ascilite
ascilite 2012
FUTURE CHALLENGES | SUSTAINABLE FUTURES
25 - 28 November 2012 | Wellington | New Zealand

MUVE-ing pre-service teachers into the future

Frances Quinn
School of Education
University of New England

Helen Doyle
School of Education
University of New England

Terry Lyons
School of Education
University of New England

This paper discusses our experiences of integrating a Multi-User Virtual Environment (MUVE) called *Quest Atlantis* into a pre-service secondary science education unit. The use of educational MUVEs as teaching tools is accelerating, so it is crucial that pre-service teachers develop some expertise with these and related technologies. We outline the processes we followed in embedding *Quest Atlantis* into the content and assessment of the unit, the results of this initiative and its implications for integrating MUVEs and other ICTs into teacher education programs. Challenges such as limited time and expertise, demands of a busy teaching program, and the need for continuous specialist support need to be overcome for sustainable integration of MUVEs and related technologies into pre-service teacher education. This is particularly important given the potential of pre-service teachers as change agents in schools, and the imperatives of the ICT-related National Professional Standards for Teachers and the Australian Curriculum.

Keywords: MUVE, Virtual World, Quest Atlantis, Pre-service teacher education, MMOG

Introduction

Recreational and educational use of Multi-User Virtual Environments (MUVEs) is accelerating in many parts of the world and teachers as future makers need to acknowledge and harness these technologies. The features defining most MUVEs include 3D graphical interfaces and chat tools that facilitate synchronous communication between multiple networked users represented by avatars (Dieterle & Clarke, 2009; Hew & Cheung, 2010). Many current MUVEs used in gaming contain highly engaging and motivating narratives that make them very appealing to users. There are more than 100 virtual worlds in existence or under development, and school leavers entering tertiary education are likely to have avatars and be using applications blending virtual worlds, games and social networking (de Freitas, 2008).

The same characteristics of MUVEs that make them so popular with adolescents also contribute to their enormous educational potential. Educational MUVEs blending online gaming and narrative with rich curriculum based content are becoming more widespread as teaching tools, and this increase is predicted to continue (Dieterle & Clarke, 2009; Hew & Cheung, 2010; Johnson, Adams, & Cummins, 2012a, 2012b). Examples include *Second Life*, *River City* and *Quest Atlantis*. In Australia, the increase in adoption of educational MUVEs at the school level is occurring in the broader context of the Digital Education Revolution (DER), a $2.4 billion federal government initiative aimed at better integrating ICTs into Australian schools (Department of Education Employment and Workplace Relations, 2012). The use of educational MUVEs is also accelerating in higher education institutions in Australia and NZ, as well as comparable countries such as the UK and USA (Dalgarno, Lee, Carlson, Gregory, & Tynan, 2011).

If our school teachers are to contribute to the DER by harnessing the teaching and learning opportunities afforded by MUVEs and related ICTs, it is vital they develop the experience and understanding to deploy them in the classroom. However, a global study concluded that a lack of knowledge on the part of school teachers was one of two major obstacles to integrating ICT in education (Pelgrum, 2001), and there is little evidence that this situation has changed markedly in the intervening decade. More specifically, reviews of the literature relating to MUVEs and related technologies in education (de Freitas, 2008; Kennedy-Clark & Reimann, 2010; Lawless & Pellegrino, 2007; Loveless, 2006; Schrader, Zheng, & Young, 2006) suggest that many school teachers may be less familiar with MUVEs than their students and are averse to using them and related technologies in the classroom. Some of the reasons for this are concerns about the effectiveness of these tools, as well as issues related to security, bandwidth and technology (Jones & Warren, 2011).

School teachers therefore require support and professional development in effectively integrating ICTs into their professional practice (e.g, review by Lawless & Pellegrino, 2007). It is therefore important that pre-service teachers (PSTs) are introduced to these technologies as an integral part of their teacher education programs, as argued by Fisher (2000). PSTs are more likely than their older in-service counterparts to be familiar with gaming and are often more open to using new technologies. Hence teacher education programs have a 'crucial role to play' in facilitating the use of multiplayer games and allied technologies in school classrooms (Fisher, 2000; Schrader, et al., 2006). It was concluded by Kennedy-Clark and Reimann (2010) that the more familiar PSTs are with virtual worlds, the more likely they are to consider using them in their subsequent teaching. However, studies indicate that PST programs often do not adequately teach PSTs how to integrate technology into their teaching, and that the ICT proficiency and confidence of PSTs is limited (Markauskaite, 2007). This is of some concern, and needs to be addressed if PST educators are to fulfill their potential role as "future makers" for the education of our next generation:

> When teacher educators provide the opportunities for pre-service teachers to practice meaningful integration of technology, while gaining the insights necessary for effective thinking and problem solving, a giant leap toward better schools for the future shall have been made (Fisher, 2000, p. 112).

In order to enhance PSTs' understandings and attitudes towards ICTs such as MUVEs, many strands of evidence argue for an integrated, authentically embedded approach. The TPACK theoretical framework of Mishra and Koehler (2006), for example, articulates the close relationship between learning how to teach with technology and the pedagogical and content knowledges of the teaching and learning context. While advocating the adoption of multiple strategies, Kay (2006; 2007) cites many studies emphasising the importance of authentic teaching tasks and an integrated approach embedding ICT into the array of units comprising PST education courses, as opposed to generic stand-alone units or add-on workshops, an approach also advocated by Lawless and Pellegrino (2007). This aligns with what we know about situated cognition (Brown, Collins, & Duguid, 1989), and assessment as the driver of the curriculum for students (Rowntree, 1987).

This paper introduces a case study in which an educational MUVE – *Quest Atlantis (QA)* – was integrated into the content and assessment of a core science education unit taken by pre-service secondary science teachers., It outlines our rationale for integrating QA, describes how we embedded the technology within the unit and discusses the enablers and barriers we encountered in this process. We hope that the lessons we learned from this exercise might encourage and inform similar initiatives in the future.

Integrating *QA* into pre-service secondary science education

Context of the study

This study emerged as one of several innovations incorporated into our teacher education programs as part of the Teaching Teachers for the Future project. This is a federally funded initiative aimed at enabling PSTs to effectively use ICT in education ("Teaching Teachers for the Future," 2012). The project was undertaken by an experienced ICT Pedagogy Officer, who had been appointed on a contract to the wider Teaching Teachers for the Future project, and two members of the secondary science education team who although reasonably technologically savvy had little direct experience with MUVEs. The intended outcomes were first, for the PSTs to learn about the science education potential of MUVEs like *QA* and second, for the learning experience to contribute to their own broader TPACK.

Choice and description of MUVE: Quest Atlantis

Of the available options, we chose to introduce the PSTs to *QA* for several reasons. First, *QA* is a free, very secure scenario-based MUVE aimed at children from 9-16 years old. It is already being used in public and independent schools in NSW, Queensland, Tasmania and Victoria. Second, *QA* embeds over 1000 curriculum-based interactive quests with integrated and customizable assessment tasks in a very engaging and motivational narrative, combined with a very strong focus on social responsibility. Third, the development of *QA* was informed by theories of transformational play, which locates learners and the content to be learned in an online game-play context (Barab et al., 2007; Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005). For example, learners can be scientists doing virtual water quality testing, or they can be managers, making difficult decisions about strategies for national park management. Their actions and decisions have consequences which impact on the narrative and relate to complex socio-scientific issues that mirror some of the complexity of the real world. Unlike the real world, learners can travel into the future and see the consequences of their decisions.

Notwithstanding these real strengths, there are some inherent challenges in using *QA* as a teaching tool in Australia. One is its North American context apparent in the vegetation and choice of organisms in graphics and some quest tasks. For the most part this raises few problems, however in the case of the ecological topic used in this project, an Australian environment featuring local flora and fauna would provide a more locally relevant context and better suit the syllabus outcomes. Hence, even though *QA* tasks can be customized to some extent by teachers, some experience and a reasonable investment of time would be necessary to make particular topics applicable to Australia. In addition, as part of the quality assurance mechanisms built into *QA*, teachers must gain accreditation by undertaking an online training course. While this is a very reasonable step, participating in this course does require a reasonable investment of time by teachers.

Integration methodology

For many of the reasons outlined above, we took the decision to fully integrate *QA* into one of the core science units studied by 49 pre-service science teachers (PSTs) enrolled via distance education mode. The 'Using ICTs in science' topic within the unit was revised to incorporate *QA*, and a major assessment task was customised around students' *QA* experiences. The Project Officer extended her previous accreditation to enable her to train teachers, and the two science teacher educators undertook the necessary training to become accredited *QA* teachers.

The PSTs were required to download *QA* onto their home computers, and to familiarize themselves with Adobe Connect. Adobe Connect was used in the training sessions alongside *QA* as it permits text and audio communication along with desktop sharing. This provided a means of talking to students outside the *QA* application (which is text only), as well as allowing the trainer to troubleshoot any technical problems as they arose. It also allowed training sessions to be recorded. A number of *QA* training sessions were scheduled in order to cater for the PSTs' work and family commitments. Training was coordinated and conducted by the Project Officer. Once training was complete, the PSTs were required to undertake some preliminary quests, and then progress to an ecological sustainability topic called "Taiga", which focuses on the importance of water quality and related ecological, social and economic issues.

Taiga was chosen because many of the concepts in the unit address outcomes in the NSW Year 7-10 science syllabus. The scenario also highlights the interplay between scientific, economic and social aspects of sustainability extremely well. This was particularly appealing given that sustainability is one of three cross-curricular perspectives of the new Australian Science Curriculum. The students were required to complete part of the Taiga quest for the assessment task, though they could complete the remainder if they so desired. As well as writing about the quest itself and its applicability to the classroom, students were also asked to discuss their experiences of using *QA*.

Lessons learned

This process had some lessons for us about dealing with the challenges in deeply integrating innovative ICTs into PST education units. Time was one challenge, as it took considerable time to redevelop the existing unit and build the associated assessment task and marking criteria. This was ameliorated by some teaching relief as part of the project. The limited experience and expertise of the science teaching staff in *QA* was another challenge that was overcome through the expertise and support of the Project Officer together with *QA* support staff.

Another category of challenges related to PST access to hardware, software and expertise. Some of these related to the fact that the unit was a distance education class distributed across Australia and abroad, rather than an on-campus group in a computer laboratory. Even though all the students were familiar with the hardware and network requirements associated with studying at a distance, one student could only access a computer sporadically, and technical problems occurred trying to load the application onto the computer lab that he could access. Some experienced *QA* "hanging" and had to log out and in again. This was difficult during the training process but greatly ameliorated by having Adobe Connect running in parallel, although this seemed to cause bandwidth limitations for some users. Some difficulties were encountered with real-time access to IT support as the platform is hosted in the US. Some students with less experience than others in ICTs and/or MUVEs found the learning curve particularly steep. The training workshop series had to be repeated several times to accommodate the timetables of the PSTs, including evening sessions. None of these problems were major, but trouble shooting them required considerable time and the combined expertise of the Project Officer, science teaching staff and support staff.

In terms of the consequences of this project, it is pertinent to note that students' experiences of *QA* and reflections on what they had learned were very positive. All students explored and gained some familiarity with *QA*, and 25 students completed all steps required to gain formal accreditation to be *QA* teachers in their own classrooms. Overall findings from analysis of in-depth interviews are described elsewhere by Doyle and Reading (2012). In summary, many of these students moved from initial resistance to appreciating the possibilities of MUVEs such as *QA*. They also recognised that they developed a range of associated ICT skills along the way. Many saw the value of the training they had received and saw a place for educational MUVEs in PST education. Standard centrally administered student evaluations of the unit were as good as they usually are, indicating that students remained well satisfied with their learning experiences in the unit.

Just as important were the impacts on two of us: the science teaching staff who were involved in this process, some of which are summarised by Reading and Doyle (2012). We learned about the difficulties that our students experienced during their training by being in-world with them, and shared many of their difficulties ourselves. We developed our ICT skills and saw the enormous potential of MUVEs such as *QA* in science teaching and learning, particularly in dealing with the thorny issue of cross-curricular perspectives in secondary education where teachers still work predominantly in their own subject silos.

In the longer term, notwithstanding the successful implementation of the project, the decision was made not to include *QA* and the associated assessment in the unit in the following year. This was in large part because the Project Officer's project-funded contract was due to expire before the next iteration of the teaching unit. Despite the gains in understanding and experience of the science teaching staff, we could not justify taking the time from other teaching, research and administrative responsibilities to repeat the process without the vital support and expertise of the Project Officer. In addition, this left more opportunity to address some of the many other sciencespecific and generic ICTs that could have been covered in the unit. However, the process has undoubtedly and significantly deepened the knowledge and understanding of MUVEs for the science teaching staff, and puts us in a much better position to connect PSTs to these and other related ICTs in different learning and teaching contexts.

Discussion and Implications

The case study outlined above illustrates some of the real challenges to some of the emerging directions of teaching and learning in PST education, as foreshadowed in this conference theme. Although the project deeply embedded a high quality MUVE into a disciplinary unit, in a way that satisfied many of the characteristics of good practice suggested by the literature reviewed above, this was not sustainable in the longer term. This outcome relates to four interconnected challenges that we were not able to overcome: time demands on academic staff, limited relevant ICT expertise of academic teaching staff, tensions between breadth and depth of ICT integration in a busy PST education program, and the need for continued high quality support and professional development from ICT specialists.

Previous studies (e.g., Kay, 2006) have also indicated that time demands have posed a barrier to effectively implementing ICTs in PST education programs. A recent report addressing the challenges faced by tertiary educators in Australia emphasises the problem of time constraints, suggesting that academic staff are ‘struggling to manage existing workloads’ (Bexley, James, & Arkoudis, 2011, p. xi). Strongly related to juggling overstretched time budgets is the issue of limited relevant ICT expertise of the curriculum area specialists, which was also raised as an issue by Kay (2006). Embarking on any new learning curve is time consuming, and integrating “innovations” almost by definition stretches the time commitments and expertise of faculty staff who may not be ICT specialists. These problems in tandem relate to a consequent fear of technological problems, which are very demanding of both time and expertise, and this is another known barrier to integrating ICTs in PST education (Kay 2006).

In relation to program constraints to ICT integration, it must be noted that this initiative focused primarily on MUVEs, with ancillary use of Adobe Connect. However these are only two of a huge palette of ICTs with which PSTs should be familiar. There is a limited number of ICTs that can be covered in any depth within a disciplinary unit with several other graduate attributes to integrate, and although this project facilitated deep integration of one promising and innovative ICT, it also narrowed the ICT palette to which the PSTs were exposed. To meet the future challenges of teachers requires ongoing selective evaluation and integration of some of the rapidly expanding ICT options into teacher education. To manage this in a sustainable and representative way requires serious consideration of course structures by mapping gaps, overlaps and opportunities across programs; and maximizing complementary links between curriculum subject areas, ICT-focussed units and any central or generic ICT workshop programs. The TPACK conceptualization (Mishra & Koehler, 2006) provides a useful framework for strategic mapping and planning, and its application has been shown to have contributed to PST TPACK (Galstaun, Kennedy-Clark, & Hu, 2011; Hu & Fyfe, 2010). There is good evidence that collaborative partnerships between universities, schools and education authorities (Kay, 2007; Pegg, Reading, & Williams, 2007) are particularly promising approaches, though implementing this kind of professional development has also been shown to be constrained by time and workload constraints for PST educators, as well as the PSTs and teachers (Pegg, et al., 2007).

One of the solutions to the limited time and limited expertise of PST educators that initially facilitated this project was appropriate support and professional development. As noted by Kay (2006), there are many ways that ICTs in general can be introduced into PST education programs, but ultimately good support of the PSTs is a key access consideration, without which many other strategies would have little effect. The commitment and expertise of the Project Officer was essential in driving the project, conducting the training and troubleshooting technical problems. Without this support, the PSTs enrolled in that unit (and the PST educators running it) would not have had such a good opportunity to experience the learning possibilities afforded by an educational virtual world in science education. However, as is becoming more common in the increasingly casualised Australian higher education sector (Bexley, et al., 2011), the Project Officer was employed on short term contract, which was not able to be renewed once the project funding ceased. One-off injections of funds and short-term strategic projects can impact on the institutional ICT-related culture and knowledge base, but as we found, sustaining the impact requires sustaining the support.

Many of the challenges that are outlined above to integrating MUVEs in particular, and ICTs more generally into PST education are equally relevant across the higher education sector. However, several features of PST education programs mark them as particularly important in this regard. Preservice Teachers are indeed ‘future-makers’. They occupy a pivotal position as potential change agents in the ICT literacy of our society (Pegg, et al., 2007), with the capacity to influence the preceding generation of older in-service teachers, and future generations of school children. The importance of this role is underscored by the recently endorsed National Professional Standards for Teachers, three of which relate directly to knowledge and practice of ICTs (AITSL, 2011). Similarly, ICT is one of three cross-curricular perspectives mandated by the new Australian Curriculum. It is the responsibility of PST educators to help PSTs meet these standards and meet the curriculum requirements. It has been predicted that MUVE-like technologies will form a component of “the updating of teacher education” (Schrader, et al., 2006). This is already happening via applications of virtual worlds such as VirtualPrex project (Gregory et al., 2011). Systemic considerations of the time, expertise, curriculum and support requirements of academic staff in non ICT teaching areas would greatly facilitate the more widespread adoption of MUVEs and other technologies in PST programs.

Acknowledgements

This research was funded by the Teaching Teachers for the Future project, an initiative of the Australian Government through the Information Communication Technology Innovation Fund. We are very grateful to Chris Reading for steering the broader project at our institution and facilitating our involvement. We would particularly like to extend our thanks to the students who participated in this study and to Bron Stuckey for so generously sharing her time and expertise to facilitate this project.

References

AITSL. (2011). *National Professional Standards for Teachers*. Retrieved from http://www.aitsl.edu.au.

Barab, S., Dodge, T., Tuzun, H., Job-Sluder, K., Jr, Jackson, C., & Gilbertson, J. (2007). The Quest Atlantis Project: A socially-responsive play space for learning. In B. E. Shelton & D. Wiley (Eds.), *The Design and Use of Simulation Computer Games in Education* (pp. 159-186). Rotterdam, The Netherlands: Sense Publishers.

Barab, S., Thomas, M., Dodge, T., Carteaux, R., & Tuzun, H. (2005). Making Learning Fun: Quest Atlantis, A Game Without Guns. *Educational Technology, Research and Development* 53(1), 86-107.

Bexley, E., James, R., & Arkoudis, S. (2011). *The Australian academic profession in transition: Addressing the challenge of reconceptualising academic work and regenerating the academic workforce.* Commissioned report prepared for the Department of Education Employment and Workplace Relations Melbourne: Centre for the Study of Higher Education, The University of Melbourne.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-42.

de Freitas, S. (2008). *Serious Virtual Worlds: A Scoping Study*. Report prepared for the JISC e-Learning Programme: Serious Games Institute.

Department of Education Employment and Workplace Relations. (2012). *Experience the digital education revolution*. Retrieved 26 June 2012, from http://www.deewr.gov.au/Schooling/DigitalEducationRevolution/Pages/default.aspx

Dieterle, E., & Clarke, J. (2009). Multi-User Virtual Environments for Teaching and Learning. In M. Pagani (Ed.), *Encyclopedia of multimedia technology and networking* (2nd ed) (pp. 1033-1041). Hershey, PA Idea Group, Inc.

Doyle, H., & Reading, C. (2012). *TTF project: Most Significant Change Pre-service Teacher story*: Teaching Teachers for the Future Project, DEEWR. Retrieved from http://www.une.edu.au/education/ttf/TTFUNESciencePreserviceTeacherStory.pdf.

Fisher, M. (2000). Computer skills of initial teacher education students. *Journal of Information Techology for Teacher Education*, 9(1), 109-123.

Galstaun, V., Kennedy-Clark, S., & Hu, C. (2011). The Impact of TPACK on Pre-service Teacher Confidence in Embedding ICT into Curriculum Areas. *Paper presented at the World Conference on Educational Multimedia, Hypermedia and Telecommunications*, Chesapeake, VA 2011

Gregory, S., Dalgarno, B., Campbell, M., Reiners, T., Knox, V., & Masters, Y. (2011). Changing directions through VirtualPREX: engaging pre-service teachers in virtual professional experience. *Paper presented at the Ascilite Conference: Changing Demands, Changing Directions*. Hobart, University of Tasmania. Retrieved from http://www.leishman-associates.com.au/ascilite2011/downloads/papers/GregoryS-full.pdf.

Hew, K. F., & Cheung, W. S. (2010). Use of three-dimensional (3-D) immersive virtual worlds in K-12 and higher education settings: A review of the research. *British Journal of Educational Technology*, 41(1), 33-55.

Hu, C., & Fyfe, V. (2010). Impact of a new curriculum on pre-service teachers' Technical, Pedagogical and Content Knowledge (TPACK). *Paper presented at the ASCILITE conference: Curriculum, technology & transformation for an unknown future*, 2010, Sydney.

Johnson, L., Adams, S., & Cummins, M. (2012a). *NMC Horizon Report: 2012 Higher Education Edition* Austin, Texas: The New Media Consortium. Retrieved from http://www.nmc.org/publications/horizon-report-2012-higher-ed-edition.

Johnson, L., Adams, S., & Cummins, M. (2012b). *NMC Horizon Report: 2012 K-12 Edition* Austin, Texas: The New Media Consortium. Retrieved from http://www.nmc.org/publications/2012-horizon-report-k12.

Jones, G., & Warren, S. (2011). Issues and Concerns of K-12 Educators on 3-D Multi- User Virtual Environments in Formal Classroom Settings. *International Journal of Gaming and Computer-Mediated Simulations*, 3(1), 1-12.

Kay, R. (2006). Evaluating Strategies Used To Incorporate Technology Into Preservice Education: A review of the literature. *Journal of Research on Technology in Education*, 38(4), 383-408.

Kay, R. (2007). A formative analysis of how preservice teachers learn to use technology. *Journal of Computer Assisted Learning*, 23, 366-383.

Kennedy-Clark, S., & Reimann, P. (2010). Scenario-Based MUVEs in the Science Classroom: Pre-service teachers' perspectives. *Paper presented at the Proceedings of the 18th International Conference on Computers in Education*, Putrajaya, Malaysia.

Lawless, K., & Pellegrino, J. (2007). Professional Development in Integrating Technology Into Teaching and Learning: Knowns, Unknowns, and Ways to Pursue Better Questions and Answers. *Review of Educational Research*, 77(4), 575–614.

Loveless, A. (2006). Professional development for technology and education: barriers and enablers. *Technology, Pegagogy and Education*, 15(2), 139-141. Retrieved from http://dx.doi.org/10.1080/14759390600769029.

Markauskaite, L. (2007). Exploring the structure of trainee teachers' ICT literacy: the main components of, and relationships between, general cognitive and technical capabilities. *Education Technology Research Development*, 55(4), 547-572.

Mishra, P., & Koehler, M. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017-1054.

Pegg, J., Reading, C., & Williams, M. (2007). *Partnerships in ICT Learning Study: Full Report*. Department of Science Education and Training Canberra. Retrieved from http://www.simerr.une.edu.au.

Pelgrum, W. J. (2001). Obstacles to the integration of ICT in education: results from a worldwide educational assessment. *Computers & Education*, 37, 163–178.

Reading, C., & Doyle, H. (2012). TTF project: *Most Significant Change Science Teacher Educator story*: Teaching Teachers for the Future Project, DEEWR. Retrieved from http://www.une.edu.au/education/ttf/TTFUNEScienceTeacherEducatorStory.pdf.
Rowntree, D. (1987). *Assessing students: How shall we know them?* London: Kogan Page.
Schrader, P. G., Zheng, D., & Young, M. (2006). Teachers' Perceptions of Video Games: MMOGs and the Future of Preservice Teacher Education. *Innovate* 2, 2(3).

Author contact details:

Frances Quinn, fquinn@une.edu.au
Helen Doyle, hdoyle2@une.edu.au
Terry Lyons, tlyons3@une.edu.au

Please cite as: Quinn, F., Doyle, H., Lyons, T. (2012). MUVE-ing pre-service teachers into the future . In M. Brown, M. Hartnett & T. Stewart (Eds.), Future challenges, sustainable futures. Proceedings ascilite Wellington 2012. (pp.748-755).