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Implementing a 3D Virtual Classroom Simulation for Teachers' Continuing Professional Development

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Abstract: 3D Virtual Worlds (VWs) are becoming important for education as they provide realistic three-dimensional environments, offer engaging, interactive and immersive experiences, and create new opportunities related to learning and teaching. To this end, it is useful for school teachers to understand these environments and explore their possibilities in enhancing their educational practices. However, in order to achieve this using 3D VWs, teachers should acquire competences that would enable them design and deliver educational activities in the context of 3D VWs, as part of their Continuing Professional Development. To this end, in this paper we present the design and the implementation of a 3D Virtual Classroom Simulation that takes into consideration the instructional strategy of Synectics.

Keywords: 3D Virtual Worlds, Second Life, SLOODLE, Teachers' Continuing Professional Development, Synectics

Introduction

3D Virtual Worlds (VWs) are becoming important for education as they provide realistic three-dimensional environments, offer engaging, interactive and immersive experiences, and create new opportunities related to learning and teaching [11], [12], [14], [18], [21], [25]. To this end, it is useful for school teachers to understand these environments and explore their possibilities in enhancing their educational practices. However, in order to effectively enhance their educational practices using the 3D VWs school teachers should acquire competences, which have been defined in our previous work according to knowledge, skills and attitudes dimensions [16], that would enable them design and deliver educational activities in the context of 3D VWs, as part of their Continuing Professional Development [5]. Moreover, Teachers' Continuing Professional Development involves among others enabling school teachers to relate their previous experiences to new concepts, ideas and/or procedures in order to develop their competences [22], [27].

On the other hand, we should take into account that the possible use of 3D VWs is a major challenge for teachers [9], since they introduce new concepts [10] with which even these teachers who are experienced and keen on using digital technologies are not familiar with.

On the other hand, several researchers [1], [19], [26] argue that 3D VWs are "*empty spaces*" that could become valuable for education if they are designed in such a way so as to support the design and the implementation of educational activities and not only the transfer of educational content in them. Moreover, nowadays school teachers must be capable of not only using digital technologies but also understand their affordances in supporting their students learning. Thus, teachers who have these competences will be able design and implement educational activities supported by digital technologies that not only help their

students understand concepts related to the subject but also concepts related to the technology and lead them acquire 21 century competences [24].

Thus, we can claim that there is a need for designing and implementing modules for Teachers' Continuing Professional Development which facilitate among others, teachers learning through the relation of their previous experiences to the new concepts introduced in 3D VWs, acquiring the skills needed to use 3D VWs in their current educational practices and eventually exploring new teaching possibilities offered by this digital technology [27]. To this end, we have designed and implemented a 3D Virtual Classroom Simulation using SLOODLE (Simulation Linked Object Oriented Dynamic Learning Environment) [20]. This 3D Virtual Classroom Simulation is implemented taking into account design considerations formulated by educational activities that derive from the instructional strategy of "Synectics - Making the strange familiar" [15]. The main objective of this approach is to help school teachers through their Continuing Professional Development to (a) explore 3D VWs, (b) understand the concepts related to them and (c) acquire competences for teaching within 3D VWs, by relating their previous teaching experiences to the new opportunities for teaching and learning that derive from 3D VWs educational specific characteristics defined in [10].

1. Background

1.1 Virtual Worlds in Education

VWs are applications that exist more than 20 years, presenting different characteristics and functionalities (e.g. Multi User Dungeons (MUDs) and Object Oriented Multi User Dungeons (MOOs)), but they have been constantly evolving leading to the development of 3D VWs, such as Second Life. This evolution was made possible due to a number of factors such as the evolution of web technologies, the development of standards that allowed interoperability between different web applications and the wide broadband access to the web. Historically, the most important design consideration for a 3D Virtual World has been its ability to constantly "move" between the "real" and the "virtual" world and to provide opportunities for experiences that simulate those of the "real" world, leading to the hypothesis that the experiences presented in a 3D Virtual World could be as "real" as those presented in the "real" world [1].

As with many emerging topics, there is not a single and consistent definition for the 3D VWs that everyone accepts [7], [8], [19]. Thus, based on the literature review, we can identify the basic characteristics and functionalities of 3D VWs: (i) they are facilitated by networked computers, (ii) they are synchronous, (iii) they offer navigational space, (iv) they support multimedia presentation and playback, (v) they provide communication facilities, (vi) they provide the creation and manipulation of avatars, (vii) they allow the creation and management of objects, (viii) they support scripting, (ix) they are persistent, immersive and highly-interactive [1], [2], [3]. Typical examples of widely used 3D VWs are (a) Active Worlds, which is proprietary, features many different user owned virtual environments and presents a virtual environment focused in education namely, Active Worlds Educational Universe (AWEDU), (b) Second Life, which is proprietary, is popular and the most used of all in research studies, is consisted of user generated virtual "islands" and also presents educational tools, such as SLOODLE, (c) OpenSim, which is open source, is relatively new and is a 3D VWs Generator that could be used to create 3D VWs that can be considered as alternatives to Second Life and (d) Edusim, which is open source, is still in an alpha version and is a 3D Virtual World compatible with Interactive Whiteboards.

Acknowledging the 3D VWs characteristics and functionalities that could be related to education, Eshenbenner et al. in [10] state that 3D VWs offer unique learning and

teaching opportunities, as they present rich, engaging, immersive, motivating and highly interactive environments, due to the fact that they: (i) recreate the sense of presence, (ii) are immediate, (iii) are adaptable, (iv) offer the possibility to simulate the "real" world, (v) offer the possibility to create new experiences that may not be possible or may be difficult to represent in the "real" world, (vi) could be offered for experimentation and (vii) allow for synchronous communication and collaboration. These can be considered as the key concepts that would be useful to be understood by teachers who want to implement 3D VWs in their educational practices.

In literature, there are a number of studies [3], [6], [8], [13], [14], [17], [18] that have acknowledged these educational specific characteristics and examine the potential of 3D VWs in teaching and learning. Those studies examine whether 3D VWs can be used for: (i) distance learning [8], (ii) personalised learning [6], (iii) project based learning [13], (iv) experiential learning [14], (v) providing real time feedback [17], vi) exploratory learning [6], (vii) collaborative learning [18] and (viii) problem-based learning [3].

Furthermore, there are research studies [11], [12], [14], [17] that focus specifically on teachers' experiences either through using 3D VWs in their teaching activities or through their participation in 3D VWs supported Continuing Professional Development. Table 1 summarises highlights from these studies.

Table 2. Studies highlighting teachers' perspectives about 3D VWs

Study	Short Description	Highlights about the Teachers' Perspectives
Esteves et al. [11]	Used Second Life in a student-centered learning and teaching approach for computer programming based on a problem-based strategy	*"the pressure felt by teachers in delivering such a course was amplified by the use of Second Life"*
Girvan & Savage [12]	Aimed to define an appropriate pedagogy for teaching through Second Life	*"teachers tend to transfer conventional instructional paradigms as they are and as a result recreate them in 3D VWs settings"*
Jarmon et al. [14]	Aimed to study if Second Life facilitates learning and how can the experiences acquired in it be applied in real life situations	*"at first teachers were not positive in using Second Life, but then acknowledged that they offer new possibilities for teaching and learning"*
Konstantinidis et al. [18]	Aimed to study how Second Life can be used to support collaborative activities	*" teachers could interact and collaborate more with the learners through SL"*
Vasileiou & Paraskeva [25]	Followed a Teachers' Continuing Professional Development approach using Second Life in combination with a role-playing strategy	*"through this approach teachers understood the new and innovative possibilities of using 3D VWs for teaching and learning"*

As it is indicated from the above mentioned studies there are a number of issues, such as the extra pressure applied to teachers who teach within 3D VWs and the lack of understanding of the new possibilities offered by 3D VWs in teaching and learning, that should be considered in order to develop modules in Teachers' Continuing Professional Development programs that aim (a) to help the teachers understand the concepts related to 3D VWs, (b) explore the new possibilities that 3D VWs present for teaching and learning and (c) equip them with useful competences related with teaching in 3D VWs.

On the other hand, the increased interest of exploiting 3D VWs in education, has led to the development of educational tools and applications which aim to integrate existing learning technologies (such as Course Management Systems) in 3D VWs infrastructure (such as Second Life) [3], [4], [7], [19]. A prominent example of those efforts is the SLOODLE (Simulation Linked Object Oriented Dynamic Learning Environment), which enables the integration of Second Life and Moodle [19], [20].

Thus, in order to support teachers understand the concepts related to 3D VWs, explore the new possibilities offered by 3D VWs for teaching and learning and acquire basic competences for teaching within 3D VWs, we propose to use the SLOODLE environment in order to design and implement a simulation of a "traditional" classroom in the unfamiliar context of the 3D VWs, so as to enable teachers achieve the above mentioned objectives

within a closed and familiar environment and then extent and apply them in the openness of the 3D Virtual World.

1.2 Application of the instructional strategy of "Synectics - Making the Strange Familiar"

The instructional strategy of "Synectics - Making the Strange Familiar" is defined as "*a strategy for making the students understand and internalize new or difficult concepts and ideas, through the use of analogies between concepts or ideas which are familiar to the students to the new concepts or ideas presented*" [15]. As a result, this instructional strategy is considered as appropriate for (i) exploring and understanding social problems by relating them to familiar situations through the use of metaphors, (ii) problem solving as this instructional strategy offers the opportunity to understand a problem by relating it to previous experiences and apply solutions based on them, (iii) creating a design or a product based on the combination of previous experiences and ideas with the new concepts and/or possibilities presented and (iv) understanding unfamiliar and/or abstract concepts through the identification of their similarities and differences to familiar concepts, ideas and/or objects [15], [23].

Based on the above we consider (a) as the "strange" part of the analogy, the concepts and the competences related with teaching within 3D VWs and (b) as the "familiar" part of the analogy the teachers' experiences in a "traditional" classroom. Thus, we claim that the use of this strategy can (i) facilitate teachers to understand the unfamiliar concepts presented in 3D VWs by exploring the similarities and differences between a "traditional" classroom and a 3D Virtual Classroom, and (ii) enable teachers to design simple educational activities by transferring their previous experiences and ideas using the tools presented in the 3D Virtual Classroom Simulation.

Next, we present the design of the proposed module of Teachers' Continuing Professional Development.

2. Proposed Module of Teachers' Continuing Professional Development Design

The potential participants of this module should be selected school teachers, who are experienced in using digital technologies both in their life and in their educational practices. It is also anticipated that they present high motivation and interest in their continuing professional development and appreciate the potential value of innovative digital technologies for education.

The module consists of seven phases that feature different educational activities. In the first five phases the 3D Virtual Classroom Simulation, will be used in order to demonstrate the second part of the analogy, that is, the "traditional" classroom to 3D Virtual Classroom, whereas in the next two phases the teachers will interact within the 3D Virtual Classroom Simulation exploring the analogy on their own and generating their own analogies, that is, educational activities in a "traditional" classroom to educational activities in a 3D Virtual Classroom.

More precisely, in the Phase 1 (Substantive Input), the educator presents the main concepts related to 3D VWs and triggers a discussion. In Phase2 (Direct Analogy), the educator presents the analogy of a "traditional" classroom to a 3D Virtual Classroom and triggers a discussion on finding the parts where the analogy is connected. In Phase 3 (Personal Analogy), the teachers express how it would have been if they were teaching in a 3D Virtual Classroom and use these expressions to further reinforce the analogy. In Phase 4 (Comparing Analogies), through brainstorming the teachers find and describe the similarities between the two parts of the analogy giving proper justification of their

opinions. In Phase 5 (Explaining Differences), through brainstorming the teachers find the differences between the two parts of the analogy and justify their opinions.
The next two phases namely, Phase 6 (Exploration) and Phase 7 (Generating Analogy), aim to address (a) how the concepts of 3D VWs can be highlighted using the 3D Virtual Classroom Simulation in this module and (b) what are the specific tools and functionalities that could be used to support these educational activities. In Table 2, we present the analysis of Phases 6 and 7 to Educational Activities (EA), the 3D VWs concepts related to each Phase, as well as, the mapping to their relevant 3D Virtual Classroom Simulation Tools/Functionalities.

Table 3. Design Considerations for the 3D Virtual Classroom Simulation

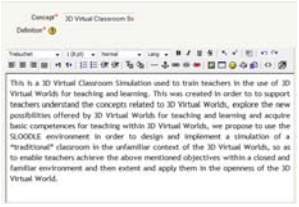
Phase	***Educational Activities (EA)***	***Concepts (C)***	***Tools/Functionalities***
6th Phase: Exploration	**Learn the Basics:** The teachers with the help of the educator create their own Moodle Accounts and Second Life Accounts, select and/or create their Avatars and then enter the 3D Virtual Classroom. There the educator presents some of the basic skills for teaching in Second Life as described in [3]. The teachers try to use the basic functionalities and the educator provides them with immediate and constant feedback. ***(EA_6_1)*** **Explore the 3D Virtual Classroom:** With the help of the educator the teachers explore the 3D Virtual Classroom in order to understand how they can (i) use the tools that are presented in the 3D Virtual Classroom, (ii) manipulate and reconfigure the tools as they like (individually and collaboratively) and (iii) use the communication facilities presented in the 3D Virtual Classroom. The educator provides teachers with immediate and constant feedback. ***(EA_6_2)***	**Recreate the sense of presence**: Use of Avatars linked to Moodle accounts.	**Avatars:** Can be used to participate in the activities.
			Group System: Defines the group of participants and their roles and can be used also to manage a large group of students by dividing them in different sub-groups.
			Access Checker Door: Enrolls the teachers and connects Avatars to Moodle accounts.
		Immediateness: The tools used for the activities should provide immediate feedback.	The tools provide immediate feedback according to the teachers' actions.
		"Real" World Simulations: The 3D Virtual Classroom should resemble a traditional classroom.	**Communal Whiteboard:** Resembles a whiteboard and offers additional functionalities. The teachers can insert slides in texture format using the Upload Image functionality of Second Life.
			Hand Show Chair and Desks: Avatars can sit and raise/lower their hands..
			Access Checker Door: Resembles a door and provides access.
7th Phase: Generating Analogy	**Design and Deliver Simple Educational Activities:** The educator divides the teachers in groups and makes some proposals for activities that could be supported by the 3D Virtual Classroom Simulation. The teachers can always get support from the educator if they face any problems with the use of the functionalities presented in the 3D Virtual Classroom. When, the teachers finish designing their activities, they deliver them to their colleagues. In this way the teachers generate their own analogies (educational activities in a "traditional" classroom to educational activities in a 3D Virtual Classroom). ***(EA_7_1)***	**Adaptable:** All the tools presented in the 3D Virtual Classroom can be reconfigured and manipulated.	All the tools that are presented in the 3D Virtual Classroom can be set as free to be manipulated and reconfigured.
		Simulate experiences that would not be possible in "Real" World: Actions such as the "automatic generation of tools" and the "automatic delivery of virtual objects" could not be easily reproduced in the "Real" World.	**SLOODLE Tool Generator:** Enables the automatic generation of tools from a predefined list.
			SLOODLE Vending Machine: Enables the automatic delivery of any type of virtual objects.

	Comment on the Activities: After completing the previous activity the teachers use the Chat Logger and discuss again the analogy that was previously presented to them, revisiting the similarities and the differences of a "traditional" classroom to a 3D Virtual Classroom. ***(EA_7_2)*** **Comment on the Module:** Finally, the teachers are given the opportunity to comment on the module expressing their opinions about the educational activities that were conducted and about the 3D Virtual Classroom Simulation that they have used in the two last phases of the module. The comments will be made in their Moodle Blogs using the SLOODLE Toolbar to update them. The educator should help the teachers if they face any problems in setting up the SLOODLE Toolbar. ***(EA_7_3)***	**Provide Possibilities for Experimentation:** The 3D Virtual Classroom should enable teachers experiment with the tools presented in it.	All the initialized versions of the tools presented in the 3D Virtual Classroom can be stored in the **SLOODLE Vending Machine.** Thus, the teachers can experiment with the tools and always have their initialized versions available.
		Synchronous Communication and Collaboration: The 3D Virtual Classroom should present different communication and collaboration tools.	**Chat Logger:** Enables teachers to discuss in real time using their Avatars (from SL) or their Moodle Accounts (from Moodle).
			SLOODLE Toolbar: Teachers update their Moodle blogs and use gestures related to the context of a classroom.
			Collaborative Editing: Enables teachers to collaboratively manipulate the tools.

3. The 3D Virtual Classroom Simulation Implementation

Based on the above educational activities we have implemented a 3D Virtual Classroom Simulation that supports the proposed design. In Table 3 we describe the implementation based on the specific steps that were taken.

Table 4. 3D Virtual Classroom Simulation Implementation

Steps	***Description of the Implementation***	***Supported Educational Activities***	***Figures***
Step 1 – Configure Moodle	For the first step a Moodle classroom (Figure 1) was created in which the teachers could create their accounts and then find a link that will lead them to the 3D Virtual Classroom Simulation which is located in Second Life. Moreover, all the Moodle activities, namely Chat, Assignment and Glossary, related to the tools presented in the 3D Virtual Classroom Simulation were created and configured.	**EA_7_1:** This step of the implementation gives the teachers the ability to transfer their own educational content in the 3D Virtual Classroom Simulation. Thus, teachers can insert terms in the glossary, create chat rooms with specified subjects of discussion and give specific assignments to their students.	 Figure 1. Inserting definitions of concepts in the Glossary to be presented in the 3D Virtual Classroom Simulation
Step 2 – Create a Classroom Building	The next step was to build a classroom building that features different rooms related to the tools that are presented in them. Thus, we have built a Presentations Room, a Discussions Room (Figure 2) and an Assignments Room and in front of each one of them we have added information related to the use of each tool (in the form of slides).	**EA_6_2:** The different rooms present different tools, thus teachers can explore the functionalities of tools that are used to support specific activities (namely presentations, discussions and assignments) **EA_7_2:** The teachers can use the Discussions Room in order to discuss the analogy revisiting the similarities and the differences under a new perspective.	 Figure 2. Presentations room in the 3D Virtual Classroom Simulation

<table>
<tr>
<td>Step 3 – Provide Access to the 3D Virtual Classroom Simulation</td>
<td>Our first action was to select and configure the SLOODLE Access Checker Door (Figure 3) in order to provide a system that enrolls an Avatar to the 3D Virtual Classroom, provides access to it and also connects it to the users' Moodle account. The next action was to create a group using the Group System in order to give the teachers who will participate in the module of Teachers' Continuing Professional Development specific roles (teacher role) and abilities (object reconfigure and manipulation).</td>
<td>EA_6_1: The SLOODLE Access Checker Door provides a mapping between an Avatar and a teachers' Moodle Account, providing access to them acknowledging them as participants.
EA_6_2: Having been acknowledged as participants the teachers can explore all the tools/functionalities presented in the 3D Virtual Classroom Simulation.
EA_7_1: Using the Group System the teachers can manipulate and reconfigure the tools as they want to design and deliver their own simple educational activities.</td>
<td> 
Figure 3. Providing Access to the 3D Virtual Classroom Simulation</td>
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<tr>
<td>Step 4 – Select and Configure the Tools</td>
<td>Based on the module for Teachers' Continuing Professional Development Design we have selected and configured, tools for supporting Presentations (Metalabs Whiteboard (Figure 4), Hand Show Chairs and Desks), tools for supporting Discussions (SLOODLE Chat Logger, SLOODLE Metagloss (glossary) and SLOODLE Toolbar (classroom gestures)), tools for supporting Blogging (SLOODLE Toolbar (Moodle blog update)), tools for Assignments (SLOODLE PrimDrop) and tools for Creation and Delivery of virtual objects (SLOODLE Tool Generator and SLOODLE Vending Machine). What is more, all the tools except for the SLOODLE Tool Generator were set as free to reconfigure and manipulate.</td>
<td>EA_6_2: All the tools were placed in the different rooms giving the teachers the ability to explore their functionalities in relation to the activities that could be supported.
EA_7_1: The teachers could use all the aforementioned tools to design and deliver their own simple educational activities.
EA_7_2: The tools that support Discussions enable teachers to discuss again the analogy after completing the design and the delivery of their educational activities.
EA_7_3: SLOODLE Toolbar blogging features give teachers the opportunity to express their opinions about the module in their Moodle Blogs from within Second Life.</td>
<td> 
Figure 4. The teachers use the Metalabs Whiteboard to do presentations while flying and using floating text that moves around their students.</td>
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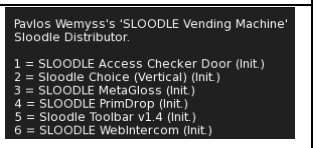
<tr>
<td>Step 5 – Provide Initialized Versions of the Tools</td>
<td>All the tools that were selected and configured in Step 4, were stored in the SLOODLE Vending Machine as their initialized versions. (Figure 5).</td>
<td>EA_7_1: While teachers are designing their own simple educational activities they could always have the initialized versions of the tools available in case something goes wrong.</td>
<td> 
Figure 5. Selecting the Initialized versions of the Tools</td>
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4. Conclusions

Recent studies on exploiting 3D Virtual Worlds in Education have indicated that this new digital technology has characteristics that could be used to enhance educational practices. On the other hand, teachers are expected to develop and participate in engaging and interactive educational activities that enhance the learning process and also provide their students with 21st century skills. Thus investigating the use of 3D Virtual Worlds in educational practices appears as attractive. However, the concepts presented in them may seem unfamiliar even to teachers who are experienced in using digital technologies. In this paper we have presented the design and the implementation of a 3D Virtual Classroom

Simulation based on design considerations derived from educational activities designed following the "Synectics – Making the Strange Familiar" instructional strategy. Thus, the next step is to design and conduct an experiment that will validate the applicability of the above proposal in (a) helping teachers understand the concepts of 3D VWs, (b) explore the new possibilities that 3D VWs present for teaching and learning and (c) acquire competences for teaching within 3D VWs but also extract valuable conclusions by comparing our teacher's perspectives to those mentioned in Table 1.

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