3D Online Spaces for Teacher Education: Mapping the Territory

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Abstract: If familiarity with games played out in 3D online spaces is truly a defining characteristic of the emerging generations of learners then teacher educators need to attend to these environments both as venues for teacher preparation and as a subject of study for preparing teachers who will be expected to work in such environments. As an aid to investigating possible applications of 3D online spaces in teacher education some means of mapping out the territory to be explored is desirable. This paper proposes one such map and suggests examples of applications that might be explored various areas of the map.

Introduction

However we label them, whether as Generation Y, the Millennials, or otherwise, there seems little doubt that the young people entering university from school and those currently in school typically have life experiences that differentiate them from previous generations (Oblinger & Oblinger, 2005). They have grown up in a world that is highly connected, and are variously described as "IT savvy", "digitally literate", "connected" and "always on". They prefer to learn through active participation, in teams with peers, and with information available when it is needed. It has been suggested that they think differently as a consequence of their brains having been wired differently by environmental influences including extensive playing of computer games (Prensky, 2001).

These changes, coupled with widespread easy access to vast volumes of information on the Internet, make the traditional understanding of teaching and learning as a process of information transmission increasingly untenable. Whether or not the "digital natives" really think differently as Prensky (2001) claims, education in the 'information age' requires strategies other than delivery of information (Herrington, Reeves, & Oliver, 2005). Methodologies for development of authentic online learning experiences that account for characteristics of learner, task and technology have been proposed as a potential solution to this challenge (Herrington, Reeves, & Oliver, 2006).

Such environments often have characteristics in common with computer games and simulations, which have been demonstrated to be effective vehicles for learning in the preparation of professionals (Ertmer et al., 2003; Kiegaldie & White, 2006) and have been proposed as a key means of developing education in ways that will help students to deal more effectively with the real world (Shaffer, 2006). For people of a certain age, mention of computer games in education will bring to mind memories of "drill and skill" classic such as *Math Blaster* and *Reader Rabbit* but modern computer games are much more powerful providers of situated experiences in which players engage in complex problem solving (Squire, 2005). Through the process of working together to succeed at the higher levels, players of Massively Multiplayer Online Role Playing Games (MMORPG) such as *World of Warcraft* can develop skills of leadership and management that match those required for success in the world of business (Brown, 2006). Such learning is not the explicit object of the game but an accidental effect that flows logically from the requirements for success in the game. The effectiveness of such games for learning naturally raises questions about the potential for designing games with the primary aim of enhancing learning and there is a growing body of research directed to that end (Gee, 2004; Gibson, Aldrich, & Prensky, 2007; Shaffer, Halverson, Squire, & Gee, 2005).

Teacher educators have more than one reason to take notice of the developments around computer games for learning. One reason relates to the need for graduating teachers to be able to take advantage of what games offer for learning in their own classrooms. "Teachers cannot be expected to embrace digital games as tools for learning without confidence in their own ability to use games effectively to enhance learning, or without a sound understanding of the games' potential as well as their limitations" (Becker, 2007, p. 482). Teacher education programs will need to ensure that teachers in preparation have opportunities to develop an appropriate understanding of computer games and how they can be used effectively to promote learning. A second reason relates to the direct benefits that computer games and simulations offer to support specific learning within teacher education programs. Among the most obvious examples of packages that might benefit teacher education is SimSchool (http://simschool.org/), a simulation intended to allow future teachers to "analyze student needs, make instructional decisions that attempt to meet those needs, and then see the impact of their decisions on student results" (Zibit, Gibson, & Halverson, 2006, p. 3132). It is reasonable to expect that, in addition to learning about the subject matter of the simulation, pre-service teachers who work with such software might reinforce their more general understanding about the value of games for learning.

3D Online Spaces

Much of the current interest around games in education is focused on MMORPGs and related systems that are sometimes collectively referred to as Multi-User Virtual Environments (MUVE) or virtual worlds, which are essentially similar environments to MMORPGs but without the goal-oriented characteristic of games. Such environments are characterised by 3D graphics, persistence and the capability for multiple simultaneous users to interact via the Internet.

Probably the best known example of such an environment is Second Life (http://secondlife.com/) which enables its residents to buy virtual land, erect buildings, produce and sell goods and services, engage in a variety of social interactions and more. Second Life started as a proprietary system, but has more recently made the client software available as open source and is looking towards moving the server technology to open source. Numerous educational institutions and groups have purchased land in Second Life and created virtual campuses or other spaces. Alternatives to Second Life that are being investigated as venues for educational activities include Activeworlds (http://activeworlds.com/), another commercial virtual world system and Croquet (http://www.opencroquet.org/), an open source MUVE.

MUVEs typically allow users considerable freedom to design and decorate spaces and other contents to suit their own purposes. Subject to the basic objects and actions provided, the ease with which content can be imported from elsewhere and the richness of the scripting language that may be available, what can be accomplished in a MUVE is limited only by the imagination, skill and time available to the users. It is possible to create spaces that mimic significant aspects of the real world and to arrange games and other activities for educational or other purposes.

In recent years, examples of the application of MUVEs for teacher education or related purposes have begun to emerge. Second Life has been used to support action learning for professional development of teachers (McKeown, 2007) and the facilities and techniques developed for that application could be applied more widely to educational activities that involve small groups meeting for discussion. Activeworlds has been used to construct a 3D virtual campus that supports a social constructivist approach to distance education (Bronack, Riedl, & Tashner, 2006). The lessons learned, including more fluid ways of interacting with students and cross-class collaboration, can be transferred to other learning environments in the virtual and real worlds.

The effective design of educational games and simulations requires facility with both educational design and materials or games design (Agostinho, Meek, & Herrington, 2005; Chambers & Stacey, 2005). By extension, the effective design and use of 3D online spaces for education is likely to require a similar combination of capabilities. However, it is relatively rare to find individuals with both and there would be value in developing tools that could support content experts in designing effective learning experiences in 3D online spaces. Hence the Web3D Exchange project (http://web3dexchange.org/) proposes to explore the development of a tool that would support educators with content expertise in the development of games with characteristics of good design in both educational and games domains.

ALIVE, AliveX3D and Web3DX

The Advanced Learning and Immersive Virtual Environment (ALIVE) project at USQ commenced in late 2005 with support from an internal grant. It received further internal funding in 2006 and in 2007 was the basis for a successful application for a national competitive grant from the Carrick Institute for Learning and Teaching in Higher Education.

The first phase of the ALIVE project (http://www.alivex3d.org/) produced a representation of part of the USQ campus (Figure 1) within which a user could tour facilities such as the library and engage in chat conversations with embedded 'bots' and/or other users. The virtual environment was intended to support orientation of distance students but the basic affordances that it presented could equally well support online meetings and other gatherings including classes.

Figure 1: ALIVE representation of USQ campus

Unlike Second Life and some other 3D environments that require connection to a server to operate at all, the first version of ALIVE was designed to run as a standalone application with an optional connection to the network for interaction with other users. Because all of the essential content was available in the base installation, which could be distributed on CD-ROM, the bandwidth requirements for interaction were governed by the exchange of simple text and were much less than what is required for Second Life or similar MUVEs – a clear advantage for learners without broadband connection to the Internet.

Currently the focus of the ALIVE team is on developing tools that make it possible for content experts without experience in designing games or 3D environments to build 3D educational materials that can be used in their courses. Both the tools and specific content developed using them is to be shared via the Web3D exchange site (http://web3dexchange.org/) with a view to building a community of users and an economy of shared materials. The materials to be produced as 3D virtual worlds may include social environments, simulations, and serious games. In addition the team is developing 2D/3D hybrids that embed small 3D elements in web pages. The latter approach is especially suitable where good quality text is required alongside the 3D content because the rendering of text in 3D environments is typically limited.

The Web3DX project presents an opportunity to develop 3D online spaces and content specifically for the teacher education program and, at the same time, raises the question of what content can and should be developed. Rather than somewhat randomly pursue the first ideas that emerge, whether based on current real world practice or previously published examples, it seems preferable to try first to develop a wider view of the universe of possibilities and then make strategic selections of opportunities from that space. Developing such a wider view might be approached by creating a map of the possible applications of 3D online spaces in teacher education.

Mapping the Educational Applications of 3D Online Spaces

Whatever learning theory may underpin the design of a course or learning environment, interaction seems fundamental to the learning process (Ertmer & Newby, 1993) and is "widely cited as the defining characteristic of computing media" (Swan, 2002, p. 4). In broad terms, there are three types of interaction that may occur within online courses: interaction with content, instructors and peers (Moore, 1989) and there is no reason to presume that 3D online spaces used for education would not manifest the same dimensions of interaction.

One possible way of mapping the interaction space available to online courses is to represent the levels of interaction, on some arbitrary scale from low to high, along three orthogonal axes for each of content, peers and instructor. The result is a cube as illustrated in Figure 2, which can be divided into eight smaller cubes representing the combinations of low and high interaction on each of the pairs of axes (Albion & Ertmer, 2004).

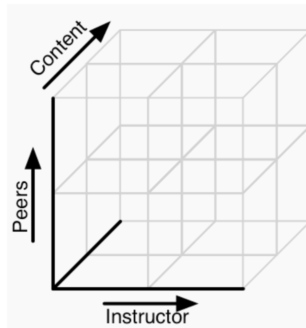
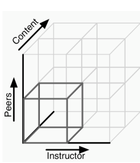


Figure 2: Instructional interaction space

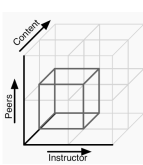
Although the degree of interaction on any of the three dimensions varies along a continuum from low (zero) to high, the crude division into low and high is useful for thinking about the possibilities for educational use of 3D online spaces.

> Deep and meaningful formal learning is supported as long as one of the three forms of interaction (student–teacher; student-student; student-content) is at a high level. The other two may be offered at minimal levels, or even eliminated, without degrading the educational experience.
>
> High levels of more than one of these three modes will likely provide a more satisfying educational experience, though these experiences may not be as cost or time effective as less interactive learning sequences. (Anderson, 2003)

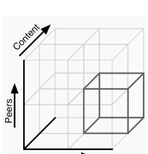
Using this map as a guide it is possible to consider the educational possibilities for 3D online spaces represented by each of the eight smaller cubes.



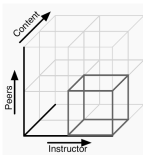
The first small cube to be considered is at bottom left of Figure 2 and represents the case when interaction is low on all three dimensions. If we accept that interaction on at least one dimension is a requirement for learning (Albion & Ertmer, 2004; Anderson, 2003), then this space is the least likely to be effective for learning and need not be considered further. On Anderson's logic, each of the other spaces will offer potential for learning if the interaction mix can be projected into a 3D online space.



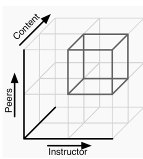
Moving along the content axis into the page, highlights the cube representing high interaction with content and limited interaction with instructor or peers. In considering applications for online learning, Albion and Ertmer (2004) matched this space to traditional print-based distance education. In a 3D online space, or other simulation, 'content' might be understood as anything that is provided by the system without direct human intervention. Possibilities for interaction with content in a 3D online world include access to information by browsing in a space or more complex examples such as a 3D navigational aid that extracts data from a library catalogue and represents the location of a book in the library stacks (Curran, 2005). More substantial examples might include the use of virtual environments for observational field experiences and interactions that allow pre-service teachers to safely step beyond their normal environments (Mullen, Beilke, & Brooks, 2008). Although the current version of SimSchool (Zibit et al., 2006) presents a 2D representation of a class, it is possible to imagine how a 3D version might add to the experience by permitting changes to the positions of objects and movement within the classroom as elements of teaching strategies.



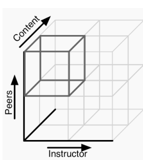
The cube at the lower-right in back represents high interaction with instructor and content but variable interaction with peers. In online learning one option for this space has been described as 'performance coaching' in which learners work relatively independently with prepared content and instructor feedback and support as required (Albion & Ertmer, 2004) but perhaps the most obvious is the conventional lecture format in which content is presented by an instructor. Presentations are possible, even common, in 3D online spaces and can provide a sense of occasion that may be motivating for learners who, for reasons of distance, are otherwise unable to participate in such events. 3D online spaces also lend themselves to ‘performance coaching’ directed towards activities carried out in either the virtual world or the real world with reporting and feedback occurring in the 3D space.



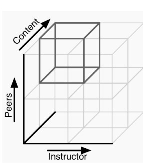
The fourth cube on the bottom layer represents high interaction with the instructor and limited interaction with prepared content or peers. One example of an interaction matching this pattern is Socratic questioning (Albion & Ertmer, 2004). In online learning such one-on-one interaction could be conducted asynchronously using email or synchronously using text chat or an online audio-video tool such as Skype. The use of a 3D online space for such synchronous encounters can be just as convenient if voice chat is enabled as it now is by default in Second Life and, compared to talking from a real world office environment, can offer a variety of virtual venues such as offices, cafes, bars, or beaches, as appropriate. The selection of an appropriate virtual venue may add atmosphere that facilitates the discussion.



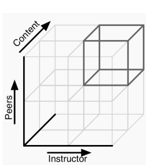
Immediately above, in the top layer of the large cube, is a cube marked by high interaction with instructor and peers but low interaction with content. One possibility for this space is ‘substantive conversation’ which is characterized by sustained dialogue about matters of intellectual substance that is not scripted or directed by the teacher (Albion & Ertmer, 2004). Similarly to the one-on-one interaction between learner and instructor, the selection of an appropriate venue can influence the course of conversations among a group of learners. Careful design of 3D online spaces would enhance their suitability for approaches such as action learning (McKeown, 2007) and problem-based learning (PBL). Use of such spaces to gather online learners at the start of a course has been shown to be very effective in accelerating the development of asynchronous text-based discourse through the remainder of the course (Jones, 2006).



The sixth small cube represents a space in which the primary interaction is with peers and the instructor and prepared materials are less prominent. Examples in online learning could include seminars and conferences conducted online in which learners share work that they have prepared in response to stimulus material provided in a course (Albion & Ertmer, 2004). Similar educational designs based on group interactions are possible in the 3D online spaces. Many of the interactions required for action learning and PBL. 3D spaces that provide for sharing of information through presentations and have flexible spaces for break-out groups would be most suitable.



Cube seven is characterized by high interaction with peers and prepared content but less interaction with an instructor. One example that fits this space is experiential learning, which involves the acquisition of knowledge through personal involvement in activities or events (Albion & Ertmer, 2004). In a 3D online world, the activities or events could involve interation with simulations or with activities devised to be engaged in-world. The interactions with content would be essentially similar to those identified for the second cube but would be overlaid with a group dimension requiring interaction with peers. Virtual field studies undertaken by groups of learners (Mullen et al., 2008) would fit this category. Working in groups would allow for multiple perspectives on the phenomena being studied.



The final cube offers high interaction on all three dimensions. Albion and Ertmer (2004) suggested online professional development that engaged groups of learners and an instructor with rich content as an example of this space. Similar experiences might be designed for learners working in a 3D online space. This interaction space could also accommodate project based learning in which a group of learners, with instructor support, engage with an in-world project, perhaps the design and development of a space and/or simulation for some further purpose within the space.

Conclusion

The technology that supports computer games and simulations is developing rapidly. With increased computing power, especially for graphic rendering, and improved algorithms, both the 3D virtual worlds and their simulated inhabitants are becoming more convincing. New generations of teachers and students are likely to be familiar with games and 3D online spaces as players and residents but may not be so familiar with the educational affordances that are on offer.

Hence teacher education programs need to adopt and present these technologies both for their utility within the teacher education program and their longer term application in the classroms where our graduates will work. Developing tools that enable teachers with only modest technical skills to design satisfying and effective learning experiences in 3D online spaces is a further important step as is exploring the range of possible applications of the technologies in teacher education. Developing a map that can be used as a guide to exploration may not ensure that all possibilities are located but it will encourage broader exploration of the varioius corners of the space.

References

Agostinho, S., Meek, J., & Herrington, J. (2005). Design Methodology for the Implementation and Evaluation of a Scenario-Based Online Learning Environment. *Journal of Interactive Learning Research, 16*(3), 229-242.

Albion, P. R., & Ertmer, P. A. (2004). *Online courses: Models and strategies for increasing interaction*. Paper presented at the Tenth Australian World Wide Web Conference. Retrieved October 22, 2007, from http://ausweb.scu.edu.au/aw04/papers/refereed/albion/index.html

Anderson, T. (2003). Getting the Mix Right Again: An Updated and Theoretical Rationale for Interaction. *The International Review of Research in Open and Distance Learning, 4*(2).

Becker, K. (2007). Digital game-based learning once removed: Teaching teachers. *British Journal of Educational Technology, 38*(3), 478-488.

Bronack, S., Riedl, R., & Tashner, J. (2006). Learning in the zone: A social constructivist framework for distance education in a 3-dimensional virtual world. *Interactive Learning Environments, 14*(3), 219-232.

Brown, J. S. (2006). New Learning Environments for the 21st Century: Exploring the edge. *Change, 38*(5), 18-24.

Chambers, D. P., & Stacey, K. (2005). Developing and using multimedia effectively for undergraduate teacher education. *Australian Journal of Educational Technology, 21*(2), 211-221.

Curran, K. (2005). 3D navigation of a Library Environment. In C. Crawford, D. A. Willis, R. Carlsen, I. Gibson, K. McFerrin, J. Price & R. Weber (Eds.), *Society for Information Technology and Teacher Education International Conference 2005* (pp. 1920-1925). Phoenix, AZ, USA: AACE.

Ertmer, P. A., Conklin, D., Lewandowski, J., Osika, E., Selo, M., & Wignall, E. (2003). Increasing preservice teachers' capacity for technology integration through use of electronic models. *Teacher Education Quarterly, 30*(1), 95-112.

Ertmer, P. A., & Newby, T. J. (1993). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly, 6*(4), 50-72.

Gee, J. P. (2004). Learning by design: Games as learning machines. *Interactive Educational Multimedia*(8), 15-23.

Gibson, D., Aldrich, C., & Prensky, M. (Eds.). (2007). *Games and simulations in online learning : research and development frameworks*. Hershey PA: Information Science Pub.

Herrington, J., Reeves, T., & Oliver, R. (2006). Authentic Tasks Online: A synergy among learner, task, and technology. *Distance Education, 27*(2), 233-247.

Herrington, J., Reeves, T. C., & Oliver, R. (2005). Online learning as information delivery: digital myopia. *Journal of Interactive Learning Research, 16*(4), 353-367.

Jones, G. (2006). Accelerating Online Text-based Discourse via 3D Online Learning Environments. In C. Crawford, D. A. Willis, R. Carlsen, I. Gibson, K. McFerrin, J. Price & R. Weber (Eds.), *Society for Information Technology and Teacher Education International Conference 2006* (pp. 1372-1377). Orlando, Florida, USA: AACE.

Kiegaldie, D., & White, G. (2006). The Virtual Patient - Development, Implementation and Evaluation of an Innovative Computer Simulation for Postgraduate Nursing Students. *Journal of Educational Multimedia and Hypermedia, 15*(1), 31-47.

McKeown, L. (2007). *Can AL in SL = RL: Taking action learning online in 3D virtual worlds*. Paper presented at the Online Learning Using Virtual Worlds Symposium. Retrieved October 22, 2007, from http://www.usq.edu.au/resources/lindyalinslusqmixedreality.ppt.

Moore, M. G. (1989). Three types of interaction. *American Journal of Distance Education, 3*(2), 1-6.

Mullen, L., Beilke, J., & Brooks, N. (2008). Redefining Field Experiences: Virtual Environments in Teacher Education. *International Journal of Social Sciences, 2*(1), 22-28.

Oblinger, D. G., & Oblinger, J. L. (Eds.). (2005). *Educating the Net Generation*. Washington, DC: EDUCAUSE. Retrieved 29 April, 2006, from http://www.educause.edu/educatingthenetgen.

Prensky, M. (2001). Digital natives, digital immigrants Part 2: Do they really think differently? *On the Horizon, 9*(6), 1-6.

Shaffer, D. W. (2006). Epistemic frames for epistemic games. *Computers & Education, 46*, 223-234.
Shaffer, D. W., Halverson, R., Squire, K., & Gee, J. P. (2005). *Video games and the future of learning*. Madison, WI: Wisconsin Centre for Education Research.
Squire, K. (2005). Game-based learning: an X-learn perspectives paper [Electronic Version]. Retrieved October 21, 2007 from http://www.masie.com/xlearn/Game-Based_Learning.pdf.
Swan, K. (2002). Learning effectiveness online: what the research tells us. In J. Bourne & J. Moore (Eds.), *Elements of Quality Online Education: Practice and Direction* (pp. 13-46). Needham, MA: Sloan Consortium.
Zibit, M., Gibson, D., & Halverson, B. (2006). simSchool - Today's Preservice Students Prepare for Tomorrow's Classrooms. In C. Crawford, D. A. Willis, R. Carlsen, I. Gibson, K. McFerrin, J. Price & R. Weber (Eds.), *Society for Information Technology and Teacher Education International Conference 2006* (pp. 3130-3136). Orlando, Florida, USA: AACE.