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3.5 USING SIMULATION GAMES TO IMPROVE LEARNING SKILLS

1 INTRODUCTION

While educators teach their students about decision making in complex environments, managers have to deal with the complexity of large projects on a daily basis. To make better decisions it is assumed that the latter would benefit from a better understanding of complex phenomena, as would students, the professionals of the future.

Virtual worlds can be used to promote higher levels of student engagement and facilitate highly interactive and multimodal learning experiences. They have the potential to radically transform education [e.g. Thomassen (2010); Kluge, S., & Riley, L. (2008); Johnson, L. & Levine, A. (2008); Freitas, (2006)]. Some virtual world technologies make use of such commercially-hosted platforms as Second Life and Active Worlds, while others extend and adapt 3D toolkit to create collaborative virtual world server platforms and open-source products such as OpenSimulator, Open Cobalt and Open Wonderland. Yet others build their own, adapted platforms and systems using a variety of programming languages and game engines to accommodate their specific needs and purposes.

In the Game Generation, computer games respond to children's contemporary needs, habits and interests (Henderson, 2005). Olson et al. (2007) pointed out that children who have never played computer games are quite rare since they regard gaming as a social activity. Game-based learning (GBL) is designed to combine learning and game playing, so it will improve the ability of the player to retain educational subjects and apply them to the real world. Educational games encompass educational objectives and subject matter that have the potential to make learning more learner-centered, easier, enjoyable, interesting, efficient and effective (Prensky, 2001; Virvou, Katsionis, & Manos, 2005).

Throughout history there has been a need to find the balance between technology and educational usefulness. The impact on users should be the main evidence of this usefulness. However, generating an educational process in a complex technological environment is a powerful journey during which we can learn from each and every decision made.

In this regard, the present document describes the final educational proposal in a 3D simulation environment. It is designed to develop generic skills –in particular, team-work and self-management– and is based on a set of decisions related to the theoretical base, the learning environment and a specific educational proposal.

The experience takes place in the framework of a research project financed by the Spanish Ministry of Education. The name of the project is *SIMUL@: Evaluation of a Simulation Technological Environment for the Learning of Transversal Competences at University* (Ref: EDU2008-01479) and is conducted by a multidisciplinary team coordinated by the Rovira i Virgili University (Spain) and which also involves the University of Lleida (Spain), the University of Hamburg (Germany), and the University of Minho (Portugal). The main topic dealt with in Simul@ is the analysis of technological environments based on simulations in work-related environments for learning generic skills at university.

In this project, we created an educational proposal to work with 68 bachelor and master students from two different disciplines: business and education. We use the same educational structure and it is this that we describe in this document.

2 STRUCTURE

This study explains each of the parts in the decision-making process: the theoretical basis, the learning environment (pedagogy and technology) and a specific educational strategy (Figure 1).

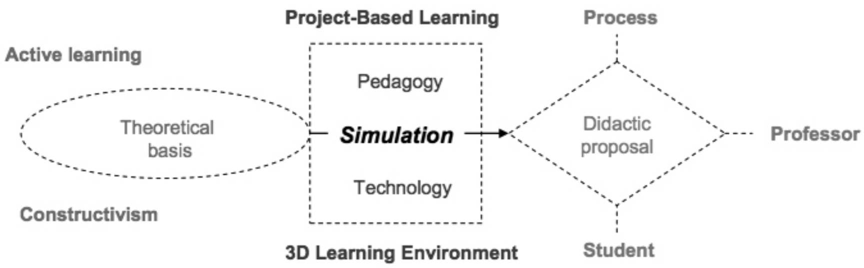


Figure 1. Decision-making process

2.1 Theoretical basis

In theory, virtual environments create particular settings and attempt to draw the participant into the setting (Gredler, 2004). Of the wide range of different approaches to learning– from the behavioural to more situational approaches –the base of the model used in simulations should be closest to constructivism. This model understands learning to be an activity in which students use their own strategies to take part. So, our starting point is an educational approach that considers learning to be an active process that is situated and contextualized in practice. This approach is consistent not only with social constructivism but also with such learning theorists as Lave & Wenger (1991) and Greeno et al. (1993), who incorporate the concept of social participation into specific activity contexts based on the situated cognition theory. These ideas can also be backed up with other social theories such as expansive learning and transfer of development (Engeström and Grohn, 2000), which states that transfer occurs when individuals involved in collective activity take action to challenge existing practice.

According to this theoretical view, the resulting didactic sequence should take into account constructivist principles of instructional design: all learning activities should be anchored to a larger problem, tasks should be authentic, learners should be supported and opportunities should be given to reflect on both the content learned and the learning process (Savery & Duffy, 1996).

This idea of construction in a specific context of practice is completed with active learning. Active learning should be regarded as an approach rather than a method (Prince, 2004) accepting that a variety of method can be applied under this generic concept. According to Meyers & Jones (1993), "*active learning derives from two basic assumptions: that learning is by nature an active endeavor and that different people learn in different ways*". In active learning, the educational proposal should mostly target higher-order activities (analysis, synthesis, evaluation) where students can explore their own attitudes and values (Bonwell & Eison, 1991).

The didactic proposal must focus on students in such a way that they take active part in the learning process rather than merely oblige them to gather information passively from a lecture delivered in the traditional way (Slunt & Giancarlo, 2004). In other words, teaching should be based on different principles: students use resources to construct their knowledge depending on their needs and how they learn; students take responsibility for learning; students learn how to learn by developing problem-solving skills, critical thinking, and reflective thinking; learning activities take into account the various learning styles of students; teachers provide clear expectations and desired outcomes before lessons begin; teachers guide and facilitate the learning process; and teachers are responsible for students being provided with content and the learning process (Sukkum, 2002, cited by Poonruksa, 2007, p.227).

The didactic sequence should take into account the conceptual considerations made above in order to respond to the challenge of using such advanced technology as 3D simulations. In fact, this is the way in which some of the principles that define good practices in undergraduate education are put into practice: contact between students and faculty is encouraged, reciprocity and cooperation is developed among students, active learning is promoted, time on task is emphasized and different talents and ways of learning respected (Chickering & Gamson 1991).

This theoretical framework based on student action and interaction, and the context in which a product is built is particularly suitable for developing the requirements defined in the construction process of the European Higher Education Area. This process defines a curriculum in which generic skills are the main content. These skills are understood to be those that are common to most professions, and which are related to the integrated application of aptitudes, personality features, educational backgrounds and other values. Technological active learning scenarios can promote the development of generic skills, which are learnt basically in work-related environments.

2.2 The learning environment

Now it has been decided that simulation is to be the base of the educational proposal, this section describes two aspect of the learning environment: the technology and the educational strategy.

2.2.1 Technological environment: 3D virtual world

Generally, 3D virtual worlds are also known as metaverses, a concept taken from the sci-fi novel *Snow Crash*, written by Neil Stephenson in 1992. Although the notions are not exactly synonymous, they are still being debated in the literature. However, and in agreement with Castronova (2005) we will assume that virtual world and metaverse can be regarded as the same.

A virtual world is a simulation of a space, a three dimensional representation of geographical features, cities and digital simulation of the real environment. Second Life (SL), for example, is a 3D environment that enables users to interact through a representation, which is known as an avatar. The main characteristics of virtual worlds are that they are simple to use, they have a series of collaborative facilities and their 3D features are attractive and provide users with a new and highly immersive sensation. All these traits have made virtual worlds an interesting scenario in which to test innovative educational environments and apply new data mining techniques. Furthermore, participants in a successful virtual world have a deep sense of presence in that world.

Pivec (2003) explains the steps that should be taken to design a successful game-based learning opportunity:

- Determine the pedagogical approach (how you believe learning takes place)
- Situate the task in a model world
- Elaborate the details
- Incorporate underlying pedagogical support
- Map learning activities to interface actions
- Map learning concepts to interface objects

Many studies and a considerable amount of data provide evidence that SL is an environment that fosters processes of socialization (e.g. Minocha & Reeves, 2010; Koster, 2006) and learning in different contexts and with different content (e.g. Thomanssen & Rive, 2010).

After exploring several simulation environments, we decided to use SecondLife (SL) and OpenSimulator as the 3D virtual world on which to base our educational proposal. The environment and the fact that it could be integrated into a standard learning virtual environment (Moodle) were the reasons for this choice.

OS allows for interaction between simulations and games, social networking by which knowledge is shared and created, collaborative work environments, and the use of different media to meet different learning needs. Through Sloodle –a module of learning activities represented as OS objects– we integrated OS into Moodle. The student performed the activities in OS and the teacher had Moodle registration in a transparent way. This made it possible for us to:

- Design and set up an island in OS that could be accessed via Moodle from Sloodle.
- Make an initial assessment of whether students would be able to learn skills by using the 3D OS space.
- Associate a learning pattern to the final results obtained and recorded in Moodle.
- Define a strategy for curriculum integration for self-management skills work and team work in OS useful for teachers.

2.2.2 The method: Project-Based Learning (PBL)

In coherence with our work philosophy, we felt that the PBL method was especially suitable for organizing the didactic sequence to deliver the students in the simulation. The joint construction of a project that must be presented to an assessment committee is an extremely powerful way of developing generic skills. There are many reasons why PBL is a very good option for preparing students for work: it increases motivation, it connects theory and practice, it builds knowledge jointly, it obliges them to share their own capabilities with others, and it establishes connections between different disciplines, etc.

Proulx (2004) defines seven features that are consistent with our idea of work and which we used as a basis for our decisions:

- A systematic process
- Acquisition and transfer of learning
- The three major moments: anticipation, planning, construction
- Individual or pairwork
- Supervision by a teacher
- An observable activity
- A final product that can be evaluated

These features, and the following statement by Grant (2002), are the base of our didactic proposal following a PBL structure: *"Project-based learning is centered on the learner and affords learners the opportunity for in-depth investigations of worthy topics. The learners are more autonomous as they construct personally-meaningful artifacts that are representations of their learning".*

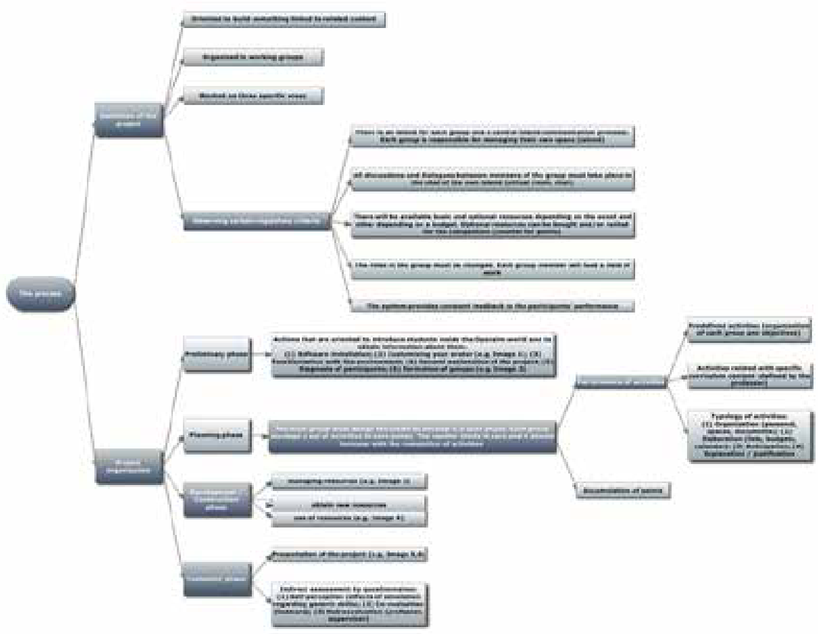
2.3 The educational proposal

To explain the educational proposal, we organize the information in three steps: the process, the teacher and the student. These three points of view have some common elements.

The aim of the teaching project is to construct a particular product (School Olympic Games or Tourist Trade Show), but we shall focus on the process independently of the specific content of the product.

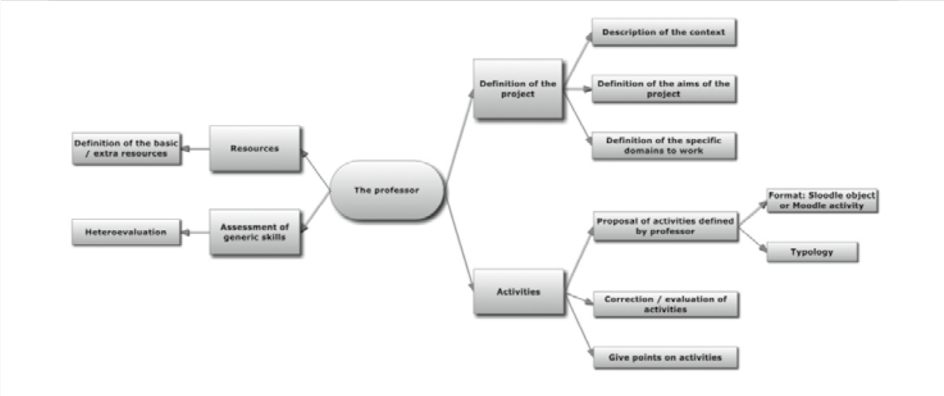
2.3.1 The process

The process is described according to the different moments of decision making:



2.3.2 The teacher

This section describes the decisions that are the responsibility of the teacher during the process:



2.3.3 The student

Finally we present the sequence that the student has to follow in order to carry out the project successfully.

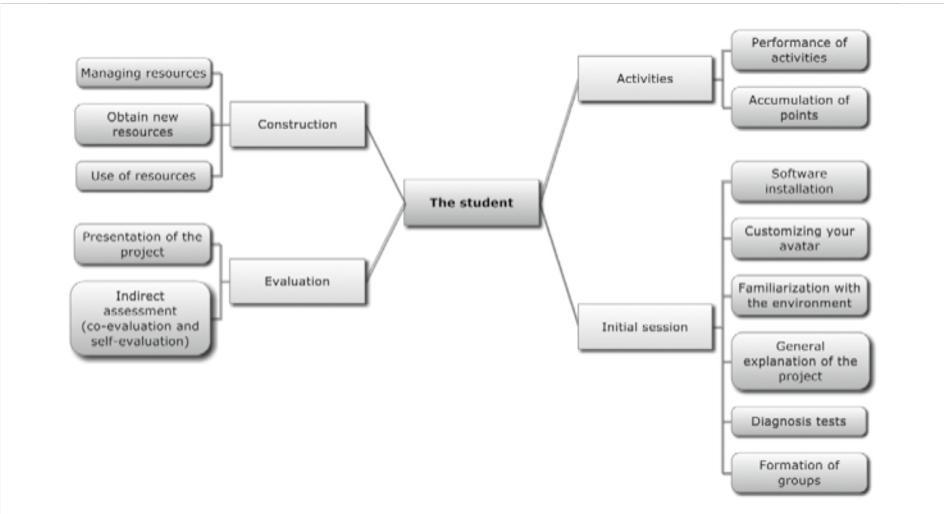


Image 1: Editing appearance

Image 2: Island map

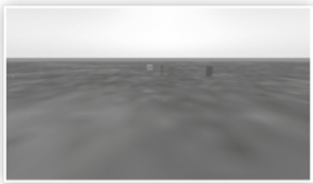


Image 3: Empty group island

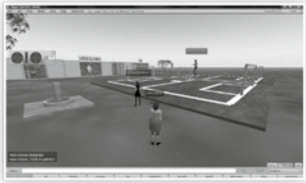


Image 4: Building their island

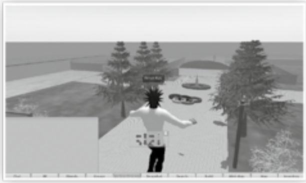


Image 5: Project presentation

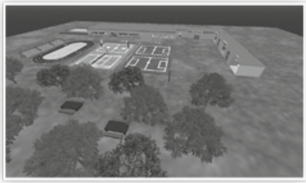


Image 6: Final island

Figure 2. Scenes from the educational proposal

3. CONCLUSIONS

Although this work describes the skeleton of the training process by which university students are trained using simulations in 3D environments, the findings should be used to provide continuity in both pedagogy and technology.

Before any analysis is made, it must be understood that pedagogy needs to be applied before technology. Working with advanced technologies requires a considerable amount of planning and design; every decision must be made with a subsequent step in mind. This work of anticipation is one of the main characteristics of this kind of process. The strategy mus be centered on the students' tasks and the learning outcomes they must acquire.

Teamwork is also very necessary when designing this kind of learning scenario. Designers have a wide range of different profiles: experts in graphic design, experts in computer management and systems, experts in pedagogy, experts in specific content (subject). The fact that they all have to put into practice such skills as expertise, patience, trust in others, planning, commitment, etc. constitutes a learning process in itself.

It is also shown that teachers and students need to be assigned different roles. Once again, the student is the center of the process but the teacher is responsible. In this regard, the evaluation process plays a special role. This kind of technological environment facilitates the assessment process because all events are recorded. This process must be planned and anticipated so that the most relevant information is collected to regulate the process and make good decisions regarding learning outputs.

Regarding technology, it constitutes a real challenge to observe other virtual worlds using the same or similar didactic sequence. In this sense, tools like Unity 3D provide a good opportunity to follow this idea. Unity 3D is a game development tool with a visually very rich browser based client. It allows developing for web, mobile, or console device. But, Unity doesn't support the Sloodle module at this moment; this is a problem but it becomes a challenge at the same time to search options in this regard.

This paper describes a process that involves one of the elements that is the basis of its content: learning by doing. The whole design process is an experience that is now a rough diamond that requires analysis. The exploitation of the data resulting from this experience will be the next step in the Simul@ Project.

We have designed a process based on the principles of active learning using PBL methodology and it is now time to analyse the dynamics generated. And there is also the need to share our findings with the scientific community to extend our knowledge on these issues.

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Acknowledgements: This research is funded by national R&D plan of the Ministry of Science and Innovation of Spain, SIMUL@: "Evaluation of a Simulation Technological Environments for the Learning of Transversal Competences at University", with reference EDU2008-01479.

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