Challenges from implementing Blended Learning in a 3D Multiuser Virtual Environment

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Tags

web-based LMS, moodle, sloodle, MUVE for learning

With their ability to simulate real life and allow users to interact with the virtual environment, Multiuser Virtual Environments (MUVEs) are very useful platforms for education and training. A survey of the related literature shows that MUVEs in education are mainly used only as a supplement of the traditional lesson in the classroom, which is mainly the idea of blended learning. In this work, we go one step beyond and examine whether this blended learning model can be fully implemented online, with MUVEs replacing the face to face interaction. This is ideal for open learning communities, whose members are able to meet only online, and can hardly meet in the same classroom. For an open learning community, we investigate whether the existence of a MUVE can be combined smoothly and productively with the already established tools for online learning communities support and the first user experiences are positive: users prefer to use LMS because of its simplicity and are attracted from the 3D virtual environment and the interactivity it offers.

1. Introduction

Although online MUVEs were not primarily designed for educational use, they have attracted the interest of educators and institutes and are used in parallel with the in-classroom courses (Miller et al, 2010; Sturgeon et al, 2009; Thomas and Mead, 2008). This use assumes that the educator spends a few teaching hours to introduce students to the new environment and explain the activities to them. During the activity, which is usually held in a computer lab, the educator is physically present in order to facilitate students on the use of the MUVE (Konstantinou et al, 2009). The result from the use of MUVEs is a blended course, which mixes face-to-face in-classroom interaction with computer mediated activities (Bonk & Graham, 2006), (Trapp, 2006)

In a MUVE, participants are represented by graphical characters called avatars and acquire the feeling of coexistence in the same virtual space. We consider that this feature may under certain circumstances substitute the presence of the participants in the same physical space. According to the analysis of Biocca (2003) the sense of presence is divided into: a) the physical presence which is defined as the simulation in a virtual world in a way that is perceived as the physical world, b) the social presence, which is defined as the individual's interaction with the other participants and c) the self-presence which is the mental sense of the individual's representation in the virtual world. Therefore, we transfer the blended learning model completely online, with the MUVE being the substitute of the classroom and the Learning Management System (LMS) being the online learning platform.

The aim of this study is to examine whether this transfer is feasible, what implications may arise and how educators and members of the learning community in general can resolve them. In order to test our idea, we designed a series of courses on different disciplines, such as chemistry, physics and astronomy, which can be significantly favored by 3D visualizations and the use of multimedia. The various learning objects and the asynchronous learning activities of our community were served from a popular e-learning platform (Moodle) and the MUVE (Second Life) was mainly employed in order to create the sense of being in a classroom to our community members. For this reason, we created a 3D virtual classroom representation and arranged weekly meetings for the community members. In this virtual classroom, members meet face to face, or at least avatar to avatar. Teachers give lectures that simulate lectures in the classroom, answer to students' questions and motivate students to use the educational material and additional web resources.

The main contributions of this work can be summarized in the following:

- An implementation of the blended learning model completely inside the MUVE. The implementation combines the merits of an open source e-learning platform (Moodle) and a multiuser virtual environment (SecondLife - SL)
- The smooth integration of a traditional e-learning platform, which focuses on the asynchronous activities of the community members, such as the distribution of any digital content and the scheduling of learning activities and the MUVE, which is the ground for all the synchronous activities of the learning community.

Section 2 performs an overview of the related research works that introduce MUVE in the learning process. They either use Second Life or other competitive MUVEs. In section 3, we provide details on the design of our first course. Section 4 highlights the most important implementation issues and section 5, illustrates the students' impressions from an educational, psycosociological and technological aspect. In this section we examine the interestingness and usefulness of the virtual blended learning approach, and the students' impressions from the simulation of the traditional learning model in the virtual environment. Finally, section 6 presents our first conclusions and summarizes our next steps.

2. Related work

The aim of virtual learning communities is to collaboratively improve knowledge in the field of expertise of the community. MUVEs such as Second Life allow individuals to interact, communicate, collaborate and learn. They can offer an enhanced learning experience if used properly in group-and collaborative project-based assignments (Lambropoulos & Mystakidis 2012). This makes them the ideal platform for taking the blended learning paradigm (Varlamis & Apostolakis 2010) completely online: face-to-face activities can be replaced by avatar-to-avatar interactions and computer mediated-activities can be more interactive and realistic in the 3D environment.

Online MUVEs, such as Second Life, OpenSim, Wonderland and Croquet offer better simulation of the interaction in classroom (Wang and Burton, 2012; Leidl & Rößling, 2007) since they support the use of 3D-avatars, voice chat, lips and other body part movements which can help address the lack of awareness and attract students' and teachers' interest (Konstantinou et al, 2009). The use of avatars lowers inhibitions and increases social interactivity (Yalcinalp et al, 2012). Most 3D virtual environments offer full customization of an avatar's appearance and gestures, allowing users to strongly identify with the chosen representation for their avatar and easily distinguish the other participants. This customization strengthens the perceived sensation of presence and awareness (De Lucia et al., 2009).

Most research works in the literature use learning activities in Second Life as a complement to the traditional learning activities (Beltrán Sierra et al, 2012; Honey et al, 2012; Baker and Brusco, 2011; Miller et al, 2010) and consider Second Life as a means for engaging learners (Iqbal et al, 2010), or as a game activity that will help students to overcome their technophobic barriers (Chow et al, 2011). In most works, the role of the teacher ends in facilitating students to familiarize themselves with the new environment. In our study, Second Life is the main platform for delivering knowledge, and the teacher is primarily educator and secondary a facilitator for the students.

According to social constructionism, a virtual world has two essential capabilities: a) tele-presence (via avatars) and b) immersion in the virtual world (Girvan et al, 2012). These capabilities are less prominent in traditional LMS' than in immersive MUVEs (Lambropoulos & Mystakidis 2012). On the other side, most of the virtual worlds are not designed for managing learning content. Although one can include

streaming media (audio and video), storing and managing documents "in-game" is still cumbersome. The import and export facilities for common file formats – e.g., Word, PDF, or PowerPoint – are currently only rudimentary. Applications like Sloodle (Livingstone & Kemp 2008) integrate web-based Course Management Systems (in this case Moodle) into virtual environments (Second Life) and try to benefit from both sides. They combine the improved social interaction capabilities of Virtual Worlds and the content-management qualities of LMS, which are more suitable for asynchronous communication, simple tests and persistent storage of related documents

As stated by Perera et al (2011), the management of the learning environment is a challenging task for teachers, since the 3D system functionalities are less cohesive for their educational processes and students might focus more on environment features over the Intended Learning Outcomes (ILO). As a result, the transfer of e-Learning and traditional learning activities to the MUVE must consider the benefits and limitations of the new environment and must be supported by traditional learning or e-learning methods. For example, when the lectures are performed in a virtual environment, it is harder for the teacher to monitor the students' attendance. So the lecture must be redesigned to be more interactive and to require students' feedback. Similarly, when designing students' assessment activities, the teacher must have in mind that students can have access to the web and other resources during the assessment.

3. Technological solution

The working example in our study was the design of a platform for learning Physical Sciences. For this reason, we developed "Physical Sciences Virtual Classroom" which is a hybrid electronic environment that combines Moodle and Second Life. We designed 3 courses, entitled "Brewing", "Health and Nutrition", "Coulomb's Law" and "Solar System" for the science of Chemistry, Physics and Astronomy respectively. The courses have been designed in order to allow students of different of ages and without prior knowledge to attend them.

The pillars of our platform were Moodle and Second Life. The bridge between the two was Sloodle, an open source module, designed for this purpose.

Moodle (Modular Object - Oriented Dynamic – or Developmental - Learning Environment) is a Course Management System which has been designed to support virtual communities that capitalize on social constructive learning. Its main characteristics are: a) Modularity, which based on a large collection of independent pieces of code (modules) which support the learning process, b) Object Orientation, by capitalizing on the use and re-usability of learning objects, c) Dynamic, since Moodle is a continuously evolving platform. The most important advantage of Moodle, is that it can be accessed through a web browser and needs no additional software to be installed in the students' of teachers' computers. In its current deployment, our "Physical Sciences Virtual Classroom" runs over Moodle 1.9.7, which has been installed over a LAMP web server installation (active URL: http://www.medialab.edu.gr/dk/vclass/). The default set of Moodle plugins has been extended with a calendar and an online text chat.

Second Life (Lybeck et al., 2011) is a 3D virtual environment, which is based on the typical client-server architecture, it provides a model of the real world, with accurate simulation of physics including a meteorological and gravitational system; as such, anything can be modeled and simulated. The virtual classroom of our community has been created from scratch. A slide projector and a multimedia screen have been added, as well as sitting desks for every student. A virtual brewery and a planetarium that have been employed in our virtual visits have been created by members of the Second Life community.

Sloodle (Simulation Linked Object Oriented Dynamic Learning Environment) is a Moodle add-on which facilitates data transfer between Moodle and Second Life platforms. Sloodle aims to bring improved learning support to 3D multi-user virtual environments through integration with web-based virtual learning environments (Livingstone & Bloomfield, 2010). It provides a variety of tools for supporting learning contexts in immersive virtual environments. The administrator of the community can simply activate or deactivate a tool in the options of Sloodle Controller. From this same controller, the administrator is able to add the virtual objects in the Second Life classroom. All the necessary configurations for linking objects between the two platforms are automatically adjusted.

Our platform comprises several synchronous and asynchronous e-learning tools and combines the merits of the 3D virtual environment of Second Life, which offers visualization of objects, synchronous voice and chat, virtual participation via avatars etc. with those of the popular e-learning community platform Moodle, which offers several synchronous and asynchronous tools for teacher and student communication

and facilitation, presentation, apprehension and assessment of acquired knowledge. Sloodle allowed us to seemingly integrate the virtual world and the e-learning platform in a homogeneous environment. The result of this platform merging, as shown in the analysis of a survey performed among the community members, is that attendants had most of the facilities that exist in a real-world classroom, whilst they stayed at home. Moreover, they had access to online resources and other facilities which are typically available only in asynchronous, web-based, e-learning environments.

4. Course management

Every student and teacher was able to connect to the LMS and apply for a login account. After approval, users are able to login to the platform, customize their profile, communicate with each other using private messages, and access the online text chat and the asynchronous forum. They can also download and study the educational material, answer quizzes or view their performance in courses. Depending on their roles (teacher, student, course creator, administrator and visitor) users have access to specific parts of the online content, activities and course administration tools.

The LMS was the main entrance point to the courses, the reading material and the online lectures performed in the MUVE. Participants joined the virtual learning community from their places by login to the LMS and from there they could either browse the reading material or teleport to the MUVE (see Figure 1). The two platforms (Second Life and Moodle) have been adjusted in order to exchange necessary data and provide links between each other, thus creating a seemingly homogeneous learning environment for the attendants. Students were able to easily switch between the MUVE and the text based e-class environment and attend the various activities in their preferable platform.

Online lectures

The lectures, were given only inside the MUVE, but all interactions were recorded and made available through the LMS afterwards. In a predefined meeting time and point in Second Life, the teacher and a technical assistant were waiting for students outside the virtual classroom. The students could either login to Second Life and teleport to the virtual classroom, or login to Moodle and then teleport to the meeting point by clicking the appropriate link. They used voice, text chat (which was common in SL and Moodle) and private messaging in order to welcome students and facilitate them in their first steps in the virtual world. Inside the virtual classroom, students sat at their virtual desks, from where they could see the virtual whiteboards and listen to their teacher (see Figure 2). The main whiteboard was used for projecting the presentation slides. A secondary whiteboard allowed the teacher to project videos and images or to display an interactive web browser. During the lecture, both teacher and students were able to communicate with voice (public) and text chat (public or private).

Figure 1. Moodle welcome screen

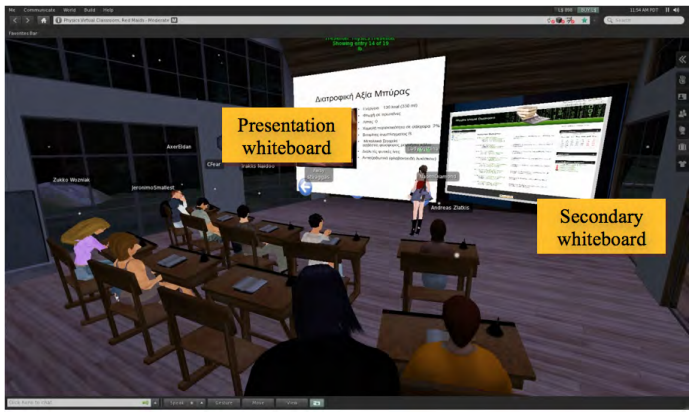

Figure 2. The virtual classroom in Second Life (from the technical assistant point of view)

Educational visits

After each lecture, students were teleported to a different virtual room, related to the lecture topic. For example, the first visit was on a virtual brewery (see Figure 3), where students had the chance to view the different stages of beer production from malting to fermentation, examine 3D virtual replicas of all the devices, click on items, read or listen to recorded info and search for the next item in the process. The teacher and the technical assistant was there to assist them in every step, or to answer questions that relate to the course subject. A virtual beer was waiting the students who managed to pass through the whole brewing process. Depending on each student's decisions during the brewing process, a different type of beer was created.

Students' evaluation

After the virtual excursion, students were able to return to the virtual classroom and answer an online test. The questions (multiple choice questions or correct/incorrect statements) covered both the online lecture and the information provided during the visit. The test was accessible both through Second Life or Moodle and was available for another 24 hours after the end of the course in order to facilitate students that needed to access the reading material. In some courses, the test was replaced by problem solving in the interactive virtual blackboard of the class (see Figure 4).

Figure 3. A visit to the virtual brewery

Figure 4. The student is solving problems on the class' virtual blackboard

Figure 5. The outside of the virtual classroom

For the courses we employed the following tools (see Figure 2 and Figure 5):

- RegEnrol Booth: A virtual booth in Second Life, where users can link their SL avatar to their user profile in Moodle with a simple click. After this registration process, any actions in the virtual world are mapped to the respective Moodle tools (e.g. chat, answering a test, getting a grade in a course etc.).
- Sloodle Presenter: The virtual whiteboard where the course slides are projected. The presentation has been created by the teacher and uploaded in Moodle.
- Web intercom: This tool allowed the connection between Moodle's and Second Life text chat services, thus creating a common real-time chat room accessible from both platforms. Students can choose in which one to be or connect at both. Plus it saves the chat logs in Moodle database.
- Quiz Chair: At the end of each lecture, students sit in the Quiz Chair and answer the questions. A correct answer moves the virtual chair to a higher level, whereas wrong answers lower the chair. As a result, a series of successful answers will elevate the above his classmates.

5. Evaluation

At the end of the first course, all students were asked to evaluate various parameters of the course and the platforms by completing a questionnaire, which combined questions found in the bibliography in related projects that evaluate LMSs and MUVEs in education. The aim of the questionnaire was to examine the users' perception of the virtual course and the linked platforms. Questions aimed to evaluate the educational value of the virtual course and its psycosocial effects and to identify usability and technical problems.

5.1 Pedagogical evaluation

The results presented in Figure 7 showed that the majority of the students were excited by the idea to participate in a virtual online course in a MUVE. Almost all found the course very or extremely interesting and understandable. They also liked the idea of 3D simulation and found it very helpful in understanding the brewing process. In comparison to a course in real a class, the opinions were contradicting. According to the negative opinions: the virtual course was not able to replace the immediate contact with the teacher, it was difficult for the teacher to interact with students and make them more active, students' attention can be easily distracted since they are sitting in their own places and the tutor is unaware of it. The MUVE provides a good simulation of the real class environment, since it gives the ability to the teacher to use an avatar and his/her own voice during the presentation and the same holds for students. On the other side, the distraction of students' attention in modern classrooms or computer labs is a reality (Barkhuus 2005, Fried 2008) and virtual classrooms cannot avoid this fact. However, a shorter lecture and more interactive activities that encourage student creativity can keep students' attention in a high level.

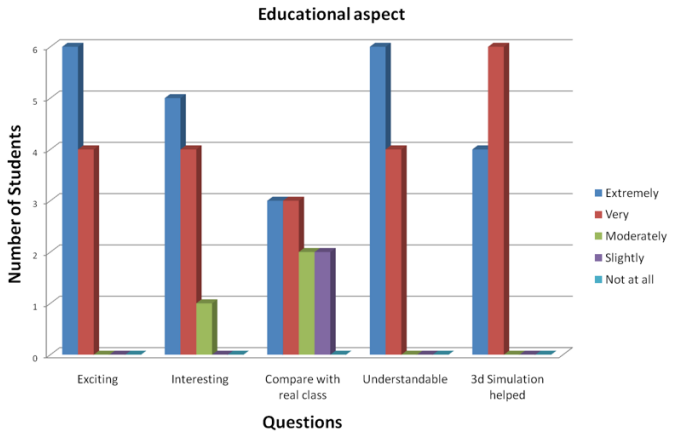

Figure 7. Results on the educational aspect

5.2 Psychosocial evaluation

The results of the evaluation of the psychosocial aspect (see Figure 8) show that most of the students had the feeling of presence inside the virtual space. Most of the students felt safe and confident inside the virtual place, although most of them have never met their classmates before in the real or virtual world.

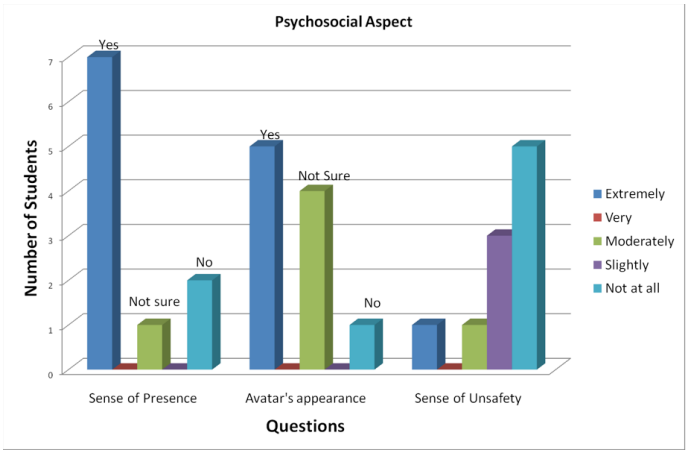

Figure 8. Results on the psychosocial aspect

Four out of ten students had never used Second Life before. Three of them felt a little unsafe from being together with people they had not met before in real life. Despite the fact that the remaining six students had used Second Life a few times, two of them felt a little unsafe in the virtual world. One student said that during his stay in the virtual space he felt he could easily lose touch with reality.

All students pointed out that they would like to use Second Life or another virtual world in the future. Half of them would do it for a learning process, three for gaming and two for meeting new people and socializing.

5.3 Technical – Functional Evaluation

Almost all students logged on easily to the virtual world and most of them were happy from their navigation in the virtual world (see Figure 9). The majority of the students feel comfortable to use the platform in the future without the aid of the teacher or a technical assistant. However, one student stated it would be too difficult for her.

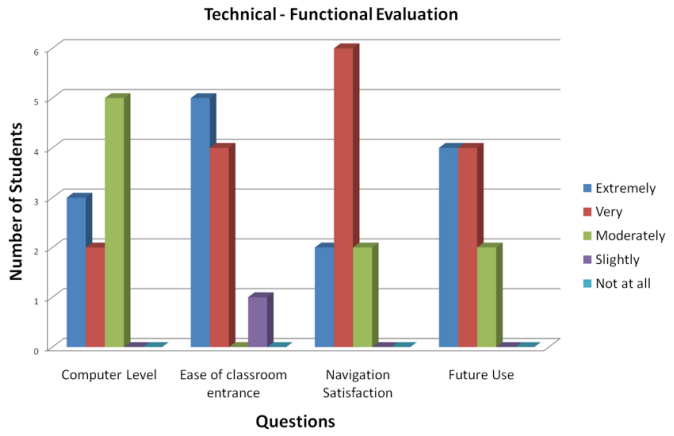

Figure 9. Results on the technical aspect

Despite the overall satisfaction, students faced several technical difficulties during the lesson, which were mainly due to their limited technical experience, and to insufficient equipments.

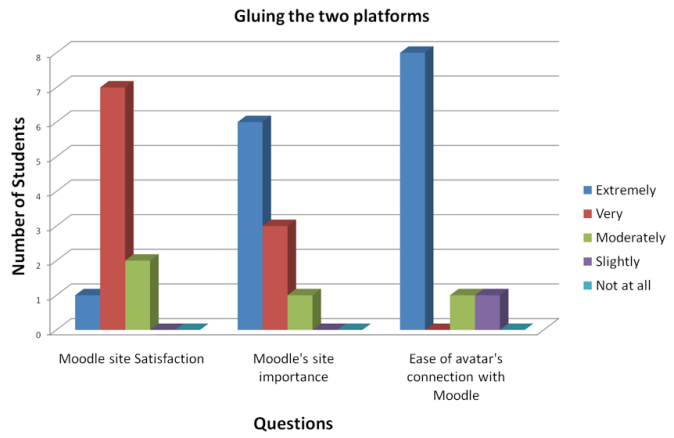

Figure 10. The evaluation of platform merging

Communicating with others in virtual worlds requires a certain skill in multi-tasking which is not necessary in the 'real world' (Edirisingha et al., 2009). A student should be simultaneously participating in public and private text discussions, using voice, observing what is happening on the screen and moving his/her avatar to indicate body language. They also should be able to switch within the two platforms, or to search the internet for context relevant to the course (as happened in the "Solar System" course). Dumitrica and Gaden (2009) note the importance of technical skill on determining the range of choices for identity. Highly customized avatars experience more interaction (Petrakou, 2010), so students need to be technically skilled in customization in order to fully participate and have presence within the learning community. There is a steep learning curve and difficultly in virtual setting navigation by users inexperienced in 3D computer games (Jarmon et al., 2009). In De Lucia et al. (2009) SL ranked lowest in terms of usefulness, ease-of- use, team attitude, and perceived team attitude, when compared with: email, forums, video conferencing, and MSN. In addition, SL requires a high level of technical infra-structure in terms of broadband access, network speed, graphics capability and processing speed on individual computers. In order to offer equitable access to the virtual learning community, technical support is necessary. Technological support staff should be available to facilitate applications, assist in development of virtual learning environments, and support teacher/learner needs (Meggs et al., 2011). Using the platform is easier for those who study computing-related careers, for the rest, if the difficulties not addressed in a correct way, can result in demotivation (Beltran et al., 2012). Along with the basic technical skills training to help learners customize avatars and navigate, learners also need to explore both the features of the 3D virtual environment and Moodle's features as well.

As far as it concerns the Moodle site, students were satisfied overall. The majority of them found it easy to connect their Moodle profiles to their Second Life avatars and stated the presence of the two-dimensional platform is important (see Figure 10). The tools and educational content were found necessary. Finally, they reported that a two-dimensional platform strengthens the sense of safety that weakens inside the virtual world. All students agreed the Moodle platform was integral in facilitating easy access to the subject matter, news, announcements, tests and grades. One person mentioned that the Moodle platform was necessary because it offers quick access to content and is closer to what most people are familiar with, while another stated it can provide a good introduction and acquaintance with the object of study, plus an easy transportation to the virtual classroom by means of a simple click.

6. Lessons learned

In order to improve the quality of the courses offered through our platform, we asked our attendants for feedback. Based on their comments on the first course, we tried to modify the educational strategy and adapt it to the specific features of the platform. An important comment in the first course was that the virtual environment allowed students to "hide" behind the virtual avatar, to move away from their computers without the teacher being aware of it. In order to improve interaction and keep student awareness high, the teacher of the second session

frequently checked the virtual presence of students, by asking questions or setting small quizzes.

We also shortened the length of the next lectures and tried to include more interactive activities. For example, in "Planets and the Solar System" course the students were asked to pick a planet or a moon in the virtual planetarium movement (See Figure 6) and instantly they transported to the planet's Wikipedia page, where they could read information about that particular celestial object. The teacher asked the students to look for information regarding the temperature of the planet or moon each had chosen, while assisting them to convert the temperature from the Kelvin to the Celsius scale. Communication through voice chat was ongoing while the students searched for the information online. Upon their return to the classroom, each student reported the temperature of the celestial object he had chosen, along with other info that had made an impression on him. The teacher solved any questions the students had, regarding the lesson in particular or the universe in general.

Figure 6. A visit to the virtual planetarium

Another interesting feature of our community is that members exchange roles from one course to the other. The teachers are not professional educators but rather community members that want to share their knowledge with other members. As a result, they learn to use the capabilities of the LMS and the MUVE both as teachers and students and in the same time they improve their teaching skills through collaboration with other community members. An analysis of the results from a survey that took place at Korea National University of Education (Cheong, 2010) concluded that the practice sessions influenced the participants (pre-service teachers) to improve their teaching efficacy. Teachers' self-efficacy has been defined as a belief on their ability to influence students' learning. The survey suggested that pre-service teachers can gain valuable teaching practice in Second Life, and furthermore that collaborative practice teaching is more effective way than individual approaches to practicing teaching. Observing others' successful teaching could strengthen the pre-service teachers' own efficacy.

7. Conclusions

This paper examined the feasibility of transferring the blended learning model completely online by combining the strengths of a MUVE and an LMS. The platform we developed allows the community members to perform every learning activity, from virtual lectures to exams and assignments, online. The goal of this platform is to support both the rich sense of place and social community that exists in 3D virtual environments while continuing to provide access to learning activities and learning management tools that are provided by modern web-based VLEs. The 3D virtual environment, since is built by the users, can be adapted according with needs of a specific teacher, subject or group of students. Real-time collaboration and cooperation ally to the several connections that can be established from in-world with Moodle also gives several possibilities for learning contexts. Everything can be built, modeled, emulated and simulated – all education areas can be covered and any subject can be delivered with the help of a 3D immersive virtual environment (Loureiro & Bettencourt, 2011).

The first experiences of users from this unified platform are positive and show that users prefer to use LMS because of its simplicity and speed of access, but are also attracted from the virtual environment, the interactivity and 3D visualization it offers. The next step of our work is to evaluate the platform in more courses and learning communities' cases and adapt this totally virtual experience to the needs of blended learning.

Since in our example students voluntarily join the community, we implicitly assume that they are positively positioned against technology. However, in the general case the technology acceptance model (TAM) is necessary to explore students' intention to participate. Recently, Chow et al (2012) have introduced an extension of TAM for Second Life and is on our next plans to apply this extension to our students. Since our learning community fits well to the Community of Inquiry framework, it is on our plans to adopt a CoI framework survey instrument (McKerlich and Anderson, 2008), in order to observe the existence of cognitive, social and teaching presence in our online blended learning model.

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Edition and production

Name of the publication: eLearning Papers
ISSN: 1887-1542
Publisher: openeducation.eu
Edited by: P.A.U. Education, S.L.
Postal address: c/Muntaner 262, 3r, 08021 Barcelona (Spain)
Phone: +34 933 670 400
Email: editorialteam[at]openeducationeuropa[dot]eu
Internet: www.openeducationeuropa.eu/en/elearning_papers