

CHAPTER 10

SUMMARY, DISCUSSION, AND RECOMMENDATION

Summary

Within the past ten years, the field of education has been greatly impacted by the Internet and more lately by the WWW. Computer mediated communication and hypermedia are not only influencing practices within the classroom, but they are also expanding the classroom. While distance learning is not by any means a novel idea, the Internet, WWW, and emerging technologies such as virtual worlds are allowing educators and learners the opportunity to re-envision the learning environment.

Three-dimensional virtual worlds are an emerging technology, which offer a variety of tools for interactive collaborative learning environments. These applications offer users the ability to communicate and collaborate in real-time 3D environments. Although little research has been conducted into these environments and their use in education, there is a body of research for investigators to draw from in the areas of text-based virtual worlds, virtual world design, educational VR, and educational games and simulations.

Studies in the design and educational use of MUDs, MOOs, chat, and 2D graphical chat environments argue for the educational potential of these types of technologies. Additional work in the area of virtual world design adds much to our

understanding of how these worlds can and should be constructed. Studies in the areas of the educational use of VR provide most interesting insight into the unique opportunities that 3D environments offer in terms of experiential learning. Some of the more critical studies into the educational use and value of computer games and simulations revealed some of the most relevant findings pertinent to an investigation into the use of 3D virtual worlds for educational purposes in terms of representation of ethnicity, race, and gender.

This study into the educational use of 3D virtual worlds was conducted to investigate the two following questions:

1. How is the user constructed by the 3D virtual world?
2. What are the unique learning opportunities provided by these worlds?

Part one of this investigation provides both a history of virtual worlds, as well as a review of related literature. Part two addresses the question, how is the user constructed by the 3D virtual world, by examining of the more popular 3D virtual worlds: ActiveWorlds, blaxxun interactive's Contact 4.0 in the context of Colony City world, and OnLive! Traveler. The focus of the study is on the affordances and limitations of various design features and how they function. The underlying methodology employed was Grounded Theory Methodology (GT) which was chosen due to the relative lack of prior research in the area of 3D virtual worlds. Consistent with GT, no *a priori* theory was offered, but instead theories were derived from data collected through long-term participatory observations and formal and informal interviews. Categories were liberally derived based on Huberman and Miles' (1994)

variable-oriented and pattern-clarification strategies for identifying themes and patterns. These categories include the design features that serve to construct the user in terms of presence, representation, and embodiment.

The findings of this investigation reveal that although all three worlds offered many design features which on the surface might seem roughly parallel, the way they function within the application serves to construct the user in different ways.

Part three of this study addresses the question, what unique learning opportunities do these worlds provide? This investigation consists of two case studies of how AW was used as a medium for both informal and formal education. The first case study, Magine's class (informal), examines an RWX object modeling class offered through the ActiveWorlds University. The second case study focuses on a beginning level business-computing course (BCOR) offered through the University of Colorado–Boulder's College of Business.

The findings reveal many unique learning opportunities were presented by the use of AW as an education medium. Both Magine's class and the BCOR course provided an environment rich in context necessary for situated learning. In addition, findings reveal that AW also allowed for a greater variety of tools to support various learning styles, particularly a greater variety of visuals. It was also found to support the notion of experiential learning supported by more traditional immersive forms of VR.

Discussion

Findings from part two of this study indicate that 3D virtual worlds serve to construct the user in various ways. While many of these worlds may offer parallel affordances and limitations by way of design features, it is how these features function within the context of the world that determine and construct the user.

Active Worlds

Many of the features and types of support of ActiveWorlds serve to construct the user as a more autonomous agent. The lack of a central governing body coupled with the provision of allowing users to build and add to an environment, allows users to define their own communities.

ActiveWorlds and Learning

Because these worlds are relatively new, there is little research about them, however, research into MOOs by both Bruckman (1998) and Riner (1996) support the importance of user-extensible features such as the ability to build within a world. Research by Gigliotti (1993; 1995) further supports the importance for user-extensible features through her notion of *plasticity*. According to Gigliotti, "a virtual world should be moldable, flexible, pliable." This notion of *plasticity* or user-extensibility holds relevance for learning. Within a constructivist paradigm, action and learning are intrinsically tied together. Learners construct knowledge by acting upon and with their learning environment. AW allows for many opportunities for individual and groups of learners to construct.

One of the more problematic features observed with AW was the limits and lack of user control over avatars. Users were limited to selecting an avatar from a pre-defined library. While world owners have the option of creating avatars for their own world, avatars are difficult to create and require knowledge of 3D modeling as well as the appropriate software. While stock avatars are provided by COF to world owners, with few exceptions, these avatars represented young, fit Western Caucasians. Additionally, there were more males with a greater variety of age and body types than females. These limitations perpetuate values that may not correspond with those of the user. Similar findings in the area of educational games by both DeVaney (1993) and Miller-Lachman, et al (1995) support the importance of questioning how the user is being represented and what values are being perpetuated through the design.

While the lack of user control over avatars was seen as problematic there were other aspects of representation where the user maintained a great deal of control. Users could choose their own unique names and control over the amount of information they wished to reveal, including whether to make their presence in a world known to others. Users also had the option of *whispering* and sending *telegrams*, and *muting* other users. The availability of unique names does aid in the development of communities because it aids in both creating trust and accountability among users (Stone, 1997).

Within the social-constructivist paradigm, learning is viewed a social activity (Lave and Wenger, 1991). AW allows for learners, locale or spatially distant, to communicate by way of and collaborate while still maintaining some control over their virtual and PW identity.

blaxxun interactive: Contact 4.0 in the context of Colony City

While it was revealed that the focus of ActiveWorlds is on personal autonomy, many of the same type of features in blaxxun's Contact 4.0 in the context of Colony city serve to construct the user as a part of a centralized community. Features such a *Peoples* list and worldwide dialogue serves to create a central community. This is further reinforced by the economic system of jobs and points. This focus on community is in many ways supported by the individual work of both Morningstar and Farmer's (1994) studies of "Habitat," and Pavel's (1995) recollections of "LambdaMOO." In both Habitat and LambdaMOO, providing environments that supported interactions facilitated the focus on community.

blaxxun and Learning

One of the main strengths of blaxxun's Contact 4.0 revealed in this investigation was the provision of allowing custom created avatars. While findings reported similar limitations of avatar gestures, actions and emotions consistent among all three virtual worlds, Contact 4.0 did allow for users control over their own visual representation. The result of this allowed for a much more diverse representation, including a rare occurrence of an avatar in a wheelchair. One of the more interesting

notes is for the most part, avatars were not photorealistic images of the user, but instead users choose to represent themselves as a variety of fantastical characters and other assorted objects.

In a virtual environment, avatars become a type of projection or personification of self. Evidence supporting this notion comes from diverse studies into MUDs and MOOs. Both Turkle (1996) and Stone (1996) have looked at the social construction of self in a computer-mediated environment. Evidence of the value and connection users' feel towards their representation (avatar) can be found in the works of Dibbell (1994) and Bruckman (1997). Although these studies primarily focus on text-based representation, many of these notions can to some degree be supported by Jeffery and Mark (1998) investigation into how users project PW physical behaviors onto their avatars into virtual worlds.

The control over visual representation is particularly important when addressing the use of 3D virtual worlds for education. In an era of cultural diversity, it is important that learners have control over how they are being represented. Bruckman's (1997) investigations in MOOSE Crossing illustrates the importance allowing learners to self-define and at times experiment with new roles and personae. The ability to representation may further add or enhance learners' ability to view problems and issues from multiple perspectives. Within a constructivist framework, multiple perspectives and diversity and control over representation are important components for the learning environment.

OnLive! Traveler

OnLive! Traveler is in many respects very different from Active Worlds and blaxxun's Contact 4.0. While all three offered somewhat parallel design features, Traveler was the only application out of the three to include real-time voice. The results of this investigation revealed that the inclusion of real-time voice, along with such features as avatars with lip-synced facial motions, collision and gravity, and degrees of freedom in motion and rotation from the first-person perspective served to greatly enhance aspects of physical embodiment. Unlike both AW and Contact 4.0, the focus of Traveler was not so much on the community or the personal autonomy of the user, but instead on creating an environment that supports experiential embodiment.

Traveler and Learning

One of the most interesting aspects of Traveler is the way in which the user is represented. For the most part (dependent upon the world) the user is required to select from an existing library of avatars. While there are limits imposed on the user's choice of visual representation, there is a degree of freedom built into the design because users can alter both the color and (with limits) the shape of their avatar. This does allow for a degree of freedom over representation.

Traveler does not allow for persistent or unique identities. While several studies (Stone, 1997) indicate the need for unique identities for establishing both trust

and accountability in a community, it could be argued that within a Traveler environment, unique identities are constructed not by a user's unique name, but by vocal qualities.

While Traveler lacks most of the sensorial input and feedback of more traditional immersive VR, it does offer the opportunity for users to collaborate within the environment. It could be argued that the availability of communication allows for a greater degree of emotional or intellectual engagement. In *Virtual Realism* (1998), Michael Heim addresses this issue with his discussion of *presence*. Heim argues that immersion is not the result of sensorial input, but rather the result of humans interacting with one another in an environment.

Heim's argument is particularly relevant to a discussion of 3D virtual worlds as learning environments. Although Traveler provides a sense of physical embodiment unparalleled by other 3D virtual worlds, it does not come close to matching the "telepresence" (Dede, 1995) or sense of immersion one might experience in some VR environments. While Traveler and other 3D virtual worlds may lack multi-sensorial immersion, these worlds do provide ample opportunity for emotional and intellectual engagement. Within the constructivist continuum, engagement both among participants and with environment is important for any educational medium.

Three Dimensional Worlds and Learning

All three of the 3D virtual world applications to varying degrees offer interesting opportunities for learning. Within this decade, educators have begun to

realize the potential for learning collaboration and cooperation afforded for learners. Within the social-constructivist paradigm, learning is regarded as a social activity (Lave and Wenger, 1991). The 3D virtual worlds discussed in this investigation allow for learners, locally or spatially distant, to communicate by way of either text (AW, and Contact 4.0) and by way of real-time voice (Traveler) and hence, collaborate.

In addition to the communication afforded by these three applications, each 3D virtual world also allows users to interact with both other users and objects in a networked immersive environment. Within these environments to varying degrees, learners are able to construct, impact, and interact with symbolic representations and data first hand which is in many ways more consistent with how learners engage and learn in the PW (Winn, 1993). Knowledge construction is not limited to the presentation of abstract concepts, but instead is tied to action (Winn, 1993; Dede, 1995).

Magine's Class

Magine's RWX object modeling class proved to be an interesting study in how 3D virtual worlds can be used for distance education. Prior to participating in the class, it was assumed that AW would not be a suitable medium for a lecture/discussion style class, however, the findings revealed within limits, it was a suitable environment and in some respects offered many unique advantages. The findings revealed that AW provided an opportunity for locally dispersed learners to learn about 3D concepts and RWX object modeling in a collaborative community.

Studies of the educational use of MOOs support the educational value of interactive collaborative environment provided by chat type applications. Both Bruckman (1997) and Riner (1995) note the importance of collaboration in the development of critical thinking skills among learners. Additionally, Bruckman stresses the importance of collaboration in the construction of "knowledge building communities" (1997).

In addition, findings revealed that Magine's class via AW provided an environment that promoted situated learning. Both McLelland (1996) and Winn's (1993) individual work in closed VR environments supports the notion that simulated environments such as those found in some educational VR applications provide both a context and a first person perspective for learners. One of the main tenets of situated learning is that abstract concepts emerge by providing a context in which learners can construct their own knowledge. Magine's class provided both chances to collaborate in a "knowledge building community" as well as providing a rich context in which to learn about 3D concepts and object modeling.

BCOR 1000

Although this short investigation does not come close to addressing all of the complexities of the BCOR 1000 course, there were several significant findings that will hopefully provide avenues for further investigation. Congruent with the findings of Magine's class, the use of AW for the BCOR 1000 course provided both a rich context for situated learning, as well as the necessary collaboration for knowledge construction among learners. However, what is additionally noteworthy about BCOR

were findings that addressed the often overlooked aspects of experiential knowledge (Winn, 1993). While BCOR did provide conventional avenues for students to access material, it also provided a unique re-envisioning of that material as well. Within the field of education differences in learning styles is a loaded topic and often little understood, however, it is generally acknowledged that learners construct knowledge in different ways. What BCOR does is acknowledge the difference among learners and learning styles and attempts to present learners with both choice and control over how they wish to access material.

Recommendations

Three-dimensional virtual worlds are relatively new technologies, which to varying degrees combine some aspects of both interactive chat environments such as MUDs and MOOs with the 3D spatiality of VR environments. Because they are new, little research has been conducted in their use for educational purposes. The purpose of this investigation was to provide preliminary research into how the user is constructed by the virtual world, as well as to investigate what educational opportunities they might provide as learning environments. Based on the findings the following recommendations are offered for the areas of development, practice, and further research.

Recommendations for Development

Object Manipulation

One of the strongest advantages of 3D virtual worlds is the graphical simulation provided. Both Magine's Class and the BCOR course illustrate the importance a visual environment can offer for providing a context and a wider variety of tools for learners. However, for the most part potential practitioners and learners are limited to using objects or environments that are to varying degrees prefabricated. While AW allows for a certain amount of interactivity by way of triggering events, animations, sounds, and Web pages, there are few opportunities for users to actually manipulate objects within the world. For instance a user cannot pick up an object and rotate or move it. Additionally, with the exception of AW, there are few provisions for users adding to an environment. This is an important consideration given these worlds potential in terms of providing a rich context for learning, particularly for fields such as science.

Multiple Platforms

All three of these 3D virtual worlds were windows based and require at least a Pentium processor. For developers interested in greater widespread use for educational purposes, it is important that the be available on multiple platforms so as not to exclude potential learners from access.

Recommendations for Practice

Selection of the Learning Environment

One factor that became evident from observations is that these worlds construct the user in different ways. Although design features may on the surface appear parallel, they are not. This needs to be taken into account when approaching the use of 3D virtual worlds for education. It is important to identify the needs and hoped for outcomes of the learning environment, and then select the appropriate virtual world.

It also became obvious during this investigation that the resources of the learners need to be taken into account. Both typing and language skills are an important part of the experience. This should be taken into consideration so as not to disadvantage any potential learners.

Recommendations for Future Research

Learning Styles

Few researchers outside of educational VR have taken on the topic of experiential learning. For this reason, more research needs to be conducted into how and what constitutes experiential learning. Additionally, more research needs to be conducted into the effectiveness of 3D virtual worlds in providing environments for situated and experiential learning.

Learner Attitudes

Throughout this investigation, little attention was focused on learner attitudes. While most of the learners encountered in both Magine's Class and BCOR reported

positive attitudes about both the style of learning and the environment, no negative case samples were actively sought. Further research in the area of learner attitudes need to be conducted.

Assessment

One of the most valuable assets these worlds may offer is both the rich context and variety of learning tools they provide to students, however, it is important that when offering alternative tools for students, that there likewise be alternative means of assessment. For example, learning environments that allow for more experiential learning also need to provide more experiential means for assessment. For this reason, further research needs to be conducted in the types of assessment that might be appropriate for experiential and collaborative learning environments.

Conclusion

Three-dimensional virtual worlds are interesting and dynamic environments which offer much potential as both supplemental learning environments and for distance/distributed education. They provide for experiences that are not always possible to replicate in the PW classroom as well as offer a collaborative setting for situated and experiential learning. However, further research needs to be conducted as these worlds continue to develop. While this investigation focused on how the design served to construct the user for Active Worlds, blaxxun interactive, and OnLive! Traveler, there are many other 3D virtual world applications to explore. The findings of this investigation revealed that although many of the design features were

parallel in all three virtual worlds, they serve to construct both the user and the community in different ways. A criterion for both design and application needs to be devised to help guide developers and practitioners in the use of 3D virtual worlds for education.

The field of education is only beginning to deal with the impact of the WWW. As new technologies emerge it is important that educators who work with instructional technologies educate themselves and delve into them. The term "educational" is so often flouted as a marketing strategy for various types of technology. In order to insure that new applications and technologies meet the claims of their developers, both practitioners and researchers must be willing to investigate. This investigation revealed that 3D virtual worlds do offer interesting potential for collaborative, constructivist learning. In conclusion, beyond all practical and educational opportunities these worlds may hold, one of the most important contributions 3D virtual worlds offer the field of education is a mirror to watch and analyze how we perceive and construct ourselves.