ENHANCING LEARNING AND SOCIABILITY IN PROVINCIAL SCHOOLS USING VIRTUAL REALITY TECHNOLOGIES

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Abstract

Students in provincial, difficult-to-access schools often face the problems of disinterest in the educational process, limited learning challenges, even social marginalization. The work proposed in this paper focuses on the applicability of a secure virtual world platform to isolated schools on remote Greek villages that allows the students among the schools to communicate and share knowledge. We aim to investigate whether the virtual platform manages to actually expand the schools' community, and to awaken the participants' social and learning interests. In this paper we evaluate various virtual worlds and technologies based on cost, security, customization and maintenance requirements. The open source OpenSimulator Virtual World server meets those criteria. We also propose a framework of simple activities, like a virtual photo gallery, that encourages students to capture, exhibit, exchange and discuss content pertaining to their local history and culture and to design the evaluation process to be performed as the next step of our research.

Introduction

In countries with unique and varied geographic morphology, such as Greece, it is common to observe large urban areas on the on one hand and small isolated communities on remote mountains or islands on the other. These isolated communities are usually separated from others and urban areas by sea or bad transport infrastructure, which makes physical communication among them problematic. This isolation has the largest impact on school infrastructure and the number of students in each class. Young people in such small classes (and communities in general) are often disadvantaged in terms of learning, communication and cultural exchange opportunities. Their communication and social skills might lack encouragement due to small social networks and their learning abilities are not challenged, due to restricted access to information sources, such as libraries and online virtual learning and information environments. Access to information over the Internet, though usually available, also requires motivation, specialized skills, and lacks the direct contact of synchronous communication. Given that there are over 200 hard-to-access secondary schools (and a large number of primary schools) in the Greek district, the significance of addressing the aforementioned isolation phenomenon becomes evident.

To this end, in this study we investigate the applicability of a Virtual World (VW) as a platform for learning (Roskilde University, 2008), socialization and cultural exchange and enrichment between groups of students in remote areas. The aim is to use immersion into a realistic, collaborative, interactive environment, in order to virtually 'bring together' distant, sparsely populated school communities. Thereby, we aim to increase the total number of class participants, as well as the level of educational standards, to improve communicational aspects of the communities, to assist in local cultural exchange, to provide more learning challenges to students and to strengthen their social skills. This is achieved by a series of activities within the Virtual World, designed and implemented by the class teacher, that aim to encourage student participation, communication and learning (Landry, 2008).

Virtual worlds have been proposed in the literature to aid educational activities (Dieterle, in press). There are printed and electronic periodicals that are dedicated to this specific purpose (East Carolina University, 2008). Shaffer (2002) used virtual reality to increase the physical and educational level of response of his students to visual stimuli. Virtual reality (VR) worlds have been proposed for teaching mathematics and geometry (Kaufmann et al., 2000), history (Jacobson, 2008), astronomy (Barnett, 2005), for training disabled people (Lanyi et al., 2006; Adamo-Villani and Wright, 2007). Several EU projects1 2 3 4 have focused on cultural exchange programs within educational settings and have offered the respective web-based ICT tools.

These approaches focus mainly on the effect of the employed technology on the learning process, rather than its impact on the students' socialization patterns. They view the underlying technology as a tool for aiding the educational activity. In the current proposal, our primary interest involves the detection of changes in the students' social behavioral skills after immersing themselves within the virtual world through a personal avatar. The VW platform is not just a tool, but a medium through which community members come closer. It has been observed (Landry, 2008) that students who are intimidated to participate in a traditional classroom find it easier to share opinions and cooperate in an online environment. Are they more challenged to exchange ideas and search for information? Are they more talkative? Do they use different vocabulary and linguistic structures than the ones they use in the traditional classroom? The intensification of their learning interest is viewed as a side-benefit of the online interaction process. Another side benefit of the virtual platform is that it encourages collaboration between schools, enabling educators to easily share teaching best practices and content across local and global borders.

The Virtual Environment

In the past few years, the increased Internet penetration and the large increase of broadband speed have been accompanied by a flourishing of Online Virtual Spaces, either in the form of videogames (Massively Multiplayer Online Games), or Virtual Worlds which can support socialization, communication, collaboration and education for their inhabitants. Some Virtual Worlds are also mature enough (and possess the required critical mass) to provide business opportunities. In a Virtual World, the user is represented by her avatar (virtual presence) which appearance can be customized accordingly. A large number of avatars can co-exist in a Virtual World. A Virtual World can be specialized, as in the form of Virtual Chat Rooms, or have a broader scope and allow any type of interaction between the users/avatars. Apart from communication, an avatar can be involved in item creation and selling, real estate, tourist attractions etc. Of the non-game Virtual Worlds, the most popular in terms of media exposure, is probably Second Life.

A Virtual World is usually hosted centrally on a server computer (or many). A user can have access to the Virtual World through a client program which must be downloaded and installed locally. Some Virtual Worlds allow access through a web browser as well. The server streams virtual world data (models, sounds, avatar positions and actions) continuously to the client which renders a view of the Virtual World.

Virtual Worlds Review

Virtual Worlds have been used to host Virtual Classrooms[5 6 7 8] in several cases, in an attempt to augment the student's learning process. Classroom participants can create their personal avatars, which can walk around the classroom, chat and interact with other avatars.

Our work is also based on a Virtual World. The Virtual World to be used must meet a specific set of requirements

- **Customization**: We would require the Virtual World to be programmable, and to allow item creation/modification, in order to develop the socialization/collaborative activities.

- **Free to use and develop for**: It would be desirable for the Virtual World to support not only free access, but free modification/customization as well.

- **Security**: All Virtual Worlds should provide a safe environment for socialization and communication. Due to the sensitive subject of our work (the users will be students), the Virtual World must support authenticated access.

- **Low maintenance cost**: The Virtual World maintenance cost (i.e. cost of service, or server cost) should be as low as possible, in order to be sustainable in the long-term. We expect that most of the positive effects of the proposed system might need more than a few weeks time to be measurable.

An evaluation of Virtual Worlds has been performed based on the above requirements to determine the most suitable for our purposes. Table 1 summarizes the results for several popular, commercial, Virtual Worlds.

Table 1: Commercial Virtual Worlds Features

Name	**Accessed via**	**Fee to develop**	**Programmable**
Active Worlds	Client	Yes	Yes
Muse	Browser plugin	Free up to 8 people	Yes
There	Client	Yes	No
Second Life	Client	Yes	Yes
Forterra	Client	Yes	Yes
Worlds	Client	No	Scripting

Most of the examined Virtual Worlds are free to access (after a simple registration process), but require a fee to modify and develop for. Second Life is probably the most customizable in terms of programmability and content creation but requires purchase of virtual land before development can commence (as do most of the other Virtual Worlds). Muse seems promising since it is geared toward the creation of Virtual Spaces for collaboration, with the added benefit that it can be accessed via a Web Browser. On the other hand, in its free version, it supports only 8 people simultaneously in a Virtual Room, which is too restrictive for our purposes. There are many more commercial Virtual Worlds in the market although most of them are either not customizable/programmable, or use bitmap graphics and are not really in 3D (Habbo Hotel).

We also performed an investigation on Open Source Virtual Worlds. In contrast to commercial VWs, open source VWs are free to use and modify, although they may require greater technical knowledge. In this type of Virtual Worlds every user can have access to the Virtual World source code, and can host her own version on

a private server. Other users can access the custom VW via the Internet as well. The user (owner) has full access to every aspect of the world and can modify it according to her needs and given application. Current Open Source VWs are broadly based on two platforms, OpenSim[10] and Croquet SDK.[11] OpenSim is an open source VW server which attempts to clone the functionality of the Second Life Server application. Croquet SDK can also be used to develop VW applications. Contrary to OpenSim and Second Life, it is not based on the traditional client-server architecture; rather the VW is distributed among the World participants. OpenCobalt[12], which is a VW viewer based on Croquet SDK, is a very promising application and was our initial choice for our VW application. During our tests though, it proved to be unstable, and rendered the world at a relatively low framerate, even when running on a local machine. Thus, we chose to base the VW application on OpenSimulator instead.

It is worth mentioning that Open Source VWs in general are constantly under development and most of them have not reached beyond Alpha, which means that they may be unstable and contain bugs. The distributed technology of Croquet/OpenCobalt is very appealing because it eliminates the need for maintenance of a central server that hosts the VW. Also, and this is very important for remote, isolated areas, the Virtual World will still function on the local network, even if broadband connection fails (or if it not present altogether). We intend to review Croquet/OpenCobalt technology again in the future.

Security and Legal Issues

Several important security and legal issues arise when virtual worlds are used by under-aged students. Teachers are often discouraged to adopt or propose the use of virtual worlds in their classes due to the inappropriate content for minors. These problems can be overcome by using virtual worlds that are suitable for children and teenagers.[10] The present study will focus on the use of virtual worlds that take special care to ensure user authentication, password protection, strict licensing, chat monitoring. During an initial trial phase, students will undergo a tutorial about acceptable word usage for chatting. Most importantly, teachers will be monitoring the virtual interaction the whole time.

Methodology

In the present study, the Virtual Environment will not function as a simple virtual chat room, but will be used in combination with online socialization and learning activities. More specifically, students, in cooperation with the responsible teacher, will choose a theme (cultural, historical, or scientific) of their interest and use the Internet to locate digital photographs related to the theme, and also organize field trips to collect their own shots. Virtual photo galleries will be set up in the virtual

environment using media uploading, in order for the students of the schools to exchange their snapshots. Discussion groups coordinated by the teacher will be held in order for information, ideas and opinions to be exchanged among the members of the virtual classroom community. Thereby, a flow of information and cultural goods is achieved. Students will be encouraged to capture, exhibit, exchange and discuss content that pertains to their local history and culture.

The virtual classroom will be installed in at least two secondary schools spread over the island of Corfu. The world will be employed by tutored teachers over a period of several months as an in-class as well as an extracurricular (after-class) activity. The experimental framework is comprised of the following phases:

Phase 1: Installing the Virtual World

The needs of all community members are specified and analyzed. Initial questionnaires are handed to the educators and interviews are conducted to determine the students' social and learning skills. The virtual world is then installed in the selected schools. Participating teachers and students become acquainted with navigating within the world, manipulating its features, components and content.

Phase 2: Interacting with the Virtual World

In cooperation with the teacher responsible, students select a topic of their interest. Photographic material related to the topic is collected, either online or by students' actual field shots. The pictures are then uploaded to the virtual platform and posted on the virtual photo gallery (Figure 1). Discussions among the students, coordinated by the educator, follow, allowing information exchange and cultural content flow. Interaction sessions, students' behavior and chat text, their moves and choices are monitored over a period of several months and recorded for processing.

Figure 1: Sample Virtual Photo Gallery, with Many Participants

Phase 3: Processing the Interaction Data

Recorded interaction sessions are linguistically analyzed. More specifically, chat text will be processed to identify changes in vocabulary richness, in usage of linguistic expressions and syntactic structures, at the beginning and at the end of the interaction period. Vocabulary richness is estimated by dividing the chat text size by the number of distinct words appearing in the chat text. A calculation of the part-of-speech (pos) distribution of the words in the chat text at the beginning and at the end of the interaction period is performed. Keyword and key-phrase spotting is used for the identification of swearwords, inappropriate language use, anti-social behavior or a cooperative mood and their change over the time period of interacting with the virtual world. Chat text is anomalous. Expressions are very often incomplete, noisy, unstructured and ill-edited. Several approaches have been proposed to deal with chat text, such as using a classic language model derived from standard text to detect chat text anomalies (Xia & Wong, 2006), or machine learning (Knoblock et al., 2007), or latent semantic analysis for topic detection (Schmid & Stone, 2008). Forsyth (2007) describes the characteristics of chat text, and addresses issues like pos tagging and dialog act recognition.

Apart from the process of chat text analysis, quantitative metrics, like the number of chat sessions each student participates in is estimated, in order to determine changes in social behavior.

Phase 4: Experimental Evaluation

Chat text processing results are evaluated. Changes in the linguistic patterns employed by the students, as well as their willingness to participate in the virtual community (estimated by the number of chat sessions they participate in) are detected. The effect of the interaction on the students' willingness to socialize, learn, cooperate and search for information is tested. The students' sociability is evaluated. How talkative are they? How cooperative? Do they solve tasks better alone or in groups? Do they show more interest in learning on a virtual platform? Do their learning skills improve? In particular, we aim to evaluate whether the subjective perception of "social presence" is enhanced by the use of online virtual worlds.

For this purpose, novel research methods are employed for the study of online virtual worlds, such as virtual ethnography, which puts the avatar of the observer (researcher) into the virtual world, in order to record (either manually or using screen capture for post-analysis) the behavior of other avatars.

In addition to virtual ethnographic methods, direct contact with the involve parties will undoubtedly also prove beneficial. Interviews will be carried out to test the students' impressions, problems, skills and talents, and the way they were affected by the virtual classroom. Questionnaires will be handed out to collect user data for evaluating the interaction and its side effects. Teachers will give their personal feedback on the platform's impact on their students' way of approaching and speaking to others, their way of thinking, their interest in learning and gathering information, their ability to cooperate.

Discussion

The expected benefits from using the virtual platform concern both the teachers and the students and they offer opportunities for informing educational policy for educational establishments in similar regions.

Regarding the teachers, they will be given the opportunity to cooperate with the students in investigating their abilities and capabilities, complement their traditional teaching practices and experiment with novel, cooperative learning schemata. Traditional educational mechanisms might be adjusted and updated for the particular case of rural schools.

Regarding students, rules of behavior within the virtual environment will need to be set, allowing students to improvise, create and explore in their own individual ways. They will learn to interact, communicate and socialize, cooperate, search for information and in particular strengthen their learning skills. They will learn to

expand their horizons, talk about issues and read about matters that were beyond the scope of their limited, traditional classroom activities.

Conclusion and Further Work

We presented our on-going research on using Virtual Worlds as socialization and learning tools for remote and isolated communities, such as those found at the many small islands and villages of Greece. Our choice of OpenSimulator as a Virtual World server and the open source nature of its viewer application will allow us to create and customize a safe environment, which will support teacher designed socialization and learning activities. In the first instance we proposed a photo-collection and gallery activity which will promote cultural exchange between two or more separate communities of students.

Our next step will be to allow access to the Virtual World to two or more remote schools and collect data about its use in order to determine whether the virtual platform actually manages to expand the schools' community, and to awaken the participants' social and learning interests.

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Notes

1. European Schoolnet (EUN) provides major European education portals for teaching, learning and collaboration and leads the way in bringing about change in schooling through the use of new technology. http://www.europeanschoolnet.org/ww/en/pub/eun/about/euninfo.htm
2. myEUROPE is a Web-based project which involves a network of more than 8000 schools. It aims to help teachers raise their pupils' awareness of what it means to be a young citizen in Europe http://myeurope.eun.org
3. In Classroom4EU students across Europe share opinions on two questions: What would you want other young Europeans to know about your country? and What do you think all young people in the EU should know about Europe? http://classroom4.eu/
4. ETwinning is a virtual meeting point for the exchange of information between schools http://www.etwinning.net
5. Project Wonderland: Toolkit for Building 3D Virtual Worlds. https://lg3d-wonderland.dev.java.net/
6. Whyville Online Virtual World. http://www.whyville.net
7. Second Life. www.secondlife.com
8. The River City Project. http://muve.gse.harvard.edu/rivercityproject/
9. Teen Second Life. http://teen.secondlife.com
10. OpenSimulator. http://www.opensimulator.org

11. Croquet. http://opencroquet.org/index.php/Main_Page
12. OpenCobalt Virtual workspace browser and toolkit. http://www.duke.edu/~julian/Cobalt/Home.html

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