)	4.3077	39	.83205	4.2083	24	.97709
Pre-Interested	4.0000	39	.79472	4.0417	24	.85867
Pre-Active	3.6667	39	.95513	3.4167	24	.88055
Pre-Nervous (Reversed)	3.8718	39	1.19603	3.4583	24	1.31807
Pre-Sad (Reversed)	4.2308	39	1.03775	4.4167	24	.82970
Pre-Inspired	3.2564	39	1.01872	3.2917	24	.95458
Pre-Upset (Reversed)	4.5128	39	.68333	4.0833	24	1.10007
Pre-Calm	3.4872	39	1.12090	3.1250	24	1.32902
Pre-Confident	3.4872	39	.91398	2.9583	24	.85867
Pre-Tired (Reversed)	3.2821	39	1.19095	2.5833	24	1.28255
Pre-Ashamed (Reversed)	4.7436	39	.63734	4.2917	24	.95458
Pre-Excited	3.5385	39	1.14354	3.7917	24	.83297
Pre-Strong	3.4615	39	.96916	3.2917	24	.80645
Pre-Alert	3.5897	39	.96567	3.3750	24	.96965
Pre-Downhearted (Reversed)	4.1538	39	1.01407	4.2083	24	.93153
Pre-Relaxed	2.7692	39	1.30710	2.1250	24	1.11560
Pre-Determined	3.6667	39	.95513	3.5000	24	.93250
Pre-Concentrated	3.7436	39	.71517	3.5000	24	.93250
Post-emotional scale						
Post-Afraid (Reversed)	4.3590	39	.84253	4.4167	24	.82970
Post-Interested	4.3590	39	.66835	4.3750	24	.71094
Post-Active	4.1026	39	.75376	3.6667	24	1.04950
Post-Nervous (Reversed)	4.0000	39	1.02598	3.8333	24	1.09014
Post-Inspired	3.7949	39	.89382	3.6667	24	.96309
Post-Sad (Reversed)	3.7436	39	1.01872	4.0417	24	.95458

Post-Upset (Reversed)	4.2051	39	.86388	3.8750	24	.89988
Post-Calm	3.7179	39	.94448	3.4583	24	1.02062
Post-Confident	3.8205	39	.99662	3.4583	24	1.02062
Post-Tired (Reversed)	3.7692	39	1.15762	3.2083	24	1.28466
Post-Ashamed (Reversed)	4.5385	39	.85367	4.2917	24	.95458
Post-Excited	3.8462	39	1.15937	3.6667	24	.86811
Post-Strong	3.7179	39	.99865	3.5417	24	.72106
Post-Alert	3.7436	39	1.01872	3.6667	24	1.09014
Post-Downhearted (Reversed)	4.2308	39	1.01207	4.0417	24	.99909
Post-Relaxed	2.7949	39	1.30141	2.5000	24	.97802
Post-Determined	4.0513	39	.79302	3.5000	24	.88465
Post-Concentrated	4.2564	39	.63734	3.8333	24	.91683

APPENDIX D-8-13

Descriptive Statistics for Pre-empathy scale

1. I sometimes find no difficult to see things from the "other guy's person's" point of view. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me very well	2	2.9	2.9	2.9
	Describes me quite well	5	7.2	7.2	10.1
	Describes me well	16	23.2	23.2	33.3
	Describes me slightly well	33	47.8	47.8	81.2
	Does not describe me well	13	18.8	18.8	100.0
	Total	69	100.0	100.0	

2. I try to look at everybody's side of a problem before making a decision.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me slightly well	4	5.8	5.8	5.8
	Describes me well	11	15.9	15.9	21.7
	Describes me quite well	31	44.9	44.9	66.7
	Describes me very well	23	33.3	33.3	100.0
	Total	69	100.0	100.0	

3. I sometimes try to understand others better by imagining how things look from their perspective.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Does not describe me well	1	1.4	1.4	1.4
	Describes me slightly well	2	2.9	2.9	4.3
	Describes me well	17	24.6	24.6	29.0
	Describes me quite well	35	50.7	50.7	79.7
	Describes me very well	14	20.3	20.3	100.0
	Total	69	100.0	100.0	

4. If I am sure I am right about something, I listen to other people's arguments. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Describes me very well	1	1.4	1.4	1.4
	Describes me quite well	7	10.1	10.1	11.6
	Describes me well	25	36.2	36.2	47.8
	Describes me slightly well	19	27.5	27.5	75.4
	Does not describe me well	17	24.6	24.6	100.0
	Total	69	100.0	100.0	

5. I believe that there are two sides to every situation and try to look at them both.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me slightly well	4	5.8	5.8	5.8
	Describes me well	17	24.6	24.6	30.4
	Describes me quite well	30	43.5	43.5	73.9
	Describes me very well	18	26.1	26.1	100.0
	Total	69	100.0	100.0	

6. When I am upset at someone, I usually try to "put myself in his shoes" for a while.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Does not describe me well	5	7.2	7.2	7.2
	Describes me slightly well	10	14.5	14.5	21.7
	Describes me well	24	34.8	34.8	56.5
	Describes me quite well	27	39.1	39.1	95.7
	Describes me very well	3	4.3	4.3	100.0
	Total	69	100.0	100.0	

7. Before criticizing somebody, I try to imagine how I would feel if I were in their place.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Does not describe me well	3	4.3	4.4	4.4
	Describes me slightly well	5	7.2	7.4	11.8
	Describes me well	16	23.2	23.5	35.3
	Describes me quite well	35	50.7	51.5	86.8
	Describes me very well	9	13.0	13.2	100.0
	Total	68	98.6	100.0	
Missing	System	1	1.4		

Total		69	100.0		

8. I often feel very sorry for other people when they are having problems. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me very well	3	4.3	4.3	4.3
	Describes me quite well	4	5.8	5.8	10.1
	Describes me well	15	21.7	21.7	31.9
	Describes me slightly well	15	21.7	21.7	53.6
	Does not describe me well	32	46.4	46.4	100.0
	Total	69	100.0	100.0	

9. Other people's misfortunes usually disturb me a great deal. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me very well	3	4.3	4.3	4.3
	Describes me quite well	6	8.7	8.7	13.0
	Describes me well	10	14.5	14.5	27.5
	Describes me slightly well	7	10.1	10.1	37.7
	Does not describe me well	43	62.3	62.3	100.0
	Total	69	100.0	100.0	

10. When I see someone being treated unfairly, I often feel pity very much for them. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me very well	3	4.3	4.3	4.3
	Describes me quite well	2	2.9	2.9	7.2
	Describes me well	8	11.6	11.6	18.8
	Describes me slightly well	11	15.9	15.9	34.8
	Does not describe me well	45	65.2	65.2	100.0
	Total	69	100.0	100.0	

11. I am often quite touched by things that I see happen.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Does not describe me well	3	4.3	4.3	4.3
	Describes me slightly well	5	7.2	7.2	11.6

	Describes me well	12	17.4	17.4	29.0
	Describes me quite well	27	39.1	39.1	68.1
	Describes me very well	22	31.9	31.9	100.0
	Total	69	100.0	100.0	

12. I would describe myself as a pretty soft-hearted person.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Does not describe me well	1	1.4	1.4	1.4
	Describes me slightly well	5	7.2	7.2	8.7
	Describes me well	11	15.9	15.9	24.6
	Describes me quite well	32	46.4	46.4	71.0
	Describes me very well	20	29.0	29.0	100.0
	Total	69	100.0	100.0	

13. I do not feel sympathy for people who cause their own serious illnesses. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me very well	1	1.4	1.4	1.4
	Describes me quite well	3	4.3	4.3	5.8
	Describes me well	13	18.8	18.8	24.6
	Describes me slightly well	16	23.2	23.2	47.8
	Does not describe me well	36	52.2	52.2	100.0
	Total	69	100.0	100.0	

14. I am really interested in how other people feel. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me well	9	13.0	13.0	13.0
	Describes me slightly well	11	15.9	15.9	29.0
	Does not describe me well	49	71.0	71.0	100.0
	Total	69	100.0	100.0	

16. When I see someone being taken advantage of, I feel kind of protective towards him\her.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Does not describe me well	5	7.2	7.2	7.2

Describes me slightly well	2	2.9	2.9	10.1
Describes me well	7	10.1	10.1	20.3
Describes me quite well	24	34.8	34.8	55.1
Describes me very well	31	44.9	44.9	100.0
Total	69	100.0	100.0	

APPENDIX D-8-14

Descriptive Statistics for Post-empathy scale

1. I sometimes find no difficult to see things from the "other guy's person's" point of view. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me very well	3	4.3	4.3	4.3
	Describes me quite well	3	4.3	4.3	8.7
	Describes me well	18	26.1	26.1	34.8
	Describes me slightly well	26	37.7	37.7	72.5
	Does not describe me well	19	27.5	27.5	100.0
	Total	69	100.0	100.0	

2. I try to look at everybody's side of a problem before making a decision.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me slightly well	1	1.4	1.4	1.4
	Describes me well	8	11.6	11.6	13.0
	Describes me quite well	35	50.7	50.7	63.8
	Describes me very well	25	36.2	36.2	100.0
	Total	69	100.0	100.0	

3. I sometimes try to understand others better by imagining how things look from their perspective.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me slightly well	1	1.4	1.4	1.4
	Describes me well	9	13.0	13.0	14.5
	Describes me quite well	35	50.7	50.7	65.2
	Describes me very well	24	34.8	34.8	100.0
	Total	69	100.0	100.0	

4. If I am sure I am right about something, I listen to other people's arguments. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me very well	1	1.4	1.4	1.4
	Describes me quite well	10	14.5	14.5	15.9
	Describes me well	14	20.3	20.3	36.2

	Describes me slightly well	21	30.4	30.4	66.7
	Does not describe me well	23	33.3	33.3	100.0
	Total	69	100.0	100.0	

5. I believe that there are two sides to every situation and try to look at them both.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Does not describe me well	1	1.4	1.4	1.4
	Describes me slightly well	1	1.4	1.4	2.9
	Describes me well	10	14.5	14.5	17.4
	Describes me quite well	33	47.8	47.8	65.2
	Describes me very well	24	34.8	34.8	100.0
	Total	69	100.0	100.0	

6. When I am upset at someone, I usually try to "put myself in his shoes" for a while.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Does not describe me well	2	2.9	2.9	2.9
	Describes me slightly well	12	17.4	17.4	20.3
	Describes me well	14	20.3	20.3	40.6
	Describes me quite well	33	47.8	47.8	88.4
	Describes me very well	8	11.6	11.6	100.0
	Total	69	100.0	100.0	

7. Before criticizing somebody, I try to imagine how I would feel if I were in their place.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me slightly well	5	7.2	7.2	7.2
	Describes me well	8	11.6	11.6	18.8
	Describes me quite well	38	55.1	55.1	73.9
	Describes me very well	18	26.1	26.1	100.0
	Total	69	100.0	100.0	

8. I often feel very sorry for other people when they are having problems. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me very well	3	4.3	4.3	4.3
	Describes me quite well	3	4.3	4.3	8.7

	Describes me well	6	8.7	8.7	17.4
	Describes me slightly well	19	27.5	27.5	44.9
	Does not describe me well	38	55.1	55.1	100.0
	Total	69	100.0	100.0	

9. Other people's misfortunes usually disturb me a great deal. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me very well	2	2.9	2.9	2.9
	Describes me quite well	1	1.4	1.4	4.3
	Describes me well	4	5.8	5.8	10.1
	Describes me slightly well	15	21.7	21.7	31.9
	Does not describe me well	47	68.1	68.1	100.0
	Total	69	100.0	100.0	

10. When I see someone being treated unfairly, I often feel pity very much for them. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me very well	6	8.7	8.7	8.7
	Describes me quite well	1	1.4	1.4	10.1
	Describes me well	4	5.8	5.8	15.9
	Describes me slightly well	15	21.7	21.7	37.7
	Does not describe me well	43	62.3	62.3	100.0
	Total	69	100.0	100.0	

11. I am often quite touched by things that I see happen.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Does not describe me well	1	1.4	1.4	1.4
	Describes me slightly well	3	4.3	4.3	5.8
	Describes me well	9	13.0	13.0	18.8
	Describes me quite well	36	52.2	52.2	71.0
	Describes me very well	20	29.0	29.0	100.0
	Total	69	100.0	100.0	

12. I would describe myself as a pretty soft-hearted person.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me slightly well	4	5.8	5.8	5.8

	Describes me well	8	11.6	11.6	17.4
	Describes me quite well	36	52.2	52.2	69.6
	Describes me very well	21	30.4	30.4	100.0
	Total	69	100.0	100.0	

13. I do not feel sympathy for people who cause their own serious illnesses. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me quite well	1	1.4	1.4	1.4
	Describes me well	5	7.2	7.2	8.7
	Describes me slightly well	20	29.0	29.0	37.7
	Does not describe me well	43	62.3	62.3	100.0
	Total	69	100.0	100.0	

14. I am really interested in how other people feel. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me very well	1	1.4	1.4	1.4
	Describes me well	4	5.8	5.8	7.2
	Describes me slightly well	14	20.3	20.3	27.5
	Does not describe me well	50	72.5	72.5	100.0
	Total	69	100.0	100.0	

15. When I see someone being taken advantage of, I feel kind of protective towards him\her.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Describes me quite well	4	5.8	5.8	5.8
	Describes me well	6	8.7	8.7	14.5
	Describes me slightly well	17	24.6	24.6	39.1
	Does not describe me well	42	60.9	60.9	100.0
	Total	69	100.0	100.0	

APPENDIX D-8-15

Ranks table on the comparison of participants' Before (Pre) and After (Post) Empathy Scores

Ranks

		N	Mean Rank	Sum of Ranks
1. I sometimes find no difficult to see things from the “other guy’s person’s” point of view. (Reversed) - 1. I sometimes find no difficult to see things from the “other guy’s person’s” point of view. (Reversed)	Negative Ranks	13	14.69	191.00
	Positive Ranks	17	16.12	274.00
	Ties	39		
	Total	69		
2. I try to look at everybody’s side of a problem before making a decision. - 2. I try to look at everybody’s side of a problem before making a decision.	Negative Ranks	9	12.89	116.00
	Positive Ranks	17	13.82	235.00
	Ties	43		
	Total	69		
3. I sometimes try to understand others better by imagining how things look from their perspective. - 3. I sometimes try to understand others better by imagining how things look from their perspective.	Negative Ranks	8	17.19	137.50
	Positive Ranks	27	18.24	492.50
	Ties	34		
	Total	69		
4. If I am sure I am right about something, I listen to other people’s arguments. (Reversed) - 4. If I am sure I am right about something, I listen to other people’s arguments. (Reversed)	Negative Ranks	10	17.35	173.50
	Positive Ranks	21	15.36	322.50
	Ties	38		
	Total	69		
5. I believe that there are two sides to every situation and try to look at them both. - 5. I believe that there are two sides to every situation and try to look at them both.	Negative Ranks	9	16.00	144.00
	Positive Ranks	23	16.70	384.00
	Ties	37		
	Total	69		
6. When I am upset at someone, I usually try to “put myself in his shoes” for a while. - 6. When I am upset at someone, I usually try to “put myself in his shoes” for a while.	Negative Ranks	11	19.50	214.50
	Positive Ranks	25	18.06	451.50
	Ties	33		
	Total	69		
	Negative Ranks	8	16.00	128.00

7. Before criticizing somebody, I try to imagine how I would feel if I were in their place. - 7. Before criticizing somebody, I try to imagine how I would feel if I were in their place.	Positive Ranks	26	17.96	467.00
	Ties	34		
	Total	68		
8. I often feel very sorry for other people when they are having problems. (Reversed) - 8. I often feel very sorry for other people when they are having problems. (Reversed)	Negative Ranks	13	16.46	214.00
	Positive Ranks	23	19.65	452.00
	Ties	33		
	Total	69		
9. Other people's misfortunes usually disturb me a great deal. (Reversed) - 9. Other people's misfortunes usually disturb me a great deal. (Reversed)	Negative Ranks	8	12.00	96.00
	Positive Ranks	19	14.84	282.00
	Ties	42		
	Total	69		
10. When I see someone being treated unfairly, I often feel pity very much for them. (Reversed) - 10. When I see someone being treated unfairly, I often feel pity very much for them. (Reversed)	Negative Ranks	10	13.70	137.00
	Positive Ranks	12	9.67	116.00
	Ties	47		
	Total	69		
11. I am often quite touched by things that I see happen. - 11. I am often quite touched by things that I see happen.	Negative Ranks	10	11.35	113.50
	Positive Ranks	15	14.10	211.50
	Ties	44		
	Total	69		
12. I would describe myself as a pretty soft-hearted person. - 12. I would describe myself as a pretty soft-hearted person.	Negative Ranks	13	16.00	208.00
	Positive Ranks	20	17.65	353.00
	Ties	36		
	Total	69		
13. I do not feel sympathy for people who cause their own serious illnesses. (Reversed) - 13. I do not feel sympathy for people who cause their own serious illnesses. (Reversed)	Negative Ranks	2	6.00	12.00
	Positive Ranks	15	9.40	141.00
	Ties	52		
	Total	69		
14. I am really interested in how other people feel. (Reversed) - 14. I am really interested in how other people feel. (Reversed)	Negative Ranks	4	9.63	38.50
	Positive Ranks	10	6.65	66.50
	Ties	55		
	Total	69		
	Negative Ranks	6	14.83	89.00

15. When I see someone being taken advantage of, I feel kind of protective towards him\her. - 16. When I see someone being taken advantage of, I feel kind of protective towards him\her.	Positive Ranks	21	13.76	289.00
	Ties	42		
	Total	69		

APPENDIX D-8-16

Ranks table on the comparison of participants' gender Before (Pre) empathy Score

	Ranks			
	Gender	N	Mean Rank	Sum of Ranks
1. I sometimes find no difficult to see things from the “other guy’s person’s” point of view. (Reversed)	Male	19	36.71	697.50
	Female	49	33.64	1648.50
	Total	68		
2. I try to look at everybody’s side of a problem before making a decision.	Male	19	36.34	690.50
	Female	49	33.79	1655.50
	Total	68		
3. I sometimes try to understand others better by imagining how things look from their perspective.	Male	19	34.95	664.00
	Female	49	34.33	1682.00
	Total	68		
4. If I am sure I am right about something, I listen to other people’s arguments. (Reversed)	Male	19	36.87	700.50
	Female	49	33.58	1645.50
	Total	68		
5. I believe that there are two sides to every situation and try to look at them both.	Male	19	42.95	816.00
	Female	49	31.22	1530.00
	Total	68		
6. When I am upset at someone, I usually try to “put myself in his shoes” for a while.	Male	19	38.82	737.50
	Female	49	32.83	1608.50
	Total	68		
7. Before criticizing somebody, I try to imagine how I would feel if I were in their place.	Male	18	34.97	629.50
	Female	49	33.64	1648.50
	Total	67		
8. I often feel very sorry for other people when they are having problems. (Reversed)	Male	19	34.68	659.00
	Female	49	34.43	1687.00
	Total	68		
9. Other people’s misfortunes usually disturb me a great deal. (Reversed)	Male	19	35.03	665.50
	Female	49	34.30	1680.50

	Total	68		
10. When I see someone being treated unfairly, I often feel pity very much for them. (Reversed)	Male	19	32.13	610.50
	Female	49	35.42	1735.50
	Total	68		
11. I am often quite touched by things that I see happen.	Male	19	35.18	668.50
	Female	49	34.23	1677.50
	Total	68		
12. I would describe myself as a pretty soft-hearted person.	Male	19	35.26	670.00
	Female	49	34.20	1676.00
	Total	68		
13. I do not feel sympathy for people who cause their own serious illnesses. (Reversed)	Male	19	30.16	573.00
	Female	49	36.18	1773.00
	Total	68		
14. I am really interested in how other people feel. (Reversed)	Male	19	30.63	582.00
	Female	49	36.00	1764.00
	Total	68		
15. When I see someone being taken advantage of, I feel kind of protective towards him\her.	Male	19	32.76	622.50
	Female	49	35.17	1723.50
	Total	68		

APPENDIX D-8-17

Ranks table on the comparison of participants' employment status Before (Pre) empathy Score

Ranks

	Employment Status	N	Mean Rank	Sum of Ranks
1. I sometimes find no difficult to see things from the “other guy’s person’s” point of view. (Reversed)	Active teacher	39	29.56	1153.00
	University Student	24	35.96	863.00
	Total	63		
2. I try to look at everybody’s side of a problem before making a decision.	Active teacher	39	32.55	1269.50
	University Student	24	31.10	746.50
	Total	63		
3. I sometimes try to understand others better by imagining how things look from their perspective.	Active teacher	39	27.85	1086.00
	University Student	24	38.75	930.00
	Total	63		
4. If I am sure I am right about something, I listen to other people’s arguments. (Reversed)	Active teacher	39	31.03	1210.00
	University Student	24	33.58	806.00
	Total	63		
5. I believe that there are two sides to every situation and try to look at them both.	Active teacher	39	30.15	1176.00
	University Student	24	35.00	840.00
	Total	63		
6. When I am upset at someone, I usually try to “put myself in his shoes” for a while.	Active teacher	39	31.17	1215.50
	University Student	24	33.35	800.50
	Total	63		
7. Before criticizing somebody, I try to imagine how I would feel if I were in their place.	Active teacher	38	31.93	1213.50
	University Student	24	30.81	739.50
	Total	62		
8. I often feel very sorry for other people when they are having problems. (Reversed)	Active teacher	39	32.81	1279.50
	University Student	24	30.69	736.50

	Total	63		
9. Other people's misfortunes usually disturb me a great deal. (Reversed)	Active teacher	39	34.15	1332.00
	University Student	24	28.50	684.00
	Total	63		
10. When I see someone being treated unfairly, I often feel pity very much for them. (Reversed)	Active teacher	39	34.00	1326.00
	University Student	24	28.75	690.00
	Total	63		
11. I am often quite touched by things that I see happen.	Active teacher	39	34.49	1345.00
	University Student	24	27.96	671.00
	Total	63		
12. I would describe myself as a pretty soft-hearted person.	Active teacher	39	33.22	1295.50
	University Student	24	30.02	720.50
	Total	63		
13. I do not feel sympathy for people who cause their own serious illnesses. (Reversed)	Active teacher	39	34.06	1328.50
	University Student	24	28.65	687.50
	Total	63		
14. I am really interested in how other people feel. (Reversed)	Active teacher	39	32.09	1251.50
	University Student	24	31.85	764.50
	Total	63		
15. When I see someone being taken advantage of, I feel kind of protective towards him\her.	Active teacher	39	33.00	1287.00
	University Student	24	30.38	729.00
	Total	63		

APPENDIX D-8-18

Ranks table on the comparison of participants' employment status After (Post) empathy Score

	Ranks			
	Employment Status	N	Mean Rank	Sum of Ranks
1. I sometimes find no difficult to see things from the “other guy’s person’s” point of view. (Reversed)	Active teacher	39	30.54	1191.00
	University Student	24	34.38	825.00
	Total	63		
2. I try to look at everybody’s side of a problem before making a decision.	Active teacher	39	35.35	1378.50
	University Student	24	26.56	637.50
	Total	63		
3. I sometimes try to understand others better by imagining how things look from their perspective.	Active teacher	39	32.00	1248.00
	University Student	24	32.00	768.00
	Total	63		
4. If I am sure I am right about something, I listen to other people’s arguments. (Reversed)	Active teacher	39	29.67	1157.00
	University Student	24	35.79	859.00
	Total	63		
5. I believe that there are two sides to every situation and try to look at them both.	Active teacher	39	32.12	1252.50
	University Student	24	31.81	763.50
	Total	63		
6. When I am upset at someone, I usually try to “put myself in his shoes” for a while.	Active teacher	39	34.14	1331.50
	University Student	24	28.52	684.50
	Total	63		
7. Before criticizing somebody, I try to imagine how I would feel if I were in their place.	Active teacher	39	34.13	1331.00
	University Student	24	28.54	685.00
	Total	63		
8. I often feel very sorry for other people when they are having problems. (Reversed)	Active teacher	39	32.91	1283.50
	University Student	24	30.52	732.50
	Total	63		
	Active teacher	39	34.37	1340.50

9. Other people's misfortunes usually disturb me a great deal. (Reversed)	University Student	24	28.15	675.50
	Total	63		
10. When I see someone being treated unfairly, I often feel pity very much for them. (Reversed)	Active teacher	39	33.15	1293.00
	University Student	24	30.13	723.00
	Total	63		
11. I am often quite touched by things that I see happen.	Active teacher	39	33.36	1301.00
	University Student	24	29.79	715.00
	Total	63		
12. I would describe myself as a pretty soft-hearted person.	Active teacher	39	33.35	1300.50
	University Student	24	29.81	715.50
	Total	63		
13. I do not feel sympathy for people who cause their own serious illnesses. (Reversed)	Active teacher	39	34.90	1361.00
	University Student	24	27.29	655.00
	Total	63		
14. I am really interested in how other people feel. (Reversed)	Active teacher	39	32.38	1263.00
	University Student	24	31.38	753.00
	Total	63		
15. When I see someone being taken advantage of, I feel kind of protective towards him\her.	Active teacher	39	35.71	1392.50
	University Student	24	25.98	623.50
	Total	63		

APPENDIX D-8-19

Presence Scale – Frequency tables

Q1. Please rate your sense of being in the virtual environment, on a scale of 1 to 7, where 7 represents your normal experience of being in a place. I had a sense of "being there" in the virtual classroom ...

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	1	1.4	1.4	1.4
	Low	2	2.9	2.9	4.3
	Slightly	1	1.4	1.4	5.8
	Neutral	5	7.2	7.2	13.0
	Moderately	21	30.4	30.4	43.5
	Very	24	34.8	34.8	78.3
	Very much	15	21.7	21.7	100.0
	Total	69	100.0	100.0	

2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	At no time	1	1.4	1.4	1.4
	Rarely	3	4.3	4.3	5.8
	Sometimes	3	4.3	4.3	10.1
	Neutral	11	15.9	15.9	26.1
	Often	19	27.5	27.5	53.6
	A great deal	22	31.9	31.9	85.5
	Almost all time	10	14.5	14.5	100.0
	Total	69	100.0	100.0	

3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Images that I saw	3	4.3	4.3	4.3
	2.00	2	2.9	2.9	7.2
	3.00	5	7.2	7.2	14.5
	Neutral	9	13.0	13.0	27.5

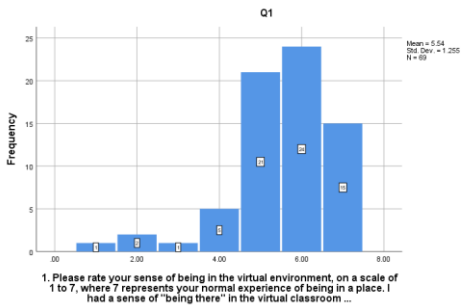
	5.00	23	33.3	33.3	60.9
	6.00	13	18.8	18.8	79.7
	Somewhere that I visited	14	20.3	20.3	100.0
	Total	69	100.0	100.0	

4.During the time of the experience, which was the strongest on the whole, your sense of being in the virtual classroom environment or of being elsewhere?

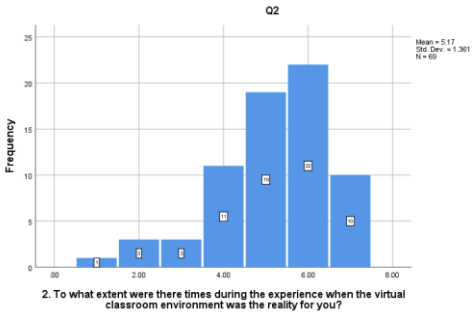
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Being elsewhere	1	1.4	1.4	1.4
	2.00	2	2.9	2.9	4.3
	3.00	7	10.1	10.1	14.5
	Neutral	4	5.8	5.8	20.3
	5.00	18	26.1	26.1	46.4
	6.00	23	33.3	33.3	79.7
	Being in the classroom space	14	20.3	20.3	100.0
	Total	69	100.0	100.0	

5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?

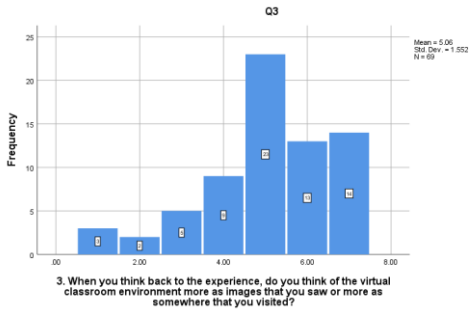
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	1	1.4	1.4	1.4
	2.00	5	7.2	7.2	8.7
	3.00	4	5.8	5.8	14.5
	Neutral	12	17.4	17.4	31.9
	5.00	19	27.5	27.5	59.4
	6.00	14	20.3	20.3	79.7
	Very much so	14	20.3	20.3	100.0
	Total	69	100.0	100.0	



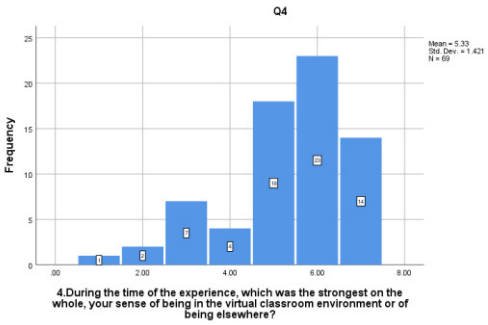
1. Please rate your sense of being in the virtual environment, on a scale of 1 to 7, where 7 represents your normal experience of being in a place. I had a sense of "being there" in the virtual classroom ...



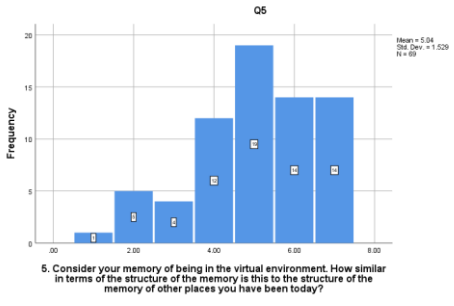
2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?



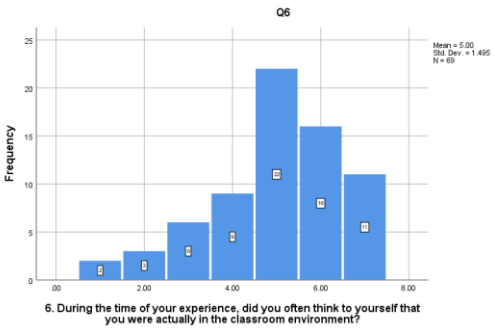
3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?



4.During the time of the experience, which was the strongest on the whole, your sense of being in the virtual classroom environment or of being elsewhere?



5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?



6. During the time of your experience, did you often think to yourself that you were actually in the classroom environment?

APPENDIX D-8-20

Kruskal-Wallis H test mean scores table for Presence scale items

	Ranks		
	Group	N	Mean Rank
1. Please rate your sense of being in the virtual environment, on a scale of 1 to 7, where 7 represents your normal experience of being in a place. I had a sense of "being there" in the virtual classroom ...	Teacher perspective	23	29.24
	Teacher-Student with a prosthetic leg	23	36.70
	Teacher-Student Refugee-Student prosthetic leg	23	39.07
	Total	69	
2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?	Teacher perspective	23	32.61
	Teacher-Student with a prosthetic leg	23	34.02
	Teacher-Student Refugee-Student prosthetic leg	23	38.37
	Total	69	
3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?	Teacher perspective	23	30.83
	Teacher-Student with a prosthetic leg	23	35.37
	Teacher-Student Refugee-Student prosthetic leg	23	38.80
	Total	69	
4. During the time of the experience, which was the strongest, on the whole, your sense of being in the virtual classroom environment or of being elsewhere?	Teacher perspective	23	27.63
	Teacher-Student with a prosthetic leg	23	35.26
	Teacher-Student Refugee-Student prosthetic leg	23	42.11
	Total	69	
5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?	Teacher perspective	23	31.26
	Teacher-Student with a prosthetic leg	23	33.85
	Teacher-Student Refugee-Student prosthetic leg	23	39.89
	Total	69	
	Teacher perspective	23	31.39
	Teacher-Student with a prosthetic leg	23	36.15

6. During the time of your experience, did you often think to yourself that you were actually in the classroom environment?	Teacher-Student Refugee-Student prosthetic leg	23	37.46
	Total	69	

APPENDIX D-8-21

Embodiment Scale – Frequency tables

Q1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely disagree	3	4.3	4.3	4.3
	Disagree	13	18.8	18.8	23.2
	Undecided	17	24.6	24.6	47.8
	Agree	29	42.0	42.0	89.9
	Completely agree	7	10.1	10.1	100.0
	Total	69	100.0	100.0	

Q2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely disagree	3	4.3	4.3	4.3
	Disagree	10	14.5	14.5	18.8
	Undecided	14	20.3	20.3	39.1
	Agree	31	44.9	44.9	84.1
	Completely agree	11	15.9	15.9	100.0
	Total	69	100.0	100.0	

Q3. I felt that the virtual body was mine. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely agree	3	4.3	4.3	4.3
	Agree	14	20.3	20.3	24.6
	Undecided	12	17.4	17.4	42.0
	Disagree	29	42.0	42.0	84.1
	Completely disagree	11	15.9	15.9	100.0
	Total	69	100.0	100.0	

Q4. During the experiment, there were moments when I felt I had more than one body.

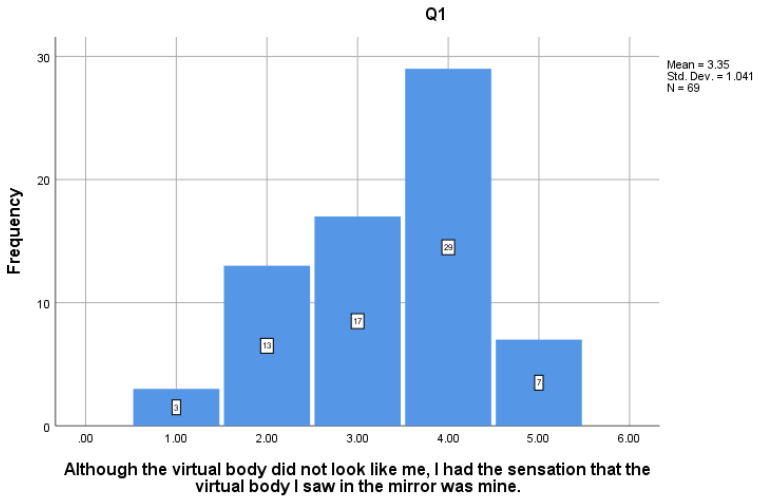
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely disagree	17	24.6	24.6	24.6
	Disagree	15	21.7	21.7	46.4
	Undecided	11	15.9	15.9	62.3
	Agree	22	31.9	31.9	94.2
	Completely agree	4	5.8	5.8	100.0
	Total	69	100.0	100.0	

5. I felt that I controlled the avatar as if it were my body.

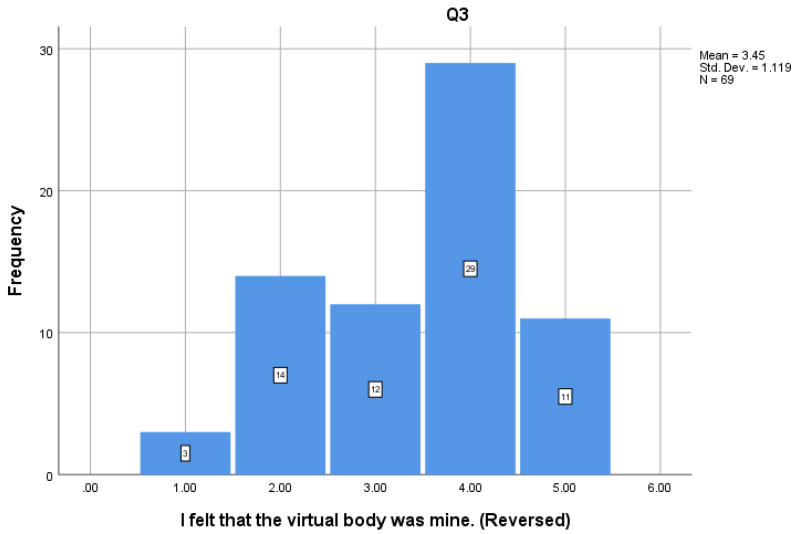
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely disagree	3	4.3	4.3	4.3
	Disagree	13	18.8	18.8	23.2
	Undecided	17	24.6	24.6	47.8
	Agree	31	44.9	44.9	92.8
	Completely agree	5	7.2	7.2	100.0
	Total	69	100.0	100.0	

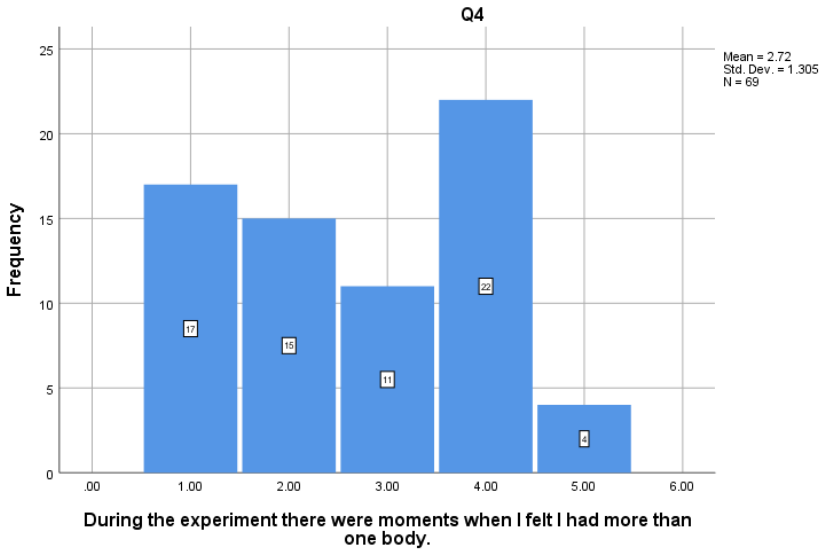
6. The virtual body moved according to my movements.

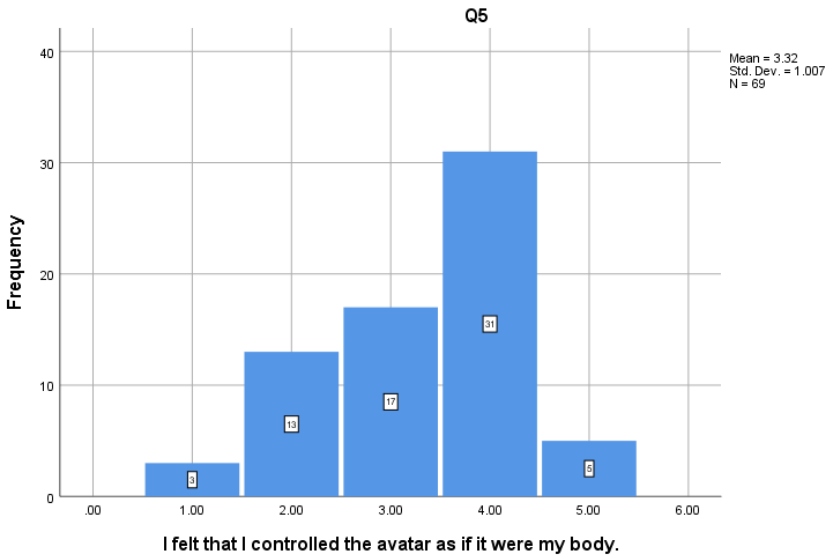
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely disagree	8	11.6	11.6	11.6
	Disagree	12	17.4	17.4	29.0
	Undecided	14	20.3	20.3	49.3
	Agree	21	30.4	30.4	79.7
	Completely agree	14	20.3	20.3	100.0
	Total	69	100.0	100.0	

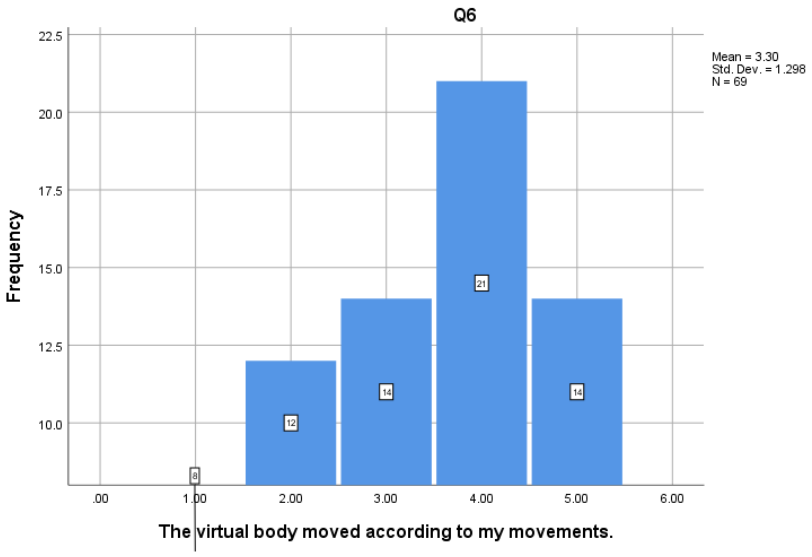

Q1
Mean = 3.35
Std. Dev. = 1.041
N = 69
Frequency
30
20
10
0
3
13
17
29
7
.00
1.00
2.00
3.00
4.00
5.00
6.00
Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.

Q2
Mean = 3.54
Std. Dev. = 1.065
N = 69
Frequency
40
30
20
10
0
3
10
14
31
11
.00
1.00
2.00
3.00
4.00
5.00
6.00
Although the virtual body did not look like me, when I looked at my body I had the sensation that it was mine.


Q3
Mean = 3.45
Std. Dev. = 1.119
N = 69
Frequency
30
20
10
0
3
14
12
29
11
.00
1.00
2.00
3.00
4.00
5.00
6.00
I felt that the virtual body was mine. (Reversed)


Q4
Mean = 2.72
Std. Dev. = 1.305
N = 69
Frequency
25
20
15
10
5
0
17
15
11
22
4
.00
1.00
2.00
3.00
4.00
5.00
6.00
During the experiment there were moments when I felt I had more than one body.


Q5
Mean = 3.32
Std. Dev. = 1.007
N = 69
Frequency
40
30
20
10
0
3
13
17
31
6
.00
1.00
2.00
3.00
4.00
5.00
6.00
I felt that I controlled the avatar as if it were my body.


Q6
Mean = 3.30
Std. Dev. = 1.298
N = 69
Frequency
22.5
20.0
17.5
15.0
12.5
10.0
8
12
14
21
14
.00
1.00
2.00
3.00
4.00
5.00
6.00
The virtual body moved according to my movements.

APPENDIX D-8-22

Kruskal-Wallis H test mean scores table for Embodiment scale items

Ranks			
	Group	N	Mean Rank
1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.	Teacher perspective	23	26.00
	Teacher-Student with a prosthetic leg	23	38.74
	Teacher-Student Refugee-Student prosthetic leg	23	40.26
	Total	69	
2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.	Teacher perspective	23	28.22
	Teacher-Student with a prosthetic leg	23	37.78
	Teacher-Student Refugee-Student prosthetic leg	23	39.00
	Total	69	
3_I felt that the virtual body was mine_(Reversed)	Teacher perspective	23	33.61
	Teacher-Student with a prosthetic leg	23	33.15
	Teacher-Student Refugee-Student prosthetic leg	23	38.24
	Total	69	
4. During the experiment, there were moments when I felt I had more than one body.	Teacher perspective	23	27.39
	Teacher-Student with a prosthetic leg	23	39.74
	Teacher-Student Refugee-Student prosthetic leg	23	37.87
	Total	69	
5. I felt that I controlled the avatar as if it were my body.	Teacher perspective	23	30.65
	Teacher-Student with a prosthetic leg	23	36.26
	Teacher-Student Refugee-Student prosthetic leg	23	38.09
	Total	69	
6. The virtual body moved according to my movements.	Teacher perspective	23	36.50
	Teacher-Student with a prosthetic leg	23	33.52
	Teacher-Student Refugee-Student prosthetic leg	23	34.98
	Total	69	

APPENDIX D-8-23

Frequency tables for the first section of Part VI

1. I was worried when the virtual students narrated their stories.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	1.4	1.4	1.4
	Undecided	6	8.7	8.7	10.1
	Agree	36	52.2	52.2	62.3
	Completely agree	26	37.7	37.7	100.0
	Total	69	100.0	100.0	

2. I see the need to understand the virtual students' problems. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely agree	1	1.4	1.4	1.4
	Agree	2	2.9	2.9	4.3
	Disagree	30	43.5	43.5	47.8
	Completely disagree	36	52.2	52.2	100.0
	Total	69	100.0	100.0	

3. I felt emotionally attached to my own virtual character/representation.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely disagree	1	1.4	1.4	1.4
	Disagree	6	8.7	8.7	10.1
	Undecided	22	31.9	31.9	42.0
	Agree	27	39.1	39.1	81.2
	Completely agree	13	18.8	18.8	100.0
	Total	69	100.0	100.0	

4. I showed much interest or concern regarding the problem(s) I experienced. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely agree	5	7.2	7.2	7.2
	Agree	23	33.3	33.3	40.6
	Neutral	5	7.2	7.2	47.8
	Disagree	17	24.6	24.6	72.5

	Completely disagree	19	27.5	27.5	100.0
	Total	69	100.0	100.0	

5. I made an effort to understand the problem I was facing. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely agree	1	1.4	1.4	1.4
	Agree	7	10.1	10.1	11.6
	Neutral	4	5.8	5.8	17.4
	Disagree	24	34.8	34.8	52.2
	Completely disagree	33	47.8	47.8	100.0
	Total	69	100.0	100.0	

6. I tried to put myself in the position of the virtual character in an effort to empathize with his problem.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	4	5.8	5.8	5.8
	Undecided	5	7.2	7.2	13.0
	Agree	37	53.6	53.6	66.7
	Completely agree	23	33.3	33.3	100.0
	Total	69	100.0	100.0	

7. It was easy for me to see things from the virtual character's perspective. (Reversed)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely agree	3	4.3	4.3	4.3
	Agree	9	13.0	13.0	17.4
	Neutral	11	15.9	15.9	33.3
	Disagree	26	37.7	37.7	71.0
	Completely disagree	20	29.0	29.0	100.0
	Total	69	100.0	100.0	

APPENDIX D-8-24

Frequency tables for the second section of Part VI

1. The virtual environment seemed suitable for practical training.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely disagree	1	1.4	1.4	1.4
	Undecided	9	13.0	13.0	14.5
	Agree	34	49.3	49.3	63.8
	Completely agree	25	36.2	36.2	100.0
	Total	69	100.0	100.0	

2. Eye-tracking interaction was particularly easy.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree?	2	2.9	2.9	2.9
	Undecided	6	8.7	8.7	11.6
	Agree	19	27.5	27.5	39.1
	Completely agree	42	60.9	60.9	100.0
	Total	69	100.0	100.0	

3. I would prefer to interact within the virtual world via a hand-held controller.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Completely disagree	21	30.4	30.4	30.4
	Disagree?	19	27.5	27.5	58.0
	Undecided	16	23.2	23.2	81.2
	Agree	9	13.0	13.0	94.2
	Completely agree	4	5.8	5.8	100.0
	Total	69	100.0	100.0	

4. The school classroom virtual (reality) simulation was satisfactorily realistic.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree?	3	4.3	4.3	4.3
	Undecided	20	29.0	29.0	33.3
	Agree	33	47.8	47.8	81.2

	Completely agree	13	18.8	18.8	100.0
	Total	69	100.0	100.0	

5. I found virtual reality user-friendly.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Undecided	2	2.9	2.9	2.9
	Agree	22	31.9	31.9	34.8
	Completely agree	45	65.2	65.2	100.0
	Total	69	100.0	100.0	

6. Sound quality was

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very poor	2	2.9	2.9	2.9
	Poor	3	4.3	4.3	7.2
	Acceptable	15	21.7	21.7	29.0
	Good	31	44.9	44.9	73.9
	Very good	18	26.1	26.1	100.0
	Total	69	100.0	100.0	

APPENDIX D-8-25

Test of Normality for scale items of Part IV of the post-questionnaire

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
1. I was worried when the virtual students narrated their stories.	.273	69	.000	.780	69	.000
2. I see the need to understand the virtual students' problems. (Reversed)	.295	69	.000	.653	69	.000
3. I felt emotionally attached to the to my own virtual character/representation.	.225	69	.000	.888	69	.000
4. I showed much interest or concern regarding the problem(s) I experienced. (Reversed)	.237	69	.000	.847	69	.000
5. I made an effort to understand the problem I was facing. (Reversed)	.267	69	.000	.757	69	.000
6. I tried to put myself in the position of the virtual character in an effort to empathize with his problem.	.297	69	.000	.777	69	.000
7. It was easy for me to see things from the virtual character's perspective. (Reversed)	.257	69	.000	.861	69	.000
1. The virtual environment seemed suitable for practical training.	.259	69	.000	.782	69	.000
2. Eye-tracking interaction was particularly easy.	.363	69	.000	.700	69	.000
3. I would prefer to interact within the virtual world via a hand-held controller.	.197	69	.000	.877	69	.000
4. Sound quality was	.265	69	.000	.849	69	.000
5. The school classroom virtual (reality) simulation was satisfactorily realistic.	.261	69	.000	.855	69	.000
6. I found virtual reality user-friendly.	.407	69	.000	.651	69	.000

1. The use of virtual reality may facilitate the increase in empathy.	.330	69	.000	.734	69	.000
2. Virtual reality can easier cultivate empathy than conventional traditional learning, as virtual reality offers the opportunity to experience a situation from someone else's point of view for the users.	.270	69	.000	.788	69	.000
If you could choose between conducting an educational activity in a real-life classroom environment and in a 3D virtual classroom environment, which would you choose?	.189	69	.000	.868	69	.000
Overall, how pleasant would you characterize the virtual training activity?	.296	69	.000	.784	69	.000

a. Lilliefors Significance Correction

APPENDIX D-8-26

Table of correlations regarding the variables ‘give advice to the virtual students’

Correlations

		Advice to student 1	Advice to student 2	Advice to student 3	Advice to student 4	Advice to student 5
Advice to student 1	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	69				
Advice to student 2	Pearson Correlation	.887**	1			
	Sig. (2-tailed)	.000				
	N	69	69			
Advice to student 3	Pearson Correlation	.695**	.880**	1		
	Sig. (2-tailed)	.000	.000			
	N	69	69	69		
Advice to student 4	Pearson Correlation	.721**	.630**	.550**	1	
	Sig. (2-tailed)	.000	.000	.000		
	N	69	69	69	69	
Advice to student 5	Pearson Correlation	.620**	.504**	.357**	.891**	1
	Sig. (2-tailed)	.000	.000	.003	.000	
	N	69	69	69	69	69

**. Correlation is significant at the 0.01 level (2-tailed).

APPENDIX D-8-27

Table of correlations regarding pre-emotional scale

		Pre-Afraid	Pre-Interested	Pre-Active	Pre-Nervous	Pre-Inspired	Pre- Sad	Pre- Upset	Pre- Calm	Pre-Confident	Pre- Tired	Pre-Ashamed	Pre-Excited	Pre- Strong	Pre- Alert	Pre-Downhearted	Pre-Relaxed	Pre-Determined	Pre-Concentrated
Pre-Afraid	Pearson Correlation	1																	
	Sig. (2-tailed)																		
	N	69																	
Pre-Interested	Pearson Correlation	.141	1																
	Sig. (2-tailed)	.248																	
	N	69	69																
Pre- Active	Pearson Correlation	.229	.432**	1															
	Sig. (2-tailed)	.059	.000																
	N	69	69	69															
Pre- Nervous	Pearson Correlation	.505**	-.043	-.024	1														
	Sig. (2-tailed)	.000	.723	.842															
	N	69	69	69	69														
Pre- Inspired	Pearson Correlation	.294*	.505**	.492**	-.034	1													
	Sig. (2-tailed)	.014	.000	.000	.780														
	N	69	69	69	69	69													
Pre- Sad	Pearson Correlation	.249*	-.012	-.166	.359**	-.183	1												
	Sig. (2-tailed)	.039	.925	.174	.002	.133													
	N	69	69	69	69	69	69												

Pre- Upset	Pearson Correlation	.227	-.011	.037	.525**	-.046	.314**	1											
	Sig. (2-tailed)	.061	.925	.765	.000	.706	.009												
	N	69	69	69	69	69	69	69											
Pre- Calm	Pearson Correlation	.399**	.279*	.212	.422**	.197	.236	.443**	1										
	Sig. (2-tailed)	.001	.020	.081	.000	.104	.051	.000											
	N	69	69	69	69	69	69	69	69										
Pre- Confident	Pearson Correlation	.485**	.462**	.391**	.201	.553**	.050	.263*	.518**	1									
	Sig. (2-tailed)	.000	.000	.001	.098	.000	.686	.029	.000										
	N	69	69	69	69	69	69	69	69	69									
Pre- Tired	Pearson Correlation	.117	.158	.120	.190	.020	.393**	.170	.263*	.069	1								
	Sig. (2-tailed)	.338	.194	.327	.118	.870	.001	.164	.029	.571									
	N	69	69	69	69	69	69	69	69	69	69								
Pre- Ashamed	Pearson Correlation	.469**	.078	.156	.218	.085	.110	.110	.250*	.301*	.036	1							
	Sig. (2-tailed)	.000	.524	.202	.072	.489	.369	.370	.038	.012	.769								
	N	69	69	69	69	69	69	69	69	69	69	69							
Pre- Excited	Pearson Correlation	.185	.617**	.531**	.095	.494**	.084	.002	.239*	.280*	.221	.022	1						
	Sig. (2-tailed)	.128	.000	.000	.436	.000	.495	.985	.048	.020	.068	.860							
	N	69	69	69	69	69	69	69	69	69	69	69	69						
Pre- Strong	Pearson Correlation	.352**	.508**	.576**	.010	.548**	-.066	.084	.435**	.614**	.265*	.193	.522**	1					
	Sig. (2-tailed)	.003	.000	.000	.936	.000	.590	.494	.000	.000	.028	.111	.000						
	N	69	69	69	69	69	69	69	69	69	69	69	69	69					

Pre- Alert	Pearson Correlation	.316**	.443**	.616**	-.016	.490**	.050	.031	.161	.317**	.319**	.231	.407**	.494**	1				
	Sig. (2-tailed)	.008	.000	.000	.895	.000	.681	.798	.187	.008	.007	.056	.001	.000					
	N	69	69	69	69	69	69	69	69	69	69	69	69	69	69				
Pre- Downhearted	Pearson Correlation	-.033	.004	-.249*	.105	-.052	.614**	.045	.158	-.022	.240*	.105	.026	-.191	-.020	1			
	Sig. (2-tailed)	.786	.974	.039	.388	.669	.000	.716	.195	.860	.047	.391	.833	.116	.868				
	N	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69			
Pre- Relaxed	Pearson Correlation	.144	.178	.248*	.254*	.068	.200	.309**	.486**	.265*	.646**	.022	.308*	.353**	.212	.114	1		
	Sig. (2-tailed)	.236	.143	.040	.035	.581	.100	.010	.000	.028	.000	.856	.010	.003	.080	.350			
	N	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69		
Pre- Determined	Pearson Correlation	.315**	.474**	.459**	-.003	.450**	.106	.141	.397**	.579**	.265*	.257*	.430**	.712**	.570**	.042	.283*	1	
	Sig. (2-tailed)	.008	.000	.000	.982	.000	.384	.248	.001	.000	.028	.033	.000	.000	.000	.731	.018		
	N	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	
Pre- Concentrated	Pearson Correlation	.229	.308*	.231	.168	.279*	.250*	.191	.501**	.396**	.224	.129	.242*	.265*	.322**	.388**	.377**	.422**	1
	Sig. (2-tailed)	.058	.010	.056	.168	.020	.038	.115	.000	.001	.065	.290	.045	.028	.007	.001	.001	.000	
	N	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

APPENDIX D-8-28

Table of correlations regarding post-emotional scale

		Post-Afraid	Post-Interested	Post-Active	Post-Nervous	Post-Inspired	Post-Sad	Post-Upset	Post-Calm	Post-Confident	Post-Tired	Post-Ashamed	Post-Excited	Post-Strong	Post-Alert	Post-Downhearted	Post-Relaxed	Post-Determined	Post-Concentrated
Post-Afraid	Pearson Correlation	1																	
	Sig. (2-tailed)																		
	N	69																	
Post-Interested	Pearson Correlation	.327**	1																
	Sig. (2-tailed)	.006																	
	N	69	69																
Post-Active	Pearson Correlation	.159	.597**	1															
	Sig. (2-tailed)	.191	.000																
	N	69	69	69															
Post-Nervous	Pearson Correlation	.485**	.240*	.143	1									≑					
	Sig. (2-tailed)	.000	.047	.242															
	N	69	69	69	69														
Post-Inspired	Pearson Correlation	.213	.626**	.716**	.260*	1													
	Sig. (2-tailed)	.080	.000	.000	.031														
	N	69	69	69	69	69													
Post-Sad	Pearson Correlation	.306*	.223	-.009	.157	.004	1												
	Sig. (2-tailed)	.011	.065	.942	.196	.976													
	N	69	69	69	69	69	69												

Post-Upset	Pearson Correlation	.365**	.261*	.086	.472**	.122	.532**	1											
	Sig. (2-tailed)	.002	.030	.483	.000	.317	.000												
	N	69	69	69	69	69	69	69											
Post-Calm	Pearson Correlation	.211	.200	.347**	.470**	.427**	.147	.481**	1										
	Sig. (2-tailed)	.082	.100	.004	.000	.000	.228	.000											
	N	69	69	69	69	69	69	69	69										
Post-Confident	Pearson Correlation	.210	.492**	.598**	.271*	.632**	.096	.175	.415**	1									
	Sig. (2-tailed)	.084	.000	.000	.025	.000	.432	.150	.000										
	N	69	69	69	69	69	69	69	69	69									
Post-Tired	Pearson Correlation	.368**	.238*	.201	.306*	.156	.081	.407**	.267*	.182	1								
	Sig. (2-tailed)	.002	.049	.097	.011	.199	.508	.001	.027	.134									
	N	69	69	69	69	69	69	69	69	69	69								
Post-Ashamed	Pearson Correlation	.281*	.220	.265*	.058	.093	.534**	.386**	.183	.221	.170	1							
	Sig. (2-tailed)	.019	.069	.028	.637	.445	.000	.001	.132	.068	.163								
	N	69	69	69	69	69	69	69	69	69	69	69							
Post-Excited	Pearson Correlation	.258*	.538**	.600**	.387**	.539**	.392**	.316**	.493**	.581**	.229	.341**	1						
	Sig. (2-tailed)	.032	.000	.000	.001	.000	.001	.008	.000	.000	.059	.004							
	N	69	69	69	69	69	69	69	69	69	69	69	69						

Post-Strong	Pearson Correlation	.146	.442**	.519**	.192	.415**	.152	.095	.328**	.594**	.212	.306*	.586**	1				
	Sig. (2-tailed)	.230	.000	.000	.115	.000	.212	.436	.006	.000	.081	.010	.000					
	N	69	69	69	69	69	69	69	69	69	69	69	69	69				
Post-Alert	Pearson Correlation	.114	.510**	.665**	.152	.505**	.222	.051	.284*	.507**	.187	.324**	.669**	.597**	1			
	Sig. (2-tailed)	.350	.000	.000	.213	.000	.067	.677	.018	.000	.124	.007	.000	.000				
	N	69	69	69	69	69	69	69	69	69	69	69	69	69	69			
Post-Downhearted	Pearson Correlation	.295*	.247*	.134	.093	.117	.418**	.348**	.096	.155	.275*	.355**	.416**	.176	.264*	1		
	Sig. (2-tailed)	.014	.041	.273	.447	.340	.000	.003	.433	.204	.022	.003	.000	.149	.028			
	N	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69		
Post-Relaxed	Pearson Correlation	.241*	.105	.234	.284*	.127	.162	.133	.302*	.124	.445**	.141	.357**	.303*	.376**	.209	1	
	Sig. (2-tailed)	.046	.392	.053	.018	.297	.183	.277	.012	.311	.000	.248	.003	.011	.001	.085		
	N	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	
Post-Determined	Pearson Correlation	.180	.492**	.647**	.280*	.532**	.107	.249*	.343**	.560**	.274*	.329**	.560**	.528**	.586**	.232	.266*	1
	Sig. (2-tailed)	.139	.000	.000	.020	.000	.381	.039	.004	.000	.023	.006	.000	.000	.000	.056	.027	
	N	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69
Post-Concentrated	Pearson Correlation	.275*	.423**	.503**	.458**	.392**	.214	.345**	.391**	.311**	.296*	.375**	.528**	.395**	.407**	.270*	.354**	.489**
	Sig. (2-tailed)	.022	.000	.000	.000	.001	.078	.004	.001	.009	.014	.001	.000	.001	.001	.025	.003	.000
	N	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

APPENDIX D-8-29

Table of correlations regarding presence scale

Correlations

		1. Please rate your sense of being in the virtual environment, on a scale of 1 to 7, where 7 represents your normal experience of being in a place. I had a sense of "being there" in the virtual classroom ...	2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?	3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?	4.During the time of the experience, which was the strongest on the whole, your sense of being in the virtual classroom environment or of being elsewhere?	5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?	6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?
1. Please rate your sense of being in the virtual environment, on a scale of 1 to 7, where 7 represents your normal experience of being in a place. I had a sense of "being there" in the virtual classroom ...	Pearson Correlation	1					
	Sig. (2-tailed)						
	N	69					
2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?	Pearson Correlation	.702**	1				
	Sig. (2-tailed)	.000					
	N	69	69				
3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?	Pearson Correlation	.520**	.657**	1			
	Sig. (2-tailed)	.000	.000				
	N	69	69	69			
4.During the time of the experience, which was the strongest on the whole, your sense of being in the virtual classroom environment or of being elsewhere?	Pearson Correlation	.558**	.624**	.638**	1		
	Sig. (2-tailed)	.000	.000	.000			
	N	69	69	69	69		
5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?	Pearson Correlation	.509**	.569**	.458**	.569**	1	
	Sig. (2-tailed)	.000	.000	.000	.000		
	N	69	69	69	69	69	
6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?	Pearson Correlation	.627**	.701**	.729**	.568**	.412**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	69	69	69	69	69	69

**. Correlation is significant at the 0.01 level (2-tailed).

APPENDIX D-8-30

Table of correlations regarding embodiment scale

		1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.	2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.	3. I felt that the virtual body was not mine.	4. During the experiment, there were moments when I felt I had more than one body.	5. I felt that I controlled the avatar as if it were my body.	6. The virtual body moved according to my movements.
1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.	Pearson Correlation	1					
	Sig. (2-tailed)						
	N	69					
2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.	Pearson Correlation	.798**	1				
	Sig. (2-tailed)	.000					
	N	69	69				
3. I felt that the virtual body was not mine.	Pearson Correlation	-.559**	-.548**	1			
	Sig. (2-tailed)	.000	.000				
	N	69	69	69			

4. During the experiment, there were moments when I felt I had more than one body.	Pearson Correlation	.126	.140	.166	1		
	Sig. (2-tailed)	.303	.253	.173			
	N	69	69	69	69		
5. I felt that I controlled the avatar as if it were my body.	Pearson Correlation	.791**	.798**	-.537**	.079	1	
	Sig. (2-tailed)	.000	.000	.000	.519		
	N	69	69	69	69	69	
6. The virtual body moved according to my movements.	Pearson Correlation	.345**	.561**	-.472**	.059	.465**	1
	Sig. (2-tailed)	.004	.000	.000	.631	.000	
	N	69	69	69	69	69	69

**. Correlation is significant at the 0.01 level (2-tailed).

APPENDIX D-8-31

Table of correlations regarding pre-emotions and post-emotions

		Pre- Interested	Pre- Active
Pre-Interested	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	69	
Pre-Active	Pearson Correlation	.432**	1
	Sig. (2-tailed)	.000	
	N	69	69
Post-Interested	Pearson Correlation	.671**	.376**
	Sig. (2-tailed)	.000	.001
	N	69	69
Post-Active	Pearson Correlation	.542**	.498**
	Sig. (2-tailed)	.000	.000
	N	69	69
Post-Nervous	Pearson Correlation	.224	.170
	Sig. (2-tailed)	.065	.162
	N	69	69
Post-Inspired	Pearson Correlation	.465**	.448**
	Sig. (2-tailed)	.000	.000
	N	69	69
Post-Sad	Pearson Correlation	.385**	.091
	Sig. (2-tailed)	.001	.455
	N	69	69
Post-Upset	Pearson Correlation	.322**	.046
	Sig. (2-tailed)	.007	.710
	N	69	69
Post-Calm	Pearson Correlation	.320**	.175
	Sig. (2-tailed)	.007	.151
	N	69	69
Post-Confident	Pearson Correlation	.483**	.486**

	Sig. (2-tailed)	.000	.000
	N	69	69
Post-Tired	Pearson Correlation	.168	.084
	Sig. (2-tailed)	.168	.492
	N	69	69
Post-Ashamed	Pearson Correlation	.434**	.148
	Sig. (2-tailed)	.000	.224
	N	69	69
Post-Excited	Pearson Correlation	.518**	.387**
	Sig. (2-tailed)	.000	.001
	N	69	69
Post-Strong	Pearson Correlation	.409**	.391**
	Sig. (2-tailed)	.000	.001
	N	69	69
Post-Alert	Pearson Correlation	.584**	.496**
	Sig. (2-tailed)	.000	.000
	N	69	69
Post-Downhearted	Pearson Correlation	.301*	-.017
	Sig. (2-tailed)	.012	.893
	N	69	69
Post-Relaxed	Pearson Correlation	.150	.111
	Sig. (2-tailed)	.219	.364
	N	69	69
Post-Determined	Pearson Correlation	.426**	.405**
	Sig. (2-tailed)	.000	.001
	N	69	69
Post-Concentrated	Pearson Correlation	.348**	.330**
	Sig. (2-tailed)	.003	.006
	N	69	69

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

		Pre-Inspired	Pre- Confident
Pre-Inspired	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	69	
Pre-Confident	Pearson Correlation	.197	1
	Sig. (2-tailed)	.104	
	N	69	69
Post-Interested	Pearson Correlation	.490**	.374**
	Sig. (2-tailed)	.000	.002
	N	69	69
Post-Active	Pearson Correlation	.383**	.371**
	Sig. (2-tailed)	.001	.002
	N	69	69
Post-Nervous	Pearson Correlation	.028	.178
	Sig. (2-tailed)	.818	.143
	N	69	69
Post-Inspired	Pearson Correlation	.403**	.291*
	Sig. (2-tailed)	.001	.015
	N	69	69
Post-Sad	Pearson Correlation	.284*	.221
	Sig. (2-tailed)	.018	.068
	N	69	69
Post-Upset	Pearson Correlation	.067	.147
	Sig. (2-tailed)	.587	.229
	N	69	69
Post-Calm	Pearson Correlation	.198	.415**
	Sig. (2-tailed)	.103	.000
	N	69	69
Post-Confident	Pearson Correlation	.414**	.595**
	Sig. (2-tailed)	.000	.000
	N	69	69
Post-Tired	Pearson Correlation	-.038	.021

	Sig. (2-tailed)	.758	.866
	N	69	69
Post-Ashamed	Pearson Correlation	.216	.185
	Sig. (2-tailed)	.075	.127
	N	69	69
Post-Excited	Pearson Correlation	.395**	.381**
	Sig. (2-tailed)	.001	.001
	N	69	69
Post-Strong	Pearson Correlation	.351**	.374**
	Sig. (2-tailed)	.003	.002
	N	69	69
Post-Alert	Pearson Correlation	.530**	.435**
	Sig. (2-tailed)	.000	.000
	N	69	69
Post-Downhearted	Pearson Correlation	.045	.126
	Sig. (2-tailed)	.713	.300
	N	69	69
Post-Relaxed	Pearson Correlation	.031	.243*
	Sig. (2-tailed)	.800	.044
	N	69	69
Post-Determined	Pearson Correlation	.318**	.434**
	Sig. (2-tailed)	.008	.000
	N	69	69
Post-Concentrated	Pearson Correlation	.269*	.376**
	Sig. (2-tailed)	.025	.001
	N	69	69

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

		Pre-Excited	Pre-Strong	Pre-Alert
Pre-Excited	Pearson Correlation	1		
	Sig. (2-tailed)			

	N	69		
Pre-Strong	Pearson Correlation	.522**	1	
	Sig. (2-tailed)	.000		
	N	69	69	
Pre-Alert	Pearson Correlation	.407**	.494**	1
	Sig. (2-tailed)	.001	.000	
	N	69	69	69
Post-Interested	Pearson Correlation	.521**	.516**	.415**
	Sig. (2-tailed)	.000	.000	.000
	N	69	69	69
Post-Active	Pearson Correlation	.364**	.474**	.470**
	Sig. (2-tailed)	.002	.000	.000
	N	69	69	69
Post-Nervous	Pearson Correlation	.198	.157	.147
	Sig. (2-tailed)	.104	.199	.229
	N	69	69	69
Post-Inspired	Pearson Correlation	.315**	.364**	.399**
	Sig. (2-tailed)	.008	.002	.001
	N	69	69	69
Post-Sad	Pearson Correlation	.350**	.236	.111
	Sig. (2-tailed)	.003	.051	.364
	N	69	69	69
Post-Upset	Pearson Correlation	.345**	.035	.060
	Sig. (2-tailed)	.004	.776	.626
	N	69	69	69
Post-Calm	Pearson Correlation	.173	.250*	.229
	Sig. (2-tailed)	.155	.038	.059
	N	69	69	69
Post-Confident	Pearson Correlation	.214	.552**	.358**
	Sig. (2-tailed)	.078	.000	.003
	N	69	69	69
Post-Tired	Pearson Correlation	.104	.097	.191

	Sig. (2-tailed)	.396	.428	.115
	N	69	69	69
Post-Ashamed	Pearson Correlation	.227	.175	.122
	Sig. (2-tailed)	.060	.151	.318
	N	69	69	69
Post-Excited	Pearson Correlation	.424**	.532**	.492**
	Sig. (2-tailed)	.000	.000	.000
	N	69	69	69
Post-Strong	Pearson Correlation	.374**	.664**	.308*
	Sig. (2-tailed)	.002	.000	.010
	N	69	69	69
Post-Alert	Pearson Correlation	.482**	.603**	.493**
	Sig. (2-tailed)	.000	.000	.000
	N	69	69	69
Post-Downhearted	Pearson Correlation	.202	.054	.046
	Sig. (2-tailed)	.096	.659	.706
	N	69	69	69
Post-Relaxed	Pearson Correlation	.251*	.233	.136
	Sig. (2-tailed)	.037	.054	.264
	N	69	69	69
Post-Determined	Pearson Correlation	.349**	.516**	.433**
	Sig. (2-tailed)	.003	.000	.000
	N	69	69	69
Post-Concentrated	Pearson Correlation	.259*	.379**	.377**
	Sig. (2-tailed)	.031	.001	.001
	N	69	69	69

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

		Pre-Relaxed	Pre-Determined	Pre-Concentrated
Pre-Relaxed	Pearson Correlation	1		
	Sig. (2-tailed)			

	N	69		
Pre-Determined	Pearson Correlation	.283*	1	
	Sig. (2-tailed)	.018		
	N	69	69	
Pre-Concentrated	Pearson Correlation	.377**	.422**	1
	Sig. (2-tailed)	.001	.000	
	N	69	69	69
Post-Interested	Pearson Correlation	.118	.499**	.201
	Sig. (2-tailed)	.336	.000	.097
	N	69	69	69
Post-Active	Pearson Correlation	.224	.505**	.098
	Sig. (2-tailed)	.065	.000	.422
	N	69	69	69
Post-Nervous	Pearson Correlation	.145	.226	.461**
	Sig. (2-tailed)	.236	.062	.000
	N	69	69	69
Post-Inspired	Pearson Correlation	.028	.364**	.079
	Sig. (2-tailed)	.822	.002	.518
	N	69	69	69
Post-Sad	Pearson Correlation	-.018	.051	.134
	Sig. (2-tailed)	.885	.675	.271
	N	69	69	69
Post-Upset	Pearson Correlation	.176	.043	.237*
	Sig. (2-tailed)	.148	.726	.050
	N	69	69	69
Post-Calm	Pearson Correlation	.262*	.281*	.183
	Sig. (2-tailed)	.030	.019	.133
	N	69	69	69
Post-Confident	Pearson Correlation	.062	.439**	.080
	Sig. (2-tailed)	.615	.000	.511
	N	69	69	69
Post-Tired	Pearson Correlation	.496**	.112	.190

	Sig. (2-tailed)	.000	.360	.117
	N	69	69	69
Post-Ashamed	Pearson Correlation	.047	.125	.188
	Sig. (2-tailed)	.699	.308	.121
	N	69	69	69
Post-Excited	Pearson Correlation	.170	.458**	.248*
	Sig. (2-tailed)	.164	.000	.040
	N	69	69	69
Post-Strong	Pearson Correlation	.195	.540**	.084
	Sig. (2-tailed)	.109	.000	.495
	N	69	69	69
Post-Alert	Pearson Correlation	.274*	.524**	.319**
	Sig. (2-tailed)	.023	.000	.008
	N	69	69	69
Post-Downhearted	Pearson Correlation	.105	-.023	.021
	Sig. (2-tailed)	.389	.854	.866
	N	69	69	69
Post-Relaxed	Pearson Correlation	.554**	.185	.305*
	Sig. (2-tailed)	.000	.127	.011
	N	69	69	69
Post-Determined	Pearson Correlation	.282*	.603**	.262*
	Sig. (2-tailed)	.019	.000	.030
	N	69	69	69
Post-Concentrated	Pearson Correlation	.215	.498**	.462**
	Sig. (2-tailed)	.076	.000	.000
	N	69	69	69

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

APPENDIX D-8-32

Table of correlations regarding pre-empathy scale

		1. I sometimes find no difficult to see things from the "other guy's person's" point of view.	2. I try to look at everybody's side of a problem before making a decision.	3. I sometimes try to understand other's better by imagining how things look from their perspective.	4. If I am sure I am right about something, I listen to other people's arguments.	5. I believe that there are two sides to every situation and try to look at them both.	6. When I am upset at someone, I usually try to "put myself in his shoes" for a while.	7. Before criticizing somebody, I try to imagine how I would feel if I were in their place.	8. I often feel very sorry for other people when they are having problems.	9. Other people's misfortunes usually disturb me a great deal.	10. When I see someone being treated unfairly, I often feel pity very much for them.	11. I am often quite touched by things that I see happen.	12. I would describe myself as a pretty soft-hearted person.	13. I do not feel sympathy for people who cause their own serious illnesses.	14. I am really interested in how other people feel.	15. When I see someone being taken advantage of, I feel kind of protective towards him\her.
1. I sometimes find no difficult to see things from the "other guy's person's" point of view.	Pearson Correlation	1														
	Sig. (2-tailed)															
	N	69														
2. I try to look at everybody's side of a problem before making a decision.	Pearson Correlation	.020	1													
	Sig. (2-tailed)	.871														
	N	69	69													
3. I sometimes try to understand other's better by imagining how things look from their perspective.	Pearson Correlation	.303*	.261*	1												
	Sig. (2-tailed)	.011	.030													
	N	69	69	69												
4. If I am sure I am right about something, I listen to other people's arguments.	Pearson Correlation	.139	-.026	.059	1											
	Sig. (2-tailed)	.256	.830	.629												
	N	69	69	69	69											
5. I believe that there are two sides to every situation and try to look at them both.	Pearson Correlation	.199	.248*	.434**	.244*	1										
	Sig. (2-tailed)	.102	.040	.000	.043											
	N	69	69	69	69	69										

6. When I am upset at someone, I usually try to "put myself in his shoes" for a while.	Pearson Correlation	.181	-.169	.214	.069	.213	1									
	Sig. (2-tailed)	.138	.164	.078	.573	.079										
	N	69	69	69	69	69	69									
7. Before criticizing somebody, I try to imagine how I would feel if I were in their place.	Pearson Correlation	.287*	.148	.506**	-.030	.253*	.338**	1								
	Sig. (2-tailed)	.018	.229	.000	.809	.038	.005									
	N	68	68	68	68	68	68	68								
8. I often feel very sorry for other people when they are having problems.	Pearson Correlation	.268*	.060	.093	.050	.074	.000	.161	1							
	Sig. (2-tailed)	.026	.626	.449	.681	.544	1.000	.191								
	N	69	69	69	69	69	69	68	69							
9. Other people's misfortunes usually disturb me a great deal.	Pearson Correlation	.079	.103	.069	.134	.045	-.027	.116	.533**	1						
	Sig. (2-tailed)	.516	.402	.574	.271	.714	.823	.346	.000							
	N	69	69	69	69	69	69	68	69	69						
10. When I see someone being treated unfairly, I often feel pity very much for them.	Pearson Correlation	.094	.137	.353**	.143	.181	-.021	.197	.461**	.542**	1					
	Sig. (2-tailed)	.441	.263	.003	.240	.137	.865	.108	.000	.000						
	N	69	69	69	69	69	69	68	69	69	69					
11. I am often quite touched by things that I see happen.	Pearson Correlation	-.306*	.183	-.021	-.137	-.014	-.210	.036	.142	.040	.165	1				
	Sig. (2-tailed)	.011	.133	.861	.261	.906	.083	.768	.246	.747	.176					
	N	69	69	69	69	69	69	68	69	69	69	69				
12. I would describe myself as a pretty soft-hearted person.	Pearson Correlation	.130	-.087	.311**	.070	.357**	.250*	.385**	.286*	.227	.354**	.268*	1			
	Sig. (2-tailed)	.287	.475	.009	.566	.003	.038	.001	.017	.061	.003	.026				
	N	69	69	69	69	69	69	68	69	69	69	69	69			
13. I do not feel sympathy for people who cause their own serious illnesses.	Pearson Correlation	.184	-.101	.197	.249*	-.027	.155	.186	.219	.152	.398**	-.139	.234	1		
	Sig. (2-tailed)	.130	.411	.104	.039	.825	.203	.128	.071	.213	.001	.255	.053			
	N	69	69	69	69	69	69	68	69	69	69	69	69	69		
14. I am really interested in how other people feel.	Pearson Correlation	-.021	-.080	.144	.192	.025	.134	.235	.357**	.286*	.495**	.137	.358**	.473**	1	
	Sig. (2-tailed)	.862	.515	.238	.113	.837	.271	.053	.003	.017	.000	.262	.003	.000		
	N	69	69	69	69	69	69	68	69	69	69	69	69	69	69	
15. When I see someone being taken advantage of, I feel kind of protective towards him\her.	Pearson Correlation	-.075	-.034	.073	.123	.037	.078	.311**	.221	.251*	.180	.208	.330**	-.026	.287*	1
	Sig. (2-tailed)	.539	.781	.553	.313	.762	.524	.010	.067	.037	.140	.087	.006	.833	.017	
	N	69	69	69	69	69	69	68	69	69	69	69	69	69	69	69

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

APPENDIX D-8-33

Table of correlations regarding post-empathy scale

		1. I sometimes find no difficult to see things from the "other guy's person's" point of view.	2. I try to look at everybody's side of a problem before making a decision.	3. I sometimes try to understand my other's better by imagining how things look from their perspective.	(Reversed) 4. If I am sure I am right about something, I listen to other people's arguments.	5. I believe that there are two sides to every situation and try to look at them both.	6. When I am upset at someone, I usually try to "put myself in his shoes" for a while.	7. Before criticizing somebody, I try to imagine how I would feel if I were in their place.	8. I often feel very sorry for other people when they are having problems.	9. Other people's misfortunes usually disturb me a great deal.	10. When I see someone being treated unfairly, I often feel pity very much for them.	11. I am often quite touched by things that I see happen.	12. I would describe myself as a pretty soft-hearted person.	13. I do not feel sympathy for people who cause their own serious illnesses.	14. I am really interested in how other people feel.	15. When I see someone being taken advantage of, I feel kind of protective towards him\her.
1. I sometimes find no difficult to see things from the "other guy's person's" point of view.	Pearson Correlation	1														
	Sig. (2-tailed)															
	N	69														
2. I try to look at everybody's side of a problem before making a decision.	Pearson Correlation	.122	1													
	Sig. (2-tailed)	.319														
	N	69	69													
3. I sometimes try to understand my other's better by imagining how things look from their perspective.	Pearson Correlation	.291*	.415**	1												
	Sig. (2-tailed)	.015	.000													
	N	69	69	69												
4. If I am sure I am right about something, I listen to other people's arguments.	Pearson Correlation	.374**	-.112	-.063	1											
	Sig. (2-tailed)	.002	.358	.609												
	N	69	69	69	69											

5. I believe that there are two sides to every situation and try to look at them both.	Pearson Correlation	.152	.281*	.359**	.078	1										
	Sig. (2-tailed)	.211	.019	.002	.523											
	N	69	69	69	69	69										
6. When I am upset at someone, I usually try to "put myself in his shoes" for a while.	Pearson Correlation	.010	.162	.445**	.220	.243*	1									
	Sig. (2-tailed)	.936	.184	.000	.069	.044										
	N	69	69	69	69	69	69									
7. Before criticizing somebody, I try to imagine how I would feel if I were in their place.	Pearson Correlation	.224	.508**	.477**	-.113	.348**	.390**	1								
	Sig. (2-tailed)	.064	.000	.000	.354	.003	.001									
	N	69	69	69	69	69	69	69								
8. I often feel very sorry for other people when they are having problems.	Pearson Correlation	.388**	.200	.169	.154	.179	.079	.183	1							
	Sig. (2-tailed)	.001	.100	.166	.207	.140	.516	.133								
	N	69	69	69	69	69	69	69	69							
9. Other people's misfortunes usually disturb me a great deal.	Pearson Correlation	.033	.171	.170	-.087	.128	.295*	.218	.339**	1						
	Sig. (2-tailed)	.787	.160	.164	.477	.295	.014	.072	.004							
	N	69	69	69	69	69	69	69	69	69						

10. When I see someone being treated unfairly, I often feel pity very much for them.	Pearson Correlation	.115	-.088	.160	.086	.023	.155	.192	.308*	.126	1					
	Sig. (2-tailed)	.345	.470	.188	.481	.854	.202	.114	.010	.302						
	N	69	69	69	69	69	69	69	69	69	69					
11. I am often quite touched by things that I see happen.	Pearson Correlation	-.126	.184	.039	.053	.015	.086	.021	-.008	.228	-.107	1				
	Sig. (2-tailed)	.304	.130	.750	.666	.900	.483	.865	.949	.059	.382					
	N	69	69	69	69	69	69	69	69	69	69	69				
12. I would describe myself as a pretty soft-hearted person.	Pearson Correlation	.158	.204	.460**	.230	.339**	.317**	.287*	.182	.332**	.039	.293*	1			
	Sig. (2-tailed)	.195	.093	.000	.057	.004	.008	.017	.135	.005	.748	.014				
	N	69	69	69	69	69	69	69	69	69	69	69	69			
13. I do not feel sympathy for people who cause their own serious illnesses.	Pearson Correlation	.108	.125	.124	.215	.008	.079	.102	.159	.181	.210	-.001	.244*	1		
	Sig. (2-tailed)	.379	.307	.308	.076	.949	.519	.403	.192	.137	.083	.993	.043			
	N	69	69	69	69	69	69	69	69	69	69	69	69	69		
14. I am really interested in how other people feel.	Pearson Correlation	.364**	.190	.308**	.214	.059	.049	.221	.251*	.317**	.136	.088	.544**	.247*	1	
	Sig. (2-tailed)	.002	.117	.010	.078	.632	.691	.069	.038	.008	.266	.471	.000	.041		
	N	69	69	69	69	69	69	69	69	69	69	69	69	69	69	
15. When I see someone being taken advantage of, I feel kind of protective towards him\her.	Pearson Correlation	.156	.473**	.345**	.010	.292*	.242*	.528**	.312**	.441**	.156	.355**	.515**	.296*	.425**	1
	Sig. (2-tailed)	.201	.000	.004	.933	.015	.045	.000	.009	.000	.201	.003	.000	.013	.000	
	N	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

APPENDIX D-8-34

Table of correlations between embodiment and presence scale

		1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.	2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.	3. I felt that the virtual body was not mine.	4. During the experiment there were moments when I felt I had more than one body.	5. I felt that I controlled the avatar as if it were my body.	6.The virtual body moved according to my movements.	1. I had a sense of "being there" in the virtual classroom ...	2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?	3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?	4.During the time of the experience, which was the strongest on the whole, your sense of being in the virtual classroom environment or of being elsewhere?	5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?	6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?
1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.	Pearson Correlation	1											
	Sig. (2-tailed)												
	N	69											
2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.	Pearson Correlation	.798**	1										
	Sig. (2-tailed)	.000											
	N	69	69										
3. I felt that the virtual body was not mine.	Pearson Correlation	-.559**	-.548**	1									
	Sig. (2-tailed)	.000	.000										
	N	69	69	69									

4. During the experiment there were moments when I felt I had more than one body.	Pearson Correlation	.126	.140	.166	1								
	Sig. (2-tailed)	.303	.253	.173									
	N	69	69	69	69								
5. I felt that I controlled the avatar as if it were my body.	Pearson Correlation	.791**	.798**	-.537**	.079	1							
	Sig. (2-tailed)	.000	.000	.000	.519								
	N	69	69	69	69	69							
6.The virtual body moved according to my movements.	Pearson Correlation	.345**	.561**	-.472**	.059	.465**	1						
	Sig. (2-tailed)	.004	.000	.000	.631	.000							
	N	69	69	69	69	69	69						
1. I had a sense of "being there" in the virtual classroom ...	Pearson Correlation	.519**	.387**	-.234	.118	.433**	.142	1					
	Sig. (2-tailed)	.000	.001	.053	.333	.000	.244						
	N	69	69	69	69	69	69	69					
2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?	Pearson Correlation	.621**	.401**	-.315**	-.006	.485**	.161	.702**	1				
	Sig. (2-tailed)	.000	.001	.008	.963	.000	.186	.000					
	N	69	69	69	69	69	69	69	69				

3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?	Pearson Correlation	.388**	.186	-.120	.102	.289*	-.045	.520**	.657**	1			
	Sig. (2-tailed)	.001	.127	.325	.402	.016	.711	.000	.000				
	N	69	69	69	69	69	69	69	69	69			
4.During the time of the experience, which was the strongest on the whole, your sense of being in the virtual classroom environment or of being elsewhere?	Pearson Correlation	.517**	.317**	-.311**	.026	.449**	.040	.558**	.624**	.638**	1		
	Sig. (2-tailed)	.000	.008	.009	.829	.000	.745	.000	.000	.000			
	N	69	69	69	69	69	69	69	69	69	69		
5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?	Pearson Correlation	.351**	.247*	-.126	-.001	.258*	.112	.509**	.569**	.458**	.569**	1	
	Sig. (2-tailed)	.003	.040	.302	.992	.032	.360	.000	.000	.000	.000		
	N	69	69	69	69	69	69	69	69	69	69	69	
6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?	Pearson Correlation	.595**	.351**	-.369**	.083	.479**	.129	.627**	.701**	.729**	.568**	.412**	1
	Sig. (2-tailed)	.000	.003	.002	.498	.000	.292	.000	.000	.000	.000	.000	
	N	69	69	69	69	69	69	69	69	69	69	69	69
**. Correlation is significant at the 0.01 level (2-tailed).													
*. Correlation is significant at the 0.05 level (2-tailed).													

APPENDIX D-8-35

Table of correlations between variables of Part IV

		1. I was worried when the virtual students narrated their stories.	2. I see the need to understand the virtual students' problems. (Reversed)	3. I felt emotionally attached to the to my own virtual character/representation.	4. I showed much interest or concern regarding the problem(s) I experienced. (Reversed)	5. I made an effort to understand the problem I was facing. (Reversed)	6. I tried to put myself in the position of the virtual character in an effort to empathize with his problem.	7. It was easy for me to see things from the virtual character's perspective. (Reversed)	8. The virtual environment seemed suitable for practical training.	9. Eye-tracking interaction was particularly easy.	10. I would prefer to interact within the virtual world via a hand-held controller.	11. Sound quality was	12. The school classroom virtual (reality) simulation was satisfactorily realistic.	13. I found virtual reality user-friendly.	14. The use of virtual reality may facilitate the increase of empathy.	15. Virtual reality can easier cultivate empathy than the conventional traditional learning, as virtual reality offers opportunity to experience a situation from someone else's point of view for the users.	16. If you could choose between conducting an educational activity in a real environment and in a 3D virtual environment, which would you choose?	17. Overall, how pleasant would you characterize the virtual training activity?
1. I was worried when the virtual students narrated their stories.	Pearson Correlation	1																
	Sig. (2-tailed)																	
	N	69																
2. I see the need to understand the virtual students' problems. (Reversed)	Pearson Correlation	.628**	1															
	Sig. (2-tailed)	.000																
	N	69	69															
3. I felt emotionally attached to the to my own virtual character/representation.	Pearson Correlation	.585**	.549**	1														
	Sig. (2-tailed)	.000	.000															
	N	69	69	69														

4. I showed much interest or concern regarding the problem(s) I experienced. (Reversed)	Pearson Correlation	.256*	.286*	.235	1													
	Sig. (2-tailed)	.034	.017	.051														
	N	69	69	69	69													
5. I made an effort to understand the problem I was facing. (Reversed)	Pearson Correlation	.292*	.350**	.369**	.230	1												
	Sig. (2-tailed)	.015	.003	.002	.057													
	N	69	69	69	69	69												
6. I tried to put myself in the position of the virtual character in an effort to empathize with his problem.	Pearson Correlation	.340**	.259*	.406**	.186	.384**	1											
	Sig. (2-tailed)	.004	.032	.001	.125	.001												
	N	69	69	69	69	69	69											
7. It was easy for me to see things from the virtual character's perspective. (Reversed)	Pearson Correlation	.316**	.473**	.586**	.156	.364**	.286*	1										
	Sig. (2-tailed)	.008	.000	.000	.201	.002	.017											
	N	69	69	69	69	69	69	69										
8. The virtual environment seemed suitable for practical training.	Pearson Correlation	.101	.013	.153	.192	.217	.244*	.023	1									
	Sig. (2-tailed)	.408	.914	.210	.115	.073	.044	.850										
	N	69	69	69	69	69	69	69	69									

9. Eye-tracking interaction was particularly easy.	Pearson Correlation	.102	-.011	.164	.203	.137	.319**	.121	.269*	1								
	Sig. (2-tailed)	.405	.929	.178	.094	.263	.007	.321	.026									
	N	69	69	69	69	69	69	69	69	69								
10. I would prefer to interact within the virtual world via a hand-held controller.	Pearson Correlation	.009	.023	.035	-.114	.078	.021	.185	-.074	-.228	1							
	Sig. (2-tailed)	.944	.849	.776	.350	.522	.863	.127	.546	.060								
	N	69	69	69	69	69	69	69	69	69	69							
11. Sound quality was	Pearson Correlation	.258*	.055	.146	.088	.038	.025	-.099	.453**	.043	-.289*	1						
	Sig. (2-tailed)	.032	.651	.231	.471	.754	.836	.419	.000	.725	.016							
	N	69	69	69	69	69	69	69	69	69	69	69						
12. The school classroom virtual (reality) simulation was satisfactorily realistic.	Pearson Correlation	.066	.035	.208	.204	.348**	.162	.091	.565**	.168	-.127	.454**	1					
	Sig. (2-tailed)	.593	.774	.086	.092	.003	.184	.457	.000	.168	.298	.000						
	N	69	69	69	69	69	69	69	69	69	69	69	69					
13. I found virtual reality user-friendly.	Pearson Correlation	.190	-.003	.200	.162	.197	.265*	.193	.206	.522**	-.258*	.074	.208	1				
	Sig. (2-tailed)	.118	.984	.099	.182	.104	.028	.111	.089	.000	.033	.547	.086					
	N	69	69	69	69	69	69	69	69	69	69	69	69	69				

14. The use of virtual reality may facilitate the increase of empathy.	Pearson Correlation	.237*	-.031	.243*	.103	.263*	.221	.022	.367**	.228	.169	.074	.290*	.243*	1			
	Sig. (2-tailed)	.049	.801	.044	.397	.029	.068	.857	.002	.059	.166	.544	.016	.044				
	N	69	69	69	69	69	69	69	69	69	69	69	69	69	69			
15. Virtual reality can easier cultivate empathy than the conventional traditional learning, as virtual reality offers opportunity to experience a situation from someone else's point of view for the users.	Pearson Correlation	.170	.036	.264*	.215	.275*	.161	.027	.361**	.231	.008	.323**	.387**	.198	.650**	1		
	Sig. (2-tailed)	.163	.772	.028	.076	.022	.187	.825	.002	.057	.951	.007	.001	.103	.000			
	N	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69		
16. If you could choose between conducting an educational activity in a real environment and in a 3D virtual environment, which would you choose?	Pearson Correlation	.294*	.070	.236	.061	.183	.270*	.002	.433**	.198	.175	.269*	.224	.135	.526**	.341**	1	
	Sig. (2-tailed)	.014	.566	.050	.616	.132	.025	.988	.000	.103	.149	.025	.064	.269	.000	.004		
	N	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	
17. Overall, how pleasant would you characterize the virtual training activity?	Pearson Correlation	.332**	.273*	.246*	.233	.441**	.331**	.280*	.348**	.515**	-.205	.232	.331**	.432**	.231	.308*	.135	1
	Sig. (2-tailed)	.005	.023	.042	.054	.000	.005	.020	.003	.000	.092	.055	.005	.000	.056	.010	.270	
	N	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

APPENDIX D-8-36

Table of correlations between variables of Part IV and post-emotional scale

		1. I was worried when the virtual students narrated their stories.	2. I see the need to understand the virtual students' problems. (Reversed)	Post- Active	Post- Determined
1. I was worried when the virtual students narrated their stories.	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	69			
2. I see the need to understand the virtual students' problems. (Reversed)	Pearson Correlation	.628**	1		
	Sig. (2-tailed)	.000			
	N	69	69		
Post-Active	Pearson Correlation	.415**	.313**	1	
	Sig. (2-tailed)	.000	.009		
	N	69	69	69	
Post-Determined	Pearson Correlation	.237	.394**	.647**	1
	Sig. (2-tailed)	.050	.001	.000	

N	69	69	69	69

**. Correlation is significant at the 0.01 level (2-tailed).

APPENDIX D-8-37

Table of correlations between variables of Part IV and post-empathy scale

Correlations

		1. I was worried when the virtual students narrated their stories.	2. I see the need to understand the virtual students' problems. (Reversed)	5. I made an effort to understand the problem I was facing. (Reversed)	7. It was easy for me to see things from the virtual character's perspective. (Reversed)	1. I sometimes find no difficulty to see things from the "other guy's person's" point of view. (Reversed)	5. I believe that there are two sides to every situation and try to look at them both.	9. Other people's misfortunes usually disturb me a great deal. (Reversed)	12. I would describe myself as a pretty soft-hearted person.	15. When I see someone being taken advantage of, I feel kind of protective towards him\her.
1. I was worried when the virtual students narrated their stories.	Pearson Correlation	1								
	Sig. (2-tailed)									
	N	69								
2. I see the need to understand the virtual students' problems. (Reversed)	Pearson Correlation	.628**	1							
	Sig. (2-tailed)	.000								
	N	69	69							

5. I made an effort to understand the problem I was facing. (Reversed)	Pearson Correlation	.292*	.350**	1				
	Sig. (2-tailed)	.015	.003					
	N	69	69	69				
7. It was easy for me to see things from the virtual character's perspective. (Reversed)	Pearson Correlation	.316**	.473**	.364**	1			
	Sig. (2-tailed)	.008	.000	.002				
	N	69	69	69	69			
1. I sometimes find no difficulty to see things from the "other guy's person's" point of view. (Reversed)	Pearson Correlation	.202	.181	.309**	.400**	1		
	Sig. (2-tailed)	.097	.137	.010	.001			
	N	69	69	69	69	69		
5. I believe that there are two sides to every situation and try to look at them both.	Pearson Correlation	.334**	.398**	.251*	.177	.152	1	
	Sig. (2-tailed)	.005	.001	.037	.145	.211		
	N	69	69	69	69	69	69	
9. Other people's misfortunes usually disturb me a great deal. (Reversed)	Pearson Correlation	.382**	.322**	.062	.059	.033	.128	1
	Sig. (2-tailed)	.001	.007	.612	.631	.787	.295	
	N	69	69	69	69	69	69	69

12. I would describe myself as a pretty soft-hearted person.	Pearson Correlation	.447**	.349**	.073	.211	.158	.339**	.332**	1	
	Sig. (2-tailed)	.000	.003	.552	.082	.195	.004	.005		
	N	69	69	69	69	69	69	69	69	
15. When I see someone being taken advantage of, I feel kind of protective towards him\her.	Pearson Correlation	.461**	.523**	.197	.121	.156	.292*	.441**	.515**	1
	Sig. (2-tailed)	.000	.000	.104	.321	.201	.015	.000	.000	
	N	69	69	69	69	69	69	69	69	69

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

APPENDIX D-8-38

Table of correlations between variables of Part IV and presence scale

		3. I felt emotionally attached to the to my own virtual character/representation.	8. The virtual environment seemed suitable for practical training.	12. The school classroom virtual (reality) simulation was satisfactorily realistic.	14. The use of virtual reality may facilitate the increase of empathy.	15. Virtual reality can easier cultivate empathy than the conventional traditional learning, as virtual reality offers opportunity to experience a situation from someone else's point of view for the users.	1. Please rate your sense of being in the virtual environment, on a scale of 1 to 7, where 7 represents your normal experience of being in a place. I had a sense of "being there" in the virtual classroom ...	2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?	3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?	4.During the time of the experience, which was the strongest on the whole, your sense of being in the virtual classroom environment or of being elsewhere?	5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?	6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?
3. I felt emotionally attached to the to my own virtual character/representation.	Pearson Correlation	1										
	Sig. (2-tailed)											
	N	69										
8. The virtual environment seemed suitable for practical training.	Pearson Correlation	.153	1									
	Sig. (2-tailed)	.210										
	N	69	69									
12. The school classroom virtual (reality) simulation was satisfactorily realistic.	Pearson Correlation	.208	.565**	1								
	Sig. (2-tailed)	.086	.000									
	N	69	69	69								
14. The use of virtual reality may facilitate the increase of empathy.	Pearson Correlation	.243*	.367**	.290*	1							
	Sig. (2-tailed)	.044	.002	.016								
	N	69	69	69	69							

15. Virtual reality can easier cultivate empathy than the conventional traditional learning, as virtual reality offers opportunity to experience a situation from someone else's point of view for the users.	Pearson Correlation	.264*	.361**	.387**	.650**	1						
	Sig. (2-tailed)	.028	.002	.001	.000							
	N	69	69	69	69	69						
1. Please rate your sense of being in the virtual environment, on a scale of 1 to 7, where 7 represents your normal experience of being in a place. I had a sense of "being there" in the virtual classroom ...	Pearson Correlation	.349**	.607**	.562**	.360**	.439**	1					
	Sig. (2-tailed)	.003	.000	.000	.002	.000						
	N	69	69	69	69	69	69					
2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?	Pearson Correlation	.406**	.612**	.482**	.404**	.578**	.702**	1				
	Sig. (2-tailed)	.001	.000	.000	.001	.000	.000					
	N	69	69	69	69	69	69	69				
3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?	Pearson Correlation	.338**	.383**	.452**	.303*	.483**	.520**	.657**	1			
	Sig. (2-tailed)	.005	.001	.000	.011	.000	.000	.000				
	N	69	69	69	69	69	69	69	69			
4.During the time of the experience, which was the strongest on the whole, your sense of being in the virtual classroom environment or of being elsewhere?	Pearson Correlation	.309**	.371**	.397**	.224	.286*	.558**	.624**	.638**	1		
	Sig. (2-tailed)	.010	.002	.001	.064	.017	.000	.000	.000			
	N	69	69	69	69	69	69	69	69	69		
5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?	Pearson Correlation	.206	.429**	.274*	.147	.397**	.509**	.569**	.458**	.569**	1	
	Sig. (2-tailed)	.090	.000	.022	.228	.001	.000	.000	.000	.000		
	N	69	69	69	69	69	69	69	69	69	69	
6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?	Pearson Correlation	.473**	.522**	.547**	.436**	.532**	.627**	.701**	.729**	.568**	.412**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	N	69	69	69	69	69	69	69	69	69	69	69

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

APPENDIX D-8-39

Table of correlations between variables of Part IV and embodiment scale

		3. I felt emotionally attached to the to my own virtual character/representation.	6. I tried to put myself in the position of the virtual character in an effort to empathize with his problem.	8. The virtual environment seemed suitable for practical training.	14. The use of virtual reality may facilitate the increase of empathy.	1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.	2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.	3. I felt that the virtual body was not mine.	4. During the experiment there were moments when I felt I had more than one body.	5. I felt that I controlled the avatar as if it were my body.	6.The virtual body moved according to my movements.
3. I felt emotionally attached to the to my own virtual character/representation.	Pearson Correlation	1									
	Sig. (2-tailed)										
	N	69									
6. I tried to put myself in the position of the virtual character in an effort to empathize with his problem.	Pearson Correlation	.406**	1								
	Sig. (2-tailed)	.001									
	N	69	69								
8. The virtual environment seemed suitable for practical training.	Pearson Correlation	.153	.244*	1							
	Sig. (2-tailed)	.210	.044								
	N	69	69	69							
14. The use of virtual reality may facilitate the increase of empathy.	Pearson Correlation	.243*	.221	.367**	1						
	Sig. (2-tailed)	.044	.068	.002							
	N	69	69	69	69						
1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine.	Pearson Correlation	.443**	.384**	.521**	.408**	1					
	Sig. (2-tailed)	.000	.001	.000	.001						
	N	69	69	69	69	69					

2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine.	Pearson Correlation	.381**	.378**	.394**	.358**	.798**	1				
	Sig. (2-tailed)	.001	.001	.001	.003	.000					
	N	69	69	69	69	69	69				
3. I felt that the virtual body was not mine.	Pearson Correlation	-.362**	-.208	-.173	-.085	-.559**	-.548**	1			
	Sig. (2-tailed)	.002	.087	.155	.488	.000	.000				
	N	69	69	69	69	69	69	69			
4. During the experiment there were moments when I felt I had more than one body.	Pearson Correlation	-.140	.096	.257*	.295*	.126	.140	.166	1		
	Sig. (2-tailed)	.252	.432	.033	.014	.303	.253	.173			
	N	69	69	69	69	69	69	69	69		
5. I felt that I controlled the avatar as if it were my body.	Pearson Correlation	.431**	.421**	.356**	.442**	.791**	.798**	-.537**	.079	1	
	Sig. (2-tailed)	.000	.000	.003	.000	.000	.000	.000	.519		
	N	69	69	69	69	69	69	69	69	69	
6.The virtual body moved according to my movements.	Pearson Correlation	.294*	.257*	.265*	.064	.345**	.561**	-.472**	.059	.465**	1
	Sig. (2-tailed)	.014	.033	.028	.601	.004	.000	.000	.631	.000	
	N	69	69	69	69	69	69	69	69	69	69
**. Correlation is significant at the 0.01 level (2-tailed).											
*. Correlation is significant at the 0.05 level (2-tailed).											

APPENDIX D-8-40

Table of correlations between variables of Part IV and embodiment scale

1. Strong Correlations

According to the results, there are statistically significant positive high relationships between the variables provision of advice to the virtual students (appendix 8-26). It seems that participants who decided to provide advice to the first virtual student they choose to listen to were more likely to provide advice to the second virtual student (r=.887, p=0.000). Moreover, participants who provided advice to the second virtual student were more likely to provide advice to the third student (r=.880, p=0.000). Furthermore, participants who provided advice to the fourth virtual student were more likely to provide advice to the fifth student (r=.891, p=0.000).

The results revealed another strong correlation between the two variables of the pre-emotional scale (appendix 8-27). Changes in the variable pre-strong are strongly correlated with the variable pre-determined (r=.712, p=0.000).

Moreover, regarding the post-emotional scale (appendix 8-28), changes in the variable post-active are strongly correlated with changes in the variable post-inspired (r=.716, p=0.000).

Another strong correlation was revealed between the variables of the presence scale (appendix 8-29). Changes in the variable ‘1. I had a sense of "being there" in the virtual classroom’ are strongly correlated with changes in the variable ‘2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?’ (r=.702, p=0.000). Moreover, the variable ‘2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?’ is positively correlated with the variable ‘6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?’ (r=.701, p=0.000). Furthermore, the variable ‘3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?’ is positively correlated with the variable ‘6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?’ (r=.729, p=0.000).

The results revealed some strong correlations between the variables of the embodiment scale (7-30). Changes in the variable ‘1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine’ are positively strongly correlated with the variables ‘2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine’ (r=.798, p=0.000) and ‘5. I felt that I controlled the avatar as if it were my body’ (r=.791, p=0.000). Moreover, the variable ‘2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine’ is

positively strongly correlated with the variable '5. I felt that I controlled the avatar as if it were my body' (r=.798, p=0.000).

2. Medium Correlations

*Groups * time*

The results indicate that there is a statistically significant positive correlation between the groups and the time spend within the VR environment, Pearson's r value 0.532, p= .000 for a two-tailed test. Indeed, the non-parametric test presented in the previous sections, revealed statistically significant differences between the groups related to time, with groups two and three remaining more minutes within VR space. This is probably due to the fact that groups 2 and 3 had the ability to change the perspective of a virtual character, which gave the participants more time within the virtual space.

Advise to virtual students

According to the results, there are statistically significant positive moderate correlations between the variables provision of advice to the virtual students (appendix 8-26). It seems that participants who decided to provide an advice to the first virtual student they choose to listen, were more likely to provide an advice to the third virtual student (r=.695, p=0.000), to the forth virtual student (r=.721, p=0.000), and to the fifth virtual student (r=.620, p=0.000). Moreover, participants who provided advice to the second virtual student were more likely to provide advice to the fourth student (r=.550, p=0.000).

Pre-emotional scale

What is more, the results revealed statistically significant moderate correlations among emotional variables of the pre-emotional scale (appendix 8-27). There is a positive correlation between the variable pre-afraid and the variables pre-nervous (r=.505, p=0.000); pre-confident (r=.485, p=0.000) and pre-ashamed (r=.469, p=0.000). Another positive correlation exists between the variable pre-interested and pre-active (r=.432, p=0.000). Additionally, it seems that the more interested the participants felt before the VR intervention the more they felt inspired (r=.505, p=0.000), confident (r=.462, p=0.000), excited (r=.617, p=0.000), strong (r=.508, p=0.000), alert (r=.443, p=0.000) and determined (r=.474, p=0.000). The variable pre-active is positively correlated with the variables pre-alert (r=.616, p=0.000); pre-excited (r=.531, p=0.000); pre-strong (r=.576, p=0.000); pre-inspired (r=.492, p=0.000) and pre-determined (r=.459, p=0.000). According to the results another medium positive correlation exists between the variable pre-nervous and pre-upset. Hence, the more nervous the participants felt the more upset the were (r=.525, p=0.000). However, the results revealed that the variable pre-nervous is

also correlated with the variable pre-calm (r=.422, p=0.000). Moreover, the variable pre-upset is also positively correlated with the variable pre-calm (r=.443, p=0.000).

Medium positive correlations were found between the variable pre-inspired and the variables pre-confident (r=.553, p=0.000); pre-excited (r=.494, p=0.000); pre-strong (r=.548, p=0.000); pre-alert (r=.490, p=0.000) and pre-determined (r=.450, p=0.000). Moreover, the variable pre-sad is positively correlated with the variable pre-downhearted (r=.614, p=0.000). The results revealed that before the VR intervention the participants who felt calm tended also to feel confident (r=.518, p=0.000), strong (r=.435, p=0.000), relaxed (r=.486, p=0.000) and concentrated (r=.501, p=0.000). The variable pre-confident is positively correlated with the variables pre-strong (r=.614, p=0.000) and pre-determined (r=.579, p=0.000). The variable pre-tired is positively correlated with the variable pre-relaxed (r=.646, p=0.000). The variable pre-excited is positively correlated with the variables pre-strong (r=.522, p=0.000) and pre-determined (r=.430, p=0.000). The variable pre-strong is positively correlated with the variable pre-alert (r=.494, p=0.000). The variable pre-alert is positively correlated with the variable pre-determined (r=.570, p=0.000). The variable pre-determined is positively correlated with the variable pre-concentrated (r=.422, p=0.000).

Post-emotional scale

The results revealed positive correlations between the variables of the post-emotional scale (appendix 8-28). It seems that changes in the variable post-afraid are moderately correlated with changes in the variables post-nervous (r=.485, p=0.000). Moreover, positive correlations exist between the variable post-interested and the variables post-active (r=.597, p=0.000); post-inspired (r=.626, p=0.000); post-confident (r=.492, p=0.000); post-excited (r=.538, p=0.000); post-strong (r=.442, p=0.000); post-alert (r=.510, p=0.000); post-determined (r=.492, p=0.000) and post-concentrated (r=.423, p=0.000). Changes in the variable post-active are moderately correlated with changes in variables post-confident (r=.598, p=0.000); post-excited (r=.600, p=0.000); post-strong (r=.519, p=0.000); post-alert (r=.665, p=0.000); post-determined (r=.647, p=0.000) and post-concentrated (r=.503, p=0.000). Another moderate positive correlation exists between the variable post-nervous and the variables post-upset (r=.472, p=0.000); post-calm (r=.470, p=0.000) and post-concentrated (r=.458, p=0.000). The variable post-inspired is positively correlated with the variables post-calm (r=.427, p=0.000); post-confident (r=.632, p=0.000); post-excited (r=.539, p=0.000); post-strong (r=.415, p=0.000); post-alert (r=.505, p=0.000) and post-determined (r=.532, p=0.000).

Changes in the variable post-sad are moderately correlated with changes in the variable post-upset (r=.532, p=0.000); post-ashamed (r=.534, p=0.000) and post-downhearted (r=.418, p=0.000). The variable post-upset is moderately correlated with the variables post-calm (r=.481,

p=0.000) and post-tired (r=.407, p=0.000). The variable post-calm is positively correlated with the variables post-confident (r=.415, p=0.000); post-excited (r=.493, p=0.000) and post-concentrated (r=.391, p=0.001). The variable post-confident is positively correlated with the variables post-excited (r=.581, p=0.000); post-strong (r-.594, p=0.000); post-alert (r=. 507, p=0.000); post-determined (r=.560, p=0.000). The variable post-tired is positively correlated with the variables post-relaxed (r=.445, p=0.000). the variable post-excited is positively correlated with the variables post-strong (r=. 586, p=0.000); post-alert (r=.669, p=0.000); post-downhearted (r=.416, p=0.000); post-determined (r=.560, p=0.000) and post-concentrated (r=.528, p=0.000). The variable post-strong is positively correlated with the variables post-alert (r=.597, p=0.000); post-determined (r=.586, p=0.000) and post-concentrated (r=.407, p=0.000). Finally, the variable post-determined is positively correlated with the variable post-concentrated (r=.486, p=0.000).

Pre * post-emotional scales

The results indicate medium positive correlations between variables of the pre-emotional scale and variables of the post-emotional scale (appendix 8-31). The variable pre-interested in positively correlated with the variables post-interested (r=.671, p=0.000); post-active (r=.542, p=0.000); post-inspired (r=.456, p=0.000); post-confident (r=.483, p=0.000); post-ashamed (r=.434, p=0.000); post-excited (r=.518, p=0.000); post-strong (r=.409, p=0.000); post-alert (r=.584, p=0.000) and post-determined (r=.426, p=0.000) (appendix 8-28). Moreover, there are positive correlations between the variable pre-active and post-active (r=.498, p=0.000); post-inspired (r=.448, p=0.000); post-confident (r=.486, p=0.000) and post-alert (r=.496, p=0.000). The variable pre-inspired is positively correlated with the variables post interested (r=.490, p=0.000); post-confident (r=.414, p=0.000) and post-alert (r=.530, p=0.000). Moreover, the variable pre-confident is positively correlated with the variables post-calm (r=.415, p=0.000); post-confident (r=.595, p=0.000); post-alert (r=.435, p=0.000) and post-determined (r=.434, p=0.000). The variable pre-tired is positively correlated with the variable post-tired (r=.602, p=0.000). The variable pre-excited is positively correlated with the variables post-interested (r=.521, p=0.000); post-excited (r=.424, p=0.000) and post-alert (r=.482, p=0.000). The variable pre-strong is positively correlated with the variables post-interested (r=.516, p=0.000); post-active (r=.474, p=0.000); post-confident (r=.552, p=0.000); post-excited (r=.532, p=0.000); post-strong (r=.664, p=0.000); post-alert (r=.603, p=0.000) and post-determined (r=.516, p=0.000). What is more, the variable pre-alert is positively correlated with the variable post-interested (r=.415, p=0.000); post active (r=.470, p=0.000); post-excited (r=.492, p=0.000); post-alert (r=.493, p=0.000) and post-determined (r=.433, p=0.000). The variable pre-relaxed is positively correlated with the variable post-tired (r=.496, p=0.000) and post-relaxed (r=.554, p=0.000). The variable pre-determined is positively correlated with the variable post-interested

(r=.499, p=0.000); post-active (r=.505, p=0.000); post-confident (r=.439, p=0.000); post-excited (r=.458, p=0.000); post-strong (r=.540, p=0.000); post-alert (r=.524, p=0.000); post-determined (r=.603, p=0.000) and post-concentrated (r=.498, p=0.000). Furthermore, the variable pre-concentrated is positively correlated with the variables post-nervous (r=.461, p=0.000) and post-concentrated (r=.462, p=0.000).

Pre-empathy scale

The results revealed moderate positive correlations between items of the pre-empathy scale (appendix 8-32). Changes in the variable '3. I sometimes try to understand others better by imagining how things look from their perspective' are moderately correlated with changes in the variables '5. I believe that there are two sides to every situation and try to look at them both' (r=.434, p=0.000) and '7. Before criticizing somebody, I try to imagine how I would feel if I were in their place' (r=.506, p=0.000). Moreover, there is a positive correlation between the variable '8. I often feel very sorry for other people when they are having problems' and the variables '9. Other people's misfortunes usually disturb me a great deal' (r=.533, p=0.000) and '10. When I see someone being treated unfairly, I often feel pity very much for them' (r=.461, p=0.000). The variable '9. Other people's misfortunes usually disturb me a great deal' is positively correlated with the variable '10. When I see someone being treated unfairly, I often feel pity very much for them' (r=.542, p=0.000). The variable '10. When I see someone being treated unfairly, I often feel pity very much for them' is positively correlated with the variable '14. I am really interested in how other people feel' (r=.495, p=0.000). The variable '13. I do not feel sympathy for people who cause their own serious illnesses' is positively correlated with the variable '14. I am really interested in how other people feel' (r=.473, p=0.000).

Post-empathy scale

According to the results, there are moderate correlations between the variables of the post-empathy scale (appendix 8-33). The variable '2. I try to look at everybody's side of a problem before making a decision' is positively correlated with the variables '3. I sometimes try to understand others better by imagining how things look from their perspective' (r=.415, p=0.000); '7. Before criticizing somebody, I try to imagine how I would feel if I were in their place' (r=.508, p=0.000) and '15. When I see someone being taken advantage of, I feel kind of protective towards him/her' (r=. 473, p=0.000). Moreover, the variable '3. I sometimes try to understand my other's better by imagining how things look from their perspective' is positively correlated with the variables '6. When I am upset at someone, I usually try to "put myself in his shoes" for a while' (r=.445, p=0.000); '7. Before criticizing somebody, I try to imagine how I would feel if I were in their place' (r=.477, p=0.000) and '12. I would describe myself as a pretty soft-hearted person' (r=.460, p=0.000). The variable '6. When I am upset at someone, I

usually try to “put myself in his shoes” for a while’ is positively correlated with the variable ‘7. Before criticizing somebody, I try to imagine how I would feel if I were in their place’ (r=.390, p=0.001). The variable ‘7. Before criticizing somebody, I try to imagine how I would feel if I were in their place’ is positively correlated with the variable ‘15. When I see someone being taken advantage of, I feel kind of protective towards him/her’ (r=.528, p=0.000). The variable ‘9. Other people’s misfortunes usually disturb me a great deal’ is positively correlated with the variable ‘15. When I see someone being taken advantage of, I feel kind of protective towards him/her’ (r=.441, p=0.000). The variable ‘12. I would describe myself as a pretty soft-hearted person’ is positively correlated with the variables ‘14. I am really interested in how other people feel’ (r=.544, p=0.000) and ‘15. When I see someone being taken advantage of, I feel kind of protective towards him/her’ (r=.515, p=0.000). Furthermore, the variable ‘14. I am really interested in how other people feel’ is positively correlated with the variable ‘15. When I see someone being taken advantage of, I feel kind of protective towards him/her’ (r=.425, p=0.000).

Presence scale

The results revealed several moderate positive correlations among the variables of the presence scale (appendix 8-29). Changes in the variable ‘1. I had a sense of "being there" in the virtual classroom’ are moderately correlated with changes in the variables ‘3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?’ (r=.520, p=0.000); ‘4. During the time of the experience, which was the strongest on the whole, your sense of being in the virtual classroom environment or of being elsewhere?’ (r=.558, p=0.000); ‘5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?’ (r=.509, p=0.000) and ‘6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?’ (r=.627, p=0.000). Moreover, the variable ‘2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?’ is moderately correlated with the variables ‘3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?’ (r=.657, p=0.000); ‘4. During the time of the experience, which was the strongest on the whole, your sense of being in the virtual classroom environment or of being elsewhere?’ (r=.624, p=0.000) and ‘5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?’ (r=.569, p=0.000). The variable ‘3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?’ is positively correlated with the variables ‘4. During the time of the experience, which was the strongest on the whole, your sense of being

in the virtual classroom environment or of being elsewhere?' (r=.638, p=0.000) and '5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?' (r=.458, p=0.000). Additionally, the variable '4. During the time of the experience, which was the strongest, on the whole, your sense of being in the virtual classroom environment or of being elsewhere?' is positively correlated with the variables '5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?' (r=.569, p=0.000) and '6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?' (r=.568, p=0.000). Finally, changes in the variable '5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?' are moderately correlated with changes in the variable '6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?' (r=.412, p=0.000).

Embodiment scale

The results revealed several moderate positive correlations among the variables of the embodiment scale (appendix 8-30). Changes in the variable '1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine' are negatively moderately correlated with the variable '3. I felt that the virtual body was not mine' (r=-.559, p=0.000). In addition, the variable '2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine' is negatively correlated with the variable '3. I felt that the virtual body was not mine' (r=-.548, p=0.000) and positively correlated with the variable '6. The virtual body moved according to my movements' (r=.561, p=0.000). Moreover, the variable '3. I felt that the virtual body was not mine' is negatively correlated with the variables '5. I felt that I controlled the avatar as if it were my body' (r=-.537, p=0.000) and the variable '6. The virtual body moved according to my movements' (r=-.472, p=0.000). Finally, the variable '5. I felt that I controlled the avatar as if it were my body' is positively correlated with the variable '6. The virtual body moved according to my movements' (r=.465, p=0.000).

Presence * Embodiment scale

Significant moderate correlations were identified between items of the presence and the embodiment scale (appendix 8-34). The variable '1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine' is positively correlated with the following variables of the presence scale: '1. I had a sense of "being there" in the virtual classroom ...' (r=.519, p=0.000); '2. To what extent were there times during the

experience when the virtual classroom environment was the reality for you?' (r=.621, p=0.000); '4. During the time of the experience, which was the strongest on the whole, your sense of being in the virtual classroom environment or of being elsewhere?' (r=.517, p=0.000) and '6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?' (r=.595, p=0.000). Moreover, the variable '2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine' of the embodiment scale is positively correlated with the following variable of the presence scale '2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?' (r=.401, p=0.001). Finally, changes to the variable '5. I felt that I controlled the avatar as if it were my body' of the embodiment scale are moderately correlated with changes to the following variables of the presence scale: '1. I had a sense of "being there" in the virtual classroom ...' (r=.433, p=0.000); '2. To what extent were there times during the experience when the virtual classroom environment was the reality for you?' (r=.485, p=0.000); '4. During the time of the experience, which was the strongest, on the whole, your sense of being in the virtual classroom environment or of being elsewhere?' (r=.449, p=0.000) and '6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?' (r=.479, p=0.000).

Part V: Overall user experience

The results identified several correlations between the variables of Part V that referred to the user's overall VR experience (appendix 8-35). The variable '1. I was worried when the virtual students narrated their stories' is positively correlated with the variables '2. I see the need to understand the virtual students' problems' (r=.628, p=0.000) and '3. I felt emotionally attached to the to my own virtual character/representation' (r=.585, p=0.000). Changes in the variable '2. I see the need to understand the virtual students' problems are positively moderately correlated with the variables '3. I felt emotionally attached to the to my own virtual character/representation' (r=.549, p=0.000) and '7. It was easy for me to see things from the virtual character's perspective' (r=.473, p=0.000). The variable '3. I felt emotionally attached to the to my own virtual character/representation' is moderately correlated with the variables '6. I tried to put myself in the position of the virtual character in an effort to empathize with his problem' (r=.406, p=0.000) and '7. It was easy for me to see things from the virtual character's perspective' (r=.586, p=0.000). Another positive correlation was identified between the variable '5. I made an effort to understand the problem I was facing' and the variable '17. Overall, how pleasant would you characterize the virtual training activity?' (r=.441, p=0.000). The variable '8. The virtual environment seemed suitable for practical training' is positively correlated with the variables '4. Sound quality' (r=.453, p=0.000); '5. The school classroom virtual (reality) simulation was satisfactorily realistic' (r=.565, p=0.000) and '16. If you could choose between

conducting an educational activity in a real environment and in a 3D virtual environment, which would you choose?' (r=.433, p=0.000). Moreover, the variable '9. Eye-tracking interaction was particularly easy' is moderately correlated with the variable '6. I found virtual reality user-friendly' (r=.522, p=0.000) and the variable '17. Overall, how pleasant would you characterize the virtual training activity?' (r=.515, p=0.000). The variable '4. Sound quality' is positively correlated with the variable '5. The school classroom virtual (reality) simulation was satisfactorily realistic' (r=.454, p=0.000). Changes in the variable '13. I found virtual reality user-friendly' are associated with changes in the variable '17. Overall, how pleasant would you characterize the virtual training activity?' (r=.432, p=0.000). Finally, the variable '14. The use of virtual reality may facilitate the increase of empathy' is positively correlated with the variables '2. Virtual reality can easier cultivate empathy than conventional traditional learning, as virtual reality offers the opportunity to experience a situation from someone else's point of view for the users' (r=.650, p=0.000) and '16. If you could choose between conducting an educational activity in a real environment and in a 3D virtual environment, which would you choose?' (r=.526, p=0.000).

Part V*Post-emotional scale

According to the results, there are a few moderate positive correlations between the variables of Part V and the variables of the post-emotional scale (appendix 8-36). The variable '1. I was worried when the virtual students narrated their stories' is positively correlated with the variable post-active (r=.415, p=0.000).

Part V*Post-empathy scale

Several moderate positive correlations were identified between variables of Part V and variables of the post-empathy scale (appendix 3-37). The variable '1. I was worried when the virtual students narrated their stories' is positively correlated with the post-empathy variables '12. I would describe myself as a pretty soft-hearted person' (r=.447, p=0.000) and '15. When I see someone being taken advantage of, I feel kind of protective towards him/her' (r=.461, p=0.000). The variable '2. I see the need to understand the virtual student's problems' is positively correlated with the post-empathy variable '15. When I see someone being taken advantage of, I feel kind of protective towards him/her' (r=.523, p=0.000).

Part V*Presence scale

The results revealed some moderated correlations between variables of Part V and variables of the presence scale (appendix 3-38). The variable 3. I felt emotionally attached to my own virtual character/representation' is moderately correlated with the presence scale variable '6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?' (r=.473, p=0.000). The variable '8. The virtual environment seemed suitable for

practical training' is moderately correlated with the variables '1. I had a sense of "being there" in the virtual classroom' (r=.607, p=0.000); '2. To what extend were there times during the experience when the virtual classroom environment was the reality for you?' (r=.612, p=0.000); '5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today?' (r=.429, p=0.000) and '6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?' (r=.522, p=0.000). Moreover, the variable '12. The school classroom virtual reality simulation was satisfactory realistic' is correlated with the presence scale variables '1. I had a sense of "being there" in the virtual classroom' (r=.562, p=0.000); '2. To what extend were there times during the experience when the virtual classroom environment was the reality for you?' (r=.482, p=0.000); '3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?' (r=.452, p=0.000) and '6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?' (r=.547, p=0.000). Moreover, the variable '14. The use of virtual reality may facilitate the increase of empathy' of Part V is positively correlated with the variable '6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?' (r=.436, p=0.000). Additionally, the variable '15. Virtual reality can easier cultivate empathy than conventional traditional learning, as virtual reality offers the opportunity to experience a situation from someone else's point of view for the users is moderately correlated to the variables '1. I had a sense of "being there" in the virtual classroom' (r=.439, p=0.000); '2. To what extend were there times during the experience when the virtual classroom environment was the reality for you?' (r=.578, p=0.000); '3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?' (r=.483, p=0.000) and '6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?' (r=.532, p=0.000).

Part V*Embodiment scale

The results revealed some moderate correlations between variables of Part V and variables of the embodiment scale (appendix 8-39). The variable '3. I felt emotionally attached to the to my own virtual character/representation' is positively correlated with the variables '1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine' (r=.443, p=0.000) and '5. I felt that I controlled the avatar as if it were my body' (r=.431, p=0.000). Moreover, the variable '6. I tried to put myself in the position of the virtual character in an effort to empathize with his problem' is correlated with the variable '5. I felt that I controlled the avatar as if it were my body' (r=.421, p=0.000). The variable '8. The virtual

environment seemed suitable for practical training' is correlated with the variable '1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine' (r=.521, p=0.000). Moreover, the variable '14. The use of virtual reality may facilitate the increase of empathy' is positively correlated with the variable '5. I felt that I controlled the avatar as if it were my body' (r=. 442, p=0.000).

3. Weak Correlations

The results revealed some weak correlations. Changes in variable '5. I believe that there are two sides to every situation and try to look at them both' of the post-empathy scale is weakly correlated with changes in the variable '1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine' of the embodiment scale (r=.394, p=0.001).

Moreover, The variable '1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine' of the embodiment scale is positively correlated with the following variable of the presence scale: '3. When you think back to the experience, do you think of the virtual classroom environment more as images that you saw or more as somewhere that you visited?' (r=.388, p=0.001).

Additionally, the variable '2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine' of the embodiment scale is positively correlated with the following variable of the presence scale '1. I had a sense of "being there" in the virtual classroom ...' (r=.387, p=0.000).

Another weak positive correlation was identified between the variable '1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine' of the embodiment scale and the variable '5. I believe that there are two sides to every situation and try to look at them both' of the post-empathy scale (r=.394, p=0.001).

Furthermore, a positive weak correlation exists between two variables of the final part of the questionnaire that referred to the overall VR experience. The variable '5. I made an effort to understand the problem I was facing' is correlated with the variable '6. I tried to put myself in the position of the virtual character in an effort to empathize with his problem' (r=384, p=0.000). Moreover, the variable '12. The school classroom virtual (reality) simulation was satisfactorily realistic' is positively correlated with the variable '2. Virtual reality can easier cultivate empathy than conventional traditional learning, as virtual reality offers the opportunity to experience a situation from someone else's point of view for the users' (r=.387, p=0.001).

A weak positive correlation was revealed between the variable ‘2. I see the need to understand the virtual students’ problems’ of Part V and the variable post-determined of the post-emotional scale (r=.394, p=0.001).

Several weak correlations were identified between the variables of Part V and the variables of the post-empathy scale. The variable ‘1. I was worried when the virtual students narrated their stories’ is positively correlated with the post-empathy variable ‘9. Other people’s misfortunes usually disturb me a great deal’ (r=.382, p=0.001). Moreover, the variable ‘2. I see the need to understand the virtual student’s problems’ is positively correlated with the post-empathy variable ‘5. I believe that there are two sides to every situation and try to look at them both’ (r=.398, p=0.001). The variable ‘3. I felt emotionally attached to my own virtual character/representation’ is positively correlated with post-empathy variable ‘9. Other people’s misfortunes usually disturb me a great deal’ (r=.404, p=0.001). Additionally, the variable ‘7. It was easy for me to see things from the virtual character’s perspective’ is positively correlated with the post-empathy variable ‘1. I sometimes find no difficulty to see things from the ‘other guy’s person’s point of view’ (r=.400, p=0.001).

Another weak correlation was revealed between the variable ‘5. The school classroom virtual reality simulation was satisfactory realistic’ of Part V and the presence scale variable ‘4. During the time of the experience, which was the strongest, on the whole, your sense of being in the virtual classroom environment or of being elsewhere?’ (r=.397, p=0.001). Moreover, the variable ‘14. The use of virtual reality may facilitate the increase of empathy’ of Part V is positively correlated with the variable ‘2. To what extend were there times during the experience when the virtual classroom environment was the reality for you?’ (r=.404, p=0.001).

Few week correlations were also revealed between variables of Part V and variables of the embodiment scale. The variable ‘6. I tried to put myself in the position of the virtual character in an effort to empathize with his problem’ is positively correlated with the variables ‘1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine’ (r=.384, p=0.001) and ‘2. Although the virtual body did not look like me, when I looked at my body, I had the sensation that it was mine’ (r=.378, p=0.001). Moreover, the variable ‘14. The use of virtual reality may facilitate the increase of empathy’ is positively correlated with the variable ‘1. Although the virtual body did not look like me, I had the sensation that the virtual body I saw in the mirror was mine’ (r=.408, p=0.001).