

# An overview of Distributed Construction through Participatory Design

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## INTRODUCTION

This paper presents an empirical study of an online learning community that collaborates with the course design team under the Participatory Design methodology. The different phases of this methodology were implemented using a four stage participatory design process (Zaphiris & Zacharia, 2001):

- (a) Building bridges with the intended users,
- (b) Map user needs and suggestions to the system,
- (c) Develop a prototype,
- (d) Integrate feedback and continue the iteration.

We took advantage of the online and distributed nature of the student community to asynchronously design, implement and study the course. We carried out the participatory design methodology by following the Distributed Constructionism pedagogical theory. During the different phases of the design process we measured the student participation and the changes in their behavior when new design elements were introduced. We conclude that the most important element of this course was our discussion board which helped us to promote student collaboration and the identification of the key community users who can participate productively in Participation Design activities.

There are three main sections to this paper. After defining the key terminology, our Participatory Design approach is presented and its linkage to the Distributed Constructionism pedagogical theory specified. The paper ends with ideas for future research and a set of conclusions.

# **B A C K G R O U N D**

## **Participatory design**

Participatory design (PD) refers to a design approach that focuses on the intended user of the service or product, and advocates the active involvement of users throughout the design process. PD is often termed as the "Scandinavian Challenge" (Bjerknes et al, 1987), since it was researchers from Scandinavian Countries who pioneered its use in information systems development (Blomberg & Henderson, 1990; Bodker, Gronbaek, & Kyng, 1993; Ehn, 1988).

User involvement is seen as critical both because users are the experts in the work practices supported by these technologies and because users ultimately will be the ones creating new practices in response to new technologies (Ellis et al, 1998).

Blomberg and Henderson (1990) characterize the PD approach as advocating three tenets:

- The goal is to improve the quality of life, rather than demonstrate the capability of technology.
- The orientation is collaborative and cooperative rather than patriarchal.
- The process is iterative since PD values interactive evaluation to gather and integrate feedback from intended users.

By involving the users in the design process, the designers also gain knowledge of the work context, so that the new technology explicitly incorporates the values, history, and context of the work system (Ehn, 1988). The users take part in the entire design, implementation and decision-making processes. Their involvement ensures that their activities are taken into account. Also by participating in the design the users have a sense of "ownership" (Brown & Duguid, 2000), and the final system will have an increased user acceptance.

## **Distributed Constructionism**

Simply put, Constructionism can be thought of as "learning-by-making" (Papert, 1991). It is both a theory of learning and a strategy for education (Papert, 1993). It focuses on the construction of a system rather than the information that will be used. The theory views computer networks as a new medium for construction, not as an information distribution channel. By embedding construction activities within a community, new ways for students to learn arise (Papert, 1993). Based on Piaget's constructivist theories, people don't get ideas, they make them. Learning is an active process where people construct knowledge from their experiences (Resnick, 1996).

Distributed Constructionism (Resnick, 1996) extends the Constructionism theory (Papert, 1991; Papert 1993) to knowledge building communities, where the online learning community (instead of one student) collaboratively constructs knowledge artifacts (Resnick, 1996). Distributed Constructionism asserts that “a particularly effective way for knowledge-building communities to form and grow is through collaborative activities that involve not just the exchange of information but the design and construction of meaningful artifacts” (Resnick, 1996). The three major activities of DC, within the context of an online learning community are (Resnick, 1996):

**Discussing Constructions:** Students discuss their constructions during the design, implementation, evaluation and reiteration phases

**Sharing Constructions:** Web based systems allow students to share their constructions and make them part of the shared knowledge.

**Collaborating on Constructions:** The community can use online communication, to collaborate on the design and development of the knowledge artifacts.

Distributed Constructionism was enhanced among the users of the system, due to the iterative structure of our Participatory Design approach. Both the learning experience of the users and the content and functionality of the course itself were enhanced by the knowledge artifacts that were contributed to the course.

## **D E S I G N   A P P R O A C H   &   C O U R S E E V O L U T I O N**

Now a case study applying the theories presented in the previous section is described.

Our focus has been to design an online learning community around a Computer Aided Language Learning (CALL) course. We believe that online interaction and community would increase users’ motivation, commitment and satisfaction with the online course. The Participatory Design methodology blends nicely with our goal. In particular, involving users during system development is thought to lead to greater user commitment, acceptance, usage, and satisfaction with the system (Baroudi, et al, 1986).

In the design phase of the on-line course, we implemented PD as a four-step process (Ellis et al, 1998).

### **a) Building bridges with the intended users:**

This step opened lines of communication between intended users and the development team. Specifically, this step involved the initialization of a

multidisciplinary development team, identifying key groups of end users, and creating new methods of communication with users.

The development team in this project came out of the Kypros-Net (Kypros-Net Inc, 2002) group. Through their involvement in Cyprus and Greece related projects, they had longstanding relations with the intended user community.

The intended users have been especially people of the Greek Diaspora, travelers to Cyprus and Greece and other Greek speaking areas and people who are generally interested in the Greek culture and language or languages in general. In our case, bridges with the intended users were build through our years of work at providing information about Cyprus through the web pages of Kypros-Net who primarily attracts the same user population as our intended Greek language online course.

### **b) Mapping user needs and suggestions to the system:**

Our conceptual design model has been “to design an effective online Greek language course that can build and sustain an online learning community of students”.

Based on the questions and inquiries we received from our users we tried to match their needs (they wanted an easy to follow, both elementary and advanced course that they could attend at their own paste) with our conceptual design model.

### **c) Developing a prototype:**

The project consists of 105 audio files, which were originally recorded as Radio lessons in Modern Greek for English speakers in the 1960's. The lessons were retrieved from the archives of the Cyprus Broadcasting Corporation, digitized in Real Audio 5.0 format and published online through the course. Although, an optional textbook accompanied the original Radio lessons, the online lessons were designed as a complete standalone course. We used several tools to assist students with the lessons, including an online English-Greek-English dictionary, a Greek spell checker and a web-based discussion board. The discussion boards served as the foundation for creating a community of online students and enhanced the learning experience with Distributed Constructionism.

### **d) Integrating feedback and continuing the cycle:**

Feedback from our users and suggestions are continuously incorporated into our design through a series of additions and corrections. For example, we were asked to add an online notes section and to encode some files again because they were corrupted.

An important element in the participatory design methodology is the direct involvement of the users in all stages of the design process. We kept the users involved by participating in the discussion boards, and sharing with them design and development plans for the course.

The students of the audio courses included people with no knowledge of Greek language, bilingual members of the Greek Diaspora, as well as high-school professors of non-Greek language. These students created an open online community whose collaboration has boosted the learning experience of the whole community. The web-based discussion board has proven to be the most constructive tool for the students learning experience and the main source of feedback for the maintainers of the project. The experiences shared on the discussion board included tricks and tips on how to record the audio files, installation of Greek fonts, learning methodologies and questions about the Greek language itself that arise from the lessons. The experienced users (some of them were retired teachers of foreign languages) had taken a lead role in the vast majority of the threads on the discussion board, answering most of the questions and encouraging the beginners to study the lessons further. They have also become the communication interface between the maintainers of the project and the community's requests.

At some point, the users started exchanging, through email, written notes taken by the experienced users. They also used the discussion board to announce the availability of their personal notes. This behavior suggests that we must provide (and we did) the users with the capability to post their notes on the project's site.

The students had initiated Distributed Constructionism themselves. The course designers only provided technical support to facilitate the students' construction activities.

### **Discussing the Constructions**

The course designers offered to provide publishing access to the online course to whoever wanted to contribute their material. Five users, asked to be given access. Consequently, the five users with the two course designers constituted the Participatory Design team. The PD team solicited contributions from the user community. The users suggested that they should transcribe the audio lessons, and compile verb lists, vocabulary lists, and grammatical notes for each lesson.

### **Sharing the Constructions**

All the user contributions were shared in the common area of the online course. The users members of the PD team regularly posted notices on the discussion board about new material for the course. Also other less active users chose to offer contributions for the course, by posting on the discussion board, rather than contacting the PD team.

### **Collaborating on the Constructions**

The user members of the PD team did not include any native speakers of Greek. They were all learning the language through the online course, and at that stage, they were primarily depended on the audio lessons. In order to ensure the quality of the new material before publishing them on the course website, the user members of the PD team implemented a peer review process. A group of 7 users,

that included the five central user PD team members, reviewed and corrected all the material before posting them on the website. Each of the 7 users offered to transcribe a number of the 105 Audio lessons, and two of them also offered to provide verb and vocabulary lists. However, all materials were posted in a private area first, reviewed by the 7 user members of the PD team, and posted on the website, when the five PD users were satisfied with the quality. Then the 2 PD course designers, who were both native Greek speakers, would go over the already published material, and make sure that it is correct. Most of the mistakes we had to correct were spelling mistakes, and we rarely had to correct grammatical mistakes.

Two months after the Distributed Constructionism effort started, students of the audio lessons managed to transcribe 81 out of the 105 lessons, correct them through the peer review process among themselves and post them on the project's website. Six months later, the students had transcribed and peer reviewed all 105 lessons.

The knowledge constructed attracted significant user attention. The accesses to the audio lessons, the language tools, and the total access of the message board and the notes pages, all kept increasing exponentially (Zaphiris & Zacharia, 2001). However, once we allowed our users to publish their own notes, there was a dramatic shift of traffic from the message board to the notes pages. In our view this is due to the fact that the users did not need any more to visit the discussion board to find out where other users had posted their notes. All the content was already aggregated and organized in a central location.

The course's popularity is apparent from the fact that the course currently has over 25,000 registered students who actively participate in an online community which evolved around the course.

## **F U T U R E   T R E N D S**

Future work on this specific project will focus on a non-virtual, face-to-face participatory design team. Like the previous PD team, key stakeholders (teachers of Greek in the diaspora, students, administrators and designers) will work together, participating and interacting throughout the whole iterative design process. They will once again collaborate on the content and functionality development, peer review and publish content contributions.

We believe that by encouraging the active involvement of the users, the product developed will be more enjoyable, more usable and most importantly, more catered to their specific needs and requirements.

Also we anticipate that the expected benefit of this face-to-face PD team versus the virtual PD team will be that everyone involved will feel more like a team and have a stronger relationship with each other. Since the PD team will be a face-to-face one, communication will be better and there will be fewer misunderstandings or misinterpretations, and finally the collaboration results should be more

immediate, and the final product more usable and acceptable by all the stakeholders.

From our analysis of existing literature we observed that there is a need for additional research in areas like ethnography in participatory design, and the application of our proposed methodology to new domains. As new delivery e-learning technologies are constantly emerging research into Distributed Constructionism with the latest technology also remains important. Finally, evaluations of case studies of PD and DC will be very useful to case specific applications of the theories.

## **C O N C L U S I O N**

By facilitating Distributed Constructionism in the iteration phase of a Participatory Design methodology, we enhanced the learning experience in our web-based training. A questionnaire evaluation (Zaphiris & Zacharia, 2001) shows that the end system received high usability ratings from the users. Therefore Distributed Constructionism enhanced the learning experience of both the PD team, and the more passive users.

The students that participated actively in the design of the course also played a central role in the discussion board answering other students' language questions, helping out students to overcome technical problems and helping them to find other resources to enhance their learning of the Greek language. These observations are with agreement with the underlying goals of Participatory Design which was an integral part of the development of this specific course.

Furthermore, the results of the analysis of the user questionnaire and the server logs shows that the final product (the course) meets to a very big extend the expectations and needs of the whole user population of this specific course. We believe that the direct involvement of the users in the development of the course helped in designing a more usable course that enhanced the learning of our users and provided them with a enjoyable and rewarding experience.

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## Terms and Definitions

**Computer Aided Language Learning (CALL):** The use of computers in learning a language.

**Participatory Design (PD):** A design approach that focuses on the intended user of a service or product, and advocates the active involvement of users throughout the design process.

**Distributed Constructionism (DC):** An extension of the constructionism theory to knowledge building communities, where the online learning community (instead of one student) collaboratively constructs knowledge artifacts.

**User-centered design:** User-centered design puts the user into the center of the software design process.

**Pedagogy:** The activities of education or instructing or teaching

**Human Computer Interaction:** The study, planning and design of what happens when humans and computers work together.



**Ethnography:** The branch of anthropology that provides scientific description of individual human societies.

**Web-based training (WBT):** Anywhere, anytime instruction delivered over the Internet or a corporate intranet to learners.