

Evaluating a Virtual Collaborative Environment for Interactive Distance Teaching and Learning: A Case Study

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Abstract. This paper presents a case study of experimenting an interactive collaborative environment for distance teaching and learning activities. It begins with reviewing the existing multiple-users collaborative environment including the Open Wonderland platform, and then outlines the requirements of using a collaborative environment to assist distance teaching and learning, and how these requirements could be met with the Open Wonderland platform. We investigated the system in our local network settings, with a particular emphasis on embedding pedagogy content into of the system. We found that such environment could allow students to have full support throughout their studies with a tutor to guide, advise and offer direct comprehensive guidance. Finally, we summarized the results from the formative and summative evaluations, and presented the lessons learned that can guide future usage of this immersive education space within Higher Education.

Keywords: Distance teaching and learning, virtual environment, Open Wonderland, pedagogy

1 Introduction

Traditional learning and teaching activities in large part show the social characteristics. The format of distance learning is an unique, but advanced way, which allows a learner to study in his own time, at the places wherever he chooses reading, watching or listening to material supplied, doing excises and assignments with regular support from his tutors. The activities described in distance learning are quite different compared with traditional lecture-style study at normal schools. Bring social interaction into normal distance learning activities among students is desired in courses that are based on team projects because a high degree of cooperation is required. The cooperation needed is challenging to achieve among distance learners, therefore requires a particular tool or environment that can assist the teaching and learning process. In this paper, we present our initial exploration study on technical feasibility of using Open Wonderland as a collaborative environment for distance learning and teaching. The issues we aimed

to address were about how we could enrich learning and teaching experiences for distributed learners and teachers who want to exchange knowledge in the academic setting of distance learning and teaching.

2 Related Work

Social interactions have been one of the key aspects studied in educational technology research. Some researchers have proposed the approaches of using asynchronous applications including email and synchronous applications like instant messaging; other suggested using more sophisticated approaches, for example, interactive collaborative game environments (ICGE) in which learners can interact with their teammates or teacher in a multiple-user set-up. The immediate benefit of a 3D collaborative environment is that it allows learners to simultaneously observe the behaviors of their peers in the groupspace. Well-designed collaborative environments allow seamless interaction between distributed users. Below is a list of several research projects and systems in the area of a collaborative environment for learning and teaching. These works have tried to find out the potential factors that affect effective collaboration and the important issues that may result from insufficient interaction and support among collaborators [1]. Prasolova-Frland investigated the mechanisms that can enhance social awareness in educational environment [2], [3] and has concluded that classic cooperative tools including ICQ and email are not sufficient technically, and the mechanism provided by collaborative environment is a promising supplement to the existing mechanisms. Bouras et al. [4], [5] described a robust environment that supports collaborative education. Nevertheless, the limitation of such environment is that editing VRML files is the only way to modify it whenever new contents need to be introduced. A typical teacher may lack of such technical expertise. Furthermore the world cannot be changed while it is in use. Okada et al. introduced a study on building an ICGE system for ecological education [6]. Although virtual areas can be added at runtime, it is complex and time-consuming. Oliveira et al. introduced collaborative learning into industrial training and e-commerce [7]. The environment allows video on demand without synchronization. Mansfield et al. describe their Orbit system, which supports a groupspace model [8]. However, it is not an ICGE and data or metadata visualization is absent. The Orbit system only allow access to data on the server.

3 The Open Wonderland

As an open-source toolkit, Open Wonderland is designed with client-server architecture and embedded with a set of technologies for creating virtual- or augmented-reality environments. The toolkit is built upon several software components or middlewares that include the Project Darkstar multiplayer game server, VoiceBridge for adding immersive audio and jMonkeyEngine (JME) to generate graphical scene. There are also other libraries around JME, such as a Collada loader, which enables users to import 3D objects or models on Google

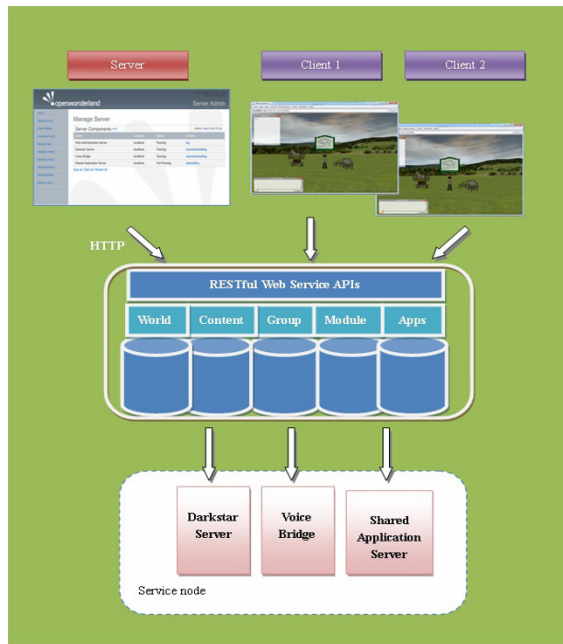


Fig. 1. The overall architecture of Open Wonderland

Warehouse. Additional objects and components (such as a camera device to record audio and video stream from a client) in Project Wonderland make use of other technologies, such as the Java Media Framework. Open Wonderland offers a rich collection of objects for building up environments, and supports shared software applications, such as word processors, web browsers, and document-presentation tools. For instance, one or several users can draw on a virtual whiteboard and view PDF documents and presentations. Every user, represented by an avatar, can communicate to others through the avatar in the same world by means of a headset or microphone and speaker or by the use of a dedicated chat window for text messages. The generated scene within Wonderland can be viewed from a first-person or several third-person perspectives. Fig. 1 illustrates the overall architecture of Open Wonderland. It complies with the Representational State transfer (REST) style of architecture. With the help of Java WebStart, there is a Wonderland client running on every users PC. Java Runtime Environment (JRE) should be available while using Java WebStart. A web page becomes accessible when it is downloaded initiated by Java WebStart. The administration tasks can also be performed via the same link, which includes selecting the initial environment, saving copy of the current environment and adding extra components. Components may be software libraries that extend the core functionality of the system, for instance, a Video Camera. The administrative facilities start and terminate several core modules remotely. The

properties of those modules can also be changed. There is an online games engine called Darkstar. Audio is possible in Open Wonderland by the Voice Bridge via Voice over IP with various audio qualities. The Shared Application Server makes the in-world sharing of X11 applications possible, such as Chrome and Clipboard.

The original objective of developing the Wonderland platform by Sun Microsystems was to create a tool that enables cooperative working by the company's employees [9]. As the consequence, the main advantages of this platform can be summarized as:

- Real-time application sharing;
- Tight integration with business data;
- Deployment internally or externally;
- Scalability of Darkstar server: from very large to very small implementations;
- Open source and extensible: 100% pure Java;
- Spatial Audio: a core feature with extensive telephony integration.

Wonderland is often compared to the Second Life or OpenSim platform. It is possible to customize and integrate the Wonderland platform into an organization's own infrastructure. On the other hand, Second Life and OpenSim are publicly online services that are accessible by lots of users. These users can make use of them to organize their lives. In particular, teaching institutions have already used Second Life extensively to carry out online teaching (for details see [10]). Although Second Life has become first choice in terms of assisting online teaching and learning, it does have privacy and security issues around its use, for example, when a participant takes part in an online session. Furthermore, it is in doubt whether organizations have sufficient controls when they use Second Life as part of their formal education infrastructure.

4 Experimental Design

As one of the best universities that is focusing on fashion and costume design education, our institute desires to offer students a unique, top-class distance learning experience. We believe that online learning enables a student to study in his own time, at home or wherever he prefers reading, watching or listening to material supplied, doing course exercises and assignments with direct support from his/her tutors. The learning activities described are quite different compared with our traditional lecture-style study for regular students. Therefore, we have particular requirements on tools or environments that can assist such teaching and learning process. Research conducted in this paper was built upon the hypothesis that an interactive collaborative virtual space can support and facilitate these kinds of teaching and learning activities. Our goal is to experiment the effectiveness of a selected platform. We list major functional requirements while selecting an experimental platform:

- Emphasis on formal and informal social interaction with improved communication

- Strong feeling of social presence, enabling to exchange their opinions about learning contents,
- Collaboration oriented, allowing active social interactions to build mutual understanding, particularly before and after scheduled events,
- Share document easily without switching contexts,
- Extremely extensible, enabling to introduce any sort of new feathers into the platform.

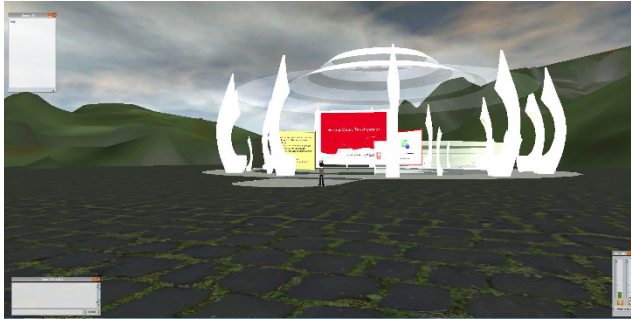


Fig. 2. The virtual auditorium

Since Open Wonderland has fulfilled most of our requirements, it has been selected as the interactive collaborative game environment for this study. The virtual classroom was realized using the Open Wonderland toolkit version 0.5. The virtual world was constructed using a collection of 3D objects. Users can launch the virtual class easily through hyper-links. The initial models for the environment were created using Google SketchUp. These models were then exported into either Collada format as .dae files or Google Earth format as .kmz files, both of which Open Wonderland is able to import. They were uploaded into the main scene and positioned according to our design. Also applications planned to be shared were placed in the virtual class scene to build up the context or meet task requirements (for example, a web browser was used to access a crossword that was completed collaboratively by the students). Fig. 2 illustrates the overview of our virtual auditorium. The world itself consists of a wide open space surrounded by mountains and a representation of the auditorium building. The auditorium contains a lecture presentation board, a note board, a sketch board, standing seats, and etc. The auditorium environment also has surrounding sound and allows application sharing. This representation of a virtual learning environment offers possibilities to build up various contexts in which social interactions between participants are possible. There are a document reader, a note stick, and a chat box as shown in Fig. 3. Teachers and students are able to pick up a particular persona as desired by their educational tasks. Users can set their preferred view perspectives (see Fig. 3).



Fig. 3. The Auditorium components

One of the advantages of this environment is that a user can drag any content (documents) located in his desktop into the auditorium world. These contents are then treated as objects within the 3D Wonderland world. As long as an object is Collada compliant, it can be imported and displayed within the auditorium. Such feature is the functionality teachers need to customize an auditorium world with new objects. It meets the requirements discussed before. The Google SketchUp 3D warehouse is a publicly available and popular repository that contains thousands of Collada content, which are freely accessible. Another advantage is that the world we experimented is extensible that allows users and developers to design their own worlds and introduce new features into it in the form of software components. The key achievement of this study was that we successfully demonstrated the feasibility of the Open Wonderland for collaborative interaction in a social learning environment. The environment we exercised could augment an existing distance education practice because it creates a sense of community amongst students who are located remotely. Such scenario is common in a non-traditional instructive higher education setting. In addition, the environment we designed allows students to reach a tutor and receive his full support throughout their studies. A tutor can supervise their learning activities and offer comprehensive opinions to their coursework. The tutor can lead group tutorials and seminars at runtime within the virtual game environment.

5 Discussion

Schlosser and Anderson pointed out that distance learning can be equally effective as learning through face-to-face [11]. In essence, there is no difference between good distance teaching pedagogy and good conventional teaching techniques. Schlosser and Anderson listed several studies that clearly proved that distance education was effective for education. However, from their points of view, they emphasized distance teachers should offer an environment that al-

lows structured note-taking, interactive study guides, and visuals. In another survey, Threlkeld and Brzoska reviewed a number of studies and concluded that the importance of the media itself to instruction was not the same as the other factors, like the characteristics and objective of learners [12]. However, they discovered it is very critical that various supports are available for a distance learner, such as, the feedback from an instructor as well as direct access to library materials and other auxiliary resources. Indications from our studies are that online learning environments should provide means for online note taking, and online communication among students and teachers should be smooth. In addition, hypermedia-based contents should be easily incorporated. With the development of new technologies including interactive 3D collaborative environments, a pronounced shift has taken place in learning theories from behaviorism to constructivism. With the deployment of new technology, students can improve their thinking skills and develop their personal knowledge [13, 14] that can be shared immediately with anyone around the world [14]. The new technologies or features of Open Wonderland exercised in our study not only offer it's users with possibilities to break the bottleneck in conventional learning and teaching, but, more importantly, to illustrate a new way of education. The Wonderland platform as a tool urges educators to re-evaluate and rethink the existing educational models and eventually to establish innovative ones. Certainly, the platform is still evolving and poses several constraints, such as lack of rich and fluent interaction style and difficult deployment in network environment with a complex firewall. The next step could be to put the virtual Wonderland in real pedagogical environment with concrete learning activities to investigate the pitfall and usability issues in details.

6 Conclusion

This paper presents a case study of exercising the Open Wonderland platform as an interactive collaborative tool for distance teaching and learning activities. The role of Open Wonderland in this study is to provide a test bed for evaluating its teaching and learning capabilities. We described our user experience and especially focused on the social aspects of such system. We investigated how we can support good practice of learning and teaching with the use of such 3D gaming environments in education. We presented our findings on the technical feasibility and pedagogical value of using 3D collaborative environments for distance teaching and learning. The issue we aimed to address is that there is a need to improve the learning experiences and outcomes for students who are located remotely at different places.

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References

1. Daradoumis, T., Xhafa, F., and Manuel, Marqus J., Evaluating Collaborative Learning Practices in a Virtual Groupware Environment, Computers and Advanced Technology in Education, 2003, June 30 July 2, Rhodes, Greece.
2. Prasolova-Frland, E., Supporting Social Awareness in Education in Collaborative Virtual Environments, International Conference on Engineer-ing Education, 2002.
3. Prasolova-Frland, E., Supporting Awareness in Education: Overview and Mechanisms, ICEE, Manchester, UK, 2002, 18th-22nd, August.
4. Bouras, C., Psaltoulis, D., Psaroudis, C., and Tsiatsos, T., An Educational Community Using Collaborative Virtual Environments, Proceeding ICWL '02 Proceedings of the First International Conference on Advances in Web-Based Learning , 2002, pp180-191.
5. Bouras, C., Philopoulos, A., and Tsiatsos, T., E-Learning through Distributed Virtual Environments, Journal of Network and Computer Applica-tions, Academic Press, 2001, July.
6. Okada, M., Tarumi, H., and Yoshimura, T., Distributed Virtual Environ-ment Realizing Collaborative Environment education, Symposium on Ap-plied Computing archive, Proceedings of the 2001 ACM symposium on Applied computing, Las Vegas, Nevada, United States, 2001, pp83 88.
7. Oliveira, C., Shen, X., and Georganas, N., Collaborative Virtual Envi-ronment for Industrial Training and e-Commerce, Workshop on Application of Vir tual Reality Technologies for Future Telecommunication Systems, IEEE Globecom 2000 Conference, 2000, Nov-Dec.
8. Mansfield, T., Kaplan, S., Fitzpatrick, G., Phelps, T., Fitzpatrick, M., and Taylor, R., Evolving Orbit: A Process Report on Building Locales. In Pro-ceedings of the international ACM SIGGROUP conference on supporting group work: the integration challenge (GROUP '97). ACM, New York, NY, USA, 1997, pp241-250.
9. Yankelovich, N., Walker, W., Roberts, P., Wessler, M., Kaplan, J., and Provino, J., Meeting Central: Making Distributed Meetings More Effective. ACM Conference on Computer Supported Cooperative Work, November 610, Chicago, IL, USA, 2004
10. Coffman, T.& Klinger, M.B. Utilizing Virtual Worlds in Education: The implications for practice. International Journal of Social Sciences, 1(2), 50-54, 2007, July.
11. Schlosser, C. A., & Anderson, M., Distance Education: Review of the literature. Ames, Iowa, Iowa Distance Education Alliance, 1994.
12. Threlkeld, R., & Brzoska, K., Research in Distance Education. Dis-tance Education: Strategies and Tools. B. Willis. Englewood Cliffs, New Jersey, Educational Technology Publications, 1994, pp4166
13. Means, B., & Olson, K., Technology's Role within Constructivist Classrooms. A symposium: Teachers, Technology, and Authentic Tasks: Lessons From Within and Across Classrooms. American Educational Re-search Association. April, San Francisco, CA, 1995.
14. Kizlik, R., Connective transactions - Technology and Thinking Skills for the 21st Century. International Journal of Instructional Media, 23, 1996,pp115122.

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