7 Embedding a serious game into an ESP curriculum

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Abstract

This paper describes how a selected Commercial Off-The-Shelf (COTS) Serious Game (SG) was evaluated before being integrated into an English for Specific Purposes (ESP) curriculum. Echoing the concerns of language practitioners regarding the adoption of SGs into their teaching practices, this paper describes the steps and decisions taken before the selected COTS SG implementation into a specific learning context; that of the course English for shipping at the Cyprus University of Technology (CUT). A combination of methods was initiated towards assessing the COTS SG. It was carried out following the qualitative embedded single case study research design, as this research explores only one case; that of the assessment of the SG called *Escape From Desolo*. The aim of the case study was to explore the areas of ESP teaching with COTS SGs by illustrating a combination of assessment methods that could be adopted by those considering SG embedding in formal ESP language settings. The present chapter first outlines the reasons which initiated such integration. The initial assessment of the selected SG and the game design, which is carried out with the use of the Relevance, Embedding, Transfer, Adaptation, Immersion, and Naturalisation (RETAIN) model, is discussed. This is followed by further evaluation of the particular SG, which occurred with the use of the four-dimensional framework. After evaluating its pedagogical use, an analysis of the application of the selected tool

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within the curriculum is presented. Both the model and the framework are presented in detail in the chapter. Although this study focusses on English for shipping, it is hoped that this process may be applied in different ESP contexts for future studies. The results of the evaluation of the chosen SG with the use of the model and the framework indicated their usefulness in assessing a SG intended to be used in an ESP teaching and learning context. It is hoped that this case can prove beneficial in other ESP learning contexts.

Keywords: formal education, serious games, COTS, Escape From Desolo, RETAIN, four-dimensional framework.

1. Introduction

1.1. Background

Nowadays, there is a noticeably growing tendency to reform the pedagogical approaches within the formal education systems in ways that facilitate the learning processes and cater to the learners' needs (Care, Kim, Vista, & Anderson, 2018). This tendency is vastly associated with rapid technological advancements that occur and therefore, shape the way people work, live, and/or learn (Hutchinson & Waters, 1987). One such technological advancement is that of SGs.

SGs are defined and interpreted from a range of different viewpoints: Zyda (2005) sees them as "a mental contest, played with a computer in accordance with specific rules that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives" (p. 26). More broadly, Michael and Chen (2005) describe SGs as computer-based games that include more purposes than pure entertainment. SGs have a long history in training in army and nursing or even aviation flight contexts (Djaouti, Alvarez, Jessel, & Rampnoux, 2011). Their simulated environment ensures that crew have the experience to safely and efficiently deal with offshore situations

and real-life emergency situations such as escaping from buildings and so forth (Djaouti et al., 2011).

This history of SGs in training is still prevalent in the maritime industry as considerable interest has been devoted to the pursuit of learning through, and with them. The cost-effective 'edutainment' nature of SGs offers the potential to facilitate both formal and informal learning (Vintimilla-Tapia et al., 2018, p. 25). As stated by Arnab et al. (2012),

> "[m]any studies point to the positive qualities of SG, such as their persuasiveness and motivational appeal, which can support immersive, situated and learner-centred learning experiences (Aldrich, 2009; David & Watson, 2008 [...]). Proponents of SGs see them as a means for active construction, rather than passive reception of knowledge [(Karshenas & Haber, 2012)], and as prime opportunities to practise key soft skills like problem-solving, decision making, inquiry multitasking, collaboration, and creativity [(Baldauf et al., 2016)]" (p. 159).

1.2.   Context

This extensive adoption of SGs in maritime studies for experiencing real-life situations (Baldauf et al., 2016) was also considered in the ESP course of the CUT Language Centre (LC). Synergies between the LC ESP teaching staff and the related CUT specific discipline staff take place annually in order to evaluate, develop, and continuously and systematically improve the ESP curricula. Such curricula are usually competency-based, centred on what students know and can do, characterised by the affluence of technology that shapes the way people work, live, and learn, and they are dictated by the demands of the labour market (of any specific workplace such as the army, nursing, aviation, and maritime, as mentioned earlier) (Robertson, 2019).

Following this process, the integration of an already-made SG was considered for the development of the English for shipping curriculum at the end of the academic year 2017-2018. The *Escape From Desolo* COTS SG was primarily

selected for its fantasy/story content relevance to the safety at sea curriculum component and its cost free nature. *Escape From Desolo* (Figure 1) was created by the Uniteam Training Oil & Gas, Marine, and Industrial Sector company in 2015. It originally intended to educate/train the prosper seafarers about the safety at sea conventions, shipboard procedures, and onboard emergencies in an engaging way. Through instant feedback loops, badges, progress bars, and leaderboards aligned with learning objectives, it primarily aimed to reduce the ever-shortening attention spans and the frequent dropouts or retention rates observed with more traditional teaching. The goal of the game is for a young cadet (the player) to disembark from 'Desolo', a small container ship, and take shore leave so he can meet up with his beloved girlfriend Eve in Hamburg; yet, he needs to go over some obstacles in his way. The cadet must use his wits and skills to navigate safety hazards, respond to alarms and drills, negotiate with a port state control officer, solve puzzles, work safely, stay healthy, follow shipboard procedures, and make sure the reputation of the owners of the Desolo is preserved. *Escape From Desolo* was the first SG for seafarers designed to improve behavioural based safety onboard ships, and it was originally designed for the training classroom of the company.

Figure 1.   Escape From Desolo SG

This research deals with the assessment a COTS SG used in a particular industry, that of maritime industry, which is closely related to the particular ESP in question, that of English for shipping, prior to its integration in the language programme. More specifically, since the particular game has not been developed

for ESP classes, the aim is to explore ways of assessing it before its use in an ESP class to find out whether it can actually be suitable for such teaching and learning contexts (English for shipping). If it proves suitable through the assessment processes examined in this chapter, it would add to innovative teaching approaches to ESP learning. Moreover, the SG assessment processes and assessment tools may prove beneficial to practitioners considering assessing a SG before integrating game-based learning and SG in their programmes.

The idea of enriching teaching approaches to the CUT LC ESP curriculum, and more particularly to that of English for shipping, triggered the interest in exploring the use of the COTS SG introduction, and as a result, a first interest in assessing such a case: assessing the selected game and game design regarding its content, and secondly, the way it would be applied within the learning context. These considerations shaped the following research questions.

- How does the assessment of the COTS SG named *Escape From Desolo* through the use of the RETAIN model justify the selection of the particular game for its use in English for shipping?

- How does the dimension of pedagogical considerations of the four-dimensional framework correspond to those of English for shipping?

- Which pedagogic approaches can support learning outcomes and activities?

To answer these questions, the authors initiated a single-case research study prior to the game's classroom implementation to evaluate the *Escape From Desolo* game and game design and pedagogic use for integration into an ESP curriculum.

2.   Research method

This study was based on a qualitative embedded single case study design with multiple sub-units of analysis. This type of research design requires a systematic

collection of either an individual, a group, or a community. They examine social settings or events for the purpose of gaining insights into their functioning (Yin, 1994, Schreiber & Asner-Self, 2011). In this study, the case of the initial assessment of *Escape From Desolo*, prior to its implementation in an ESP programme, constitutes the main unit of research.

This case study entails only one case of SGs and therefore the research findings are limited to this type of SG and its related ESP context implementation. However, it explores a set of game assessment processes which were followed in order to prepare the implementation of the SG in the particular ESP environment. This combination of methods is yet to be documented in assessing COTS SGs, at least to the researchers' best knowledge. Based on this, the data was collected through heuristic inquiry. Heuristic inquiry is an adaptation of the phenomenological inquiry. It is an experience-based technique (Djuraskovic & Arthur, 2010). It involves problem-solving and self-reflection; the researcher is expected to be involved in the research process in a disciplined manner (Djuraskovic & Arthur, 2010, Kocdar, Okur, & Bozkurt, 2017, p. 54). As such, the researchers participated in the whole procedure by selecting the framework models to be enforced as typical examples of assessing games and their educational value for curriculum development.

The RETAIN model framework – developed by Gunter, Kenny, and Vick (2008) to assess games and game design, was utilised in order to assess how well *Escape From Desolo* contains and incorporates the educational content of safety at sea (Research Question 1). Therefore, the RETAIN's aspects constitute the (first) sub-units of analysis. To inform the way *Escape From Desolo* could be applied within the ESP curriculum (Research Question 2), the researchers further employed the four-dimensional framework of de Freitas and Oliver (2006). This framework was particularly chosen as it is one of the few that provides a tool (a table to focus on specific issues) to help practitioners incorporate games in practice in such a way as to ensure a smooth continuum from theory/planning to deployment and evaluation. As a rather non-prescriptive approach, it is the only one, to the researchers' current knowledge, that allows educational designers to consider a more user-based

and specialised set of educationally specific factors (De Freitas & Oliver, 2006) (Research Question 3). Therefore, the four aspects of the framework are considered as (the second) sub-units of analysis.

2.1.   The RETAIN model

Escape From Desolo COTS SG was initially selected by the authors regarding its cost free nature and its fantasy/story content relevance to the safety at sea curriculum component. Yet, recent literature notes that the selection of an educational game to be integrated signifies more than its attractive content or fantasy story, or even the fact that "it will eventually teach something" (Ulicsak, 2010, p. 56). It presupposes a strong correlation between the academic content and the relevance, embedding, transfer, adaptation, immersion, and naturalisation aspects of the game (Gunter et al., 2008). The model known as RETAIN, which was developed to assess games and game design in general, is based on three existing theories: (1) Keller's attention, relevance, confidence/challenge, and satisfaction/success model, (2) Gagne's events of instruction, and (3) Piaget's ideas on schema. Each of the RETAIN aspects is further divided into four levels: 0, 1, 2, 3. "Level 3 means that there is a strong correlation between the game and that relevant aspect, while Level 0 indicates the game does not meet that aspect" (Gunter et al., 2008, p. 520).

In his table on page 59, Ulicsak (2010) describes the six aspects that are required for appropriate SGs.

With 'relevance', he refers to the way materials should be presented to learners, and the necessity for the material to be relevant to the learners' needs and learning styles. He also stresses the need of relevance of instructional units with each other so that everything links together and it is built upon previous work.

A second required aspect for appropriate SGs according to Uliscak (2010) is 'embedding'. This refers to the assessment that has to take place to ensure that the academic content is linked with the fantasy/story content (narrative structure, storylines, player, experience, dramatic structure, fictive elements, etc.).

The third aspect required for appropriate SGs according to Uliscak (2010) is 'transfer'. This refers to the ability of the player to use previous knowledge in other areas.

'Adaptation' is the fourth required aspect for appropriate SGs. This is about the ability of the learners to change their behaviour as a result of the transfer.

'Immersion' refers to the ability of the player to intellectually invest in the context of the game.

Finally, Ulicsak (2010) refers to 'naturalisation' as the fifth aspect required for appropriate SGs. This makes reference to the development of habitual and spontaneous use of information the players gain while playing the game.

Gunter and colleagues, though, have further ordered the aspects based on their importance in a context that involved both game designers and instructors/ professors (Gunter et al., 2008). They created a rubric that enables the educators and game designers to assess the importance of the games. "Specifically, they had ordered the aspects from the least to the most important, as follows: Relevance, Immersion, Embedding, Adaption, Transfer and Naturalisation" (Gunter et al., 2008, p. 527). The RETAIN weighting chart is illustrated in Table 1.

Table 1. RETAIN weighting chart (Gunter et al., 2008, as seen in Prinsloo & Jordaan, 2014, p. 393)

		Level 0	Level 1	Level 2	Level 3
Relevance	1	0	1	2	3
Embedding	3	0	3	6	9
Transfer	5	0	5	10	15
Adaptation	4	0	4	8	12
Immersion	2	0	2	2	6
Naturalisation	6	0	6	12	18
Total possible points = 63					

This RETAIN rubric and its weighting chart was thus utilised to answer the first question, how does the assessment of the COTS SG named *Escape From Desolo*

through the use of the RETAIN model justify the selection of the particular game for its use in English for shipping?

2.2. The four-dimensional framework

The four-dimensional framework of de Freitas and Oliver (2006) is for evaluating games and simulation-based education. It requires the practitioner to consider four main dimensions before using games and simulations in their practice in a way that all the aspects are related to each other and not considered individually (Ulicsak, 2010). In a nutshell, the four dimensions are as follows.

- "**Context:** which covers where the learning occurs – it includes the macro level, so historical, political, and economic factors (for example, are you playing because it is a school directive), through to micro, the tutor's background and experience, cost of game licences etc.

- **Learner Specification** for the individual or group – it requires the ESP instructor to consider their preferred learning style and previous knowledge and what methods would best support them given their differing needs.

- **Mode of Representation:** this includes the level of interactivity required, the fidelity, level of immersion produced. It also covers diegesis, the separation of the immersion aspect with the reflection around the process of playing the game. Most importantly it highlights the potential of briefing and debriefing to reinforce the learning outcomes.

- **Pedagogic principles:** these require the ESP instructor to reflect on the learning models which enable them to produce appropriate lesson plans" (De Freitas & Oliver, 2006, p. 260).

The framework was used to clarify the way the *Escape From Desolo* SG could be applied within the specific learning context by evaluating the pedagogic use

of the tool, and not just the tool itself (De Freitas & Oliver, 2006) The aim was to answer the following questions.

- How does the dimension of the pedagogical considerations of the four-dimensional framework correspond to those of English for shipping?

- Which pedagogic approaches should be used to support learning outcomes and activities?

3. Results and discussion

3.1. The RETAIN model in Escape From Desolo

To assess how the *Escape From Desolo* COTS contains and incorporates academic content, the RETAIN aspects were calculated according to the weighting chart (Table 1 above). As proposed by Gunter et al. (2008), the aspects in the rubric were ordered according to their importance – from least to most important – as follows: relevance, immersion, embedding, adaptation, transfer, and naturalisation. This approach was adopted in the current paper as well. In fact, the lead researcher developed the weighting chart after playing and familiarising herself with the game.

Table 2.   Resulting scores for Escape From Desolo

Element/Rating	Level x Rank = Rating
Relevance (2.5)	2.5 x 1 = 2.5 total pts
Embedding (3)	3 x 3 = 9 total pts
Transfer (2.5)	2.5 x 5 = 12.5 total pts
Adaptation (2.5)	2.5 x 4 = 10 total pts
Immersion (2)	2 x 2 = 4 total pts
Naturalisation (2)	2 x 6 = 12 total pts
Total:	50 / 63 pts

The table signifies each of the weighting aspects of the *Escape From Desolo* SG. Beginning with the least important, relevance (Rank 1), the resulting scores in

Table 2 revealed that the game has a strong relevance with the academic content (Rating : 2.5/3). Specifically, the focus of learning various onboard safety skills is evident in the game from the tutorial of the game, and it is designed in such a way that it is enjoyable to all ages, genders, or ranks. The *Escape From Desolo* SG is designed for prosperous seafarers/people wishing to work in the shipping industry. For this reason, the ESP learners will play the character/role of the young cadet who looks for a shore leave to meet his girlfriend. Yet, at points there is limited wording of the safety equipment, restricted to some snippets of information, probably based on the belief that the players have the knowledge already.

The game also provides moderately high levels of immersion (Rank 2) and naturalisation (Rank 6) because the game world creates a compelling fantasy for the player to be involved in cognitively and physically. The game mechanics such as sounds, graphic designs, and scenario based situations offer the opportunity for belief creation. Added to this, the players are psychologically and emotionally into the game content, as if they fail to do a good job, they will miss the opportunity to get a shore leave and thus meet Eve in Hamburg. Instant feedback loops, badges, progress bars, and leaderboards during each unit of the gameplay inform decisions of the players to reach their goal while adding to the pedagogy related mechanics.

As Table 3 reveals, *Escape From Desolo* embeds (Rank 3) relevant content at the highest level and therefore it was assigned with full points (nine total). Despite the partial lack of depth in educational content, the ability to play in a simulated ship environment provides the player with experiences of problems and contexts specific to the curriculum. The act of playing the game by moving around the simulated environment of the ship, while searching for clues to tackle situations, also builds up knowledge of the interior/exterior part of a ship while keeping players immersed in the fantasy context. Also, "the fantasy involves the learning material so much that players get to experience both simultaneously as if they are one (i.e. the educational content is fully endogenous to the fantasy context)" (Gunter et al., 2008, p. 517). However, "the challenge of the game is not based on increasingly difficult learning materials, but rather increasingly difficult game mechanics which are, though, not formed in discrete levels" (to be exact, there is a complete absence of levels) (Gunter et al., 2008, p. 533).

Adaptation (Rank 4) received equally high scores with relevance and transfer of knowledge (Rank 5) because it allows for repetitive play through its varied content and fantasy context. As the player wanders across the simulated world of Desolo, he is repeatedly ventured into new, most of the time, risky situations. Learning thus becomes an active and participatory process in which the player builds upon what has already been learned in order to construct new ideas. In this manner, the player's way of thinking is improved, facilitating the need to look at how else acquired knowledge applies to the real world; a likely reason for this may be that the game world itself coincides so much with the academic context of safety at sea component of the English for shipping curriculum that players can easily understand the reason this knowledge may apply to a different context. The reason the game received a lower score for adaptation was due to the fact that the game provides the new content sequenced in such a way as to require players to identify old schema and transfer it to new ways of thinking.

The safety conventions, health/behaviour rules, and shipboard procedures deployed in the game are universal. Consequently, the principles learned from the game can easily be applied to other venues/countries and therefore facilitate the transfer of gained knowledge. Since the game features authentic real-life experiences – from responding to false abandon ship drills/fire alarms or emergencies of any kind to proper recycling of waste – active problem-solving is required to move to the next challenge. The very existence of experiences of this kind reward meaningful 'post event' knowledge acquisition, enforced with snippets of information that include facts about seafarers who, for instance, got injured or even died as a result of working at heights.

Going hand-in-hand with adaptation, the game features a wide spectrum of information for the player to utilise as he wanders in the different parts of the ship. The player is compelled to constantly revisit all that information in order for him to overcome future difficult conditions. As a result, players become more knowledgeable of everything they had previously found (this could be irritating/exhausting at parts). Yet, once the player has completed the game, there is little left to be accomplished. Repeated play is encouraged mostly to increase their

scores on the international leaderboard; still, there is no variation offered "with regards to adding curiosity or novelty to practice. Replaying the game does not add anything new for the player other than perform the same game over for the same knowledge – possibly acting as a refresher, but with little motivation to do so, once the novelty wears off" (Gunter et al., 2008, p. 532).

Overall, with the use of the RETAIN model, the game received 50 points out of a total of 63.

3.2. The four-dimensional framework in Escape From Desolo

The four-dimensional framework was used to evaluate the potential use of *Escape For Desolo* as part of the specific ESP curriculum (De Freitas & Oliver, 2006). The authors proposed a table of focus to help practitioners estimate properly the four dimensions/aspects of games before their implementation and thus anticipate particular issues. Employing this table, the authors show the way it has been used to evaluate the *Escape From Desolo* SG as illustrated in Table 3.

Table 3. Using the four-dimensional framework to evaluate Escape For Desolo

Context	Learner Specification	Pedagogical Considerations	Mode of Representation (tools for use)
School-based learning in English for shipping studies/ commerce, finance, and shipping studies.	School learners 22-26 years old, undergraduate students of commerce, finance, and shipping, at CUT. The learners are familiar with the context of safety at sea as they have attended related classes over their studies but in the Greek language.	"Use of theories such as Kolb's (1984) Experiential learning where learners learn from experience through abstract conceptualisation and application into practice might be effective" (De Freitas & Oliver, 2006, p. 261).	Escape From Desolo uses a medium of fidelity based upon the use of 3D animated characters.

Interactions with the software via the students own mobile phone/ easy installation/ no further need for technical support after it is downloaded and installed/ Free access.	The tool is currently been used for training the prospect seafarers on onboard safety skills in classroom but it can be used by all ages, ranks, and genders.	Curricula objectives include safety at sea conventions (MARPOL-International Convention for the Prevention of Pollution from Ships, SOLAS-Safety of Life at Sea, and STWC- International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers) and safety issues including overloading, collision, fire, and (personal) protective equipment. Learning outcomes: conversancy with onboard difficulties (interior/exterior part of the ship) and approaches allowing the students to experience emergency conditions/situations onboard first-hand and learn how to anticipate them.	Escape From Desolo "uses a high level of interactivity between the media world and the learners' own experiences and knowledge, allowing the student to develop an increasing conservancy with the rules and functionality of the simulation tool" (De Freitas & Oliver, 2006, p. 261).
Escape from Desolo supports safety at sea components of the English for shipping curriculum. It can support classroom-based practical teaching/learning or even informal learning due to its aforementioned specifications.	The tool can be used by learners working only singly, not in groups, due to its single story driven nature. Therefore, teacher-led instruction of the related academic context should be preceded.	Learning activities: the student learns through tasks based upon problem-solving situations of safety onboard.	Learning activities and outcomes achieved through specially developed software supporting an increased awareness of the learner of the processes of reaction in emergency situations and emergency drilling through increased usage.

	"Range of differentiated learners with different learning styles can be catered to through the use of this tool as each learner can engage with the resource according to their own preferences" (De Freitas & Oliver, 2006, p. 261).	Briefing/Debriefing: pre-class preparation and post activity reflection and consideration.	
		"Simulation embedded as a practical session into the lesson plan of the tutor. Individuals will need different levels of attention from the tutor at different stages of the learning process" (De Freitas & Oliver, 2006, p. 261).	

Completing the table, the game design and its possible pedagogic use are highlighted. Regarding the context, it is obvious that *Escape From Desolo* specifications serve for both classroom-based implementation as well as at home use; hence, the learners may want to practise using the tool in the home context as well, supporting informal as well as formal learning processes and thus, reinforcing learning. In both situations, it may be applied as a practical tool; a tool that serves for practical experience of safety onboard skills. It is particularly interesting that it may be used by anyone, regardless of gender, age, or rank. Due to its nature, all types of learners may engage with the tool, yet prior knowledge of the academic content is necessary. Therefore, the tutors should consider some pedagogical challenges in advance to the game's integration. In particular, the table highlights the pedagogic models and approaches that are needed to embed *Escape From Desolo* into effective practice. In this particular context,

"experiential learning (Kolb, 1984) might be used to support the cyclical transition from abstract conceptualisation towards concrete action and reflection. The table also enables a deeper reflection of the ESP instructor as to whether the tool can be used to support informal as well as curricula led consideration' (De Freitas & Oliver, 2006, p. 262).

A notable strength of *Escape From Desolo* is that it is designed alongside the international conventions and laws of the maritime Studies which shape the duties onboard and/or how to react in an emergency situation or even in false alarms. This allows for a closer fit with the English for shipping curriculum component of safety at sea; a key consideration for ESP instructors wishing to embed games and simulations into teaching practice.

4.   Conclusion

This case study intended to explore current evaluation techniques and tools relevant in clarifying the characteristics of the *Escape From Desolo* SG integration into an ESP curriculum. From the analysis of the data collected from the tools employed, it was evident that the *Escape From Desolo* COTS SG could be applied in the English for shipping curriculum and specifically as part of the safety at sea component. Not only the close relevance of the academic content but also the high levels of immersion, naturalisation, and adaptation of the fantasy/story content were considered primarily for the validation and the selection of the curriculum component it could be integrated into. The fact that the academic content was so highly embedded in the fantasy story of the game enables players/learners to use the game as an opportunity for experiential learning or learning-by-doing. Facing simulated difficulties onboard which are stimulated by the game mechanics can emerge real-life situations that would be difficult for the ESP instructor to bring into the classroom otherwise. This element may also add to the level of the player's attention into the game as they are trying to find solutions to the occurring situations. In fact, these emergency situations, which revolve around the story-driven nature of the gameplay, can be thought of as a reinforcing relationship between the player and the sequence of

events of the gameplay. They work as a snowball – something that starts up as a small part and gets larger as it happens over and over again. They grow over the use of the feedback loops and/or progress bars. The very existence of feedback loops and progress bars as game mechanics enables the players to put emphasis on the early game, since the effects of the early game are magnified over time. They thus eliminate the teacher led instructions during the gameplay and provide the player with the opportunity of learning the academic content by playing. It also provides the player with the opportunity to revise and thus enhance prior acquired knowledge. Yet, the story driven nature of the game does not include discrete levels of the game. This absence of integrated levels within gameplay allows room for consideration on behalf of the ESP instructor regarding the best way to implement the game, at which particular part of the in-class lesson, and for how long the players should use it in order to keep them interested to carry on playing. The specifications of the game regarding its cost free nature, the no-limit age, or gender group that it addresses were proven highly valuable. Although the free mobile access is considered an advantage, prior to the implementation the instructor should consider the system of the phones each student occupies as the software is only available on Android and not iOS. Finally, the single user/learner specification of the game requires prior class preparation with teacher-led instruction of the related content and post activity reflection and consideration regarding the added value of the game as a teaching practice.

This chapter has examined the decisions instructors should take before embedding a SG in formal education. The authors have proposed an approach to SG evaluation that draws inspiration from the principles of the RETAIN framework and the four-dimensional framework. These were adopted in the single-case study design research of *Escape From Desolo* COTS SG in an attempt to examine and share some fundamental issues arising from the enactment of experimental activities in formal education contexts. The results from the case study, although limited to a specific ESP context, could prove useful and could be applied in different contexts for future studies. Finally, we should highlight here that this paper constitutes the pre-implementation evaluation of the *Escape From Desolo* SG. An analytic description of the *Escape From Desolo* SG implementation will be provided in a future paper.

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References

Aldrich, C. (2009). *The complete guide to simulations and serious games: how the most valuable content will be created in the age beyond Gutenberg to Google*. John Wiley & Sons.

Arnab, S., Berta, R., Earp, J., De Freitas, S., Popescu, M., Romero, M., …, & Usart, M. (2012). Framing the adoption of serious games in formal education. *Electronic Journal of E-Learning*, *10*(2), 159-171.

Baldauf, M., Schröder-Hinrichs, J.-U., Kataria, A., Benedict, K., & Tuschling, G. (2016). Multidimensional simulation in team training for safety and security in maritime transportation. *Journal of Transportation Safety & Security*, *8*(3), 197-213.

Care, E., Kim, H., Vista, A., & Anderson, K. (2018). *Education system alignment for 21st century skills: focus on assessment*. Center for Universal Education at The Brookings Institution, 1775 Massachusettes Avenue NW, Washington, DC 20036.

David, M. M., & Watson, A. (2008). Participating in what? Using situated cognition theory to illuminate differences in classroom practices. In A. Watson & P. Winbourne (Eds), *New directions for situated cognition in mathematics education* (pp. 31-57). Springer. https://doi.org/10.1007/978-0-387-71579-7_3

De Freitas, S., & Oliver, M. (2006). How can exploratory learning with games and simulations within the curriculum be most effectively evaluated? *Computers & Education*, *46*(3), 249-264. https://doi.org/10.1016/j.compedu.2005.11.007

Djaouti, D., Alvarez, J., Jessel, J.-P., & Rampnoux, O. (2011). Origins of serious games. In M. Ma, A. Oikonomou & L. C. Jain (Eds), *Serious games and edutainment applications* (pp. 25-43). Springer. https://doi.org/10.1007/978-1-4471-2161-9_3

Djuraskovic, I., & Arthur, N. (2010). Heuristic inquiry: a personal journey of acculturation and identity reconstruction. *Qualitative Report*, *15*(6), 1569-1593.

Gunter, G. A., Kenny, R. F., & Vick, E. H. (2008). Taking educational games seriously: using the RETAIN model to design endogenous fantasy into standalone educational games. *Educational Technology Research and Development*, *56*(5-6), 511-537. https://doi.org/10.1007/s11423-007-9073-2

Hutchinson, T., & Waters, A. (1987). *English for specific purposes*. Cambridge University Press.

Karshenas, S., & Haber, D. (2012). Developing a serious game for construction planning and scheduling education. In *Construction Research Congress 2012: Construction Challenges in a Flat World* (pp. 2042-2051). https://doi.org/10.1061/9780784412329.205

Kocdar, S., Okur, M., & Bozkurt, A. (2017). An Examination of xMOOCs: an embedded single case study based on Conole's 12 dimensions. *Turkish Online Journal of Distance Education*, *18*(4), 52-65. https://doi.org/10.17718/tojde.340381

Kolb, D. A. (1984). *Experiential learning: experience as the source of learning and development*. Prentice-Hall.

Michael, D. R., & Chen, S. L. (2005). *Serious games: games that educate, train, and inform*. Muska & Lipman/Premier-Trade.

Prinsloo, J. W., & Jordaan, D. B. (2014). Selecting serious games for the computer science class. *Mediterranean Journal of Social Sciences, 5*(21), 391-398. https://doi.org/10.5901/mjss.2014.v5n21p391

Robertson, S. L. (2019). Interactive digital instruction: pedagogy of the 21st century classroom. In *Handbook of research on promoting higher-order skills and global competencies in life and work* (pp. 166-180). IGI Global. https://doi.org/10.4018/978-1-5225-6331-0.ch011

Schreiber, J. B., & Asner-Self, K. (2011). *The interrelationship of questions, sampling, design, and analysis*. Wiley & Sons.

Ulicsak, M. (2010). *Games in education: serious games-a futurelab literature review*. https://www.nfer.ac.uk/publications/FUTL60/FUTL60.pdf

Vintimilla-Tapia, P. E., Peñafiel-Vicuña, C. J., Bravo-Torres, J. F., Gallegos-Segovia, P. L., Yuquilima-Albarado, I. F., & Ordónez-Morales, E. F. (2018). A multi-subject serious game as an education tool: analysis from the teacher's perspective. In *2018 IEEE Biennial Congress of Argentina (ARGENCON)* (pp. 1-7). https://doi.org/10.1109/argencon.2018.8646131

Yin, R. K. (1994). Discovering the future of the case study. Method in evaluation research. *Evaluation Practice*, *15*(3), 283-290. https://doi.org/10.1016/0886-1633(94)90023-x

Zyda, M. (2005). From visual simulation to virtual reality to games. *Computer*, *38*(9), 25-32. https://doi.org/10.1109/mc.2005.297