Collaborative learning and 3D virtual worlds: two experiences in a new didactic perspective

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ABSTRACT. Nowadays teachers and trainers pay attention to the research and the experimentation of innovative pedagogical tools and approaches, such as simulation and 3D virtual world in order to improve the learning capacity of their students. Sometimes they invest time and financial resources to manage their updating courses, especially about how new technological potentialities can be exploited and integrated into their mainstream teaching methods. Also the use of different learning environments apart from the traditional class can stimulate the learning processes creating more educational opportunities and favoring the development of other approaches, such as collaborative learning. This type of learning approach is represented by a situation where two or more individuals learn or try to learn something together aimed to the building of a common knowledge. Unlike the individual learning, people engage themselves in a collaborative learning process in order to capitalize on each other’s resources and competences. More specifically, the collaborative learning model is based on knowledge that can be constructed within a community in which members interact actively through sharing experiences and assuming asymmetric roles. In other terms, the collaborative learning refers to methodologies and specific environments where the students engage in a common task in which each individual depends on each other and is responsible for the others.

KEYWORDS: 3D virtual world, Collaborative learning and ICT

Collaborative learning and 3D virtual world

What distinguishes the collaborative communities by most communities is the desire to build new meanings of the world
through interaction with the others. These become a mean both to know and to express themselves (Scharage, 1990, p. 48). As a result, the collaborative learning, often also called cooperative learning, can be defined as a learner-centered approach, where groups of individuals work together sharing a specific learning task structured into didactic and training objectives (Smith, Macgregor 1992).

For this reason, the combination between Information Communication and Technology (ICT) and collaborative learning can play an important role in the exploitation of all the technological potentialities in the pedagogical and didactic field. Indeed, according to Kirschner (2002), ICT establishes the relation among features of the training actions realized by teachers and learners, who receive these actions, aiming to create an environment focusing successfully on the learning.

Chris Dede (1995), from Harvard University, was one of the first researchers who discussed about the possibility to combine the potentialities of virtual environments with the synchronous capacity of the computer-mediated communication tools (CMC), especially in the supporting of the collaborative learning. The author asserts that the efficacy of the collaborative learning approaches depends on the following factors:

- active construction of knowledge
- teaching among peers and opportunity to develop verbal-communication ability
- stimulating feedbacks from the others.

Therefore, in this context, the Web3D represents the greatest opportunity provided by Web for educational purposes (Anderson, 2004, p. 42) thanks to the use of new virtual environments, where learners, from different geographical areas, can explore concurrently a 3D environment also through as avatar.

This environment allows one or two students to start jointly and synchronously tactile or kinesthetic activities within the game (such as in TALETE) or the virtual world (such as in AVATAR). In addition to the tools for communication verbal, virtual worlds allow users to ensure the integration of nonverbal elements with the writing and/or speaking skills. This guarantees that the interactions among students, permitted in the 3D virtual worlds, can be considered richer than those realized in the 2D environment.

As many authors and researchers report, the immersion in 3D environments offers considerable potentialities in the support of the collaborative learning, if combined with appropriate teaching strategies. For instance, the strategies of the role plays can be used in order to encourage students to “let go” to a voluntary “acceptance of the ‘non-credible’”, at the time they play their role out and identify themselves with their own avatar (Dickey, 2005).

Antonacci e Modress (2008) underline the pedagogical benefits which are so reached permitting the students to build collaboratively their simulated worlds with different objects interacting with them. Moreover, these 3D virtual worlds encourage the creativity development of the students more than in a Web 2.0 environment (Boulos et al., 2007).

The virtual reality can be considered as a communicative environment able to amplify the cognitive capacities, strengthening those H. Gardner defines “multiple intelligences” of our thought. In fact, the interaction with objects and images simulated allows the representation of the knowledge’s contents as a game to compare and verify with the real situations. This favors a real comprehension following the different styles of individual learning where each learner re-creates own educational path in the virtual reality (Di Lieto, 1995).
During the construction of the virtual environment, the activity of the student is structured on the base of a comparative analysis on the problems occurred. Each student acts as a member of a group of learning who gives a personal contribution within the dynamic interaction and favors the “processes of organisational learning” through knowledge sharing (Trentin, 1998). The 3D virtual worlds, thanks also to the combination between the playful-fantastic dimension and the social one, support the development of knowledge through “learning by doing” (Papert, 1991) especially through specific activities such as constructing, interaction and designing.

In this article we describe the learning environments produced in the framework of two projects co-funding by European Commission. These two project experiences are as follows: TALETE - Teaching maths through innovative learning approach and contents and AVATAR - un mondo virtuale per l’apprendimento (a virtual world for learning). They represent two ways to build and to use, successfully, 3D virtual environments as a tool in order to support the teaching and learning processes focused on the concept of collaborative learning.

**Math and 3D games: TALETE project**

TALETE project aimed at investigating different ways of the mathematics representations, in the topics, already, defined in the PISA, IEA TIMSS and National surveys concerning the maths skills of 14-16 years-old students. The worldwide surveys reported that EU students often lack mathematical competence and key basic competencies in science and technology. The learning of the mathematics literacy enables students to contribute effectively in actual society, improving their employment prospects. In this context, the project intended to develop with the teachers more attractive and fun pedagogical tools for the maths literacy delivered in two virtual environments: e-learning platform and 3D virtual world.

TALETE training path, addressed to the teachers and their students, aimed to test an innovative pedagogical tool making the study of Mathematics more interesting and creative, transforming a possibly difficult situation into a simpler, more dynamic, flexible, surprising, engaging one to foster the student’s curiosity.

Through the TALETE training path the 14-16 years-old students have improved their deep mathematical understanding with a focus on the geometry, especially their performances on the base of OCSE PISA, IEA TIMSS and national evaluation schedules.
The TALETE course was constituted of two main parts as follows:

- First part: It started up from the training of the teachers involved in the experimentation phase. It was structured in educational pills delivered through the e-learning platform where they knew the contents and were able to get more familiar also with the 3D virtual environment to be used with their students during the next step.
- Second part: The teachers involved were tested the engaging and innovative pedagogical tools with their students in 3D virtual world. Trained teachers were taught their students how to use project virtual environment. They monitored, supported, and managed the virtual training of their students based on the selected assessment schedules re-produced into 3D scenarios. Students coming from different countries were able to share knowledge and experiences. They had experience in ability to work quickly, analyze and develop complex virtual objects from the basic ones supporting the understanding of practical uses of math concepts in the real world.
The 3D virtual environment was realized in order to test the pedagogical tools with the students and to evaluate the student performance. This environment allowed target groups (teachers and students) to access the virtual world that hosts the needed tools for the achievement of the final educational goal.
The TALETE training path was delivered through an e-learning addressed only to the teachers and 3D virtual environment addressed to both teachers and students. It included no. 23 hours of theoretical knowledge, web seminar and testing of the TALETE pedagogical tools, no. 15 hours of experimentation with the students involved.

In order to obtain valid data to be compared and discussed, two kinds of student groups were formed to the testing phase: a control group and an experimentation group. They were set up in order to check and compare better the results obtained at the beginning and at the end of the experimentation phase.

The two groups were independent and none of them had to know the existence of the other group. In each partner country one experimental group, including 30 students, and another control group, including at least 30 students, were selected for the experimentation. Each partner or the teachers trained were divided two student groups on the base of a random criterion.

Teachers were submitted to both experimentation and control groups the maths schedules before and at the end of the practical activities with them in the framework of the experimentation second phase in order to collect relevant and evident data on the efficiency of new educational tools. These maths schedules are those selected for the production of the scenarios in the 3D virtual environment.

**A virtual world for learning: AVATAR project**

With the aim to improve, assist and support teaching and learning activities through using innovative tools and methodologies, the Leonardo da Vinci TOI project “AVATAR” - AVATAR: un mondo virtuale per l’apprendimento - aims at providing teachers and trainers of 4 European nations (UK, IT, DE and TR) with knowledge and tools necessary to define and carry out training activities through the virtual worlds, adapting and transferring the learning areas e-Learning and Virtual Learning (V-Learning), the instruments and didactic contents created in the previous project Comenius AVATAR – “Added Value of teAching in a virTuAl woRld”.

![Figure 4. V-Learning environment](image-url)
This project aimed at enhancing the level of ICT use in education and providing teachers with relatively new methodological and pedagogical tools. Virtual Worlds, for example Second Life, can be used as an innovative teaching tool available for teachers and educators that guarantees an efficient teaching method capable of offering students key skills and information regarding different subject matter, while incorporating collaborative learning and a learning by doing approach. Most surveys show that students, attending the vocational education and training paths, show learning difficulties caused by environmental, relational and emotional issues. During the school years these difficulties appear with a more evident complexity, especially, in facing cultural and scientific subjects or subjects asking students to carry out abstraction and logic tasks. To support and facilitate these students it’s important that teachers and trainers have at their disposal tools that facilitate their learning in both cultural and scientific subjects. By using the 3D virtual worlds, such as Second Life, the knowledge that may seem more abstracted to students, can have immediate applicability and can become more respondent to the students’ learning, especially, of vocational schools. In this context the AVATAR project, still active, plans also a sectorial transfer because it adapts and applies a learning environment in vocational education (IFP) and vocational training (IeFP) fields, created for secondary school’s teachers and students. During the project activities a testing phase has been foreseen in order to show and demonstrate, as in TALETE project, the efficacy of the pedagogical tools used and the didactic approach implemented. The aim of this experimentation is to improve, assist and support teaching and learning activities through using innovative tools and methodologies made available by virtual worlds. Within the experimentation the project wants to promote integration among the worlds of vocational education, vocational training and labour market. This aims to search didactic methodologies that are more functional for both learning and teaching pointing on concreteness, imagination and game, fundamental elements for an environment that promotes learning. The interesting aspect for teachers is the possibility to build knowledge through a close interchange with students, and it’s exactly this building which fascinates students, giving them a new and different motivation to learning. In this way the relationship between teachers and students changes. This means it becomes necessary to build together a project thinking on how knowledge to be acquired is seen and on what knowledge has to be built in order to simplify it and how a plan of knowledge construction can be realised. So, in order to make all this real it’s necessary to reach the following main aims:

- to implement and support teaching and learning activities through using tools made available by virtual worlds
- to increase computer and methodological trainers competencies for an efficient application of innovative methods, as the virtual reality
- to promote, through virtual worlds, learning of cultural and technical fields’ subjects
- to transfer tools and methodologies experimented until this moment to the different partners involved.

Highlight COLLABORATIVE LEARNING AND 3D VIRTUAL WORLDS
Conclusion

The teachers, in both experiences, consider innovative and interesting the ICT use as well as the link with learning contents and reality that exercises created. They are even motivated, in some case, to extend this approach during all their teaching activity. Both the projects have given chance to get into the subject to those students usually facing problems or not interested in, such as mathematics in TALETE. Even if the involvement and the collaboration of students depends on also from the interest of their teachers and their ability to get in a game with their students.

When you introduce a new digital tool, such as a 3D virtual world, into learning and teaching activity, this is not just the use of a new device, but it determines the adoption of a new prospective and didactic methodology combining new roles for teachers, trainers and learners. This means that teaching and learning activities can’t be just moved from physical environment, such as traditional classroom, to a new digital context, but the features of the new environment have to be exploited in order to support better the achievement of the specific educational objectives related to the different subjects. In this way teaching through virtual worlds represents a way specifically suited to learning.

In conclusion in order to maximize the success chances in experiencing collaborative learning through the use of virtual worlds, the teacher centrality is crucial for playing an active role. Indeed the teacher becomes a facilitator and a mentor with the aim to support the students during the learning process favoring the construction of a common knowledge based on a deep involvement in a socio-experiential learning.
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