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Final Report 2013

A Systematic Review and Environmental Analysis of the Use of 3D Immersive Virtual Worlds in Australian and New Zealand Higher Education Institutions



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EXECUTIVE SUMMARY

3D immersive virtual worlds, such as Second Life, have been the focus of substantial attention from tertiary educators in recent years and the potential for the use of such environments in learning and teaching contexts has been a frequent topic of discussion by commentators on higher education futures. However, despite anecdotal evidence of an increase in usage of such environments for learning and teaching in Australian and New Zealand higher education, there have been no published studies reporting on the breadth of use and the nature of the experience of adopters of such environments across the sector.

This report draws on data from a review and environmental analysis of the use of 3D immersive virtual worlds in higher education in Australia and New Zealand carried out by researchers from Charles Sturt University (CSU), the University of New England (UNE) and the University of Southern Queensland (USQ) from 2010 to 2012. The study sought to identify and examine existing applications of 3D immersive virtual worlds by educators throughout the two countries, with the aim of developing an understanding of how the technology is being used for learning and teaching across institutions and disciplines and the relevant experiences of academics, educational designers and Information Technology (IT) support staff.

The study has been carried out under the auspices of the Distance Education Hub (DEHub at <http://www.dehub.edu.au>), a federally funded research consortium based at UNE that involves UNE, CSU, USQ and Central Queensland University in Australia and Massey University in New Zealand. The study set out to provide the higher education community with exemplars, guidelines and recommendations to encourage the successful uptake, implementation and use of 3D immersive virtual worlds.

The scoping study consisted of three phases of data collection:

1. Literature searches and searches of institutional web sites leading to the establishment of a database of 179 higher education staff (135 in Australia and 44 in New Zealand) with an interest or involvement in using 3D immersive virtual worlds for learning and teaching;

2. An online questionnaire completed by 117 respondents, including 82 from Australia and 35 from New Zealand, to obtain information about the ways in which 3D immersive virtual worlds were used and about the perspectives of the teaching staff involved;
3. Interviews to gather more detailed information and perspectives from 13 academic staff who had implemented virtual worlds in their teaching, from six educational design staff and from five Information Technology (IT) support staff.

The 62 respondents who indicated they had already used 3D immersive virtual worlds in their teaching reported on a total of 125 individual subjects in which they had used the technology, including 201 individual subject offerings. Details were provided about the use of virtual worlds in 100 subjects. Of these, the majority used *Second Life* (78.0%) as the virtual worlds platform, followed by *Active Worlds* (5.0%) and *OpenSim* (4.0%). Within these 100 subjects, the virtual world-based tasks were compulsory and assessed in 41% of subjects, compulsory but not assessed in 16% and neither compulsory nor assessed in 43%.

There was a fairly even distribution of subjects using virtual worlds across disciplines, although the science discipline was somewhat underrepresented. Specifically, 29% were in the Arts and Humanities, 21% in Education, 18% in Information Technology, 10% in Legal and Business Studies, 9% in Health, 4% in Science and 9% in other discipline areas. Respondents provided 53 detailed descriptions of the way in which virtual worlds were used in their teaching, and from these descriptions ten categories of learning design were identified, with a number of subjects fitting into more than one category. The most commonly used virtual world supported learning design was role-play (43% of subjects), followed by learning designs centred on communication (40%), learning designs focussing on instruction or presentation (23%) and learning designs focussing on place exploration and building/scripting (each 17%).

Fifty-five respondents provided more detailed information about a specific virtual world implementation and, of these, 55% indicated that the virtual world, island or space was developed specifically for the purpose of the subject they taught. Twenty-two per cent of these 55 respondents indicated that an important aspect of the learning task was familiarisation with *Second Life* and, consequently, these respondents indicated that students were required to explore the environment as a whole, rather than using a space developed for a specific pedagogical purpose. Of these 55 respondents, 55% indicated that they had drawn on the support of non academic staff within their institutions, such as information technology or educational design support staff. Fifty-five per cent also indicated that they had drawn upon dedicated funding to support the implementation, with this funding coming from a variety of internal and external sources.

Interview participants described a number of different virtual spaces that had been developed to meet the specific needs of their particular learning context, including a

virtual hospital emergency department, a virtual classroom and a simulated street with retail outlets allowing students to undertake a business role-play. Others described the development of spaces designed for various types of online teaching including amphitheatres, boardrooms and informal student meeting spaces. Some of the spaces developed consisted largely of static building and furniture, while others incorporated dynamic features controlled by complex scripts; for example, one participant described a virtual environment containing business outlets controlled by a complex back-end economic simulation. Other spaces relied on user interface enhancement allowing avatar control beyond that provided by default within the viewer software.

With respect to evaluation, little systematic evaluation was described in the interviews, with participants mainly describing informal feedback mechanisms and some types of formal but not systematic evaluation. Most commonly, participants described informal student feedback or informal observation of student activity as the main evaluation mechanisms. Formal evaluation procedures predominately included student subject evaluation forms that were included as part of a university reporting system. Of those that did mention systematic evaluation, most referred to research projects associated with the virtual world implementation.

Respondents to the questionnaire mentioned a number of problems they had encountered in their attempts to integrate virtual world activities into their teaching and these problems were grouped into the following categories: technology, support, funding and time, usability and familiarity, equity and ethics, inherent limitations of virtual worlds, acceptance of virtual worlds, and management and planning. Interview participants also provided more detailed descriptions of many of the problems identified and a number of recommendations for others emerged from both the questionnaire responses and interviews.

Other perspectives emerging from interviews included identification of a lack of specific funding for, and an absence of, institutional policies relating to virtual worlds, an acknowledgement of the need for substantial time commitment by staff considering the adoption of virtual worlds and noting of the value of working with others through informal and formal networks. Additionally, academic staff members interviewed highlighted the increased engagement of students that had occurred through the introduction of virtual worlds based tasks and the fact that the process of introducing virtual worlds into their teaching had led to new reflections on their teaching practice.

Based on the analysis of data collected during this study, along with ongoing reviews of the emerging literature, a series of recommendations have been derived. These have been grouped into recommendations relating to institutional policy, recommendations directed at teaching staff considering the adoption of virtual worlds into their teaching and recommendations relating to research.

Recommendations for institutional policy are as follows:

Recommendation 1. Institutions need to establish a clear mechanism for teaching staff wanting to adopt a new online technology to request that certain Internet Protocol (IP) ports are opened for access by devices connected to the campus network either wired or wirelessly.

Recommendation 2. As well as providing technical support for teaching staff using specific institutionally sanctioned technologies, institutions should ensure that technical support is also available for teaching staff attempting to trial new technologies.

Recommendation 3. Institutions should provide mechanisms for teaching staff exploring the use of new technologies to share their experiences with others so that they can collectively work to resolve the barriers they encounter.

Recommendation 4. In defining the specifications for new desktop computer hardware, institutions should ensure that the graphics capability is taken into account and appropriate 3D graphics processing, RAM and CPU specifications are included.

Recommendations for teaching staff considering the adoption of virtual worlds are as follows:

Recommendation 5. Teaching staff should expect to devote considerable time to familiarising oneself with the virtual world platform and in particular developing a clear sense of its limitations and affordances before designing the learning activities or embarking on building work.

Recommendation 6. Teaching staff planning to use virtual worlds in their teaching should engage with Information Technology support staff early.

Recommendation 7. Staff leading the adoption of virtual worlds should set up activities such as workshops to familiarise teaching colleagues with the virtual world platform and its educational potential early.

Recommendation 8. Teaching staff should seek mentors or join a network to obtain help from more experienced others as they conceptualise their learning design and in attempting to resolving the problems that will inevitably be encountered.

Recommendation 9. Using a well established commercial platform such as *Second Life* is the easiest entry to the use of virtual worlds but consideration of a move to an open platform such as OpenSim in the future is recommended.

Recommendation 10. There are likely to be costs involved in any use of a virtual world aligned to specific curriculum outcomes because such uses typically require labour costs for the building of environmental features and either land rental or server infrastructure and support costs, so budgetary planning is important.

Recommendation 11. In planning for the development of new environmental features, teaching staff should consider employing a person experienced in development for the chosen platform, because even if the cost per hour is greater the productivity is likely to be substantially greater.

Recommendations for research are as follows:

Recommendation 12. Ongoing technological research is needed to improve the capabilities of virtual world platforms and also their stability and usability.

Recommendation 13. Continuing fundamental research is needed to improve knowledge of the affordances of virtual environments for particular types of learning tasks and the possible learning benefits which might ensue.

Recommendation 14. Applied research is needed to evaluate implementations of virtual worlds in an authentic higher education context in order to assure the highest possible learning outcomes and to derive best practice guidelines for others.

3D immersive virtual worlds such as *Second Life* and *Active Worlds* have attracted substantial interest due to their potential for supporting and enhancing tertiary learning, teaching and pedagogy. For the purposes of this report, 3D immersive virtual worlds are defined using the definition proposed by Lee (2010, p. 2):

a computer-based, simulated environment in which users are able to immerse themselves, and within which they are able to, through their avatars (computer-based representations of themselves or alternative selves), experience, manipulate, interact with and/or create virtual objects and places that are graphically depicted in three dimensions. The objects and places within a virtual world may be modelled according to those in the real world or may be fantasy based. Most current virtual world applications allow for multiple users and include facilities that enable users to communicate and interact with one another within the virtual environment.

This report is the culmination of work by academics from three Australian universities, Charles Sturt University (CSU), the University of New England (UNE) and the University of Southern Queensland (USQ), who conducted a systematic review and environmental analysis of the use of 3D immersive virtual worlds in higher education in Australia and New Zealand. This work was parallel and complementary to other similar sector-level research already completed in other parts of the world. The project sought to identify and examine existing applications of 3D immersive virtual worlds by educators within the two countries, with the aim of developing an understanding of how the technology is being used for learning and teaching across institutions and disciplines.

The study has been carried out under the auspices of the Distance Education Hub (DEHub at <http://www.dehub.edu.au>), a federally funded research consortium based at UNE that involves UNE, CSU, USQ and Central Queensland University in Australia and Massey University in New Zealand. In late 2009, DEHub established a Virtual Worlds Working Group (VWWG) to assist in facilitating cross-institutional collaborative research into 3D immersive virtual worlds, striving to identify research gaps/needs and to define, document and promote good and/or best practices in this area. The scoping study project was intended to provide the VWWG, as well as the educational

technology and higher education communities at large, with exemplars, guidelines and recommendations to encourage the successful uptake, implementation and use of 3D immersive virtual worlds by educators, institutions and their students.

The decision to undertake this scoping study was in part motivated by the level of interest in virtual worlds within the higher education sector in Australia and New Zealand at the time of commencing the study. This level of interest is illustrated, for example, by the range of papers and sessions dealing with this topic at the 2009 ascilite conference, where 13 papers relating to 3D virtual worlds and multi-user virtual environments were presented. For example, within this collection of papers, there were reports of applications in a wide range of disciplines including teacher education (Campbell, 2009), nurse education (Rogers, 2009) and cultural studies (Henderson, Huang, Grant & Henderson, 2009); and research studies with a wide range of foci, including educator perceptions (Gamage, Tretiakov & Crump, 2009), student perceptions (Gregory & Tynan, 2009) and virtual world teaching practices (Willems, 2009).

This report begins with a review of the literature on which the reported study was able to build on (Chapter 2). Following this (in Chapter 3), the study design is presented, including the details of data collection strategies and timelines. The next four chapters present the results of the study from a number of different perspectives. Specifically, Chapter 4 provides a top level view drawn from a questionnaire completed by 117 respondents, including an overview of the demographics of the respondents and summarised information about the teaching contexts and virtual world platforms. Chapter 5 provides more details about the virtual world implementations described by questionnaire respondents and described in more detail by 24 interview participants, including the learning designs used, virtual learning environments created, and assessment and evaluation strategies used, culminating in the presentation of five case studies of virtual world adoption. Chapter 6 looks in detail at the perspectives of the academic staff members, educational designers and Information Technology (IT) support staff interviewed; while Chapter 7 reports on the issues and challenges encountered by questionnaire respondents and interview participants and how these were addressed. Chapter 8 provides a summary of findings, a list of recommendations in the areas of institutional policy and teaching staff adoption and research, then concludes with an overview of future directions in the use of virtual worlds in higher education. Finally, Appendix A provides an annotated bibliography, listing virtual worlds related publications by staff members at each Australian and New Zealand higher education institution, and a summary of reported usage of virtual worlds at each institution.

2.1 Introduction

This chapter provides a review of the literature on which the study has built. Section 2.2 summarises related studies undertaken internationally and their findings. Section 2.3 summarises published research on the characteristics and learning affordances of virtual worlds, which provides background for the material in Chapter 5 relating to specific implementations and applications of virtual worlds emerging from the study. Section 2.4 summarises the results of earlier research, exploring the implementation issues encountered in introducing virtual worlds into higher education teaching, and provides background for the material in Chapter 7.

2.2 International context

In the United States, the 2007 *Horizon Report* (New Media Consortium and EDUCAUSE Learning Initiative, 2007) classified virtual worlds as an emerging area likely to impact higher education within the next two to three years. In the following year, the inaugural edition of the Australia–New Zealand version of the *Horizon Report* (Johnson, Levine & Smith, 2008, p.4) was released, and it pinpointed ‘virtual worlds & other immersive digital environments’ as a ‘technology to watch’ with a likely time-to-adoption of one year or less. The number of virtual worlds in existence was reported to have risen steadily during the first decade of this century, with numbers predicted by some to exceed 900 by the year 2013 (Mitham, 2008), with Linden Labs’ *Second Life* widely acknowledged as the most popular platform in higher education. Cummings (2010) estimated that approximately 750 institutions were operating their own islands in *Second Life*, in addition to those that own smaller parcels of virtual land.

In a review of international research covering the school and higher education sector, Hew and Cheung (2010) found that virtual worlds were being used for three main purposes: (i) as communication spaces, (ii) for simulation of space (spatial), and (iii) as experiential spaces. Lee (2009) analysed examples of virtual world use in education, and emphasised the collaborative aspects of the learning activities afforded by such environments. Collins (2008) on the other hand argued the importance of students

obtaining experience in virtual contexts, and suggested that “business and industry will be looking for an educated workforce ready to meet the challenges these new environments present, from new modes of marketing, design, and manufacturing to new kinds of management and organizational leadership models” (p. 56).

The Joint Information Systems Committee (JISC at <http://www.jisc.ac.uk>) in the United Kingdom (UK) published a report in 2008 derived from a scoping study focussing on the use of virtual worlds in the British education and training industry (de Freitas, 2008). As well as presenting a comprehensive review of the field, this report also included case studies that were representative of the multitude of ways in which 3D immersive virtual worlds could be and were being used for learning. The list of case studies included examples of mentoring, exploratory quests, role-plays and skill practice. The report also provided valuable resources for researchers and practitioners, including a typology and a list of virtual worlds.

Also in the UK, Kirriemuir (2007a, 2007b, 2008a, 2008b, 2009a, 2009b, 2009c, 2010b) authored a series of rolling ‘snapshots’ of the use of 3D immersive virtual worlds in higher and further education. This work was funded and supported by Eduserv (<http://www.eduserv.org.uk>). Like the JISC report, the Eduserv snapshot reports testify to rapid growth in the number of UK academics using 3D immersive virtual worlds—by Spring 2009, there was evidence of almost every university in the nation using the technology in some way for development and/or teaching (Kirriemuir, 2009b). A large proportion of the activities and initiatives were funded internally, with staff frequently donating considerable amounts of their own time. As with the JISC study, academics surveyed by Kirriemuir made reference to a broad spectrum of 3D immersive virtual world-based activities for the purposes of learning, teaching, research, performance, demonstration and construction. A wide range of discipline areas and a wide range of applications were reported, while the more recent reports point to the emergence of some clear trends. For example, the Health and Medical Science disciplines account for a large proportion of 3D immersive virtual world activity in UK academia, although others such as Languages, Computer Science, Health and Safety, Art, Performance and Design also stand out as areas in which many institutions are using the technology for learning and teaching (Kirriemuir, 2009a, 2009c).

The EDUCAUSE Center for Applied Research (ECAR at <http://www.educause.edu/ecar>) in the United States (US) published a bulletin in 2007 on Second Life in education, with a primary focus on the tertiary sector (Kelton, 2007). This bulletin drew on literature published to that point in time, as well as interviews with educators, and included coverage of both technological and pedagogical aspects of the technology’s use. Similar to the UK reports mentioned above, the ECAR bulletin identified a wide range of possible applications of virtual worlds.

In Australia, Bradshaw (2006), published a report for the Australian Flexible Learning Framework (<http://www.flexiblelearning.net.au>), looking at the use of virtual worlds in the VET (vocational education and training) sector. The report suggested that virtual worlds had the potential to engage students by encouraging creativity and

facilitating learning through simulations, experimentation and observation. In deciding to undertake this scoping study, we felt that there was a need for research that was complementary to the above, concentrating on the Australian and New Zealand higher education sectors. We felt that such research needed to transcend isolated anecdotal reports to accurately depict and represent in detail the unique opportunities, challenges and realities of the technology and its deployment within a higher education context in the two countries.

This scoping study project was intended to address this need, culminating in the provision of analysis and recommendations to inform policy, practice and future research in the field. We felt that undertaking such a study was important for a number of reasons. Firstly, no Australian or New Zealand study of its kind had been undertaken to date, and there had been no national capture of activities, uses and impact of 3D immersive virtual worlds for enhancing higher education learning and teaching in either country. Secondly, there was a need for an accurate picture of the 'state of play', including current, past and planned applications at the various institutions, so as to help direct future research, development and use. Thirdly, we felt that the compilation of an annotated bibliography of published research into, and evaluations of, 3D immersive virtual worlds in Australian and New Zealand higher education would provide a solid platform for further research. Lastly, we felt that an examination of the lessons learnt, including perceived benefits, support provided and barriers to use of the technology at the various institutions would be valuable in informing future applications and initiatives.

2.3 Learning affordances of virtual worlds

Over the years, attempts have been made by a number of authors to classify virtual world applications, learning activities and learning designs, and recent interest in such efforts has been stimulated by growth in usage of mainstream virtual world platforms such as *Second Life*. For example, Ryan (2008a, 2008b) outlines 16 pedagogical approaches to the use of *Second Life* and other virtual worlds, building on data collected from survey responses, interviews, meetings and informal conversations, as well as her own personal observations, reflections and ethnographic journal entries. Some of the 'ways' Ryan suggests using the technology are "to add a visual element", "to house an interactive library or collection of learning objects", "as a connection device (i.e. for communication)", "as a role-playing device", "as a simulation device", "to facilitate games for learning", "to conduct virtual tourism and field trips", "for machinima creation" and "for building for the sake of learning how to build" (pp. 269-276). A similar, although much larger, list is presented by Kay and FitzGerald (2013), although the method and approach they followed to arrive at the list is largely unclear. Their list comprises 43 categories of educational activity in *Second Life* including "self-paced tutorials", "displays and exhibits", "role-plays and simulation", "data visualisations and simulations", "historical recreations and re-enactments", "machinima" and "treasure hunts and quests" (p. 1).

Both Ryan's 'ways' of using *Second Life* and Kay and FitzGerald's types of educational activity in *Second Life* are somewhat similar to the 'educational activities' dimension of the taxonomy developed by Duncan, Miller and Jiang (2012) and derived from their analysis of virtual worlds in higher education. This dimension is one of six dimensions in their taxonomy. The categories in this dimension are "problem-based learning", "enquiry-based learning", "game-based learning", "role playing", "virtual quests", "collaborative simulation", "collaborative construction", "design courses", "language teaching and learning", "virtual laboratories", "virtual fieldworks", and "attending lectures and classes" (p. 953). Hew and Cheung's (2010) international meta-analysis of studies reporting on 3D VLE use in K-12 and higher education culminated in the identification of three much broader categories, describing the main purposes for their use as communication spaces, for simulation of space (spatial) and as experiential spaces.

While much has been written in recent years about the possible benefits of virtual worlds for learning, evidence of the actual learning benefits is sparse (Dalgarno & Lee, 2010; Lee & Wong, 2008; McLellan, 2004; Mikropoulos & Natsis, 2011). One approach to understanding the potential benefits of learning technologies is to consider their use from an affordance (Gibson, 1979; Norman, 1988) perspective. In the most basic terms, an affordance of a tool is an action made possible by the availability of that tool. Hollins and Robbins (2008), for instance, discuss five broad educational affordances of virtual worlds—"identity", "space", "activity", "tools" and "community" (pp. 174-179)—drawing on their observations and data collected through their experiences as tutors, researchers, long-term residents of *Second Life* and players of other massively multiplayer online role-playing games (MMPORPGs).

Warburton and Pérez-García (2009), in their review of educational uses of virtual worlds focusing particularly on *Second Life*, characterise their main educational affordances as being the creation of opportunities for "extended or rich interactions" between individuals and communities, between individuals and artefacts, and among intelligent artefacts; "visualisation and contextualisation" through the production and reproduction of otherwise inaccessible content; exposure of learners to "authentic content and culture"; "individual and collective identity play"; "immersion" in the virtual environment; "simulation" of contexts that may be prohibitively expensive, impractical or impossible to reproduce in real life; "community presence" in the way of promoting a sense of belonging and purpose; and 'content production' opportunities enabling the creation and ownership of the learning environment and objects within it. Lim (2009), on the other hand, derived a framework that he dubbed the "Six Learnings of *Second Life*", based on his own experiences and reflections of using *Second Life* in his teaching and research. He recommends that in-world curricular interventions be designed to target one or more of the "Learnings" of "Learning by exploring", "Learning by collaborating", "Learning by being", "Learning by building", "Learning by championing" and "Learning by expressing" (p. 7). These "Learnings" may be viewed as types of affordance of 3D VLEs for learning.

In much of the literature in this area, the concepts of affordances and benefits of virtual worlds are often treated as one and the same. One exception is the work of Dickey, who has published the findings of a number of studies aimed at examining and comparing the affordances and constraints of specific platforms, including *blaxxun interactive* (Dickey, 1999), *OnLive! Traveler* (Dickey, 1999), *Active Worlds* (Dickey, 1999, 2003, 2005, 2011), *Adobe Atmosphere* (Dickey, 2005) and, most recently, *Second Life* (Dickey, 2011). The approach taken in some of these studies (Dickey, 2003, 2011) has been to attempt to determine the affordances of the environment in question from the perspective of the user through methods such as participatory observations, class logs and interviews with students and teachers; while in others (Dickey, 1999, 2005), the affordance analysis has centred around a review of the software by the researcher to identify specific features and functionalities.

In an article published in the *British Journal of Educational Technology* (BJET) (Dalgarno & Lee, 2010), two of the authors of this report systematically reviewed published research on three-dimensional virtual learning environments (3D VLEs) from the past 20 years and carried out a theoretical analysis based on that body of research, with the goal of identifying a set of unique characteristics of such environments, as well as a series of learning benefits arising from the tasks they can afford. The results of that analysis led to the development of a model of learning in 3D VLEs (see Figure 2.1). The model includes ten distinguishing characteristics of 3DVLEs, the first six of which relate to the representational fidelity and the remaining four of which relate to the learner-computer interactivity these environments are able to facilitate. It is argued that the ten environmental characteristics give rise to three characteristics associated with the experience of using or 'being in' the virtual environment (construction of identity, sense of presence and co-presence), and that the environmental and experiential characteristics, either together or individually, then afford various types of learning task, which in turn lead to a set of five potential learning benefits that are believed to accrue from the performance of those tasks.

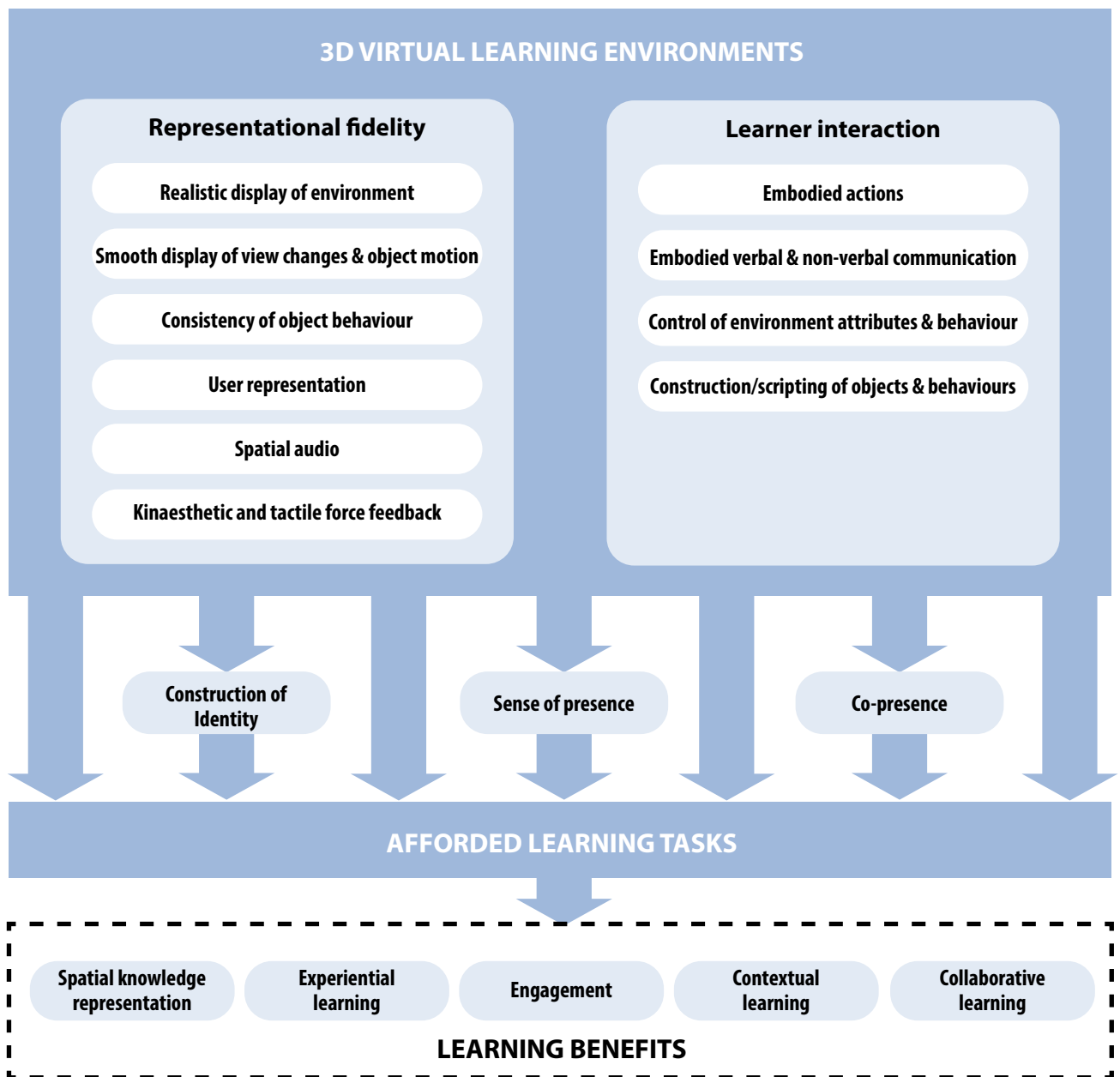


Figure 2.1: A model of learning in 3D VLEs (Dalgarno & Lee, 2010)

In proposing this model, the authors adopted a view of affordances consistent with the conception of Norman (1999), who differentiates between ‘real’ and ‘perceived’ affordances and argues that, until an affordance is perceived, it is of no utility to the potential user. The view implicit within the model is that what is ‘afforded’ is not specific learning benefits or outcomes, but rather the tasks that educators/ educational designers and learners perceive the technology as being useable for. The model recognises that the technologies themselves do not directly cause learning to occur, but that the afforded learning tasks *may* give rise to certain learning benefits. Importantly, the model was explicitly framed and presented as a theoretical one encapsulating what scholars were asserting to be the distinguishing characteristics and potential learning benefits of such environments, as well as those that are implicit in the design of applications described in the literature.

2.4 Implementation issues and barriers

A number of studies of the use of virtual worlds in higher education have identified barriers to adoption and the need for certain types of support, particularly at the early stages of usage. For example, although recognising the widespread interest in and usage of virtual worlds such as *Second Life* in higher education, Warburton (2009) cautions that the promise of this new technological environment must be weighed against the barriers to managing and using it for learning and teaching. He outlines eight broad types of barriers relating to the use of *Second Life*, based on a survey of Internet newsgroups, blogs and wider literature:

1. **Technical issues**, including bandwidth, hardware, firewalls, downtime and lag as well as usage problems such as navigation, object creation and avatar manipulation.
2. **Identity issues** faced by users as they grapple with the fluidity and playfulness inherent in identity construction in the virtual world.
3. **Cultural issues**, such as the difficulty of finding, developing a sense of belonging to and becoming an active participant of an in-world community, as well as the need to become comfortable and familiar with the codes, norms and etiquette rules of the virtual world.
4. **Collaboration issues** that have to do with the challenges in cooperation and co-construction within a virtual world, and the minimal social networking tools and functions available.
5. **Time issues** and the associated workload impositions on educators in not only mastering the technology but also designing and implementing learning activities and resources that make use of the technology in pedagogically sound ways.
6. **Economic issues**, including the cost of purchasing land, uploading images and textures, buying in-world objects/tools, and employing skilled people to perform building and scripting tasks.
7. **Standards issues**, specifically the lack of open standards and interoperability between virtual world platforms, which limits educators' and institutions' ability to transfer resources between platforms.
8. **Scaffolding, persistence and social discovery issues**, the former of which arise from the fact that although the virtual world itself is persistent, persistence for avatars only exists when their users are online, the latter of which is due to the limited functionality of the in-world profiles associated with each avatar, as compared with egocentric social networking services on the Web such as *Facebook* and *LinkedIn*.

As mentioned in Section 2.2, a number of large reports on the use of virtual worlds in education have been published in Europe and North America and these reports tend to be optimistic about the opportunities and potential offered by the technology. However, a number also highlight the challenges and barriers to successful adoption. For example, one of the earliest of these reported on the results of a May 2007 survey run by the New Media Consortium (NMC) (2007) in the United States to collect information on the activities, attitudes and interests of educators in *Second Life*. Of the 209 respondents, 113 (54%) claimed they were involved in an education-related activity in *Second Life*. The respondents were asked to describe their most positive and negative experiences in *Second Life*. The positive experiences described related predominantly to the richness of in-world interactions and the opportunities for meeting new people and expanding social and professional networks, in addition to the generosity of the in-world community in offering assistance. Respondents most frequently cited issues of a technical nature, including the steep learning curve required to master the software, as being among the most negative aspects of their experiences.

In the same year, the NMC survey was carried out, the US-based EDUCAUSE Center for Applied Research (ECAR) released a research bulletin on *Second Life* in education, drawing on interviews with various North American educators and innovators in the areas, as well as the wider literature (Kelton, 2007). In the bulletin, the author warns that “[h]istory has proven that higher education incurs real risk when entering into a close alliance with a for-profit company when consistency for academic purposes is such an important issue” (Kelton, 2007, p. 9), and discusses a number of obstacles to broad-scale adoption of the technology. He echoes the NMC survey respondents’ comments about technical problems and the complexity of using the *Second Life* software and, moreover, observes that “[b]ecause those involved with *Second Life* appear to be having fun, some have come to question it as a serious teaching, learning, or research tool” (p. 8). In a later article, Kelton (2008) expands on this discussion, classifying the challenges into four major categories:

- **Perceptual:** This includes challenges caused by the misconception that virtual worlds are all games, as well as other negative ideas about the use of virtual worlds in education that are perpetuated by the mass media.
- **Technical:** While technical issues relating to bandwidth, processing and memory will be overcome with time, two major technical hurdles needing to be addressed at this time, according to Kelton, are the lack of tools for facilitating truly collaborative interactions between users in real time and the lack of interoperability between the different virtual world platforms.
- **Operational:** The three main issues in this category are the need to learn how to use the tool, the occurrence of server downtime and the existence of legal age restrictions.
- **Pedagogical:** This category relates to the educational value and assessment of the technology, as well as the intellectual property and ownership issues involved.

The UK Joint Information Systems Committee (JISC) scoping report on 'serious virtual worlds' (de Freitas, 2008) also identified a number of opportunities and challenges facing their use for educational purposes. It named creating more engaging, personalised and student-centred learning experiences, especially for hard-to-reach and unmotivated learner groups as well as those studying at a distance, as a particular area of opportunity, along with providing support for learners with disabilities or mobility issues to help reduce the need for them to travel. Other opportunities suggested by that report include empowering learners to construct their own spaces, content and activities, facilitating cross-disciplinary collaborative research and learning initiatives, as well as mixing or 'blending' virtual and real spaces and experiences. Some of the challenges identified by the JISC report include accessibility and the need for broadband connectivity, the development of open standards, and the provision of support for practitioners in the form of guidelines, case studies and implementation models.

Also in the UK, the reports emanating from the 'snapshot' surveys undertaken by John Kirriemuir with sponsorship from the Eduserv Foundation have identified problems relating to virtual world adoption (Kirriemuir, 2007a, 2007b, 2008a, 2008b, 2009a, 2009b, 2009c, 2010b). The first few of these snapshot reports pointed to problems in terms of the negative reactions staff using virtual worlds were receiving from their colleagues and peers, but the later snapshots indicated that the situation in this regard was slowly improving over time. Workload levels, funding, resources and support appear to be persistent complaints, as do technical issues, resulting in the need for staff to put in large amounts of their personal time in order to sustain their projects and efforts in this area.

Kirriemuir (2010a) expounds on his findings in relation to technical support in an article published in a special issue of the journal *Educational Research*. Drawing on qualitative data gathered from the first six snapshot surveys, he lists four categories under which comments from respondents about technical issues fell: "updating the *Second Life* viewer", "technical capability" (i.e. hardware, software, network), "port, firewall and proxy issues" and "lack of knowledge of virtual world use in education" (on the part of IT support departments) (pp. 218-222). Based on the survey data, as well as informal correspondence from academics, he details a number of recommendations in the way of possible solutions to the technical obstructions and limitations, arranged under the headings of "IT awareness of virtual worlds in teaching and learning", "national minimum standards for IT innovation support", "flexibility of high-end IT provision in universities" and "greater production of support materials and software by Linden Labs" (pp. 222-224). According to Kirriemuir (2009c), where institutions have managed to overcome institutional technical barriers and support issues, substantive virtual world developments have taken place.

Clearly, despite the substantial interest in virtual worlds among academic staff and the growing body of examples and success stories of the use of such environments in higher education learning and teaching, the international studies reviewed above show that a number of important issues and challenges are frequently encountered.

To some extent, these issues are similar to those identified in studies of early adoption of other technologies for learning and teaching in higher education. For example, Samarawickrema and Stacey (2007), in a study of adoption of learning management systems (LMS), found that academic time, technology problems and funding limitations all impacted upon successful adoption. Similarly, in a review of studies spanning five decades in the school education sector, Leggett and Persichitte (1998) pinpoint time, expertise, access, resources and support as key implementation obstacles.

3.1 Aims and objectives

The scoping study primarily sought to achieve a broad understanding of the current status of the use of 3D immersive virtual worlds in the Australian and New Zealand higher education environment. As well as capturing a broad snapshot of usage of these technologies for learning and teaching across the sector, there was a particular emphasis on university teachers', educational designers' and information technology (IT) support staff members' perceptions and experiences. Specifically, the objectives of the study were to:

- Compile a list of higher education practitioners who have explored the use of 3D immersive virtual worlds in their teaching;
- Locate and document a range of examples of current, past or planned 3D immersive virtual world use at the various institutions for learning and teaching purposes;
- Examine the costs and perceived benefits for learning and teaching (as well as the actual benefits where these have been evaluated);
- Identify the current level(s) of access to and support for 3D immersive virtual worlds afforded by the institutions to their students and staff, as well as any training provided in their use;
- Isolate actual and perceived barriers to adoption, uptake and use of the technology within institutions and assemble and disseminate advice on how academics and institutions can effectively overcome such barriers;
- Collate an annotated bibliography with a particular focus on articles written by researchers and higher educators within Australia and New Zealand; and
- Provide a forum for collating and disseminating lessons learnt by academics and institutions, both individually and collectively.

Overall, the project strived to assist in facilitating ongoing dialogue and exchange of ideas within a community of researchers and practitioners among institutions involved in DEHub, as well as in the educational technology and higher education communities more broadly.

3.2 Data collection

The scoping study consisted of three phases of data collection:

1. Literature searches and searches of institutional web sites with the goal of compiling an initial database of higher education staff with an interest or involvement in using 3D immersive virtual worlds for learning and teaching;
2. An online questionnaire to obtain detailed information about the ways in which 3D immersive virtual worlds have been or are being used and the perspectives of the teaching staff involved; and
3. Interviews to gather more detailed information and perspectives from a subset of questionnaire respondents and from additional educational design and IT support staff.

3.2.1 Phase 1: Compilation of a 3D immersive virtual world user database (January 2010 to May 2010)

A database of 179 higher education staff members who were currently using, had used or had considered using 3D immersive virtual worlds in their teaching was compiled through literature searches, web searches and word-of-mouth networking. This database provided a list of potential respondents to the questionnaire. The 179 individuals identified included 94 males and 87 females, with 135 of them based at Australian institutions and the other 44 based at New Zealand institutions.

3.2.2 Phase 2: Questionnaire (February 2010 to August 2010)

The questionnaire was developed using an iterative process, as follows: initial drafts were created through discussions within the project team; the key questions were then trialled with potential participants using cognitive interviewing techniques (Willis, 1999); a pilot version of the questionnaire was produced using the *SurveyMonkey* online questionnaire delivery platform (<http://www.surveymonkey.com>) and pilot tested by ten suitably experienced participants drawn primarily from the Virtual Worlds Working Group (VWWG); and the final version of the questionnaire was created based on feedback from this pilot testing.

The questionnaire included questions arranged into the following sections:

1. Demographic data including age, gender, institution, teaching discipline area, teaching experience and experience with 3D immersive virtual world platforms;
2. Views and beliefs about the potential of 3D immersive virtual worlds for learning and teaching;
3. Summary information about each subject in which 3D immersive virtual worlds had been used, including the years of offering, the discipline area, the virtual world platform used, the delivery mode, the number of students involved, whether the use of virtual worlds was compulsory and whether it was an assessable component of the subject;
4. More detailed information about a single subject in which 3D immersive virtual worlds were used; and
5. Key success factors and barriers to the use of 3D immersive virtual worlds in learning and teaching as perceived by participants, based on their observations and experiences.

Higher education staff members identified during Phase 1 were invited via email to complete the questionnaire. Additionally, the questionnaire was made available through various electronic mailing lists and other distribution mechanisms. In particular, the questionnaire was publicised through the mailing lists and newsletters of several associations, including The Australasian Society for Computers in Learning in Tertiary Education (ascilite), the Open and Distance Learning Association of Australia (ODLAA), the Higher Education Research and Development Society of Australasia (HERDSA) and the Distance Education Association of New Zealand (DEANZ). Announcements were also distributed to a number of national and international online communities with a specific interest in the use of 3D immersive virtual worlds in education, such as SLED (the Second Life Educators group) and AusSLERs (Australian *Second Life* Educators and Researchers). As an incentive, those completing the questionnaire were given the option of being placed in a draw for a chance to win either an iPod Touch or \$250AUD paid as Linden Dollars (the currency used in *Second Life*). The online questionnaire was able to be completed for a period of eight weeks between June and August 2010.

3.2.3 Phase 3: Interviews (January 2011 to December 2011)

From the list of questionnaire respondents, selected academic teaching staff, educational designers/developers and IT support staff were approached to be individually interviewed. Interviewees from a range of institutions, including academic teaching staff from a range of discipline groups, were selected. Because the number of IT support staff responding to the questionnaire was relatively small, additional interviewees in this category were sought with the assistance of the DEHub VWWG. In all, 13 academic teaching staff, six educational designers/developers and five IT support staff were interviewed. Pilot testing of the interview questions, procedures and protocols was undertaken in early 2011. The interviews took place between January and December 2011 and were semi-structured, each lasting 45 to 60 minutes. Interviews were undertaken using either telephone or online audio conference (Skype).

Academic teaching staff interviewees were asked to elaborate on their views, experiences, observations and reflections in relation to the use of 3D immersive virtual worlds for learning and teaching as described in their questionnaire responses. They were encouraged and given the opportunity to discuss in detail the ways in which they had used and/or intended to use the technology in their teaching practice, along with the motivating factors and pedagogical drivers underlying their instructional designs and decisions. Educational design/development staff and IT support staff were asked questions about their own experiences in supporting the use of virtual worlds in learning and teaching within their institution, as well as about their institutional policies and processes for the support of virtual world implementations in general.

3.3 Data analysis

Quantitative questionnaire data were analysed primarily using descriptive statistical techniques with the goal of deriving tables and charts to present the data in as clear a way as possible. Inferential statistics were used to explore some specific questions; for example, questions about the relationship between teachers' perceived affordances of virtual worlds and the learning designs they implemented. Open-ended questionnaire responses, such as descriptions of learning designs and descriptions of implementation and support issues encountered, were categorised and grouped according to common themes emerging from the data. The number of participants describing particular categories of learning design or identifying particular categories of implementation and support issues were recorded so that, as well as presenting example quotes from participants to help the reader understand the identified categories, the actual prevalence of each category could be reported.

Interviews were transcribed and then coded using nVivo™. Specifically, a set of initial descriptive codes divided into various categories based on the objectives of the study,

the categories of questions included within the interview schedule and the themes emerging from analysis of the questionnaire responses, was developed and an initial subset of six interviews was chosen for initial coding. This initial coding stage was undertaken in an iterative way, with the identified codes applied, as well as an open coding process being used to allow additional themes to be identified. The project team met on a number of occasions during this period to discuss problematic codes and emergent themes and, through this iterative process, a final coding schedule was developed. This coding schedule was then applied to the wider set of interviews, during which a small number of additional themes emerged, resulting in minor changes to the coding schedule. A final sweep through all interviews was undertaken to apply codes emerging during later interviews.

4.1 Introduction

A snapshot of 3D immersive virtual world use in higher education in Australia and New Zealand is presented in this chapter, drawing on data from Sections 1 and 3 of the questionnaire (as described in the above chapter), that is, demographic data about the respondents and summary data about the particular subjects in which 3D immersive virtual worlds have been used.

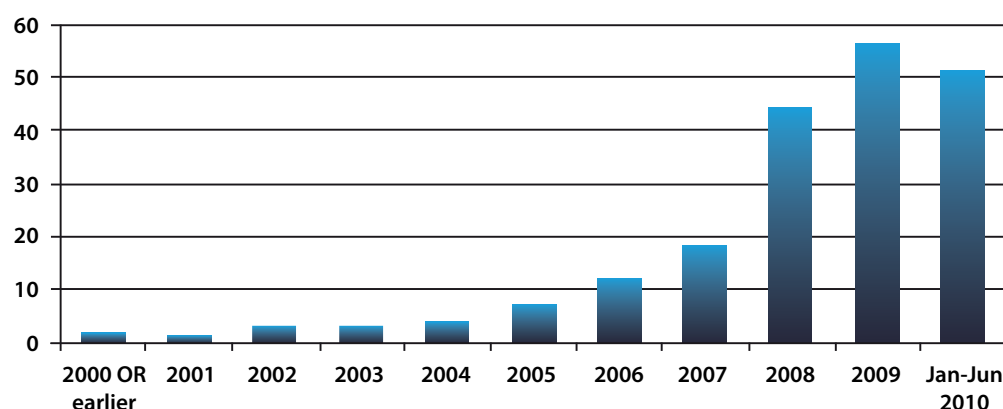
4.2 Respondent demographics

Of the 117 respondents to the questionnaire, 82 were from Australia and 35 from New Zealand. A total of 62 respondents indicated that they had actually used 3D immersive virtual worlds in their own teaching. Fifty-nine of the respondents were male, 56 were female and two did not specify their gender. There were nine people in the 26–35 years age range, forty in the 36–45 years age range, forty six in the 46–55 years age range, nineteen in the 56–65 years age range, one in the over 65 years age range and, again, two who did not specify. The age distribution of the sample is interesting because it appears to include a slightly larger proportion of older academic staff compared to published demographic statistics for the sector (Department of Industry, Innovation, Science, Research and Tertiary Education, 2011), which to some extent questions assertions by commentators on *digital natives* (Prensky, 2001a, 2001b) and the *Net Generation* (Oblinger & Oblinger, 2005), who suggest that older academic staff are likely to be ‘digital immigrants’ who are reluctant to consider ways of integrating new technologies into their teaching. The large number of older academics adopting virtual worlds suggests, consistent with the findings of Kennedy et al. (2009), that younger academics are not, in fact, more likely than older academics to use new technologies in their teaching.

4.3 Usage trends and platforms

The 62 respondents who indicated they had used 3D immersive virtual worlds in their teaching reported on a total of 125 individual subjects in which they had used the technology, including 201 individual subject offerings. Figure 4.1 shows the distribution of these subject offerings over the past ten years. There is a distinct upward trend in usage, with offerings in 2008 (44) being well over double the number in 2007 (18), offerings in 2009 (56) again increasing substantially and offerings in the first half of 2010 (51) already approaching those over the whole of 2009.

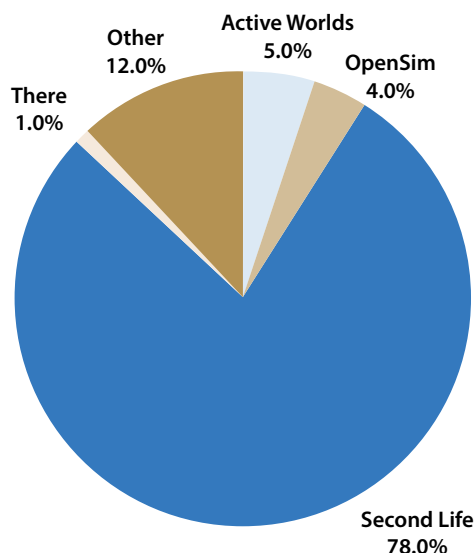
Figure 4.1: Distribution of subject offerings in which 3D immersive virtual worlds have been used over the past ten years



Of the 62 respondents who indicated that they had used 3D immersive virtual worlds in their teaching, 61 provided data on the details of a total of 100 subjects. Summary information about these subjects is presented in this subsection and the following three subsections.

Figure 4.2 shows the 100 subjects, broken down by virtual world platform. The majority of subjects using 3D immersive virtual worlds utilised *Second Life* (78.0%), followed by *Active Worlds* (5.0%), *OpenSim* (4.0%) and *There.com* (1.0%). *Vastpark*, *Multiverse*, *Worlds.com*, *Reaction Grid* and *web.alive* were also listed as options on the questionnaire but were not selected by any respondents. A small group of respondents (12.0%) indicated that they had used another, unlisted platform. Of these respondents, one specified that they had used the *MaidMarian* MMORPG (massively multiplayer online role-playing game), with others reporting use of worlds developed using the *Neverwinter Nights* toolset, the *Torque* game engine, the *Unreal Tournament* game engine, *OpenGL*, *Blender* and the Virtual Reality Modelling Language (VRML).

Figure 4.2: 3D immersive virtual world usage by platform



4.4 Subjects and delivery modes

Figure 4.3 shows the 100 subjects broken down according to delivery mode. A large proportion of subjects reported to have made use of 3D immersive virtual worlds were delivered in face-to-face mode (60.0%), which may be attributed to the fact that the majority of subjects across the sector are delivered in this mode. Another reading of these results may suggest that the use of 3D immersive virtual worlds requires levels of instructional and technical support that make them difficult to use in non-face-to-face teaching.

Figure 4.3: Subjects using 3D immersive virtual worlds by delivery mode

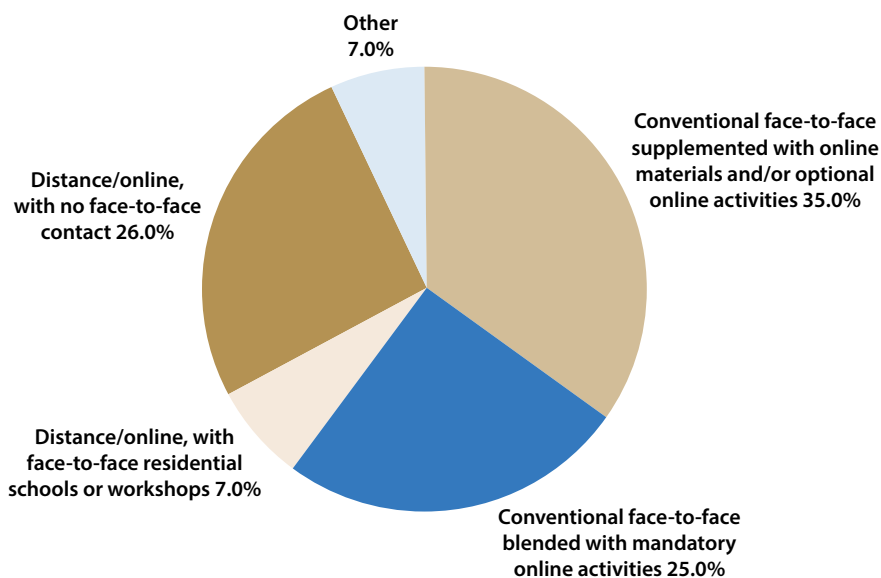


Figure 4.4: Subjects using 3D immersive virtual worlds by role of virtual world tasks

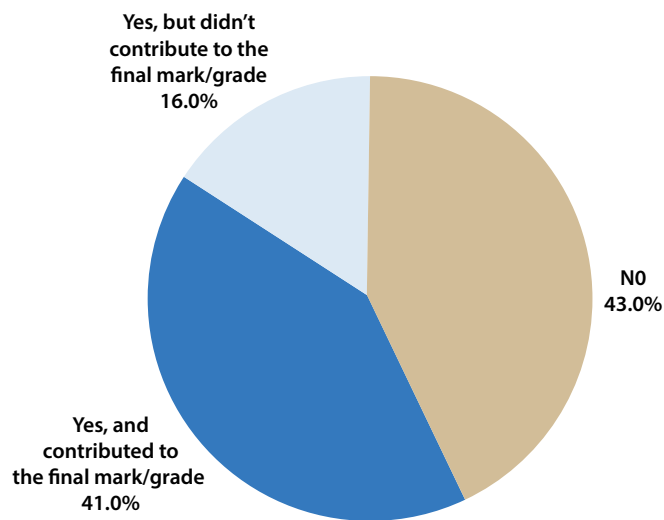


Figure 4.4 shows the proportion of the 100 subjects where the virtual world-based tasks were (i) compulsory and assessed (41.0%); (ii) compulsory and not assessed (16.0%); or (iii) neither compulsory nor assessed (43.0%). The large number of subjects in which the offerings were neither compulsory nor assessed strongly indicates that the use of 3D immersive virtual worlds is not yet a mainstream or core part of many subjects.

Figure 4.5 shows the 100 subjects broken down by level of study. The data appear to suggest that virtual worlds are being used predominantly with undergraduate students. It is possible that this just reflects the higher proportion of undergraduate courses in the sector and consequently the increased likelihood of innovations occurring in undergraduate rather than post graduate courses. There were no comments in the interviews or the open ended questionnaire responses suggesting that academics were specifically targeting undergraduate courses in their use of virtual worlds.

Figure 4.5: Subjects using 3D immersive virtual worlds by level

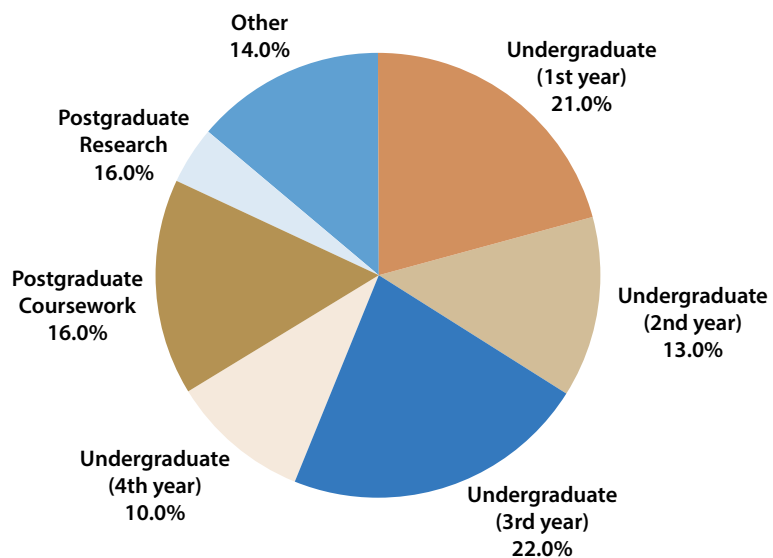


Figure 4.6 shows the subjects broken down by discipline area. Respondents were asked to name in their own words the discipline area of each subject, and the responses were then coded into the following categories:

- Education;
- Arts and Humanities;
- Science;
- Health Professional;
- Information Technology / Computing;
- Legal and Business; and
- Other.

It is not clear to what extent the proportion of implementations in each discipline area reflects or departs from the proportion of subjects in each discipline within the sector. Certainly, the number of implementations within the Science and Health Professional discipline areas is noticeably small, and one would expect that these proportions are substantially smaller than the proportion of subjects within these discipline areas within the sector. There were no clear comments within the interviews or open ended questionnaire responses that would explain the lack of implementations within these disciplines or the relatively high number within the Arts and Humanities and the Education discipline areas.

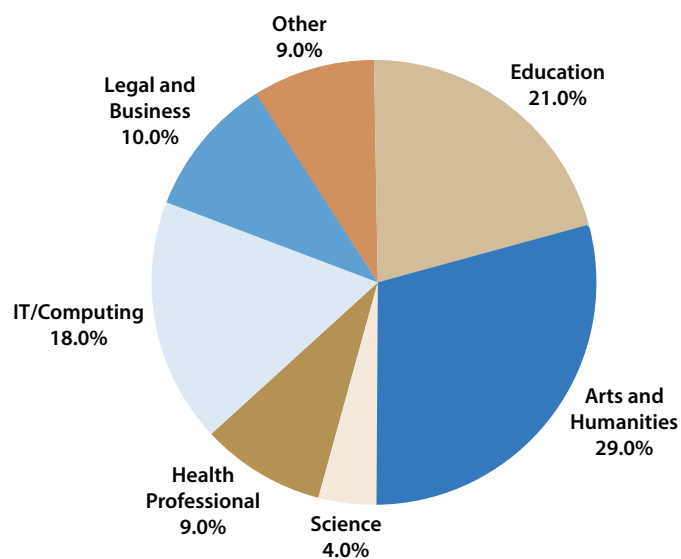


Figure 4.6: Subjects using 3D immersive virtual worlds by discipline area

4.5 Summary

Use of virtual worlds for learning and teaching has increased in recent years, with data from the questionnaire showing a noticeable upward trend, particularly from the year 2008 until the time of the questionnaire in 2010. Overwhelmingly, *Second Life* (78%) was the virtual world platform used by most respondents, with the second most used being *Active Worlds* (5%). With regard to discipline areas, respondents used virtual worlds mainly in Arts and Humanities (29%) closely followed by Education (21%). Virtual worlds were used by respondents mostly in face-to-face subjects (60%) and predominately those that are at an undergraduate level (56%). In terms of assessed and/or compulsory tasks within subjects, the results are split almost evenly between those that were not compulsory or assessed (43%) and those that were compulsory and contributed to the final grade (41%).

5.1 Introduction

This chapter provides information about the variety of applications of 3D immersive virtual worlds across the sector, drawn from the questionnaire and interviews. Section 5.2 provides a summary of the types of learning designs used by questionnaire respondents, drawn from a qualitative analysis of open-ended responses in which the learning activities undertaken by students were described. Section 5.3 discusses the learning environments used and developed by participants, drawing on data from the questionnaires and from more detailed descriptions provided in interviews. Section 5.4 discusses the strategies used for assessing student learning as part of virtual world-based activities and some of the issues encountered relating to assessment, while Section 5.5 discusses the degree to which the virtual world implementations were subjected to formal or informal evaluations. Finally, Section 5.6 provides five more detailed case studies of specific applications of virtual worlds, drawn from interviews with academic staff. In addition to the case studies presented in this section, Appendix A contains an annotated bibliography that includes an overview of virtual world usage across 45 higher education institutions in Australia and New Zealand, with reference to over 350 publications relating to virtual worlds emanating from research and teaching activities within these institutions.

5.2 Learning designs and activities

A major objective of the scoping study was to capture the range of learning and teaching applications for which 3D immersive virtual worlds are being used across the higher education sector. To this end, the questionnaire respondents' descriptions of the virtual world-based learning tasks they designed for their students were systematically analysed. Specifically, 55 respondents provided detailed information about a single subject or unit in which they had used virtual worlds for teaching, including the actual learning activities undertaken by students. However, three of the respondents did not provide sufficient information to allow their learning designs to be categorised. Ten learning design categories were identified from an inductive analysis of the remaining 52 responses, the frequencies of which are shown in Table 5.1. The categories are not

mutually exclusive, that is, some respondents described learning designs and tasks that spanned multiple categories. Equally, some responses did not fit neatly into any of the ten categories and so were classified as 'Other'.

Category	Frequency* (n = 52)
Place exploration	9
Concept exploration	7
Task or skill practice	5
Role-play	23
Gaming	1
Communication	21
Instruction	12
Slide show	7
Machinima	6
Building or scripting	9
Other	11

Table 5.1: 3D immersive virtual world-based learning activities designed and implemented by respondents

**Note that some activities were found to fit into more than one category*

The ten categories broadly represent the ways in which Australian and New Zealand higher educators are integrating virtual worlds into in their teaching and implicitly suggest the types of pedagogical uses of the technology that they consider to be worthwhile and appropriate. Each of the categories is described in more detail in the subsections below, with reference to examples drawn from the data. It should be noted that in a number of instances, respondents reported that they did not set specific in-world learning tasks for their students, but instead simply asked them to explore the virtual world and various places and objects in it, engaging in broad discussion about possible uses of the technology relevant to the subject or topic area they were studying and/or evaluating its potential application to their current or future work contexts. Moreover, many of the respondents, particularly those in disciplines such as Design/Architecture, Education and IT, made it clear that the intention was for their students to learn both *through* and *about* 3D immersive virtual worlds. For example, in addition to participating in in-world learning activities, the Education students were often required to research and consider how they might use the technology with their students in their own professional practice and, in some cases, had to actually design their own virtual world-based learning tasks for a cohort of students to meet particular curricular requirements and learning objectives. In an IT subject on Computer-Supported Collaborative Work, the students' assessment called for them to undertake a set of collaborative experiments, such as designing, implementing and evaluating an in-world icebreaking activity.

5.2.1 Place exploration

Place exploration tasks are tasks in which learners visit and experience simulated places that may or may not correspond to places in the real world. An example of simulation of a real-world place was one respondent's use of a 3D *Virtual Chemistry Laboratory*—modelled according to an actual laboratory located on the university campus—with first-year distance education students. Students used the virtual environment to familiarise themselves with the laboratory space and procedures in preparation for their on-campus residential schools. Another instance of the use of virtual worlds for place exploration can be seen in a Studies in Religion lecturer's use of virtual world-based historical recreations with her students, where they could, through their avatars, explore virtual religious spaces and be presented with informative note cards, landmarks and links at various points. Many other respondents also described how they made use of the variety of regions or 'sims' available in *Second Life* to take their students on virtual 'excursions' or 'field trips'. In one case, an Electronic Commerce lecturer exposed his students to different models of virtual businesses and the use of virtual space to implement in-world presences for such businesses.

5.2.2 Concept exploration

Some respondents used virtual worlds as a means of supplying their students with visualisations and interactive examples of concepts in action. For example, a lecturer of a foundation-year Management subject explained in his questionnaire response that he had used the technology for its ability to simulate the business environment and allow students to test theoretical concepts. Pharmaceutics students undertook an immersive experience in which they manufactured and quality-tested tablets within a virtual manufacturing plant and, in doing so, gained a conceptual understanding of the process and machinery involved, as well as the role of inactive ingredients for controlling tablets' physical properties, without the need to concern themselves with the detailed mechanics of operating the actual equipment.

5.2.3 Task or skill practice

Learning designs in this category involve the learning of skills and the practising of tasks in a virtual simulated environment that may be overly expensive, dangerous, time-consuming or inconvenient to practise regularly or repeatedly in the real world. Several respondents from the medical and allied health disciplines gave accounts of learning designs and tasks falling into this category. For example, medical students were formatively assessed as they 'admitted' virtual patients in need of acute care, including taking their history, examining, treating and diagnosing them as appropriate. Midwifery students undertook scenario-based activities in a virtual birth centre

designed to develop their skills in managing normal childbirth. Nursing students worked through six different scenarios requiring them to assess and implement care for a patient with heart failure. Finally, in the field of Social Work, one respondent's students practised their interview and suicide risk assessment skills with 'clients' in distress.

5.2.4 Role-play

In this type of learning design, students take on and enact roles as part of a given event, situation or scenario. For example, a cohort of external Criminal Law students completed an advocacy exercise requiring them to role-play courtroom delivery of submissions relating to a trial or appeal within a simulated virtual courtroom environment. Drama Education students played different roles while working in process drama in the virtual world, using Internet governance as a pretext. Students in a Chinese Media Studies unit conducted in-world interviews with speakers of the language from China, Singapore and the USA who were active users ('residents') of Second Life. The students visited their interviewees' 'home bases' in *Second Life* to gather information in preparation for the 'talk show' interviews, which were filmed in an in-world 'studio'. They also had to produce news desk reports (also filmed in-world) and written news reports.

5.2.5 Gaming

Games are activities that seek to challenge learners, often engendering cooperation or competition between them, as they work towards the achievement of goals or objectives. One of the respondents, an Education academic, taught a subject in which students learnt educational psychology theories and concepts through game play in a 3D world developed using the Neverwinter Nights toolset.

5.2.6 Communication

One of the most common uses of virtual worlds identified by respondents was to promote socialisation and online discussion with and amongst students, both as a learning activity in itself and as a component of or adjunct to other activities. In-world discussion typically appeared to rely on the text-based chat features and/or other forms of verbal (e.g. voice) and non-verbal (e.g. actions and gestures) communication facilities available in the world. Besides discussions that took place during scheduled class times, many respondents also told how their students got together in their own time in the virtual meeting spaces provided, for example, to work on group assignments or

projects. In one such subject that required students to work collaboratively to develop accessible web sites for organisations, they used *Second Life* to meet with clients and people from disability groups based in other countries. A number of respondents capitalised on *Second Life's* massively multi-user nature to encourage and enable their students to connect with and take part in wider communities of learning and practice, such as through holding panel discussions with subject matter experts and other users not belonging to the institution. To gain an appreciation of what music means to different people, one respondent's students attended virtual concerts in *Second Life* and spoke to musicians from around the globe.

5.2.7 Instruction

Many of the respondents organised and/or delivered real-time in-world lectures, tutorials and presentations for their students. One respondent specifically pointed out that he gave students the choice of attending lectures in either the physical (real world) or virtual world-based classroom. In most cases, the lectures appeared to be delivered by the respondents themselves, although there were allusions to guest lectures and attendance at public seminars run by other groups in *Second Life*. In some subjects/units, the students themselves delivered their own in-world presentations.

5.2.8 Slide show

This category included activities in which students viewed or created slide shows within the virtual world. For example, PowerPoint images, photographs and other two-dimensional graphical content are able to be rendered on a 'screen' in *Second Life* with the help of a special slide projector object. The content can be browsed independently by students or used as visual aids during a lecture or other synchronous class activity.

5.2.9 Machinima

A few respondents' learning designs involved students creating or using pre-created 'machinima'—animations or 'movies' that record action occurring within the virtual world. Respondents described the use of machinima sequences for various purposes, including as introductory material to foreground exercises and concepts to be covered in face-to-face lessons, as well as to provide a narrative context and scaffolding for virtual world-based activities. In some cases, the students viewed the machinima clips while immersed within the virtual world; in others, the clips were embedded in a subject/unit website or courseware package external to the environment.

5.2.10 Building or scripting

Some respondents from more technical disciplines set learning tasks requiring students to construct places and objects within the virtual world and/or to write scripting code to produce dynamic object behaviours. At one institution, students pursuing postgraduate qualifications in Design, Communication and IT worked collaboratively and in real-time, using *Second Life* as a free 3D modeller, visualiser and games development platform as part of a subject on Usability and Interaction Design. In a final-year undergraduate-level Information Systems project unit at another university, students created software artefacts embedded in objects in *Second Life* and integrated them into scenarios to model or simulate processes applicable to a real business case.

5.3 Learning environments

As mentioned in Section 4.3, questionnaire participants who provided details about the implementation of virtual worlds in specific subjects/units (100 such implementations were mentioned) used a variety of virtual world platforms, with *Second Life* the most common (78%), followed by *Active Worlds* (5.0%), *OpenSim* (4.0%) and *There.com* (1.0%) with the remaining participants (12%) using a variety of other platforms, including online role-playing games, and purpose-built virtual worlds developed using game engines or 3D software development environments. Of the 55 respondents who provided detailed information about a specific virtual world implementation, 55% indicated that the virtual world, island or space was developed specifically for the purpose of the subject they taught, while a number of others used purpose-built spaces that had been developed by others for a similar purpose. Twenty-two per cent of these 55 respondents indicated that an important aspect of the learning task was familiarisation with *Second Life* and, consequently, these respondents indicated that students were required to meet in various places within the environment and explore the features of the environment, rather than using a space developed for a specific pedagogical purpose.

Interview participants described a range of virtual environment features that were included within the spaces developed for their subjects. For example, one participant whose students undertook a business simulation activity described a purpose-built space that included aspects modelled on specific real world buildings:

“
Right in the centre of the island is a pretty much exact replica of our building, our real world building. Surrounding the building there is [sic] five streets, so the streets are all named after main streets in Brisbane: Eagle Street, Alp Street, Main Street etc, all streets that are familiar to anyone who lives in Brisbane. On each street, there are eight shops. ... The eight businesses are ... mainly hospitality based, so we've got a couple of health clubs, a cinema and a couple of coffee shops; the two coffee shops are the ones [with which] we have direct partnerships in the real world businesses and [that] are just literally outside our door.
”

“
It's just a 3D representation of a classroom; a single building with a single room with the only other infrastructure ... a sort of staging area built as a sort of a playground where the groups of student teachers and the teaching staff would meet before the project for a briefing on how the session would proceed and also as a de-briefing area.

There's...a students' only section, and it has a building where students can create their own little offices or little homes in Second Life ... and we've got two teaching areas built into the mountains on the island ... amphitheatres. There's a common building, which is one where students can come and meet in groups and just spend time together and do activities together, so it's separate to the teaching amphitheatres and it's separate from the little homes. I also have a little office on the island, which is in the form of...an air balloon. I have a little study running there, and we have sort of little, almost...retreat areas where a bunch of students can go off to. There are a couple of different beaches and garden areas. Oh also, we have an area, like a circus in the sky, how could I forget about that. It's a really highly interactive sort of like a circus, I guess in the sky...I don't know how else to describe it.
”

Participants whose student learning activities included in-world meetings and in-world teaching described spaces with features to support these purposes:

Another participant whose students participated in mock job interviews described an environment that was dynamically changed by the coordinator during the activity through an interactive console, so that the environmental features needed for each part of the activity appeared when needed:

“

We changed what's inside it using a console, so what happens is we raised up a shop when the students first come in after orientation, we get them to choose clothing suitable for an interview, so there's obviously clothing there that's most suitable for an interview and there's clothing there that is not suitable so they have to make that choice; they dress themselves, we have changing rooms available for them. Once that's done we take the shop away and we raise a catwalk and we have chairs down the side of the catwalk and the students take turns walking up and down the catwalk while we have a discussion about "Is that suitable for an interview or isn't it?" Once they've done that then we take away the catwalk and we raise a general interview room in the centre of the holodeck and we can role-play a suitable interview.

”

“

There's basically at the moment an emergency department. So you've got a nurses' area, you've got a cubicle area, a room with a couple of cubicles in it and you've got a resuscitation area—to see the patients and then you've got a sort of waiting room type area. And then ... the nurses' station is all there, the things that you'd expect to find there in terms of the lab request forms and radiology request forms as well as the opportunity to review the investigations that you've ordered etc. And ... all the things that you'd expect to find in terms of oxygen and ... a tray to put in cannulas ...

”

Some participants described highly specialised spaces tailored for specific simulation activities. For example, one participant described a space which replicated a hospital emergency department:

”

As well as rich visual/special elements designed to replicate certain types of buildings or environments, the spaces developed often included interactive features that supported particular simulation activities or enhanced the user interface provided within the viewer software. The console described above that allowed the coordinator to dynamically change the features of the environment to fit the various stages of the role-play is one example. Another example is the use of a 'Heads up Display' provided to students undertaking a classroom role-play, which provided them with controls allowing them to make their avatars display certain gestures, such as nodding, raising their hand, falling asleep and so on. In other cases, the interactive behaviour of the virtual environment was controlled through a sophisticated simulation running behind the scenes. The following description of a space supporting a business simulation activity is an example:

“

It's a street, which contains eight businesses and students—five students run the business representing five different positions, CEO, Finance Manager, the Sales or Marketing Manager, HR Manager, and the Operations Manager ... There are a massive range of variables that can be altered and changed by the teacher to create an infinite number of scenarios. So it becomes a totally dynamic learning environment. Basically what underlies and drives the economics of the system is that the avatars of a company have a display which is driven by Maslow or derived from Maslow's Hierarchy of Needs. And what they have to do is maintain that HUD, that HUD up in the green area which they can only do by buying products from other companies. And each of those products have different impacts on the HUD and they also have differing levels of quality. So that creates the economic loop if you like, that then drives the economics of the system. And then of course, they have a set level of financial resources that they have to do to manage buying in the raw materials and manufacturing and determining the quality and establishing their marketing strategies and so forth.

”

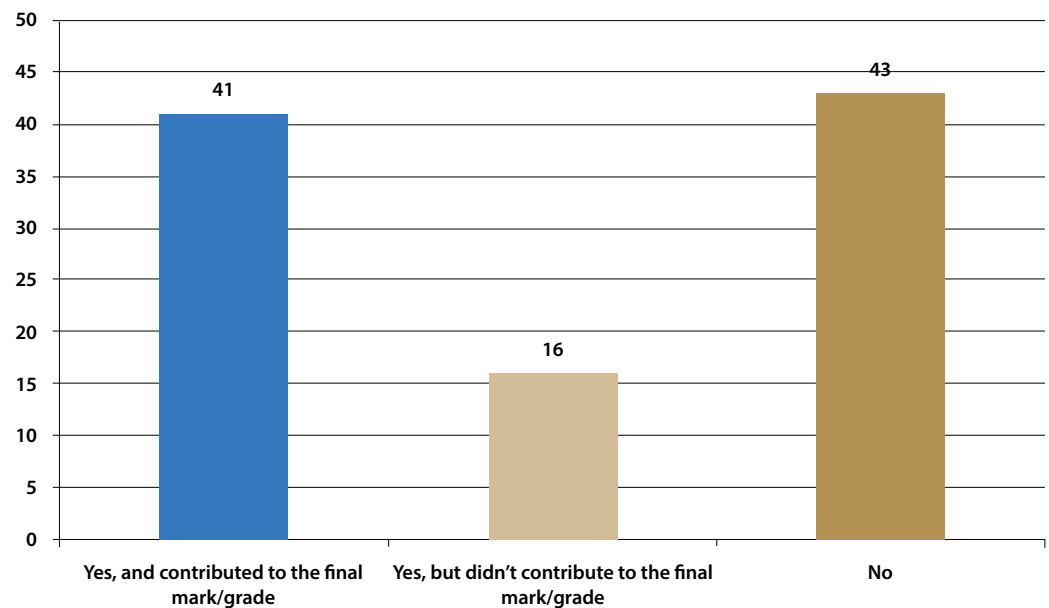
Of the 55 respondents to the questionnaire describing in detail an implementation of virtual worlds in a single subject, 55% indicated that they had drawn on the support of non academic staff within their institutions, such as IT or educational design support staff. Fifty-five per cent also indicated that they had drawn upon dedicated funding to support the implementation, with this funding coming from a variety of internal and external sources. The support needed for the implementation of virtual worlds in teaching is discussed in more detail in Chapter 7.

5.4 Assessment

Both academic staff interview participants and questionnaire respondents were asked whether the tasks/activities they developed for their students were compulsory or non-compulsory and assessable or non-assessable.

As reported earlier (see Section 4.3), 61 questionnaire respondents provided data on the details of a total of 100 subjects. Specifically, the questionnaire required respondents to select one of three options to indicate whether the virtual world-based activities associated with the subjects were compulsory and/or assessable. As illustrated in Figure 5.1, 41 subjects were compulsory and assessed; 16 subjects were compulsory and not assessed; and 43 subjects were neither compulsory nor assessed.

Figure 5.1: Subjects using 3D immersive virtual worlds, by whether tasks were compulsory and/or assessed



The interviews aimed to capture the reasons why student learning tasks/activities were assessable and/or compulsory or why they were not. A couple of academic interview participants raised the issue of difficulty of assessing in-world tasks:

“

...the varying subjects must have assessment, a certain amount, certain kinds; so, that's why they were assessable, but then, how do we assess these things, how do we assess people's reflection upon their avatar.

we're still looking at how you can assess it or what you can assess ... and that's our real dilemma at this stage, really.

”

Some academic staff who indicated that they made the tasks assessable commented that they gave their students some options in relation to what was included as an assessment task:

“

Some tasks in Second Life for the social networking subject are not assessable...it's up to students to nominate whether they want one or more of their tasks they complete in Second Life assessable in terms of it either being used as part of their project assignment or whether they decide to use it as one or more of their learning tasks that they use for their online learning journal, and their final assignment.

”

“

...everything I have my students do form[s] part of their assessment, generally using a portfolio type assessment model whereby they're gathering experiences and reporting on those experiences or reflecting upon those experiences... through their blogs or through a digital portfolio of evidence of their learning etc, so they were assessable but not in terms of what you consider probably content knowledge of facts and being done on an exam or specific elements to be detailed in an essay.

”

When providing details of the type of assessment tasks that students completed, some academic staff interview participants described tasks that were associated with students' virtual world experience but were not specifically assessed in-world:

Several academic staff chose not to make the student learning tasks/ activities assessable. Concern was expressed by some academic staff interview participants about student equity/ access issues:

“

...it's really important, when you're looking at using something like a 3D virtual world environment in the learning design of the subject...to really think very carefully about whether or not you are going to make something assessable and whether or not you're going to make that compulsory or voluntary in terms of either using, experiencing the environment and/ or completing assessment tasks...maybe in ten years time, everyone's going to be able to access these sorts of environments on their mobile phones, for example.

”

“

Assessment number two; most of the students who didn't have the Second Life experience just had a real life interview.

...I've had it as an assessable task [now] for the past two years...but it's a choice so not everyone has to explore this option...with on-campus I've made it a compulsory component they have to do a workshop on it...with the off-campus I can't make it compulsory because I can't guarantee they can get on.

”

A couple of academic staff interview participants described how equity/ access issues were addressed when it came to assessment, in particular giving students a choice of either real life or in-world/ virtual assessment tasks:

“

The tasks aren't going to be assessable because it's, I guess, it's an early project to try and establish the validity of this approach, so now we are asking for volunteers at this stage to take part.

...because this was the first time I was doing it I wasn't very confident—I didn't want to cause a big ripple in the course by modifying the assessment methods in any sort of extreme way and I wasn't all that confident that I would get the same level...so I didn't do it.

”

Other concerns raised about making the tasks/activities assessable were that the subject was part of a new project and was the first time that the subject had run:

“

I really wanted to make it assessable. I wanted the students to work together on a group project. I had them in groups of five working on this more or less and I wanted to make it assessable, but my school was very conservative and they didn't even want me doing group assessment and another part of the course I had a group task that was assessable and that freaked them out.

”

Some participants encountered resistance from their teaching colleagues that prevented them from making the tasks assessable:

5.5 Evaluation

Academic staff interview participants were asked about whether any systematic evaluation of their use of virtual worlds for learning and teaching had occurred. In several cases, no systematic or formal evaluation occurred:

“

No, there's not been any real evaluation; apart from reports written by myself to my management in terms of how successful or how worthwhile I have felt various project were...no systematic evaluation...which is probably somewhat of a failing, but also probably just a reflection of the way that it's just happened at our institution with not an enormous amount of interest.

”

“

In terms of student feedback, I just got a few comments but I haven't really taken any formal way at this stage and normal feedback at the end of courses from students, which I am required to do, but generally there's not much comment about it...I've had some anecdotal feedback—some were very enthusiastic and I've had a couple who...one boy who said basically he got distracted and he played at it rather than learned.

I guess it's not systematic, no it's pretty ad hoc, even quite responsive I guess, to whatever's going on in the class and it still feels like we're beginners...only evaluation from the students not from us, so that's actually, probably what we should be doing next.

...the first thing that became quite clear is that the ramp up to them using a technology was quite quick...they were a bit daunted in the first sort of couple of days because I just think they weren't used to that type of course delivery.

”

Other participants commented that although no systematic evaluation took place, informal evaluation occurred, mainly in the form of student but also staff feedback. With regard to student feedback, this was received both informally (anecdotal) and formally (through subject learning and teaching evaluation questionnaires):

One participant commented on the difference between staff and student feedback for a particular subject, noting that the students were more positive than the teaching staff when it came to using virtual worlds:

“

Staff that have used Second Life only minimally have generally not [provided] positive feedback...There's been some really good comments [from students]...We took five students in to explore some of the offerings around drama in Second Life. There was really positive feedback from them and they thought it was a very worthwhile exercise, while the poor teaching staff [member] in that particular class was a bit bewildered by it all...There's been a mixed result.

”

“

...there's something about the feedback we get from students, and I think it comes out of the technology we're using...I think, in the feedback we received, it's perhaps been franker than it would be for a live class... there's a cohesion and a trust built between the students and the staff that you just don't get elsewhere...students might be IM-ing [instant messaging] you during an in-world class, so you've got this whole different kind of communication, and even though they're IM-ing you...the student-teacher boundaries are still there; it's just they're different, the communication is different.

”

On the other hand, another participant gave an example of student feedback that suggested positive and cohesive relationships between staff and students were a result of using virtual worlds for learning and teaching:

Some academic staff also mentioned that they observed students whilst using the virtual environment as a way of informally assessing the success of using virtual worlds for learning and teaching and identifying areas for improvement:

“

...we recorded like observations and those sorts of things; recorded conversations but we didn't apply for ethics approval for them. It was just a general watching our students and seeing what worked because really we were just piloting it and we thought we would be doing it more in the future.

”

“

...we always evaluate how the program's gone and what happened...they rated, they suggested how it's contributed to their understanding, how they wish it could've improved, what they think of it, how valuable it's going to be to them in their future. Every single student that goes through performs that analysis.

...I decided that I was going to make sure there was some sort of statistical analysis done so I managed to get hold of all the evaluation material at the end of the course...it all indicates that I have now statistical evidence to show that the Second Life experience that students went through was a huge asset. My retention is higher and my success is higher, my results are better...I had 100% retention and a 100% success so I don't think you could get much better than that.

Pre-test, post-test testing and analysis of ... transcripts and that's basically how we are doing it. But it's pretty hard to...we sort of are still looking at constructability in terms of does the environment...is the environment able to show how well people perform and then what does performance mean, and that's the whole problem with it.

...because it is my research focus I'm always evaluating it, looking at it from different angles, thrown it through different systems coming up with...trying to think of it in a different light to how I might have in the last time I looked at it...I do have surveys happening and putting all that data into, analysing that data...I would just use Excel for...evaluating the students grades. I have gone through and read...every single script to find themes but I've also used a program called Leximancer to come up with themes and major themes, minor themes, things that are happening in the conversations that I may not have noticed.

”

Those participants that did conduct a systematic evaluation described the process by which this took place and the tools used to evaluate:

Formal student feedback occurred in some of the examples and was also used to inform learning and teaching with virtual worlds, including the design/development of islands:

“

...in the first intake that went through or the first cohort I should say, yeah we did some very, very detailed evaluation of student feedback and we've been using that feedback for the next versions of Business Island...the different designs that we're incorporating in Business Island are a direct result in student feedback in terms of their experience of using it in class...basically at this stage they have been used...to help drive the...development evolution of Business Island itself and also taking team learnings, developing other products as well.

”

Other academic interview participants commented that evaluation took place as the use of virtual worlds for learning and teaching was part of a research project:

“

...I've done several research projects around the use of the virtual worlds and how they enhance or otherwise the learning process in the various courses...whenever I implement any new technology I build a research project around that and sort of explore the effectiveness of the technology...we have our internal student evaluation processes of the courses as well.

”

5.6 Case studies

5.6.1 VirtualPREX—Virtual teaching practice in Second Life

Name: Sue Gregory

Institution: University of New England

Discipline area: Education

Platform: *Second Life*

Subject/unit: ICT in Education

Level: 1st year undergraduate (also used with postgraduate students)

Delivery mode: On-campus (also used with off-campus students)

Students: 154 on-campus undergraduates (also used in subjects containing 150 off-campus undergraduate and 120 off-campus postgraduate students)

Years: 2011 to 2012 (virtual worlds also used in other subjects from 2008)

Learning context

The subject addresses the accreditation requirements for pre-service teacher education in the effective integration of Information and Communication Technologies (ICTs) across the primary curriculum, including the use and evaluation of software suitable for classroom use, such as social networking software and other computer-based tools. The specific assessment task, in relation to a virtual world, required students to describe how a virtual world could be used in a primary classroom and to discuss relevant emerging issues such as privacy, gender, bias and copyright issues.

Development of the virtual environment

VirtualPREX role-plays were developed from a \$220,000 grant from the Office of Learning and Teaching (OLT) to create a space for students to undertake virtual professional experience (hence the term, VirtualPREX). Sue Gregory led this project, which also involved team members from the University of New England (UNE), Charles Sturt University (CSU), Curtin University, Royal Melbourne Institute of Technology (RMIT), Australian Catholic University (ACU) in 2011 only and the University of Hamburg. Four colour-coded VirtualPREX classrooms were created, with all classrooms the same, except for their colour. The classrooms were created on Australis 4 Learning, an island in Second Life developed by Sue over a number of years. One male and one female teacher were created for each classroom and their clothing was colour-coded according to the classroom to which they were assigned. Ten primary school student avatars were created for each classroom—five male and five female. All were made to look like children (i.e. body shape, hair, size, etc.) and wore a colour-coded school uniform. Interactive tools and resources were added to each classroom as a resource for the practising teacher. Part of the grant was to create bots to enable pre-service teachers to undertake asynchronous role-plays with non-player characters. Role-plays were recorded to create machinima (in-world video) to be used as a resource. Assessment tasks around machinima have also been established. Machinima and the assessment tasks, which can be used by teachers or students, can be found on the VirtualPREX website: <http://www.virtualprex.com>



Figure 5.2: Sue Gregory's avatar, Jass Easterman, standing outside a VirtualPREX classroom

Learning activities

There are three main activities for the VirtualPREX sessions. The first is role-playing teaching scenarios with their peers, the second is using bots to role-play teaching and the third is the use of machinima for classroom tutorials and assessment tasks.

Aside from the on-campus VirtualPREX activities, in various off-campus subjects/units optional weekly sessions are provided. These are designed to familiarise students with *Second Life* and provide them with experience in a variety of virtual world-based learning activities. These sessions are varied, but typically include activities such as excursions, tours, role-plays, building or scripting exercises, guest lectures, explorations, experimentations or web quests, as well as group reflective discussions.



Figure 5.3: One of the classrooms used in the VirtualPREX project

Reflections

Sue has found that UNE has always been very supportive in assisting her in using *Second Life* in her teaching. In 2008, when Sue began teaching students in *Second Life*, she did this from her own home in the evening. However, once on-campus students began learning via this mode in 2009, Sue found that UNE staff were efficient and effective in enabling the computer laboratory to be set up and ready for classes, and this helped to avoid technical hitches. Over the years, Sue has evolved her strategies for preparing students for virtual world sessions: students have to sign up early by providing their avatar's name to Sue; they are provided with documentation via web pages, emails, machinima, images and audio to prepare for their journey; and they are encouraged to log into *Second Life* and familiarise themselves with the environment.

Sue acknowledges, however, that everything doesn't always go to plan and, consequently, she has frequently been required to trouble-shoot issues 'on the fly'. Issues encountered include problems with remote student Internet connections, lag for both on- and off-campus students and problems with group chat and 'rezzing' (images of the world coming into focus).

Sue has been tracking student's grades and perceptions of their learning since 2008. She has found that students that opt to learn in a virtual world are typically very engaged in their learning, and they often outperform other students who decide not to use a virtual world for their learning.

Plans for the future

Sue will continue to teach UNE education students about the potential affordances of virtual worlds for teaching and learning. She has many ideas about how she would like to progress with VirtualPREX, role-plays, in general, and engaging her students in their learning.

She believes that virtual worlds lend themselves particularly to distance education because of the potential for off-campus students to engage in their learning in authentic learning environments. Students are able to participate in activities that are impossible even in a face-to-face situation. She is excited by the potential that teaching and learning in virtual worlds offers, while believing that we are only at the beginning of this interesting stage in the development of education.

Name: David Craven

Institution: International Education Services (institution responsible for delivering the University of Queensland Foundation Year program)

Discipline area: Business

Platform: *OpenSim*

Subject/unit: Business Management

Level: Foundation year (pre-university)

Delivery mode: Conventional face-to-face, supplemented with online materials and/or optional online activities

Students: 580 per year enrolled in the institution, all of whom undertake the virtual worlds activity

Years: 2010, 2011, 2012

Learning context

The aim of this subject/unit is to teach students the fundamentals of business management. This involves the delivery of learning content through lectures and tutorials that the student engages with in a business simulation in *OpenSim*. The virtual world activities in this subject are mandatory and contribute to the final mark/grade.

David's rationale for using virtual worlds in this subject is to allow students to test the theoretical concepts associated with business management:

“

I have tried a large number of applications and software items to enable students to understand business... they can understand the concepts in a textbook but... that does not necessarily translate into being able to understand what business and business management is all about...the OpenSim platform... was an ideal platform to be able to develop a simulation that could demonstrate to students the impact of their strategic decisions and therefore enable them to better understand business and what the impact of those decisions are on how businesses operate.

”

Development of the virtual environment

David obtained \$50,000 in external funding for the development of PierSim, the *OpenSim* based virtual world used in this subject/unit, as well as considerable funding from PIER (Professional International Education Resources).

PierSim is a virtual world comprised of islands containing over 40 different businesses. PIER has used young Brisbane developers recently graduating from university to construct the environment using the latest gaming technologies on the *OpenSim* platform.

“

I wanted to provide the young talent here in Brisbane with the opportunity to showcase their talent in a cutting-edge learning environment. We are committed to the challenge of bringing a revolution to the way that business and management is taught. The partnership extends to educators, students and the corporate sector who are working collaboratively with the developers to improve and enhance the product. The stakeholders are involved in an iterative, totally innovative developmental process...what we have come up with is something that is extremely outstanding and highly engaging.

”

David described the development of the environment as an iterative and innovative process:

After early use of Second Life, the use of *OpenSim* as a platform arose out of the identified limitations of *Second Life* as a platform for innovation, user control and distribution.



Figure 5.4: View of a street with advertising space within PierSim

Learning activities

As part of the Business Management subject/unit, students, in groups, are required to operate a business within PierSim. Within the groups, each student is allocated one of five different positions within a company: CEO, Finance Manager, Sales or Marketing Manager, HR Manager or Operations Manager. Each student is provided with a job description and is required to develop business strategies and implement them in-world. Within the virtual environment there are a large range of variables that can be altered and changed by the teacher/lecturer to create an infinite number of scenarios. David described the learning experience in the following way:

“

...it becomes a totally dynamic learning environment...what underlies and drives the economics of the system is...Maslow's Hierarchy of Needs...[the students] have a set level of financial resources that they have to do to manage buying in the raw materials and manufacturing and determining the quality and establishing their marketing strategies and so forth.

”

Each tutorial/class is run with two teachers/lecturers, one operating 'out-world' or in the real world, working with the groups, providing feedback and support, and the other operating in-world, playing the role of government and occasionally as a mystery shopper (with students unaware of the lecturer's identity).

Figure 5.5: A view from inside one of the businesses within PierSim



Reflections

As a part of this subject/unit, students are constantly asked to provide feedback on several aspects of the virtual environment and learning activities. Students are asked to provide feedback/comments on the contribution of the subject/in-world learning activities to their understanding, any improvements that could be made to the environment, how valuable it is going to be to them in their future and their overall comments on the environment. David commented that the feedback from students so far had been very positive:

“

...they give it consistently a rating from 8 to 10, there is nothing ever below that...The end product is an Annual Report that they deliver to their shareholders. They demonstrate a level of knowledge and understanding that can only occur from the hands-on operation of the business.

”

The main issue David identified in relation to the use of virtual worlds for learning and teaching was limitations in people's mindsets as to what the technology was/is capable of:

“

I don't think there's any constraints...the constraints are how people use the technology...a lot of people are limited in that they...[see] virtual worlds, and they go, "Hey what a great medium, this is awesome" but...it's very quickly followed by they don't know what to do in it...they end up...creating replicas of their real world...there's no replacement for the real world. The essence is being able to...apply some imagination, innovation...I think that's where everybody's hitting brick walls.

”

“

Look, there's barriers and constraints within systems... but...none of the barriers have been insurmountable... for instance firewalls...what do you do? You develop a system that can be...used being downloaded onto the local server...there's problems, and there's opportunities but it's how you solve those.

”

David also made brief mention of firewall issues, but suggested that these kinds of problems could be overcome:

Plans for the future

David mentioned future plans for PierSim. The learning platform has been successfully implemented into five secondary schools in the Brisbane area and was showcased on Channel Seven News.

“

Our plan now is to put this into the school system, into as many schools as we can here in Australia and internationally and in both business organisations for the training of their staff and for educational institutions and organisations for the training of the students.

”

“

...it just makes learning much more dynamic; it creates a range of experiences that allow students to draw their meaningful conclusions from it themselves...if it's done properly it has an enormous potential to offer in creating something that really will make the learning memorable...that's its potential.

”

David described the value of using virtual worlds for learning and teaching, highlighting the potential for more engaged learning:

5.6.2 Job interview practice in Second Life

Name: Merle Hearn

Institution: Manukau Institute of Technology

Discipline area: Career planning

Platform: *Second Life*

Subject/unit: Foundation Studies—Future Focus Career Planning

Level: 1st and 2nd year undergraduate

Delivery mode: Face-to-face in a computer lab

Students: 20 students

Years: Activities undertaken in 2008 and 2009 described here

Learning context

The New Zealand Government provided the *Second Life in Education in New Zealand (SLENZ)* project with \$500,000, originally with six institutions involved, but eventually only two went forward with projects (the other was a virtual birthing suite for use by midwifery students). The overall aim of Merle's part of the project was for students to develop their interviewing techniques in order to gain skills for job preparation.

“

I approached goodness knows how many local businesses and worked with people from the community to get together interview scripts and to recreate the interview rooms, so on our build the interview rooms that the students use are actually very, very similar to the ones that they would be interviewed in in the real world had they gone for those particular jobs here in South Auckland.

”

Development of the virtual environment

There was six months of planning by a team. It began with establishing the aims and objectives of the project, including the background philosophy, the pedagogy that fitted with the aims and objectives and then establishing what would be built, how it would be built and how it would be used once it was built. The development was built on a vision of a round shape so that students wouldn't feel as if walls boxed them in. It didn't necessarily have to be realistic—the intention was to provide an open space that would stimulate the imagination.



Figure 5.6: Students participating in an interview role-play

Learning activities

The space was created in *Second Life* specifically for Merle's teaching. There was a central building used as a holodeck (scene changer) within a circular building. When students first visited, it was set up as a shop where they could purchase clothes appropriate for an interview. The next scene was a catwalk so that the students could display their purchases and discuss their appropriateness. After this, an interview room was available for general discussions. Students were taught to use the lip sync features of the environment so that it would appear like the avatar was speaking when audio was being used. They were also taught how to use the gestures available. Three types of interview rooms and interview scenarios were created: a generic room for any interview scenario, a pathway room to prepare the students for their chosen degree pathway (e.g. nursing, teaching, social work, engineering) to help students facing interviews to get into their course, and specific job scenario rooms with affiliated job advertisements and job descriptions:

“

We have all these different companies and we have their interview rooms so [students] go through realistic interviews for a job that [the company] have chosen that [have] in the past actually [been] offered ... Now in New Zealand because we are very, very multi-cultural ... when students go for an interview, they are offered the opportunity for a whanau/fono pacifica interview where they can bring along support people so we give them the opportunity to role-play that as well. Our whanau room made virtual world history because we actually had Kaumatua who are Maori elders coming into Second Life ... And we have also got a telephone interview room should they need to practise that as well.

”

“

... but I found once the students were in there and they knew what their task was that they were so motivated and so absorbed in what they were doing they really didn't need me much. Initially I did a role-play of a good interview for them and there was some guidance from me in the discussions, but you know they would take a discussion topic and they would run with it and my two cents was just not overly valuable. I mean it was their discussion. I found also that once they were in their groups and they were practising their role-plays they had the scripts, they had the instructions, they knew what they needed to do and basically they went along and they did it.

”

While facilitating the activities in-world, Merle tried not to intervene beyond where necessary:



Figure 5.7: One of the interview rooms used

Reflections

Feedback from students was very positive and a very high proportion of students participated in the activity:

“

I have now statistical evidence to show that the Second Life experience that students went through was a huge asset. My retention is higher and my success is higher, my results are better. [In the most recent iteration of the activity] we had 100% retention and 100% success so I don't think you could get much better than that.

”

“

I had the advantage of being part of a project that was funded where I had a lot of money and the build was only possible because we had the funding from the government. Now you don't always have funding, but you still have access to a huge wealth of resources that you don't have to build yourself, so rather than use something that I built myself with the other classes, I was using what's already there.

”

Merle also discussed how fortunate she was to have had a project in SLENZ behind her teaching that enabled the resources to be created for use beyond the project:

Plans for the future

The SLENZ project concluded in 2009 with a final report disseminated in 2010 (see <http://slenz.files.wordpress.com/2010/03/slenz-final-report-milestone-2-080310cca.pdf>). Due to a change in the structure of the program, the Future Focus Career Planning subject/unit in which the virtual world application described in this case study occurred is no longer operating. However, Merle is very enthusiastic about the benefits of using virtual worlds in her teaching and described a number of more recent developments in her own virtual worlds work:

“

There is so much potential ... Already I have trained some of our lecturers here who are teaching at a preschool level ... Well what they're doing is they're sitting the students down in front of these big screens and they are acting out with their avatars in Second Life—they are acting out these scenes for them. You know the little people are just absolutely loving it I do have so many people who have approached me ... There is a huge amount of interest and it's not just from one area or one department. It's from all over the place.

”

5.6.3 Practising acute care medicine in OpenSim

Name: Dr Phil Blyth

Institution: University of Otago

Discipline area: Medicine

Platform: *OpenSim*

Subject/unit: Acute Care

Level: 4th and 5th year undergraduate

Delivery mode: Distance/online with no face-to-face contact, but virtual world activity carried out on campus using a university supplied computer

Students: 80 enrolled, 8 undertaking the virtual worlds activity

Years: 2010



Figure 5.8: An operating room used for learning and teaching

Learning context

The overall aim of the unit was for students to build teamwork skills in acute patient care. Creating a context allowing for students to practise acute care is difficult, so the subject lends itself well to the use of a simulation to allow practise of these skills in a safe environment:

“

The reason why we chose [to use] virtual worlds is because it is very hard to [provide a situation where students can practise] all the things that are needed to ... assess [an] acute patient care episode without large cost ... so if it's simulated then you can create it once and then just roll it out to as many students, you know you can scale it, basically.

”

“

...there's one example that we use here where you have actors that play the patient and then the students can ask investigation [questions] and you give them the answer on a piece of paper. The difference I think...is you're purely reliant on paying an actor to do that for the student whereas now you can have a student role-play it. And it's obviously easier to role-play in a virtual environment than in a classroom setting.

I mean the problem with the actors is ... they can give a history really well, but they can't necessarily have signs of heart failure or if you listen to their chest it will seem that they're healthy, whereas the condition they're portraying is supposed to be pneumonia or something like that. Obviously having said that, looking at an avatar and saying "Gee you're looking unwell today" isn't quite the same as [looking at a real patient either].

”

A common approach in clinical education is to use a real-world simulation suite with actors or other students playing the role of patients. However, there are clear potential advantages of the use of a virtual world to house the simulation:

“

[We] looked at Second Life and saw that there was an opportunity there to create a virtual hospital ... and I had seen a number of examples [of similar environments using] Second Life ... and critiqued those and saw a different way of doing things.

”

Development of the virtual environment

Having previously used Second Life, the team considered using this as a platform for this project, but eventually decided to use *OpenSim* instead:

“

So you've got a nurses' area, you've got a cubicle area, a room with a couple of cubicles in it and you've got a resuscitation area and then you've got a sort of waiting room type area. And then ... the nurses' station is all there, the things that you'd expect to find there in terms of the lab request forms and radiology request forms as well as the opportunity to review the investigations that you've ordered etc. And then ... all the things that you'd expect to find in terms of oxygen and ... a tray to put in a cannula and [so on].

”

The environment is modelled on a hospital emergency department:

Funding was obtained through an internal grant and also through a national (NZ) grant, and this allowed an Assistant Research Fellow to be appointed who assisted with the development of the environment and the design of the learning activities.



Figure 5.9: Avatars in the virtual environment

Learning activities

The learning activities undertaken by the students are structured around the normal patient admission process:

“

We set about doing as much of the patient admission as we could so that involved talking to the patient or, in our case [text], chatting to take a history to find out what's wrong with them. And then examining them—you click on the chest then [respond to a system query and indicate that you] want to listen to the heart and then you can hear the heart sounds. So examining them in that way and then the other parts of the medical admission ... choosing investigations so they click on the appropriate form to request the appropriate lab test etc. And then they review the results that they get from that and then they write a discharge note or admission note depending on what's happening.

So, it very much parallels what they do in real life. I guess the thing that's different in the simulation is that the students get an opportunity to manage the entire care of the patient whereas in the clinical runs they'll go and see a patient and maybe take a history or maybe do an examination, but they won't go the next step and order the investigations. [In the virtual environment] they would actually order them themselves and then do it themselves, interpreting the results ... and then plan the treatment.

”

Reflections

Although some technology issues were encountered, for examples, issues associated with the lack of stability of *OpenSim* at the time of the first instance of the subject, in general, the activity was considered to be successful. At the time of the interview, although a structured pre-test, post-test analysis of the students' learning had been undertaken, the results were not yet available.

Plans for the future

The stability of the virtual worlds platform was seen as a continuing barrier to the ongoing use of such environments:

“

Robustness of the platform [is] still an issue and [we] can only just wait for things to get better. I think that's one barrier and similarly the acceptance of the virtual worlds [by users]—I think it's just a question of time.

”

“

If you are in an environment where there's actually a real person at the other end, ... in the world that has got real issues or real scenarios, then it's incredibly captivating And I think an example of that is how people ... go in the world and do a scenario and they don't want to leave and step out of the scenario. Even if the technology is not working that well they still are so immersed that they want to carry on.

”

A feeling of overall optimism was expressed regarding the continuing use of this type of environment in a medical education context, particularly because of the student engagement that such environments and activities facilitate:

Name: Dr Helen Farley

Institution: University of Southern Queensland (note that this case study focusses on work done while at the University of Queensland)

Discipline area: Religious Studies

Platform: *Second Life*

Subject/unit: World Religions

Level: 1st year undergraduate

Delivery mode: Face-to-face supplemented by mandatory online activities

Students: 100 enrolled, 25 undertaking the virtual worlds activity

Years: 2008, 2010



Figure 5.10: Top view of Religion Bazaar

Learning context

The overall aim of the unit was for students to develop familiarity with a number of world religions and to gain perspectives about a number of contemporary issues involving religion. Prior to Helen teaching the subject, students were sent unsupervised to visit places of worship within the community. Helen thought this was not ideal for a number of reasons:

“

To start with, I thought that was a really bad idea because students are always very time poor and they don't necessarily have access to transport ... and, also, I thought it was just ethically the wrong thing to do to send students out to watch genuine religious practitioners doing their worship or participating in their worship and having students watch them like they were zoo animals. Another reason was because I wanted my students to experience a wide range of religions and St Lucia, where the University of Queensland is and where most of the students are living, is white middle class and there are churches and maybe there's a synagogue in Brisbane but there's not really many Hindu temples or Buddhist temples or Taoist temples or Pagan groups that they could readily go to, so I thought by sending them out to religious spaces, we were giving them a very one-eyed view of what religion was all about.

”

Development of the virtual environment

Helen obtained \$30,000 of grant funding, which included funding for a *Second Life* builder to develop an Island specifically for the purposes of this unit, containing spaces modelled on the places of worship of a wide range of world religions. Helen also attended a course on learning and teaching in *Second Life* and joined a *Second Life* mailing list and, through these, she was able to gradually build up a network of people involved in using *Second Life* for education. She was also able to identify possible *Second Life* builders who could be employed to develop the Island. Part of the funding was also used to employ a Research Assistant to research the requirements for various types of religious spaces and, with the help of this Assistant, she was able to provide the specifications to the builder.



Figure 5.11: Inside view of a place of worship on Religion Bazaar

“

I sent them on treasure hunts so I would give them a list of places to go to. I would say go to this place—this Buddhist temple here, this is the [Second Life URL]; I want you to find out what the noble eight fold path is all about for example. I want you to find out what Dharma is and I would have vetted these places so I knew they would be able to find out. I want you to take a photo of yourself meditating and email it back to me, those sorts of things so it was a combination of teaching them how to use Second Life without me supervising them and also getting them to learn content so that was the first part.

”

Learning activities

Prior to the development of an island specifically for this purpose, Helen used existing locations in *Second Life*:

“

When we actually did have a Second Life island where they could go to, I would ask them to take on an identity and to actually role-play part of a religious ritual or maybe it would be a historical ritual, something of some religious significance anyway. They would adopt a role and they would do that.

”

Once the Island was built, the activity became more of a role-play:

So that students could undertake the activities in an authentic way, Helen provided avatars with appropriate appearance and clothing:

“

I also equipped the avatars with all sorts of things I felt they would need, so they had implements and things like they would need and all the outfits they were likely to need.

”

Reflections

Helen encountered resistance to the use of *Second Life* and to the use of group assessment activities from colleagues within her discipline. Additionally, although the university was generally supportive, there were substantial delays early in the project due to Helen being the first within the institution to purchase space in *Second Life*:

“

UQ was deciding whether or not to be a member of the New Media Consortium (NMC) at that time; and the lawyers kept looking over that contract about five and half billion times and the same with the Second Life terms of agreement [and terms of service] and so it was really slowed down because of the legal processes and so I had a builder ready to go to build the buildings and we couldn't even get an island for her to start with so there were all sorts of scheduling problems because of that so that really impacted on my ability to plan

”

Because many students did not have adequate hardware and network bandwidth at home, most students were restricted to undertaking the activities using on-campus computing facilities. Some class time was devoted to the activities and students were also able to use a computer laboratory on campus outside of class time.

“

It's hard to tell how much of it was from the platform itself because, you know, like every new lecturer taking on a course, I changed everything about that course, so I changed all of the assessment; I changed the format of the lectures. I changed everything basically, so overall it went really well and students really liked [the redesigned subject, but [it is not clear] how much of that was due to Second Life.

”

Helen felt that the activity was very well received by students and the feedback from subject evaluations was very supportive, however:

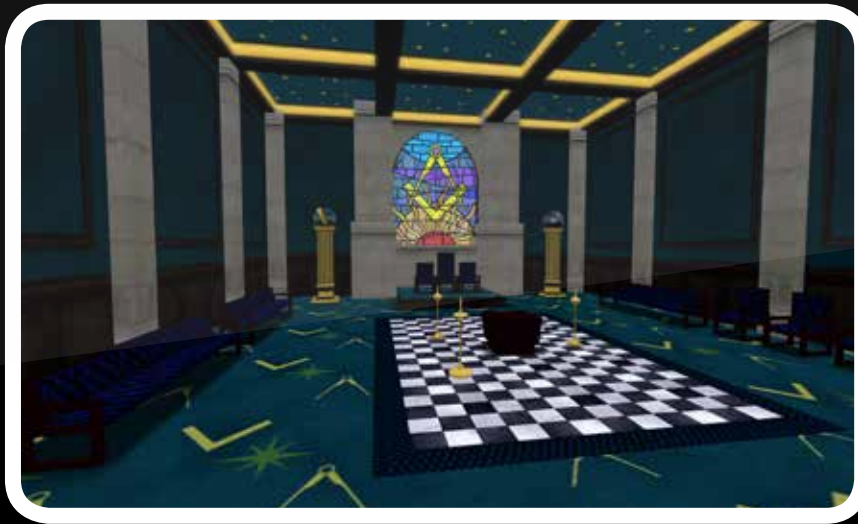


Figure 5.12: Another place of worship on Religion Bazaar

Plans for the future

Helen has now moved institutions and so is no longer teaching this particular unit. Her position at USQ is a research role, but she has been working with teaching staff in facilitating their use of *Second Life* in their teaching and the evaluation of these activities forms a part of her research. At the time of the interview, she was working on funding proposals for activities in Nursing and in Language Learning. She was also in the process of evaluating *OpenSim* as an alternative platform to *Second Life*.

“

I see the biggest value in using virtual worlds for teaching and learning is that you have the potential to transform learning from being third hand to being first hand, so having a direct experience rather than hearing someone else talking about an abstract idea and you have the potential to let students experiment in a completely safe environment.

”

5.7 Summary

Respondents provided 55 detailed descriptions of the way in which virtual worlds were used in their teaching and, from these descriptions, ten categories of learning design were identified, with a number of subjects including learning design features fitting into more than one category. The most commonly used learning designs were role-plays (43% of subjects), followed by learning designs centred on communication (40%) and learning designs centred on instruction (23%) and, then, designs incorporating place exploration and building/scripting (each 17%).

Interview participants described a number of different virtual spaces that had been developed to meet the specific needs of their particular learning context, including a virtual hospital emergency department, a virtual classroom, and a simulated street with retail outlets allowing students to undertake a business role-play. Others described the development of spaces designed for various types of online teaching, including amphitheatres, boardrooms and informal student meeting spaces. Some of the spaces developed consisted largely of static building and furniture, while others incorporated dynamic features controlled by complex scripts; for example, one participant described a virtual environment containing business outlets controlled by a complex back-end economic simulation. Other spaces relied on user interface enhancement allowing avatar control beyond that provided by default within the viewer software.

There were mixed views emerging from the questionnaires and interviews in relation to assessment of, or compulsory use of, virtual world based tasks/activities. The questionnaire results showed that in the majority of subjects (57%) the virtual world-based tasks were made either assessable or compulsory but there was a sizable majority (43%) where the tasks were neither assessable nor compulsory. The interview data allowed for elaboration on the reasons for this diversity, with some participants stating that they made the activities optional because they couldn't guarantee that students would have access outside of class time, while some made the tasks assessable but provided alternative tasks for those without convenient access to appropriate hardware and software.

With respect to evaluation, little systematic evaluation was described in the interviews, with participants mainly describing informal feedback mechanisms and some types of formal but not systematic evaluation. Most commonly, participants described informal student feedback or informal observation of student activity as the main evaluation mechanisms. Formal evaluation procedures predominately included student subject evaluation forms that were included as part of a university reporting system. Of those that did mention systematic evaluation, many referred to research projects associated with the virtual world implementation.

Five case studies have been presented here that illustrate a range of different types of virtual world-based learning activities and environments. A recurring theme across the interviews from which the case studies were drawn was one of enthusiasm from the teaching staff involved about the learning potential of virtual worlds within their specific discipline area and very positive feedback from students.

6.1 Introduction

This chapter draws on data from the interview phase of the project. Specifically, it draws on questions that asked both academic and educational design/development IT support staff to give their perspective and comment on their experience related to institutional context, future plans, wider use of virtual worlds, professional development and networking. In addition to these questions, academic staff members were also asked to reflect on aspects of their virtual world design and teaching practice. Section 6.2 discusses the perspectives of academic staff members interviewed, while Section 6.3 discusses the perspectives of educational design/development and IT support staff.

6.2 Academic staff

6.2.1 Reflections on institutional context

Funding issues were a common theme amongst the academic staff interviewed, with a number of staff commenting that only relatively small amounts of internal funding was available within their institution:

“

... a small amount of funding has been provided...but nothing significant at this stage. I think it's a bit of a wait and see approach...

”

A few academic staff reported that they did receive adequate funding to support their development and subsequent use of virtual worlds and that positive outcomes had led to continued support and interest:

“
...my school faculty allowed myself and a couple of other people to just play around with virtual teaching and have provided the funding for payment of the island, so that's you know, a few grand a year now, but they hadn't really known what we were doing in there, so they were quite trusting...I think that more and more, they're going to start looking at what we're doing and start making use of it themselves because they realise...we're making good things happen.

Each year I've had to request the next year's funding, and I sort of justified why the subject is being continued. I think that really, it won't even be a question for the next little while, simply because the university has to explore more virtual environments for teaching, simply because they don't have the physical resources to cope with the predicted influx of students next year.

...in terms of money and grants, internal grants, that was also very high. I probably received upwards of \$100,000 worth of internal grants to support the development of the courses and the research and the development of the island, so that was very good.
”

“
...to be quite honest, the institution really didn't provide me any support, it was really a case of me seeking out mentors, experts, groups, that I could communicate with and learn from.

...there was no faculty support, there was no funding...there was nothing of that kind. And all of the IT support and things that we got, was all done in a voluntary way...the person from the International Office would send over her IT person to help us.

I find the IT people here...are not supportive at all...but there was...the Vice-Chancellor...so I had high level support and [the university] actually used it a lot for marketing and making them look good.
”

There were mixed reviews about the amount or lack of management support received by academic staff within their institution. The majority of participants reported a lack of management support:

One participant mentioned that they had been asked to take on further work around virtual worlds but were not given any financial or time release support to do so:

“

My boss...he came to me...about a month ago and... said...that we need someone who is going to be completely in charge of everything digital. All the digital resources, all the training of the staff on the digital resources, the introduction of resources into the projects and he said “Would I do that job?”. So I said to him “Is there any release time?”...“Is there any remuneration, any funding?”“No” and he still thought I would do the job...since 2009, I have had no time release...I have constantly worked on it. I have been producing resources. I have been trialling things and I have done it all in my own time.

”

“

...[there was] minimal interest...I got the ethics through and that's because my Head of School had been to a meeting where they'd been talking about some innovative stuff and she came back and she said, “What are we doing?” And I said, “Well I did put through that ethics last year around having a trial?” “Oh good.” And that was that. So anything that's been done has been squeezed in around a normal teaching load.

...it was just part of my normal teaching time and, then, my own time.

”

Similarly, other participants chose to do more work in virtual worlds but were not offered any financial or time release support to do so:

Another academic staff interview participant mentioned that initially their university marketing department had concerns, but these were successfully overcome:

“

...probably the only impediment that I ever had was with our marketing group. When they eventually discovered that the Second Life environment existed, they were a little concerned about how it was portraying [the university] but I was able to document all of the processes that I'd done in preparation for their discovery and I had high level support.

”

“

... my biggest problem is there hasn't been a huge uptake of the use of Second Life by other faculty members, in any of the faculties, even though there was a lot of interest in being supported in getting and understanding and skills in the use of the environment, there hasn't been others that have wanted to take that on as their particular interest or focus and use the environment... I have had to go outside the university to seek other supportive colleagues and progress things.

”

A lack of interest shown by other academic staff members in adopting the technology was raised by one participant:

There were also accounts of where academic staff had received adequate support from various people and divisions within their institution:

“

...with regards to support, I emailed IT and asked for it to be put into that particular lab where I taught and it was done within a few days or a week ... it was fantastic. I had the support of the educational designer that worked at the university and he actually did a workshop for the staff, so then the staff knew a little bit more about Second Life... my boss was always extremely supportive of the things that I did.

I do have support at our various highest levels from our IT managers and our teaching and learning Deans, so that's never been a real problem, initially part of my process was to develop up a corpus of academics for the university to expand the use of Second Life throughout the whole university and, interestingly, that was very well supported, I was able to get quite a lot of academics, including several Deans of faculties, involved in action learning groups around the use of Second Life.

”

“

I think lack of institutional support and I suppose bureaucratic attitudes towards funding, and those sorts of things are the main barriers.

The legal people fought me on it... it's probably [the university's] view on it and...they said "Well you know we won't do anything until the first person comes to us and wants to do something" and, unfortunately, that was me.

One of the other things that I encountered of course was the issue from the university insurers, and those sorts of people, who were worried about the risks that were involved in it...students being exposed to things that were outside the normal learning environment, they kept saying, "Well what happens if someone walks in during a class?" And it's like, "Well that could happen, in the real world, too." So I suppose it's...the resistance to using technologies from the powers that be.

”

Several participants highlighted the other barriers/problems that were faced when using virtual worlds for learning and teaching.

6.2.2 Reflections on own practice

Academic staff were asked if they thought their teaching had changed in any way as a result of using virtual worlds and, if so, in what ways. Several academic staff interview participants commented that their teaching had changed, citing various different changes that had resulted from using virtual worlds for learning and teaching.

“

I think it's made me...integrate technology. I was already using educational technology as much as was appropriate previously, but...it's heightened my awareness of the importance of not just getting students to use technology but to understand why they're using it and how they're using it...it's made me see the importance for students, regardless of what they're studying, to be more reflective about their technology use.

...teaching it... with that fourth year course, to me I really learned a lot about supporting students while they're endeavouring to learn a new technology and talking to them about the possibilities in the future when they're teachers... I probably still take some of that and use that in my teaching now... virtual worlds were so new and so much more out there than what I normally taught... it really meant I was extremely supportive of the students... just that extra mile but at the same time that extra mile got fantastic results, so that was worth it.

”

Improving awareness of the range of ways in which technology can be integrated into teaching was mentioned by one academic staff interview participant:

“

I think I'm less anxious about getting people to do things that they might be resistant to, or things they might be confused by, so, using 3D virtual worlds as an example, for a lot of students its confusing, and it's a little bit scary, it's overwhelming; all of these things.

I've been perhaps less experimental and less anxious about getting students to do strange things. I've become probably more directive early on, I've sort of developed some ways to get people comfortable with technology really early, and that works for any kind of technology, I guess. Orienting people to technology is probably the best thing you can do, if you want people to use it, rather than just saying, here you go, here's the new computer, or here's the new technology, off you go it'll change your life; that doesn't seem to work. So, walking people through it, giving them a little bit of a guided tour, if you like, seems to make a big difference—putting the effort in at the beginning of the journey, I guess ...

”

A couple of academic staff interview participants commented that they were less anxious about using/integrating technology as a result of using virtual worlds and that, being less anxious, they were able to find ways to make their students more comfortable with using the technology:

Virtual worlds were also seen as a way of providing a different teaching 'space' or medium for teaching and learning, with academic interview participants noting that it allowed for more effective teaching of content, as well as providing first hand experiences for their students:

“

...how did I change with virtual worlds? It just gave me an extra teaching space. I look at it as a different teaching space. I was able to teach the same content more effectively because I had a far more effective space to teach in. I hope I keep changing too. Just since I've started in virtual worlds my use of virtual worlds has changed. As I've said, I see no limit to what is actually possible there at the moment.

I have really learnt the value of experiencing things first hand... what I would have done before Second Life came along is I would have put a PowerPoint...had some... pictures of what it means to be a Muslim but I'm not a Muslim and I don't know many Muslims so learning is very much third hand. I'm telling them about something I haven't even directly experienced myself... with Second Life what I can do is I can send them into Second Life and I can make them be Muslim. I can dress them up in the garb... they have a direct experience of what it feels like, obviously not totally but it's... more than they would have got just watching a PowerPoint.

”

“

It certainly extended my skills and capabilities in terms of being a synchronise[d] online teacher and facilitator...I actually think it's made me be a little bit more laid back and a little bit more flexible about it, and I think that's probably been a good thing for me as a teacher.

”

Other academic interview participants mentioned that they had improved/ increased their skills in relation to using the technology for teaching and learning:

Comments were also made about academic staff finding the unpredictability of virtual worlds uncomfortable or threatening:

“

...when I first came into Second Life I wanted to control the environment like I used to when I was teaching in our ... multi object oriented [MOO] environment...I'd been teaching in that sort of environment for over ten years and I felt very confident with it, knew exactly what to do... I really thought I controlled the environment...coming into Second Life I've had to be a bit more relaxed, I have to come to terms with the fact that you need to just go with the flow a bit more, because there's, it's such a complex online environment, so many things can go wrong, whether it's in-world or with different people's technology.

...for other teachers the answer to that question is yes, it does transform their teaching style, it makes it very challenging for them because you move into an unsafe environment... you become more like a consultant than a teacher in a way...it's not safe anymore...you don't quite know what is going to be thrown up at you because the environment is such that it's not totally predictable. It is driven by what the students do in environment and what their needs might be.

”

Further to teaching staff feeling anxious about using virtual worlds, one academic interview participant highlighted the importance of a student-centred approach to using the technology:

“

...if you were a new teacher you'd find it really threatening.. I've got a couple of new people here on staff and I just see their anxiety... you wouldn't want to be doing this if you hadn't already had some experience. It just reinforces perhaps about keeping it centred and focussed on student learning...you've actually got to set up right from the beginning...So, that it is on the learning not on the technology, because if you ask the students there, so what did you see going on? And they start talking about the technology, boy, have you got it wrong ... technology is just the tool, the medium to do your magic, but it can make it more realistic.

”

“

My teaching's always been this way, it's just I've lacked the tool that can allow me to really hit my straps...I've always believed you learn nothing unless you get a chance to do that...I've always in my teaching [tried] to emphasise the practical and always tried to be highly innovative in the approaches that I use and have been frustrated in trying to find something that does exactly what I want it to do.

”

Some participants noted that their teaching had not changed as a result of using virtual worlds, rather it complemented and/or enhanced their existing teaching style, again highlighting the importance of student-centred learning:

The importance of relevance when using virtual worlds for learning and teaching was raised by one participant, stating that there had to be a 'match' between the technology to the content/context of the subject/discipline area:

“

...it was never particularly important to me, to actually teach so much in virtual worlds. Apart from giving the students a bit of hands on experience, I have no desire to, in any of my other subjects, where it's not contextually relevant, to replace any of my classes with that...it doesn't really add anything I think, to what it is that I'm doing...for me, and the way in which law is taught, and the subjects that I teach, I can't see it replacing anything that I currently do...I see it as a knowledge area that you need to acquire, but not an environment that I necessarily need to teach in, or that's going to add anything for my students.

I'm a compulsive technical—got to try every new toy that's imaginable...if I play with it and it's just not benefiting my students, then, I don't do it again but my teaching kind of—I roll with it and I don't know—I just use what I can as it comes within the context of what the objectives or the aims of the course are.

”

6.2.3 Learning design

Academic staff members were asked a series of questions in interviews which related to/required reflection on the learning design that they used for teaching with virtual worlds.

Several participants commented that virtual worlds provided a more 'active'/'alive'/hands on style of learning, noting increased engagement with learning tasks, ability to create learning tasks where students could practise skills in a safe environment with less/no real-life risk or concern (if error occurs):

“

...anything that gets people to think differently about themselves, I don't know it just seems to enliven a class. There's something about it. I think it brings to life many concepts that would otherwise be very abstract or very theoretical... because they're creating another self, they think differently about the whole idea of self and the whole idea of identity, because they're actually creating one, and that means that anything to do with sort of social psychology, or I guess the sociological sort of studies of the self can be really [explored] in living colour in virtual worlds.

...these examples of virtual worlds offer a means of teaching that the real world doesn't - you can do things in a virtual space that you can't do in the real world.

...student teachers do not get the opportunity to practise their classroom behaviour management skills; it's too difficult to get access to a real classroom with real students, so the reasoning behind the project was to give them some practise in some of the principles of classroom behaviour management. The reasoning behind the tasks that we would give them in role-playing these students or role-playing the teacher is to that end; for them to practise their behaviour management skills.

...was great to have them working together in virtual environments and to really shift the mode through which, or the mode in which they collaborate and communicate with one another, and relying on texting or meeting in virtual environments and becoming aware of the problems that arise from those situations and, again, the affordances of those sorts of technologies.

”

“

I originally wanted to use virtual worlds with this subject because traditionally ... we used to send students out to real religious spaces so we would send them to a Greek Orthodox church or to a synagogue or whatever to talk to the people who were worshipping there and to talk to the authorities there; whether they be priests or monks...there was a few reasons why I thought that was a really bad idea...students are always very time poor and they don't necessarily have access to transport and we couldn't afford to take them ourselves because that was all during the time when public liability insurance became horrendously expensive and we weren't allowed to do anything, so we had to send students out there sort of unsupported...it was just ethically the wrong thing to do to send students out to watch genuine religious practitioners doing their worship or participating in their worship and having students watch them like they were zoo animals.

”

Further to being able to have experience in a 'risk-free' environment, one participant commented that the virtual environment provided a multitude of opportunities that perhaps were not readily available, accessible or ethically sound in real life:

“

...it's a very novel, unique way of delivering the course and a lot of our students...are international students, predominately Asian Chinese and they're just not used to that way of learning, they're very used to a passive learning style where they're given resources, they go off and they memorise them, come back stick it back out, that's the course done thank you very much. But...they were able to work out the game so quickly... within about a month, they were coming to us pointing out to us the limitations of what it could do, what they'd like it to do... once they got over the hump of "Okay, how do I actually succeed in these activities, how do I actually go in-world or do these activities to get a successful outcome, what else can it do?"... what that said to us is that they're extremely engaged in the activities.

...just to get them engaged with the process and, I suppose, sort of break down preconceptions a lot about what an avatar was and what a 3D world was...although we attracted some geeky types, we got some people who were just curious...some students [were] really resistant to Second Life, and I'm thinking, well, why are you taking my subject? But there's something that, I guess draws people in.

...the relationship you have with your students is different to the one you have in real life...you have a whole new set of boundaries, but there seems to be...it seems to be a closer relationship with your students when you're in a virtual world together...all the little cues are missing and everyone's got a silly name, and everyone looks a bit silly, so it knocks out a few of the things that would divide the student and the educator.

”

Some participants also highlighted that the type of learning environment and pedagogy offered by virtual worlds was initially an adjustment for some students, particularly those more familiar or comfortable with a passive style of learning:

6.2.4 Future plans and wider use

Academic staff were asked in interviews to respond to interview questions relating to their future plans for the use of virtual worlds in their learning and teaching, including whether they would continue to use and/or explore the use of virtual worlds to accompany their teaching strategies. Some participants indicated that they would continue to use virtual worlds in their learning and teaching:

“

I will continue and, hopefully, it will continue and get better and that virtual worlds will be introduced into mainstream teaching as an alternate way of teaching and learning in schools.

....my plans are to see how they can be used effectively in vocational situations... we've got some engineering focus and we've got trades like builders and things like that, and we also have hairdressers and business administrators, and we have degrees as well... in terms of the teaching I'm probably going to head towards the more vocational area and basically see how that works. If it works well, that's what I'm going to be doing for the next—till the end of 2013 any way. Those are my immediate plans.

”

“

I think my immediate future plan is to continue to use a Second Life learning centre for the subjects that are currently using them. There's... a new academic coming into our school next year, who has done some work in Second Life before, so that will be really great for our school to have another person who already has a skill set. In terms of other future plans, we've got a little bit of money there that could support the design of other learning spaces.

”

One participant indicated their interest in continuing to use virtual worlds for learning and teaching, but noted that they were facing some difficulties trying to achieve this:

“

...there's a lecture and a tutorial for Second Life... I tried to book some collaborative teaching labs and I couldn't so I'll have to see how it goes with that as to how I'm going to teach it.

”

“

It's like I have become busier and busier, and have less time to spend in the [virtual] world. So, my skills are probably becoming less, and I changed institutions and I think that it wasn't so easy for me to access my online environment, and I didn't have that same group of colleagues anymore. So, in my case, it's diminished. I suppose though, that said, that has given me the impetus and I suppose the confidence to explore other sorts of 3D environments. So, I suppose my confidence as a gamer, for example, has increased.

Probably not, no, unless I was again teaching a virtual worlds [subject] but that's not on my horizon...I suspect that I will return to it, in some point in time.

”

Other participants indicated that they would not continue to use virtual worlds, reflecting on their recent lack of use and factors contributing to this:

One academic interview participant indicated their hesitation with regard to continuing use of virtual worlds for learning and teaching, subject to further evaluation of the benefits to students:

“

The plan is to investigate it further and then I guess ... assuming that it...provides a valuable way of teaching/learning then... [we'll] get it into the program in a small fashion...we need to be sure that it's not wasting the students' time. I mean, certainly all the students that have gone through it have said that it has been really useful but is that enough to say "Look, let's stick it on the curriculum".

”

“

Future plans also included things beyond the own academic's use of virtual worlds for learning and teaching; for example, larger school based projects, training for other staff and research higher degree projects:

Our plan now is to put this into the school system, into as many schools as we can here in Australia and internationally...In both business organisations for the training of their staff and for educational institutions and organisations for the training of the students.

I would like to teach educators how to use it. I'd like to get my colleagues and my institution, ...you know, even if they're not all going into virtual worlds and teaching, I want them to think about, you know, you're going to have to leave the whiteboards and the PowerPoints behind some time...getting them to think about a future where we teach differently, where we're not standing in the centre of the class...there's no escaping it.

As I said, my PhD, I want to look at the transferability of skills learnt in Second Life to real life... I want to be able to do something that will work towards my PhD and ...will benefit the department at the same time...I want to include some very practical skills and some of the literacy skills and, hopefully, some of the soft skills as well.

”

One participant described some further research they were doing in relation to advancing the current capacity for virtual worlds, in particular *Second Life*, to mimic real life body movements and gestures:

“

...one aspect that I'm really keen on at the moment is linking ... reality and Second Life and being able to mimic or to mirror human body movements and gestures and all of those sort of aspects and the technology is almost there but not quite yet, so that we can have our webcam set up and using [Xbox] 'Kinect' type devices mirror in Second Life all of our body movements so that we get a much greater sense of presence, and I tend to speak a little bit with my hands, ... and being able to use that in conversation in a virtual environment or in online education is something that I can see being very advantages...the sense of presence is the biggest thing I see as an advantage of Second Life and I see that ability to mirror body gestures will make that expediently more effective.

”

“

I think we should be using public virtual worlds. I think everyone needs to join the one virtual world, apart from it sort of being cheaper and less technically demanding, it will just give a more meaningful experience for students and educators and researchers...I keep hearing that people want to have these little customised little virtual worlds, but I just don't see the point in that, so I think there needs to be a shared platform...we all need to be using something similar, and maybe, even developing conventions around the use of these worlds, these virtual worlds.

”

Reflecting generally on the future of virtual world use, one participant suggested that the direction for the future should be towards more publicly accessible spaces rather than private spaces:

Participants were also asked what their thoughts were on the value and feasibility of wider use of virtual worlds for learning and teaching. Some participants stated that they could see value in wider use of virtual worlds for learning and teaching, but there were still some issues/barriers that possibly interfered with wider use. One of the issues was related to bandwidth:

“

I do see a huge advantage in using Second Life for our class students, for our distance students, for everyone and as the technology improves so the feasibility of using it is going to improve dramatically. I think we are only held back at the moment by things like bandwidth and not having grunty enough computers, and these are the things that are holding us back. Once the technology catches up with what we're doing I think there's no stopping it.

”

“

I think the biggest problem, and I have it here because like distance learning classes can be very big...classes of hundreds and hundreds, and you can't have that many concurrent users on a sim in Second Life, and I think it's a real stumbling block to you know being implemented more widely here. Not that all teaching needs to be synchronous, I don't believe that it needs to be, but we still need to probably have more concurrent users than 40 or 50, which is probably the maximum feasible number of students to have in the environment at any one time.

”

Another issue raised was that of the practicality of having large numbers of students within a virtual environment for learning and teaching:

“

...you won't have something that has widespread use unless it's flexible in its use. And it has to be adaptable to a range of situations, and that's about having an environment that people can attach their course content into and, then, bridge it with activities, in that world...you need to have a world that enables that and has an enormous amount of flexibility in what you can do in it...they've also got to have some structure and sense to it, otherwise it just becomes another fantasy world...it [also] has to have some underlying illogic in the sense that we don't live in a logical world either, there are variables and randomness and things that affect things.

One participant described what they felt were necessary aspects to consider in developing an environment so that it attracted more widespread use generally. Things such as trying to make the environment as real as possible, including considering the unpredictable nature of real life when developing an environment:

The value is in that plus the ability to communicate with people in a sort of social manner, which is not always facilitated by flat systems. The other thing is simulations that virtual worlds or game worlds or virtual simulations give us an opportunity to practise make mistakes, and this is the simulation aspect and it's safe in lots of different ways and social ways, and there's a stage, if you wanted to take it to the aircraft simulators as simulated—just very specialised ones—that sort of thing where you could learn how to fly a large 747, before actually hopping on board it, is going to become more prevalent, and that's the value of it.

”

“

...you have to be intelligent with how you use it. You can't just use technology because it's there. I get quite angry when I see people just jumping into a new technology and doing something really stupid or reinventing the wheel. Looking at the pedagogy, the aims, the objectives and why you are going in there in the first place and then designing the activity with the students in mind.

...there's potential there but just got to make sure that the focus is on the learning. It is so easy to get caught up with the hype of the technology and what you can do and, if it's really going to work, it's got to be about learning.

”

Several participants highlighted the importance of using the technology with clear intentions and outcomes, not just using it because it is available:

6.2.5 Professional development and networking

Participants were asked questions relating to their initial interest in virtual worlds and the development of their skills and familiarity with virtual worlds. Many participants described themselves as being self-taught in terms of virtual world use, referring to the fact that self-exploration of a chosen platform and time was required to develop skills and familiarity:

“

Considering what I teach or how I teach it, I probably have minimal skills but, basically, I just signed up and I went in there and I learned about it and spent a bit of time in there... Yeah just self-taught and try to be time effective.

...it was very do it yourself, and it still is do it yourself... maybe that's generally ... I like to nut things out myself in teaching, I don't want to be presented with; here is this beautiful island, in which you are going to teach; I need to build it around my own specifications and be able to modify it on the go.

To start with I just did a lot of wondering around hoping to stumble upon all the fantastic things that I'd heard about... I still do it now—if I am deficient in a particular area I will just go along to a Second Life building class or something like that.

”

“

I think... if there was an academic who wanted to try this out, I'd be saying, find a buddy and do it with someone, because going into a virtual world by yourself can be such a lonely experience and you won't enjoy it, there won't be that same element of fun. It's a bit like going exploring, going travelling somewhere and doing it by yourself, it's nice to have other people to do it with.

”

One participant commented that familiarity with virtual worlds was best explored with other people in-world:

“

...[it's] great because it means that we all get together and we can talk about possible collaborations...we have put out papers and we are working on research proposals and doing all those sorts of things and I go to most of the meetings.

It's such a vibrant educational community, all of the people ...come from all different walks of life, and it's not just educators, there's psychologists and there's artists and a whole range of other sorts of communities as well.

...for a more academic orientated group such as the Virtual Worlds Working Group, it's more about finding out new opportunities to collaborate in research and in grant writing or journal writing or conference presentations etc...[for] some of the more informal groups, it's more about exploring where the technology is going and sort of being at the very cutting edge of that technology and, then, [for] probably more traditional groups... it's more supporting the use of virtual worlds for professional development and encouraging other people to use virtual worlds for educational purposes.

”

Several participants indicated that they had collaborated/networked with others, including small collaborations to large group collaborations/memberships and highlighted the benefits gained from belonging to such group/collaborations. Several participants spoke about publication opportunities that arose from belonging to groups/communities within the area of virtual worlds:

Others mentioned that belonging to interest groups/communities was a great way to share ideas and learn new things about virtual worlds that can be applied to learning and teaching:

“ I’ve worked with [another experienced Second Life teacher] who basically was very instrumental in showing me what she had put together with her [virtual world environment]. So, of course, they’ve all been instrumental and helpful in just getting an idea of what you can and can’t do.

...we started discussions to collaborate on teaching in-world, trying to work out how the two universities’ teaching interests and needs overlap to create a course that students from both universities can participate in to get that internationalised experience. I think...[we] wanted to use Second Life to connect our students from different campuses and to connect students with people from around the world...[to] allow for those sorts of cultural experiences that they wouldn’t otherwise, necessarily have.

I think it’s about networks and about learning more about how to use Second Life in my teachings so that then I improve my teaching and I give the students a better experience...The other thing is...because I get the emails I know that they just did a call for papers for a special edition of [a journal] and I look at my data and go “perfect”.

There’s quite a few commercial orientated groups that I’ve been sort of part of ... and these groups focus particularly around commercialising the use of virtual worlds and some of them involved the commercial game industry and the use of virtual worlds in that respect, and I’m interested in those in terms of the potential educational aspects of that, but they do have a very different focus and one that I’m not particularly interested in ...but I am aware that a lot of the money and resources are being put into the commercialisation aspects, so I do need to be abreast of what’s happening with that, but I don’t want to be drawn too much into those aspects.

...it’s kind of like seeking out people to try to connect with people and be a member of different communities of practice, because that kind of grassroots contact with people is really how you learn, how—it helps motivate you, it keeps you going, you’re getting that encouragement and that support and that reinforcement from people who understand what you are doing...When you are working in any kind of educational institution and doing something like this in virtual worlds, a lot of people just think you’re just a geek and that what you’re doing is quite trivial ... they don’t understand the power of the kind of learning environment, kind of like birds of a feather really isn’t it, if everyone’s together and you’ve all got that same understanding, you all understand, you all kind of understand the power of the medium in which you’re working and it’s really nice to celebrate that with people.

”

“

I've co-written a paper with five other academics from that Virtual Worlds Working Group...that's been really great because when you're co-writing a paper with people from different disciplines, and you all come together and have to somehow work on the commonalities and stuff of what you do—it really provides a really nice rich professional engagement. So that's been fabulous.

”

Another participant mentioned that they had worked with others on virtual worlds-based publications:

One participant noted that being a member of some of the collaborations was a good way to pass on information about the work that they were doing, as opposed to taking away/learning from the group itself:

“

I am just really a member of those ones in case I need to disseminate information rather than gain it myself.

”

“

I've reached the point, I had been attending up 'til then, more recently I'm now really struggling with... really trying to see the benefit in it...trying to struggle with its relevance. I think, a lot of people are...using it as academic research activities...I'm not sure that that's going to advance the cause some way. It might advance your ability to get whatever you need... to survive in an institution but I'm not sure that that's advancing the future of virtual worlds. ... So, it's fine to sit around and pontificate about research this and conference that and conference this. Quite frankly, where I'm at, at the moment, is making this thing happen and making virtual worlds a reality in learning environments, that's where my head space is at.

”

A couple of participants commented that they didn't see the benefit of belonging to a particular group, highlighting that some people were more focussed on career advancement/opportunities rather than improving/enhancing student learning and their own teaching practice:

One participant described the issues they had with meeting in-world with an interest group and that due to this, their attendance and participation in the group has declined:

“

I initially, was... I really was interested in what was going on, but I found that the way that it met in-world was just bizarre... going to those meetings, and it was required that you use your real name, that people refer to each other by their real names, there seemed to be a real, almost like a resistance to the technology; that made me think, what are we doing in here anyway. I, in the end, didn't find attending the meetings that useful and, I think, probably I was put off by this, just sort of the set-up of not allowing you to use your avatar's name, which I found really strange... I haven't found taking part in meetings that useful, so far. Even though I think Second Life is really, really good for conducting meetings, but it requires everyone to be in-world not kind of one foot in and one foot out.

”

6.3 Educational design/development and IT support staff

6.3.1 Reflections on institutional context

“

I would say as of this moment less supportive... probably the lack of growth in the interest of using virtual worlds in teaching, so the continued sort of low level involvement of teaching staff... there is always a couple of projects on the go but there is no real growth in that. It's not like we suddenly need another island or, you know, we suddenly have large groups that are very interested in using it, so it's probably the wait and see phase has probably finished, and we've waited and seen and we've seen that there's not a growing demand for it in our institution.

”

Several participants commented about the lack of overall support and/or enthusiasm for the use of virtual worlds for learning and teaching within their institution:

“

...generally, they're interested in the technology. I guess they're interested in a potential for the technology. There isn't...there's a small amount of funding provided... nothing significant at this stage. I think it's a bit of a wait and see approach... there's certainly a stronger emphasis on teaching through learning technologies, and I think there will be more focus on these types of virtual environments in the coming years, but at the moment I couldn't say that there's—the interest is there but there's no [commitment] financially here for it, really.

”

In some cases, the support from the institution was present in terms of recognising the potential of virtual worlds for learning and teaching, but this interest was not matched in funding required to support such endeavours:

Interest from academic staff to use virtual worlds was raised as an issue associated with gaining and maintaining institutional support. Participants mentioned that time commitment and continuity of interested staff were issues in terms of on-going use and improvement of virtual worlds for learning and teaching, as well as continued and increased support from institutions:

“

...[the university] is very supportive of new initiatives, the problem is then, you need someone to keep it going. And so, when someone leaves...having to keep that going...to keep the interest going and really, move it forward a little bit more...they're supportive of it, but they haven't proactively said we're going to have virtual worlds for all our courses, or anything like that.

I'd say it was very narrowly; well, the use was very low. It wasn't discouraged. It had support, but I don't think there was a lot of interest in using it until recently and, even then, it's a small amount of interest...I think that just because of time resources.

”

“

It [the university] has got a space that has been funded and it just sits there and hasn't been used... To my knowledge, it is still sitting there and still not being used...so no-one's using virtual worlds...and it won't be used either because there is no one to drive it. If there was going to be someone to drive it, it would be me.

I think other people are flirting with the idea, but it hasn't really gone beyond that...Not happening at all to my knowledge.

I don't think there is anyone interested in doing that work in my institution at the moment. They're just getting their heads around [it] ... I don't think there would be anyone interested in doing virtual worlds.

”

Interestingly, some participants described scenarios where the resources/technology were available but interest from academic staff was lacking:

Only a few participants had a good understanding as to how widespread the use of virtual worlds for learning and teaching was within their institution. The majority of participants indicated that use was not widespread:

“

...say there's five schools I've just named, I would say, at the moment, there's one or two staff that are involved, and so we're looking at about 10 or 12 staff members who are involved actively in building and getting ready to engage students. There are more staff that are involved in getting themselves ready, but these, say, 10 or 12 staff have the specific intention or have already commenced using it with students... over the last 12 months.

It's very small, it's very small and it's really ... and then any ... activities...as far as I know there's only, probably only two or three staff using it...quite small ... faculties ...[only started using it] about the last two years.

...there's a few pockets of people who are using it. It's used, probably most broadly within the Faculty of Education, and there's a strong interest [from a group involved in] advanced learning and teaching, which is very interested in the possibilities of using Second Life for teaching.

”

“

The institution is currently only doing experimental work. It's not a mainstream thing. It's used in a number of faculties but I think it still has an experimental feel to it. If those continue to be successful and they see them as valuable, I would imagine that they will expand the use and build their mainstream system, but at the moment, it's all grant funded experiments. It's not core technology. In fact, I don't know of any Australian institution where it is core technology yet.

”

Others commented that, although the use of virtual worlds was not widespread across faculties, support did exist within the institution:

Conversely, comments were made about the difficulties of funding and resource support related to increased use:

“

I could say that on an understanding that there are isolated pockets of activity occurring using virtual worlds, that there was certainly an attitude to facilitate where possible use of those environments without having to spend a lot of time and resources doing so. So, it's sort of, there's a positive attitude to try and encourage diversity in the use of technology and certainly choice and an understanding that different people will use different tools to help in their learning and teaching activities... and that is certainly supported but it really hits the crunch time when it comes to the question of resources. If someone needs to spend money or, more challengingly, needs time from staff to support things, that's when you really sort of get an indication of how much support there is for something, and we haven't had to do that, so they haven't been tested in that area.

”

“

...there's no specific policies no. We would just use the general guidelines IT use and social media policies that we have in place at the university.

It's still experimental and those kind of guidelines and policies haven't been developed, beyond saying we have to consider as we would any other online technology things.

No ... guidelines or policy, I sense that it's used as a bit of an experimental thing...it's used...for a small group of people who'd like to spend a lot of time trying new things.

”

Many participants commented that no specific policies/guidelines had been developed for the use of virtual worlds for learning and teaching within higher education institutions:

A small number of participants mentioned that their institution was in the process of developing such policies/guidelines for learning and teaching using virtual worlds, with one participant stating that this documentation already existed:

“

...we're in the process now of developing guidelines, the reason we haven't... explicated or formalised those at this point in time because we still sort of are seeing this as a pilot program, it's only been something that's been run in one subject and it's only now that we're [including] other subjects. And now that we are doing that and we're engaging more of the teaching community, we will be putting down formalised guidelines for its use.

I don't know if any specific guidelines or policies have been formulated but I do think that there are discussions underway.

...there is a formalised policy act...[it] was formalised I think in 2008 so it's a while ago now, the policy is clear cut...they have very formalised, very good policies for how to go about purchasing land in Second Life, about how to set up your environment, where you're using it, all that's been done very well.

”

“

I haven't seen any policies or guidelines, now that's not to say they don't exist but I certainly haven't come across it...it's something that we're happy to facilitate but haven't really had much need to get involved in...there's very little requests coming through and it's certainly not one of those issues, I know that some institutions are quite active and...were spending a significant amount of time and money and resources developing their virtual world presence...[they] tackled and used the technology in fairly sophisticated ways.

”

One participant indicated that they possibly had a lack of awareness/knowledge of specific existing policies/guidelines with relation to using virtual worlds for learning and teaching. This was attributed to the level of involvement with virtual worlds that the IT support staff participant had, which was also related to a lack of demand for support in the use of virtual worlds by academic staff:

6.3.2 Future plans and wider use

Educational design/development and IT support staff were asked about future plans for their institution as a whole in terms of continued/further support for the use of virtual worlds for learning and teaching.

“

...at the moment we are looking at integrating the accounting activities for the accounting subject in with business So, what we're doing is we're actually creating exercises and extending the business model so that the business management students in their role plan, the activities for their course, create general ledger documents and spreadsheets which the accounting students with their avatars will then use to do activities for accounting subjects.

”

An expansion of existing resources and support for virtual worlds with institutions was described by some participants:

Some participants talked about a move away from current platforms due to financial reasons:

“

...it's a definite strategic move to move away from Second Life to OpenSim and that's for the reasons that I mentioned before, no other reason but OpenSim best suits our purposes for what we want to achieve. So no, we're looking at a range of things; so yes, we do—we are looking at different ways of supporting it, so at the moment we are only really interested in locally hosted ... but we're also looking at ... centre hosted solutions as well.

”

“

We plan to not renew our contract with Second Life in the second half of this year, but just recently that's probably changed with just a couple of ongoing projects. It's probably making it worthwhile for us to renew for another six months, so our plan going into this year was to probably finish up with Second Life support in late October, but to look at cheaper alternatives with open source alternatives in that time, but as of now, I would say chances are we will continue with our use of Second Life into the first part of next year.

”

Others commented that they were staying with the existing platform for now, but looking to move away to cheaper alternatives:

Rationales as to why support for virtual worlds for learning and teaching would continue included interest from staff and the capacity for virtual world learning and teaching to support universities with a large proportion of distance students:

because there's just enough continuing interest from staff and there is probably just enough happening in the wider higher education community in terms of virtual worlds to warrant us keeping an eye on the space and maintaining some presence in virtual worlds.

I think it is very feasible because [the] university has always been a dual mode university... and now that we're looking at converging those modes into a core offering for students regardless of their enrolment kind...we're looking at providing a core learning experience that will be accessible to both cohorts. The virtual worlds is certainly something that fits that role...we have a lot of people who need a lot of flexibility in their learning and the provision of experiences and activities in the virtual worlds environment offers those opportunities.

...specifically, this new development for, you know, the international doctoral supervisors to get together and discuss as a community of practice, that's a particular thing that we can't do very effectively in any other way.

”

The effect of positive feedback on the use of virtual worlds for learning and teaching was identified by one participant as a key factor in determining the support received from the institution:

“

I think it's going to be based on use cases and how successful it is for learning and teaching, so the more positive feedback, the better retention, the more student ratings that are affected by it. It's data that will drive that decision making.

”

“

...we will definitely [support it] if we get more people doing things in Second Life or virtual 3D worlds, but I don't think ... is going to become a major... I think the majority of academics in my institution ...[see it as] too much work for the pedagogy...[it] needs to be more appealing to especially those ...already looking at stipulation, scenarios, role-plays... or something... content-based.

”

Some participants indicated that they didn't see a future increase in the use of virtual worlds at their institution, noting the time commitment involved in developing a subject using the technology:

Participants were also asked to comment on the feasibility and value of more widespread use of virtual worlds for learning and teaching within their institution. Mixed responses were received from comments that showed a disinterest or lack of understanding about the potential of virtual worlds to comments that indicated the institution was very supportive about continuing and in some cases increasing support for virtual world use:

“

I don't understand the pedagogical advantages to using virtual worlds so, from that point of view, I couldn't comment.

”

Some comments indicated that although the resources/support would be available, the educational design/development staff did not see that an increase of interest to use virtual worlds was likely:

“

I think it's fairly feasible with the set up that we have here. I don't think it's likely with the level of interest that we have had over the last two years...I think the current status quo will probably continue with one or two projects happening at a time but widespread use not occurring...it kind of depends on the teaching staff and their enthusiasm for it. I have not seen a huge amount of enthusiasm for virtual worlds from the staff in terms of going and using it themselves and integrating it into their courses and units, so I just don't think the interest level is here with the people that we have at the university.

”

Some participants indicated that institutional support for virtual world use would continue in the future, with an increased interest in engaging distance education students:

“

...there's an interest there and that, as more of the results of some of the work that's already been done with virtual worlds is published and gets the attention of the executives, I think there will be more focus given to it. The university is always looking at ways of engaging more students, particularly remote and mobile students, and younger students who may already have an experience with Second Life may find it attractive if the university is offering courses through a virtual world to attract them to the university, and these days the university needs to operate as a business and the students are our customers, so whatever we can do to attract more customers, more to them.

I think there's particular value for distance students because all the research says the distance students have a very high dropout rate and the retention rate and a lot of that is [because] they feel very disconnected from their institution. They feel a large transactional distance between the teacher and themselves and, in the research I've just done, that transactional distance was very low between the teachers and the participants because of the virtual space, because of that feeling like they were there together, and it uses a lot of synchronous communication, which they don't get in other online technologies.

”

“

I don't see the advantages of students...logging into Second Life, getting an avatar, styling an avatar, and then going and learning about navigating and moving your avatar through the environment and operating equipment ... I think that for...activities [which involve] changing a parameter and then testing it [are] probably quite good... there are several in Second Life where you can do tests, ... change the parameters and get results, and reflect on and draw conclusions from the changes to your results because you've changed the parameters. I think there is potential for that, but it needs to be a little more accessible, a little less difficult to get in and learn the environment.

...there's value, I think in areas such as the medical [practice] ... demonstrating how things should work, you know; getting involved in practicals, getting involved in environments where it's not feasible to do it in the real world.

It's going to be a challenge in terms of changing the mindset of some teachers, now it's not just, I don't think to be honest with you, I don't think it's just to do with virtual world technologies, I think this is just a much wider view about technology use by educators or by teachers. You just get some who feel comfortable using technology in the classroom and others who are not so comfortable and, of course, it's a spectrum of experience, we're not talking about they either love it or they hate it, there's lots of ... in between as well, and you'll get some teachers who, once they master a technology, they love using it, but they're very resistant to change. So, you really...it's a matter of implying a lot of basic change management principles, it's a matter of engaging them early, a matter of making sure you get the right sort of training to the right people ... it's a very different mindset, so that's why we've taken a year basically to see how we manage four teachers in one subject, get their feedback and tailor any ... limitation strategy, training strategy for the other teachers to make it as seamless as possible. Our goal is to ensure that the teachers are focussing on the content delivery and not the technology.

”

One educational designer/developer saw the potential in the use of virtual worlds for particular types of learning, but also acknowledged that initial familiarity with the virtual world was an issue:

6.3.3 Professional development and networking

Educational design/development and IT support staff were asked a series of questions in the interviews relating to their personal learning about virtual worlds. Participants were asked to comment on how they originally became interested in virtual worlds and how they developed their skills/familiarity with virtual worlds.

Some participants commented that they were already familiar with particular virtual worlds as part of their role:

“ ... I've been using...open source technologies in my role as an IT manager for years now, so I understand how all support networks for open source technologies work...I quickly found the mailing lists, quickly discovered the key people who I need to become familiar with, to be able to help me initially in the ramp up phase of getting business technology...using all of that plus Google. ”

“ ...attending ASCILITE 2009... it [virtual worlds] was the subject of multiple presentations. That's the main reason. ”

Others mentioned that conference presentations they had attended had sparked their interest:

Several educational design/development and IT support staff mentioned that much of their familiarity came from networking with other people, both in and outside of their institution. Mailing lists were one way that information was shared and discovered for academic and education design/development and IT support staff:

“ ...through the mailing list, OpenSim uses mailing list...[the Second Life] mailing list tends to be more of a discussion of ideas and concepts rather than sort of directly about Second Life itself. There are now a couple of splinter break off mailing lists, such as VWE, Virtual Worlds in Education. Those lists are definitely using moving towards people using technologies other than Second Life, including OpenSim mainly— where you can basically get help, particularly, it's good for the academics because they can get very quick technical help there, in a language they can understand, so there are those sort of things available, yeah. ”

“

In terms of OpenSim... in the larger institutions you'll have cluey IT people around ...and willing to learn it and help you out, but initially it's something that you do have to spend a lot of time to play with [it]. ...

...trial and error, playing with the technology is how I developed my skills in it. For something like OpenSim you can't just go out and do a course at an institution about OpenSim, you have to really teach yourself. Which unfortunately for an academic is going to be a challenge.

I spent a lot of time in virtual worlds—self-taught. I also did in-world tutorials and watched videos and got other people to teach me things but it's all self-taught—just read everything I can possibly get my hands on.

...it's by being in it ... by experiencing it, by practising it...I've been making note cards with instructions to myself.

Trial and error, lots of asking of other people; very little reading; very little watching of video—it was really trial and error and asking the people that use Second Life experts.

”

In addition to seeking help from others, many participants stated that they were self-taught, employing what they described as a 'trial and error' approach. Many also highlighted the time commitment involved with this familiarity and skill development required:

A couple of participants mentioned that they had collaborated with others interested in virtual worlds, with the outcomes being combined virtual worlds related events between different institutions and collaborative research projects:

“

We ran an event we called SouthernWorlds 2010 which was sort of subtitled Tasmanian Educators Exploring Virtual Worlds and that was a collaboration with the University of Tasmania, the Tasmanian Polytech, the Department of Education and the Hutchins School—one of the private schools in Hobart. So, we ran that with about 30 attendees at a physical get together. We also ran some accompanying virtual sessions on the proceeding days.

”

Not many of the educational design/development and IT staff belonged to professional networks related to virtual worlds. Reasons for this usually were associated with a lack of time available to explore and participate in these networks/collaborations or decreased interest from the higher education institution, thus a lack of need to focus on this area:

“

...my interest kind of got cut off really, by the failure at [the] university, so I just sort of backed away from it really.

I just haven't got the time for it at the moment and it's right down the bottom of my list of areas of interest at this moment in time.

”

“

I really want to make as much of a contribution as I can and I envisage myself being able to help—particularly through a wiki once I get a chance to put a lot of information about OpenSim to make it user friendly for academics, so there is less ramp up and, ideally, you want a situation where they're focussing on their learning outcomes not the technology. So hopefully, I'll be able to help in that regard, that will be my knowledge input to the group.

I am really interested in international collaboration and I really would love to do work with other[s] around the world where we all work together...[have] our students work together...I joined it for looking for opportunities for collaboration and for further research.

”

There were a couple of support staff who were involved in virtual worlds networks/groups. One participant indicated that they were interested in becoming more involved and were keen to share their knowledge with others:

Conversely, another participant commented that they weren't confident about what they could contribute to the group and, as such, watched the group's progress from a distance:

“

I've not attended any meetings this year, although I do get the emails...I guess personally I am just not sure what I can really contribute at this stage to that group so I am just keeping an eye on it and just plugging away at our own project in the mean time.

”

Belonging even to the mailing list of a virtual world network/group was viewed as a good way to 'keep in the loop' with current trends and projects occurring in the area, with a greater level of participation often not part of core business for support staff:

“

...just a good reference point as to what everyone else is doing. I think that would be the main value. I know there are several projects in terms of books and papers and things, but I am not really in the land where I do that in my role anyway; so for me, being the sort of focal point for virtual worlds at our institution and not being someone who contributes to papers all that much, I don't take part on those types of activities. I guess I just keep a watch on what's going on and look to see what everyone else is doing.

...[it] is such an active group that I can't keep up with it in my general work load, so I dip in and out of that. I'm not a really sort of solid member but I do sit on the sidelines and observe what I can in the time I have so yeah it's about just keeping it on the agenda for me and keeping it as a regular thing that I'm doing.

...there's a whole lot of professional associations that circulate information to each other and I get some ideas from there... when...virtual world events [come up] I also get notified...I get notices from them about anything coming up...so there's a few different professional groups that I tap into.

”

6.4 Summary

There were a number of common issues raised in interviews with academic staff, educational design/development staff and IT support staff, particularly relating to the way that they went about developing their virtual worlds skills, the absence of institutional policies and the lack of available funding.

Specifically, many academic and support staff commented that they developed their skills via self-learning and exploration of the environment and through involvement in special interest group networks. Most mentioned the time commitment associated with this. A number from both groups indicated that they belonged to virtual world special interest groups, although not all of the participants were involved to the same degree, and the value gained from membership varied, with some benefiting from the academic research aspects, and others benefiting more from the sharing of technological and pedagogical exemplars of practice.

Staff from all groups generally indicated that there was a lack of institutional policies and guidelines relating to use of virtual worlds for learning and teaching, although some participants did state that policies were in the process of being developed. A number of staff highlighted the lack of funding made available within institutions to support the use and development of virtual worlds for learning and teaching, with a number commenting that interest from management did not always translate into allocation of resources and funding.

A number of academic staff members discussed the learning benefits of their virtual worlds-based learning designs and indicated that virtual worlds allowed them to provide different, more engaging learning experiences for their students, including some experiences that would be considered too risky in the real world. Some academic staff noted that their practice had changed as a result of using virtual worlds; for example, that they were more confident and more relaxed with using technology for teaching, while others commented that using virtual worlds hadn't changed their practice but rather provided another medium for their student centred teaching style.

A number of educational design/development and IT support staff commented that usage of virtual worlds within their institution was confined to a relatively small number of teaching staff. In some cases, this was used as an explanation for the absence of institutional policies and dedicated support; in some cases, the support staff appeared to express frustration at the lack of interest by teaching staff and indicated that the support and infrastructure for the use of virtual worlds was available, but there was insufficient interest in making use of it.

7.1 Introduction

This chapter discusses issues related to support for the use of virtual worlds, and some of the implementation challenges encountered, as well as some of the support networks available. Specifically, Section 7.2 discusses support for virtual world implementation within institutions in general, while Section 7.3 discusses a wide range of problems encountered by staff implementing virtual worlds as well as some discussion of how these have been overcome. Finally, Section 7.4 discusses various support networks in existence within Australia and New Zealand, with a particular focus on the Virtual Worlds Working Group.

7.2 Institutional support

As mentioned, the majority of questionnaire respondents who provided information about a specific implementation of virtual worlds (49 or 79%) indicated that they had used *Second Life* as the platform, with *Active Worlds* (4 or 6.5%) being the next most commonly used platform, followed by *OpenSim* (2 or 3.2%) and *There.com* (1 or 1.6%). Respondents were also asked whether a virtual world, island or space was developed specifically for the purposes of the subject/unit and, if so, they were asked to provide details. Thirty-one respondents indicated that they had developed a world or space specifically for the subject, while 25 indicated that they had not. An analysis of the additional details provided revealed that 13 of the respondents had purchased new land or space, 12 used an existing space, with seven of these indicating that they had developed new environmental features within it, and three rented or borrowed a space, with one of these indicating that they had developed new environmental features. Most of the Australian participants who used an existing island or space indicated that their institution owned it, while a number of New Zealand respondents indicated that they used land provided by the SLENZ group (see <http://slenz.wordpress.com/>).

Respondents were asked whether they had drawn on the support of other staff within their institution and, if so, were asked to give details. Thirty-one respondents specified that they had drawn on such support, while 25 specified that they had not.

In providing details about who provided the support, 16 listed IT support staff, nine listed educational designers, six listed academic colleagues, three listed casual staff or students, two listed project officers and one listed library staff. Respondents also listed ten categories of support provided. Consistent with the fact that the most frequently cited support role was IT support, almost all of the categories of support related to IT aspects of the work, rather than pedagogical aspects. Specifically, nine mentioned the solving of connectivity or firewall issues, suggesting that many university networks do not readily allow the use of virtual worlds. Additionally, eight mentioned that they had received support with the development of the environment, which perhaps illustrates that developing environmental features within a virtual world is still not something that most academics can be expected to do themselves. Other categories of IT-related support included support with installing and configuring software (5 responses) and the provision of ongoing technical support (4 responses). Non-IT categories of support that were identified included the running of workshops for staff or students (3 responses) and pedagogical support (1 response).

Questionnaire respondents were asked whether they had obtained dedicated funding to support their implementation and/or use of virtual worlds in the subject/unit and, if so, were asked to provide details. Thirty respondents indicated that they had received funding, while 26 indicated that they had not. The funding sources described were categorised according to whether they were research (5 responses), learning and teaching (13) or not specified (7), and whether they were internal within the institution (11), external (3) or not specified (11). The most commonly described grant source was internal learning and teaching grant funding (8 responses). The fact that more than half of the respondents had relied on some sort of funding beyond the normal funding allocated for teaching implies that the use of virtual worlds is still at the early-adoption stage. If and when it becomes more mainstream and grows into a standard component of the university teacher's technology toolkit, it is conceivable that the need for separate, dedicated funding and support will fade.

7.3 Problems encountered

Questionnaire respondents who described a particular implementation of virtual worlds were asked to describe the main problems and stumbling blocks that impeded their efforts. In addition to this, all participants were asked to list up to five general limitations/disadvantages of virtual worlds for university learning and teaching, the three most significant barriers and the three most critical success factors in the implementation and use of virtual worlds in university learning and teaching. There was considerable overlap in the answers to these four questions, so they were coded using a common set of categories. Twenty-six categories were identified and these were then clustered into seven higher-level categories: technology (see Table 7.1), support, funding and time (see Table 7.2), usability and familiarity (see Table 7.3), equity and ethical issues (see Table 7.4), inherent limitations of virtual worlds (see Table 7.5), acceptance of virtual worlds (see Table 7.6), and management and planning (see Table 7.7).

The most frequently mentioned problems in the questionnaire responses were those under the broad category of technology. As shown in Table 7.1, the main technological problems identified were lack of sufficient bandwidth, firewall issues, hardware requirements and audio problems. More general technological problems represented in the questionnaire data included reliability of student Internet access and problems with students getting the virtual world software to work on their computers off campus.

In alluding to bandwidth as an issue, most questionnaire respondents did not specify whether the problems were at the student's or the institution's end, but it appears from the wording used (e.g. 'broadband issues') that they meant home rather than university Internet bandwidth and this is consistent with statements during interviews, which generally suggested that the bandwidth at the institution tended to be adequate, but that this could not be assumed to be the case in the students' home. The following extract from an academic interview provides a typical perspective on this:

We had a building ... that had a lot of computer labs ... with lots of technology and I had Second Life installed ... and so, if the students wanted to access Second Life after hours outside of class, they could go there and do it, but not necessarily home, because there were still technology and bandwidth issues that were significant at that time.

Table 7.1: Questionnaire responses reporting technological problems, limitations and success factors

Category	Number of mentions as a limitation	Number of mentions as a barrier	Number of mentions as a success factor	Number of mentions in relation to a particular subject
Bandwidth	47	19	6	14
e.g. "limited to people with broadband Internet" "connecting from home always presents the user with problems in our regional area"				
Firewalls and other IT policy issues	34	31	18	10
e.g. "campus IT infrastructure limitations (bandwidth, security firewalls, etc)" "firewalled at the university so all work by the respondent done at home after hours"				
Hardware requirements	25	11	8	6
e.g. "availability of computers with the necessary system requirements whether they be university or the students' own computers" "some students did not have the technology to enable them to enter Second Life which is why it could not be compulsory"				
Audio problems	2	0	2	4
e.g. "initial problems with voice for some students" "there were technical issues of trying to get students to talk (in real time) to each other (voice and text)"				
General technology requirements or problems	32	18	10	9
e.g. "some students weren't able to get their software to run on their computer" "challenges in configuration of applications on desktops"				

Problems with institutional policies regarding firewalls were mentioned very frequently by questionnaire respondents and also emerged as a significant issue in interviews. The following comments were typical:

The main things were not really about the technology, per se, they were about the developmental stage of the technology, they were about the nature of [the] university's Internet connection. You know, we had to sort of convince the university, I mean eventually, they realised it was fine, but we had to actually get special permission to get through the firewalls, and that seemed like a very foreign idea to them, our IT office.

Now, both the [initial virtual world] activity which was to be integrated into one of our existing university units of study, and [a second activity] that I built on the university's island failed, and they failed because the university's firewall was never opened for students in the period that we wanted to use it. So, the period when we wanted to use it had already passed when we finally [managed] to open the firewall.

The university firewall is almost impossible to get around. So again, that's a problem, to say, well I've got 30 students who need to be able to access online services of various kinds, I mean not just Second Life, and the firewall being specifically designed to stop people accessing World of Warcraft and that sort of thing. So again, you might be requiring people to rely upon them having the private resources, because the university computers are not necessarily going to allow them to do what they need to do.

A number talked about poor graphics quality or poor frame rates when rendering the environment as issues, which were in some instances put down to the bandwidth and in others to the computer hardware used on campus. The following extract from an academic staff interview illustrates this:

So, once we'd solved the firewall problem, it turned out that a lot of the computers couldn't actually handle the program, because it's quite resource intensive. And so, that created a lot of lag in-world, especially if we had a lot of things going on.

The following extract from an interview with an academic staff member illustrates the way in which he perceived that inadequate hardware could impact on usage of virtual worlds with students:

In terms of the performance of virtual world technologies, you have a couple of main criteria that you judge its performance on, one is from a technical point of view ... called lag, ... now lag is basically the ability for all the objects and all the things happening in-world to keep up with what you're doing. ... where they can pick something, you read something and it takes ten seconds to read it, that's lag or when you're walking along, it's sometimes a bit jumpy, now that's lag. Concurrency is the number of avatars you can have in the scene at any one time. Now, the more avatars that you have in the scene at any one time, ... the performance of the simulator diminishes quite substantially. So, depending on the hardware you're running on it, more than 20 to 25 avatars, you start hitting real performance constraints. Now, where you're looking at subjects where you hope to have thousands and thousands of different avatars on and hopefully classes of large numbers, obviously that's going to require a very specific hardware setup and that's going to be probably the greatest challenge in terms of the implication of it.

“

I think the biggest problem and I have it here because like distance learning classes can be very big. Like I am talking...if am talking to the engineering people, I am talking about classes of hundreds and hundreds, and you can't have that many concurrent users on a sim in Second Life, and I think it's a real stumbling block to, you know, being implemented more widely here. Not that all teaching needs to be synchronous. I don't believe that it needs to be, but we still need to probably have more concurrent users than 40 or 50, which is probably the maximum feasible number of students to have in the environment at any one time.

”

For some, the performance issues were seen as being dependent on the number of students present in the environment at the one time. For one respondent, the poor performance with large numbers of students using the environment concurrently was seen as a significant barrier:

A number of interview respondents indicated that the hardware capabilities of the computers in student homes and in computer labs had improved substantially during the period that they had been using virtual worlds, so that some of the problems initially encountered had now been resolved. For example, one academic staff member commented that:

“

I mean these days you can get most computers and they will run Second Life without issue but that wasn't the case.

”

“

Another issue we found was that, if they wanted to use it a lot, they would use up their monthly allocation too quickly, and so they would either get shaped, so they would slow down, or they would have no Internet because of the volume that a 3D environment downloads. So, as the quotas for the amount of volume you get in Australia gets bigger, then it is not so difficult, but when we first started using virtual worlds, people had just like 100 mgs or something a month and they would just run out of access because of the volume charging in Australia.

”

There were similar reports that problems associated with bandwidth limitations or download limits in students' homes were gradually diminishing as the base levels of both bandwidth and volume limits increased:

An additional technological problem reported in several instances was difficulties in getting in-world audio communication to work. In some implementations of virtual worlds for learning, the use of text chat is sufficient, and the use of spoken audio is not really feasible because students are collocated in a computer lab and hearing each others' voices in the room may interfere with their immersion in an in-world experience. However, in some cases spoken audio was considered essential for the experience to feel authentic and, in some cases, headsets were purchased to allow spoken audio to be used in a computer lab environment. In *Second Life*, audio is transmitted using a separate Internet port, and so, in some institutions, even when the main *Second Life* Internet port is unblocked, the audio port is left blocked on the Firewall. This made diagnosis of audio problems difficult and led to frustration for some:

“

So, we had headsets and had checked all the sound and then on the day a couple of people's sound wasn't working. Damned if I know why.

”

Table 7.2 lists issues emerging from the questionnaire associated with lack of support, funding or time to devote to the activity. A distinct message here is that successful implementation of virtual worlds requires management and IT support, together with additional funding, coupled with substantial time commitment from the lecturer. The following excerpt from an academic staff interview captures some of the common themes relating to management and IT support:

Probably the biggest thing at [my institution] was, because it wasn't a core task, it's very hard to get support of the course IT systems people for it, because they don't see it as the main game. They just see it as a project and, in this particular case, the virtual worlds, you need some pretty special access through your firewalls. If it was some other sort of technology that didn't require that, you could have done a lot more without them being worried about it, but it's the special access that you need to access virtual worlds through firewalls and ports being opened that made it difficult to get that kind of support. So, being a special project grant thing and with no extra funds to do things like employ more IT staff to do that extra work and monitoring and stuff, that makes it more difficult.

Table 7.2: Questionnaire responses reporting support, funding and time related problems, limitations and success factors

Category	Number of mentions as a limitation	Number of mentions as a barrier	Number of mentions as a success factor	Number of mentions in relation to a particular subject
Time commitment	25	23	17	5
e.g. "commitment and enthusiasm of lecturer for that mode of pedagogy" "[lack of] time to devote to project"				
Cost and funding	19	26	12	4
e.g. "cost to students and institutions (Internet charges, land rentals, etc.)" "lack of resources to keep application current and well supported in a teaching context"				
Management support	5	7	11	0
e.g. "support from institutional management/ IT department on board – i.e. the infrastructure issues"				
Resources – general	0	0	6	0
e.g. "sufficient resources to build something worthwhile"				
Support – general	16	16	32	4
e.g. "support across the university from academic and general (IT support) staff" "lack of understanding/help from IT support"				

High level management support on its own is not necessarily sufficient to resolve the support issues if there is a not a coordinated approach by the IT support branch of the organisation:

So, I got interested because the faculty decided, there was a top down decision in the faculty to start doing this, and I thought, okay you beauty, we're off. But the top down decision was basically, from the Dean was, yes let's do it, and that was it. So, yes we should do this, yes we have to do this, says the Dean; you go and do it. And the support that was needed for it never happened. So, it was a really interesting lesson in the change management where someone at the top says, yes we have to do that, and then never actually puts any grunt into achieving it, and sort of flicks it to someone else and assumes it's going to be done without any effort on their behalf.

In some institutions, high level management support was provided, but this did not necessarily increase uptake of virtual worlds:

I do have support at our various highest levels from our IT managers and our teaching and learning Deans, so that's never been a real problem. Initially part of my process was to develop up a corpus of academics for the university to expand the use of Second Life throughout the whole university and, interestingly, that was very well supported, I was able to get quite a lot of academics, including several Deans of faculties involved in action learning groups around the use of Second Life, and that all progressed quite well. But, unfortunately, probably my biggest problem is there hasn't been a huge uptake of the use of Second Life by other faculty members, in any of the faculties, even though there was a lot of interest in being supported in getting and understanding skills [needed] in the use of the environment, there hasn't been others that have wanted to take that on as their particular interest or focus and use the environment which is a bit disappointing. So, I've sort of remained a bit of a loan wolf at the university in that respect, so that has some advantages but I have had to go outside the university to seek other supportive colleagues and progress things.

The following excerpt from an academic staff interview highlights the reasons why the use of virtual worlds requires a substantial time commitment for the lecturer, well beyond what would be required for the implementation of other new technologies in teaching:

Barriers or constraints could be financial, for example, for some people that the financial might relate to the actual building and rental of virtual spaces and building of spaces, but it could also mean funding in terms of, or financial constraints in terms of, academic staff, basically trying to do this stuff in their own time, or on top of their normal load rather than being given some kind of allocation to help them explore and trial the use of 3D virtual worlds. I use the example of pilots having to get up so many flying hours before they can actually legally fly. It's a bit like that in virtual worlds as an educator, you kind of, you have to basically get your hours up in terms of immersing yourself in the environment and watching other people teach and watching other people present a PD session to really kind of get a sense of what you can do, and that takes time and, for most people, that's going to be done in their own time, rather than probably in their normal work time. And that's probably why you're not going to get a lot of academics getting involved.

On the other hand, there were comments from some academic staff indicating that they were happy with the level of support provided by their institution, and a number of IT support interview participants provided details of significant support available within their institution:

“

I'm very supportive, I answer to the managing director and he's also extremely supportive so our mission statement is excellence, growth and innovation. So obviously, this sort of activity very much goes into the innovation part of that vision, so it's very team supported, not in terms of, not only in terms of a positive vocal support, but also in terms of resources as well, so we're very lucky in that way.

”

“

I was one of two main projects that SLENZ ran. I was the leader educator... we started off with six institutions... we had plenty of government funding. We were given half a million dollars of what they called "Innovative Learning Funding" so we were well funded. That paid for part of my time.

”

The availability of land and funding through the SLENZ group was helpful to some New Zealand participants in getting started with the use of virtual worlds in their teaching:

Another issue that emerged in the interviews was the fact that the virtual world viewer software (in most cases *Second Life*) was not generally installed by default on staff computers and in student computer labs, and so permission and assistance from Information Technology support areas of the university were required to have the software installed:

“

Yeah, they would need to have special permission to install it on the machine. To use a lab machine, they would have to ask for it to be installed on those machines and, at the moment, we haven't installed it on any of our lab machines.

”

“

... and while I know many universities, well, many academics have had trouble getting Second Life installed at the universities, at [our institution], it proved surprisingly easy, it was a matter of a couple of phone calls and it was installed on every machine as part of our standard operating environment.

”

Importantly, the situation varied substantially from institution to institution with some interview respondents providing positive reports of the support received and the ease with which problems were able to be resolved:

A related issue was that, as well as not being provided with adequate support, some participants indicated that they were also prevented from being able to support and configure their own desktop computer environment due to restrictive security policies, and this, in conjunction with the need to periodically upgrade to a new version of their virtual worlds viewer software, caused major problems as they attempted to experiment and plan for their use of the environment during class time:

“

That's sort of... we are a bit sort of constrained by university policies around technology; so, on our desk, this is again, another reason why I go home to teach, because often I would switch on my [computer], login in to Second Life and discover that in the last 20 minutes they had updated or created [a new version] and I could no longer use the previous version, and we can't install programs on our desktop computers, we don't have administrator rights, which meant having to ask someone to come and anyway it's a pain in the neck; so, even though our IT staff have been really supportive, as much as they can, the policies that are in place made it kind of difficult ... we can't experiment, or we can't update software. So, that's a bit of a pain.

”

“

I actually taught it from home, just because you know, with the firewalls and you often get a lot of lag with university systems, or things can go wrong, software can't be updated as quickly as you need it, so I actually live near the campus, so I would go home and teach it ... afternoon, just because it was a better connection. So, that's always going to be a problem, I think.

”

The fact that some academic staff chose to work from home further exemplifies the fact that the infrastructure and support required for mainstream use of virtual worlds is not yet adequate in most institutions:

Table 7.3 lists the problems identified by questionnaire respondents that were linked to staff or student ability to use the relevant software. Some referred to students' IT skills as the major problem, while others cited their own learning curve or the lack of familiarity of their academic peers as an issue. Still others laid blame on the software's usability.

Table 7.3: Questionnaire responses reporting usability and familiarity problems, limitations and success factors

Category	Number of mentions as a limitation	Number of mentions as a barrier	Number of mentions as a success factor	Number of mentions in relation to a particular subject
Student user familiarity and learning curve	24	7	5	8
e.g. <i>"getting students au fait with the mechanics of the 3D world, how to move around ..."</i> <i>"students slow to acquire requisite control of the technology and interface"</i>				
Academic user familiarity and learning curve	12	13	8	3
e.g. <i>"many lecture[r]s are still new to us[ing the] 3D environment"</i> <i>"colleagues are generally 'scared' of learning to use SL [Second Life]"</i>				
General user familiarity and usability software	13	7	18	8
e.g. <i>"complex software that is difficult to learn"</i> <i>"challenges with setup and the proficiency learning curve / intuitiveness"</i>				

In general, academic staff members who were interviewed acknowledged that there was a substantial learning curve in getting started with the use of virtual worlds, and that this learning curve continued as they attempted more advanced tasks, such as enhancing the environment by undertaking their own building, as illustrated by the following quote:

“

I think that it's very labour intensive, I mean a huge...if you want to set up specific learning activities in an environment like Second Life, you have to have the skill to be able to do them. I mean, I'm really hopeless at building, really hopeless as building, so that makes it difficult.

”

For some, the time required to become sufficiently familiar with virtual worlds when compared with other teaching technologies was a frustration:

“

It's just too hard and I am really up with the technology but you know I find Second Life hard, and I think the thing that I resent is being told by members of the team I was working with that I was putting up barriers because I wasn't immersed, but as an educator I don't want to have to spend hours and hours and hours and hours with the technology before I feel comfortable with it before I can use it. I want something that's quick, easy, intuitive, user friendly. All right, I might take a couple of hours to get the hang of it but something I can go straight into pretty much and go from there and Second Life doesn't do that for me.

”

“

Now the biggest challenge, obviously, in instituting new technologies is that you are dealing with teachers who have varying levels of technical capability. We don't have virtual world software particularly, whether it be Second Life or OpenSim, it's not something you sit down and start using immediately, it does require some level of training, even for people who are comfortable with using a PC or using technology generally.

”

The challenges in working with academic colleagues with less familiarity with virtual world platforms were also noted during interviews:

Some suggested, however, that the fundamental skills required for using virtual worlds will become more common as 3D user interfaces become more pervasive:

“

I think, increasingly, ... it's a skill that people will have to acquire. I think that once social networking becomes more immersive, and people get used to using avatars and it all becomes more 3D, I think people will have more interest in acquiring those sorts of skills.

”

The varying level of student skill and experience with virtual world platforms was also noted by a number of academic staff interviewed:

“

...using 3D virtual worlds as an example, for a lot of students its confusing, and it's a little bit scary, it's overwhelming.

I think the other thing is that we always overestimate the technical skills of the student base, so we tend to think that just because they're used to using a laptop in class to take notes all the time, that that somehow makes them proficient in all things technical. I don't...that's not the case at all. So, they can have trouble, just doing the most basic things online.

”

“

...so, the actual interface itself could have been a problem with a different group of people, and I've experienced that with a group of midwives, for example, that weren't used to the now sort of accepted way you interact with a game and that was a bit of a barrier.

”

It was also acknowledged that this can vary depending on the background of the students, with students from some disciplines less likely to have had experience in such environments:

Table 7.4 summarises questionnaire responses relating to ethical or equity issues. These included inappropriate behaviour by students and others in the virtual world, the problems of obtaining institutional clearance to use virtual worlds in teaching, and the difficulty of ensuring all students had access.

Table 7.4: Questionnaire responses reporting equity related and ethical problems, limitations and success factors

Category	Number of mentions as a limitation	Number of mentions as a barrier	Number of mentions as a success factor	Number of mentions in relation to a particular subject
Ethical issues	23	3	1	1
e.g. "possible grieving by rogue users" "supporting unsocial character development" "getting ethical clearance to use a 'social networking' tool with students"				
Equity issues	3	3	0	0
e.g. "access and equity – financial and age restraints"				

Comments in interviews suggested that some participants felt that management fears about ethical or safety issues associated with the use of a public virtual worlds platform were somewhat unfounded:

“

One of the other things that I encountered, of course, was the issue from the university insurers and those sorts of people, who were worried about the risks that were involved in it, and students being exposed to things that were outside the normal learning environment. They kept saying, “Well what happens if someone walks in during a class?” And it’s like, “Well that could happen, in the real world too.” So, I suppose, it’s those, it’s the resistance to using technologies from the powers that be can also be a problem.

”

“

It was an issue for them outside of class and, at home, it was an issue for some of them, because that was still the time especially early on where hardware made a big difference... I had Second Life installed in all of the labs in there and all of the computers in there, and so, if the students wanted to access Second Life after hours outside of class, they could go there and do it, but not necessarily home, because there were still technology and bandwidth issues that were significant at that time.

”

A number of interview respondents mentioned that, especially when they first started using virtual worlds in their teaching, access to their environment by students outside of class time could not be guaranteed because it could not be assumed that all students had sufficient computer hardware and Internet bandwidth:

Table 7.5 summarises questionnaire responses identifying inherent limitations of virtual worlds as tools for learning and teaching. Issues highlighted included problems with communicating through an anonymous avatar and limits in non-verbal communication in a virtual world, a lack of clarity about the actual learning benefits of virtual worlds, limits in the authenticity or fidelity of visual simulations in a virtual world, and the potential for students to be distracted by the game-like appearance of a virtual world or by irrelevant objects and avatars within the world.

Table 7.5: Questionnaire responses reporting inherent limitations of virtual worlds and associated problems, limitations and success factors

Category	Number of mentions as a limitation	Number of mentions as a barrier	Number of mentions as a success factor	Number of mentions in relation to a particular subject
Limitations of communication mode	18	1	1	0
e.g. "not being able to identify people outside of the avatar appearance" "interaction is very much through an interface, face-to-face behaviour and practices could be lost"				
Need for clarity of learning benefits	9	8	16	0
e.g. "needs to provide opportunity not possible in other methods"				
Limits in the authenticity of the representation	4	0	0	0
e.g. "possible missing of steps in real world process unless the virtual experiment is set absolutely accurately"				
Student distraction by virtual world or game-like appearance	6	0	0	0
e.g. "technology can distract from learning"				

The need for complex gestures and other forms of non-verbal communication varied from implementation to implementation, with one respondent commenting that “we tried using gestures, animations in *Second Life*, but they just didn’t really add anything to the conversation”, while for others the ability to use gestures in a variety of ways was seen as really important:

“

If you are doing a religious ritual, you know, you need to behave in a certain way and move in a certain way, and sometimes you could buy gestures to do that or animations to do that. That’s what we had to rely on, but sometimes those gestures and animations weren’t available, so we just had to talk through them at this point; then, I would do this, this and this. Also, because you had to activate gestures and animations separately, it’s not part of the regular flow of conversation or whatever, it interrupted the flow and, I think too, decreased the level of immersion in the environment, so I see the sort of thing that I would do anyway that just gestural-based computing would be a big step forward.

”

“

Yep, the people can talk a lot faster than they can type and equally because there’s a lag because of their typing the... having a discussion can be a little bit ... in terms of two conversations going on in the chat world. So, yeah, there are limitations.

”

Some who, for logistic or technical reasons, may not have had the ability to use spoken audio in their environment highlighted the limitations of text chat as a communication medium:

The lack of ‘lip sync’ when using spoken communication was also highlighted by one interview participant:

“

... I think ... to make an avatar’s lips move when they’re talking, because you don’t know—again, it’s not feedback happening, and it’s not giving you the... it’s giving you very much less feedback than you get from real life.

”

“

The other thing that bothers me about, in particular Second Life, is that it's not all haptic, so there is no feedback, there's no tactile feedback. What I mean by that is when you turn the wheel of your car ... the steering has resistance [while this is not the case in Second Life].

If you have a post partum haemorrhage right, one of the things as a nurse you should do is feel the woman's tummy and do an abdominal assessment and you put your hands in, you're actually feeling for the top of the uterus... You can't do that in Second Life.

”

For some interview participants the lack of a tactile experience or haptic feedback in the virtual environment was an issue:

Others, however, acknowledged that even though not all aspects of the real world are able to be simulated in a virtual world, this does not necessarily limit their potential as training environments, especially compared to other alternatives for on-campus experiences:

“

I mean, virtual worlds are not the same as clinical practice. It's not the same as having a real patient in front of you, but I think it was an improvement on what we had been doing in a clinical skills room.

”

Table 7.6 lists problems emerging from the questionnaire associated with student or academic acceptance of the potential value of virtual worlds for learning and teaching. A recurring issue for academic staff seemed to be the fact that students and other staff often did not initially see in-world learning activities as something to be taken seriously, as illustrated by the following interview excerpts:

The most exposure most people get to virtual worlds technology is through 'A Current Affair', or 'The Herald Sun' ... damning reports in the media about terrible things happening, or it's a waste of time... maybe because it's not seen as a serious educational tool, so maybe it needs to be re-branded as such, and you know, most people don't realise how much

education goes on in Second Life and that educators are a very big part of it, you know, the activity, apart from online prostitution and stuff like that, and sex bars, there are a lot of educators in Second Life doing things that have nothing to do with sex. So, maybe it kind of needs to be re-branded in that way, as an educational tool.

I think the other problem that we have is people's attitudes to immersive environments, because I tend to think that the population probably divides into two groups of people. One group who are probably very well predisposed to immersive environments, because they're role-players, they're prepared to put themselves into it. And then you'll always have that other group of people who don't, they're always just who they are, but that's okay.

But at the moment it is quite a conceptual shift for someone to have an avatar represent themselves in a foreign environment for a teaching purpose, so that's probably my biggest inhibitor in terms of that mind shift and I don't think it's going to be achieved by encouraging people into virtual worlds because they're still too foreign.

Table 7.6: Questionnaire responses reporting acceptance of virtual worlds and associated problems, limitations and success factors

Category	Number of mentions as a limitation	Number of mentions as a barrier	Number of mentions as a success factor	Number of mentions in relation to a particular subject
Student acceptance	15	7	9	8
e.g. "student reluctance to use the technology" "students were concerned about the validity – saw it more as fun than as a learning tool" "students thought it was weird and decided against it"				
Academic staff acceptance	11	6	13	1
e.g. "when it is not valued by current assessment, students and staff do not usually value it" "general scepticism of other faculty"				
General acceptance	8	17	6	2
e.g. "bad press of VWs – although dropping off" "resistance to a new paradigm concerning teaching and learning"				

Table 7.7 summarises questionnaire responses in which management and planning issues are highlighted. The need for careful and considered planning in terms of the design of both the environment and the learning activities was heavily represented in the questionnaire data. A number of the interview participants described quite detailed thinking regarding the learning problem they were trying to address, the learning activities they wanted students to undertake, and the actual virtual world environment requirements to allow these activities to be undertaken, as the following excerpt illustrates:

So, at that stage I had a Cert IV subject that had a clear set of competencies and outcomes that were required and what I was looking for was a capstone event in semester 2 that would test not only the topics that they had covered which were pretty much capstone topics like Change Management, Customer Service, Sales and Marketing for the semester, for semester 2. So, I then . . . obviously, I developed the concept of the learning environment in, what I call, Business Island, separate from the program. So, it was designed to have a multifunctional application that could be used in a wide range of learning situations. And, then, I developed a learning management system that was then attached to the virtual world, in which each learning outcome was linked to an activity that the students were required to perform in-world in a session, as well as still operate within the broader commercial environment that was established in Business Island.

Table 7.7: Questionnaire responses reporting management and planning associated problems, limitations and success factors

Category	Number of mentions as a limitation	Number of mentions as a barrier	Number of mentions as a success factor	Number of mentions in relation to a particular subject
Planning for learning (content, outcomes, timelines)	12	1	32	0
<i>e.g. "[need for] clear purpose and goals in the implementation"</i>				
Design and development of the environment	10	0	7	0
<i>e.g. "creation of useful, repeatable simulations can be difficult"</i>				
People synchronisation issues	6	2	0	0
<i>e.g. "time zone differences can make synchronous participation challenging"</i>				
Continuity as subject is revised and/or teaching staff changed	0	3	0	0
<i>e.g. "the way courses are passed from lecturer to lecturer inhibits continuity"</i>				
Need for workshops, meetings, training	0	0	6	0
<i>e.g. "professional development of staff that includes pedagogical changes and task modification needed to maximise new learning opportunities in 3D"</i>				
Need to collaborate with others	0	0	5	0
<i>e.g. "good support from educational community and good contacts with relevant people"</i>				

“

Look there was a huge amount of planning. I mean the SLENZ—I don't know if you know much about the SLENZ project, but we had basically six months of planning and we planned as a team. Although the Foundation build was my baby as such, we went through all the stages of planning... First of all, we had to go through things, what were our aims and our objectives and, then, trying to fit in the background philosophy, the pedagogy that fitted in with those aims and objectives; then, looking at the environment and, then, trying to tie it all together with planning what we would build and how we would build it and how we would actually use what we then built, so it was a really long process.

”

For some participants who worked as a team on the development of a shared virtual space to meet a range of different purposes, the planning process took place over a relatively long period of time:

“

And none of us had really that much experience in running it. So, between us, we had the technical, the content and the teaching experience to pull it together. Then, we had to get the learning topics and learning objectives [clear], because otherwise, you're going to take some focus onto the technology instead of the learning. And, then, we had to choose some medium—well, we've already been playing in Second Life that's the only one we knew at that time. And, then, we had to set up Second Life, and so, we had a whole series of little tests and we'd play. We'd have a go, we'd go and meet and we'd say, "what do you actually need?"

”

For some, it appeared that the design process could not be over planned, because the teaching staff involved had to develop familiarity with the environment and its capabilities at the same time as they were designing the learning activities and environmental features needed:

The need for an iterative process of pilot testing also emerged during the interviews, with a number describing the way in which their environment features and learning activities evolved through pilot testing:

“

And in fact [in] one of our earliest tests ... a student came and joined us and played for us. And she was wonderful because she came as a student into a virtual world where the rest of us were all educators or techie types or whatever, and we watched her play and find her way around and saw where the problems were.

”

“ So, for me, it was a case of ... any of the official class times, that would normally happen at night, because most of our DE students are working during the day, so a number of class times would be done anywhere between say 6:30 and 7:30 [pm], or 7:30 and 8:30 [pm]. ”

Difficulty in organising for students and staff to be able to synchronise given their diverse locations, time zones and commitments was another recurring problem identified. One interview participant indicated that it was necessary to schedule in-world meetings with students at night in order to fit with the students' work and family schedules:

Many respondents stressed the importance of opportunities for professional development and for sharing and collaboration between teaching staff involved in the use of virtual worlds. For some participants with substantial experience in the exploration of leading edge technologies, their learning was undertaken using a self-directed process involving online reading, exploration of technologies, and participation in email lists:

“ Google is my friend when it comes to [learning new technologies]. OpenSim, it's an open source technology, I'm very familiar with the [culture] of open source technology, I've been using open source technologies in my role as an IT manager for years now, so I understand how all support networks for open source technologies work, so I quickly found the mailing lists, quickly discovered the key people who I need to become familiar with, to be able to help me plus ... trial and error, playing with the technology is how I developed my skills in it. For something like OpenSim you can't just go out and do a course at an institution about OpenSim, you have to really teach yourself. ”

“

Yeah, we had a very loose group called SLIG, which is Second Life Interest Group, and we would meet occasionally and share ideas and skills, and it was very do it yourself, and it still is do it yourself. ... and I guess that's... I think, maybe that's generally ... I like to nut things out myself in teaching, I don't want to be presented with; here is this beautiful island, in which you are going to teach; I need to build it around my own specifications and be able to modify it on the go. Yeah, so, there was certainly this sort of sense of community with other interested educators, but most of us didn't really collaborate in very big ways in our teaching, I don't think.

”

The role of networks was emphasised by some interview participants but, for a number of participants, their learning was nevertheless very self directed, with the networks providing opportunities to share experiences and help each other out with problems they had encountered:

“

I saw advertised through the Second Life educator's mailing list a course on teaching and learning in virtual worlds that was run through Boise State University. It's a part of a Master of Education program and so enrolled in that and that really got me up to speed with what was possible in that environment and so on.

”

Some, however, were able to find formal courses that helped get them started:

7.4 Solutions and lessons learnt

Questionnaire respondents describing a particular implementation of virtual worlds in university teaching were asked what they had done or planned to do to overcome the problems they had encountered. All respondents were also asked what additional advice and/or recommendations they had for other university colleagues contemplating the use of virtual worlds for learning and teaching. Responses to these two questions were coded using a common set of categories and the results are summarised in Table 7.8.

Table 7.8: Questionnaire responses providing recommendations and advice

Category of recommendation	Number of times mentioned in relation to overcoming problems in a particular subject	Number of as additional advice or recommendation
Professional development	11	6
e.g. <i>"I will continue to learn as much as possible myself so as to enable me to reduce my reliance on technical assistance"</i> <i>"Attend classes, meetings, events and explore in the virtual world to learn from others and don't limit this to universities"</i>		
Learning design	6	8
e.g. <i>"Continue to develop lesson designs, tools, the environment and the bots to the point where they overcome the ... challenges and enable the learner experience of interacting with the environment"</i> <i>"Has to be a purpose for the learning other than simply being in SL [Second Life]"</i> <i>"We used machinimas to overcome the problems we encountered during the design stage"</i>		
Technology infrastructure	8	1
e.g. <i>"Put in a case for a new lab with equipment designed to facilitate SL [Second Life] teaching"</i> <i>"Provide open access to labs were students can practise and play in SL [Second Life]"</i>		
Virtual world platform	8	0
e.g. <i>"Moved to an open source platform (Project Wonderland) so we could work with Java and not pay a third party for ... land"</i> <i>"Moved to OpenSim on a LAN to avoid dealing with Linden Labs"</i>		
IT support	5	3
e.g. <i>"Made submissions to ICT regarding access – firewalls are supposedly coming down [next year]"</i> <i>"Collaborative approach to dealing with the politics of getting it through the damn firewall"</i>		
Research, scholarship and evaluation	5	3
e.g. <i>"More focused research to explore the factors effecting 'intuitiveness' as it pertains to Second Life and medical education"</i> <i>"One current 3D MUVE project has benefited from the experiences of the earlier encounters and this has resulted in design elements helping to facilitate student engagement"</i> <i>"Read what others have done in this field"</i>		
Networking	3	5
e.g. <i>"I networked with other people using Second Life in education, in particular the New Media Consortium"</i> <i>"Network and connect with the 'experts' and mentors who are already using VWs in education"</i>		
Policy and support	2	6
e.g. <i>"Attempted to explain to the gatekeepers that if innovation is desired then gates must be opened and barriers removed"</i> <i>"Give yourself time and get support"</i>		
Time and commitment	2	5
e.g. <i>"It takes time to get on top of the virtual world and its capabilities but once you have reached a sufficient level of familiarity the potential for creating engaging and effective learning experiences is boundless"</i> <i>"Also be prepared to commit substantial time to the effort, but have fun in doing so"</i>		
Planning	0	3
e.g. <i>"Make sure that resource requirements (R&D, support, hardware, software) for a proposed system are detailed and costed in advance"</i> <i>"Plan everything. Have a Plan B, and a Plan C, and a Plan D"</i>		

Interestingly, although the vast majority of the problems identified (see tables above) were technology related, the most frequently mentioned recommendations had to do with professional development (primarily suggesting that the more professional development undertaken by the lecturer, the better). When the interview participants talked about their own learning, however, they generally spoke of a combination of self-directed exploration and the occasional formal professional development session rather than relying primarily on formal professional development. Those who did attend specific professional development activities tended to draw on a range of different sources for these, but generally outside of their own institutions:

“

... a number of people really: Jo Kay who really took on the role of mentor for us when we were building this and then starting to trial it with students... and I've been to a number of professional development sessions that have been hosted by different educator and library and information professional kind of groups. I certainly tapped into a lot of people in terms of their ideas, in terms of their experience, and then, with the Virtual Worlds Working Group ... I found that that's been a really great community of practice to be part of.

”

“

Yeah, well, I guess as I was saying a minute ago the context of professional development in this case I believe needs to be within the same context of student engagement, so in terms of bringing everybody into Second Life, rather than just talking about that, that's got to be how people learn to engage with the possibilities that Second Life provides.

”

Participants involved in providing professional development for academic staff also emphasised the importance of hands on activities:

Another common recommendation related to learning design (a common theme here being that the use of virtual worlds requires a clear pedagogical purpose), as illustrated by the following comments from academic staff interview participants:

“

You can't just use technology because it's there. I get quite angry when I see people just jumping into a new technology and doing something really stupid or reinventing the wheel. I like to see it intelligently used. Looking at the pedagogy, the aims, the objectives and why you are going in there in the first place and then designing the activity with the students in mind.

I think it's...there's potential there but just got to make sure that the focus is on the learning. It is so easy to get caught up with the hype of the technology and what you can do and if it's really going to work it's got to be about learning.

”

There were, however, a number of recommendations related to the virtual world platform (often suggesting a move away from *Second Life* to other platforms). The following extract from an academic staff interview provides an exemplar of one perspective on future directions with regard to the virtual world platform:

I strongly suspect we will move towards more game play environments because the game play 3D immersive worlds such as in Unity and various other first person shooter type environments are a quantum leap ahead of ... our current virtual worlds and I think that that's where the next big advance will happen, whereby the actors in those games will take on more avatar-based aspects. We'll have more control over the actors and we'll be able to then utilise those game play environments as immersive virtual 3D worlds far more effectively than with Second Life.

Other recommendations in the questionnaire related to IT support (especially the need to obtain approval to bypass or 'punch through' the firewall) and computer laboratory infrastructure. A related recommendation emerging from the interviews related to the need for support beyond just the technical is illustrated by the following excerpt

...if in fact an institution was serious about using this kind of learning environment to support other subjects, and other courses, in other disciplines, in other schools and faculties, I think that a university does need to seriously consider introducing some kind of teaching and learning [educational designer] kind of mentor and support person to work with staff, because it is a demanding environment to get a handle on, and once you do, I mean, you know, you look at all the people in the Virtual Worlds Working Group, for example, they're all the self starters and the innovators and those that are really interested in exploring this, not just for their students, but for their own kind of personal satisfaction as teachers.

The value of research, scholarship and networking were also underscored, along with the need for ongoing time commitment and for thorough planning. For some interview participants, the overall recommendations or summary statements were quite positive, as exemplified by the following excerpt from an academic staff interview:

Well, I see 3D virtual worlds as being a really powerful environment to support teaching and learning at the tertiary level. And because I'm teaching, teachers and people working in the information professions who really should be within our complex, sort of socially networked world, I think those two professions need to be active participants within that socially networked world, and it's, I see it as my role or my duty as an academic to ensure that I'm providing my students with opportunities to explore the potential of 3D virtual worlds to support education at whatever level, school, TAFE, tertiary, as well as professional learning and the same

with the information professions, getting people to... exposing them to the potential of how information professionals can support the learning and information needs of people who are living, working and socialising in these virtual world environments.

There were others, however, who were left feeling pessimistic about the realistic possibilities regarding the use of virtual worlds for learning. For example, one academic interview participant, when asked “can you give a brief statement about your general impressions of the use of virtual worlds for learning and teaching at your institution?” responded by saying “yeah the brief statement is that it’s not, the institution isn’t at the point where the effort to set it up will pay off”.

7.5 Networks and collaboration

A number of special interest groups, in-world support networks and funding consortiums were identified by participants through the questionnaire and interviews. The most substantial activity in this area during the life of the scoping study was through the Virtual Worlds Working Group, which included members from 54 institutions within Australia and New Zealand and, consequently, a section is devoted specifically to discussing its activities. The activities of a number of others groups, collaborations and partnerships are then discussed.

7.5.1 Virtual Worlds Working Group

The Australian and New Zealand Virtual Worlds Working Group (VWWG) was established in November 2009 to assist in facilitating collaborative research into virtual worlds, identifying research gaps or needs and to assist in providing information on best practice in the use of virtual worlds for teaching and learning. At present, there are approximately 190 members from 54 higher education institutions from Australia and New Zealand higher education institutions.

The VWWG began with ten academics from the DEHub Consortium, consisting of the University of New England, Charles Sturt University, University of Southern Queensland and University of Central Queensland. As the DEHub consortium only consisted of four institutions, it was felt by the initial members that this was too limiting, given the expertise that was available from higher education institutions more broadly and, as a consequence, membership from other institutions within Australia and New Zealand was sought.

A teleconference was used for the first meeting, the second meeting trialled Skype and, since then, the VWWG has been meeting at Australis 4 Learning in Second Life (see: <http://slurl.com/secondlife/Australis%204%20Learning/134/136/22>). Much of the activity of the group is recorded online at <http://www.vwwg.info>.

The first collaboration stemming from the VWWG was between the University of New England and Charles Sturt University with this Scoping Study in early 2010. Members of the group have also written several joint papers with the first in 2010 with 23 authors (see S. Gregory et al., 2010). Two joint papers were written in 2011 with 46 members presenting an Australian perspective and 23 members presenting a New Zealand perspective of virtual worlds in higher education (see B. Gregory et al., 2011; Hearn et al., 2011). Finally, in 2012, 46 authors from both Australia and New Zealand presented a joint paper (see S. Gregory et al., 2012).

Members of the VWWG teach and research in virtual worlds in a variety of disciplines, including education, art, languages, drama, business, health, science, behavioural studies and social work. Applications reported include role-plays, simulations, problem-based learning, scenario-based training, construction and design, lectures, tours and excursions, discussion, debates, games and play. Members of the group have presented seminars, workshops and lectures at others' institutions, joined in presentations at symposiums and conferences, as well as co-written publications and co-presented posters.

7.5.2 Other cross-institutional projects and partnerships

Aside from the VWWG, other groups that have brought together a number of educators using virtual worlds from higher education institutions in Australia and New Zealand include the Virtual Life Education NZ group (VLENZ) established in 2010 (see <http://nzvwwg.org/>) and Australasian SL Educators and Researchers (AusSLERS) (see <http://www.3dmuvesig.net/>).

A number of institutions have pooled resources to purchase land or share virtual world infrastructure, including the following:

- The University of New England, Australian Catholic University and Curtin University together established Australis 4 Learning, an island in *Second Life* in 2009 (although Curtin University withdrew and moved to *OpenSim* in 2011).
- In 2008, the *Second Life* Education New Zealand (SLENZ) consortium funded by the NZ Government began a research project which led to two pilot virtual world implementations (see <http://slenz.wordpress.com/>).
- The New Zealand Virtual World Grid was created with an academic focus to be

used for research and education, as well as for proof-of-concept application deployments and testing (see <http://nzvbwg.org/>).

A number of cross-institutional collaborative grants have been awarded to projects in recent years, including the following, which at the time of writing are all still underway:

- A 2010 Office of Learning and Teaching (OLT) grant titled 'VirtualPREX: Innovative assessment using a 3D virtual world with pre-service teachers', involving researchers from the University of New England, Australian Catholic University, Curtin University of Technology, Charles Sturt University, the University of Adelaide and Hamburg University (see <http://www.virtualprex.com>).
- A 2011 OLT grant titled 'Design as a catalyst for engaging students in creative problem solving', involving researchers from the University of South Australia, the University of Adelaide, the Royal Melbourne Institute of Technology, James Cook University, the University of New England and Massey University (see <http://www.communitywebs.org/iDeate/>).
- A 2011 OLT grant saw the launch of another grant project, 'Blended synchronicity: Uniting on-campus and distributed learners through media-rich real-time collaboration tools', involving researchers from Macquarie University, the University of Melbourne and Charles Sturt University (see <http://blendsync.org/>).
- A 2011 DEHub funded project titled 'Social work and pharmacy interaction contextualization experience (SPICE)' involving researchers at the University of New England and Charles Sturt University.
- A 2011 OLT grant focussing on Language Learning from which two virtual worlds-based projects have emerged, 'ARABIA: Language learning through cultural experiences in a virtual world', involving researchers from Monash University and the University of Melbourne, and 'Language learning in virtual worlds: The role of foreign languages anxiety and technical anxiety' at Monash University (see <http://www.lcnau.org/>)

In addition to these current grant funded projects, a number of Australian Learning and Teaching Council (ALTC) grants and fellowships with a focus on virtual worlds have been awarded in recent years:

- A 2010 ALTC funded project titled 'Teaching and learning in multi user virtual environments: A case study in the Learning to Teach Online Project' involving researchers from the University of NSW and Deakin University.
- A 2010 ALTC Fellowship awarded to Professor Geoff Crisp of the University of Adelaide (now at RMIT University) titled 'Transforming assessment' (see <http://www.transformingassessment.com/>).

- A 2009–2010 ALTC funded project titled ‘Getting a MUVE on’, involving researchers from the University of Adelaide and Murdoch University (see <http://www.hss.adelaide.edu.au/historypolitics/digital-humanities/muve/>).
- A 2009 ALTC Fellowship awarded to Professor Des Butler of the Queensland University of Technology titled ‘Entry into Valhalla’ (see <http://eprints.qut.edu.au/46275/>).
- A 2009 ALTC funded project titled ‘Learning and teaching in the discipline of Law: Achieving and sustaining excellence in a changed and changing environment’ involving researchers from Flinders University (see http://www.olt.gov.au/system/files/resources/altc_LawReport.pdf).
- A 2008–2009 ALTC funded project titled ‘Teaching physics using virtual reality’, involving researchers from the Australian National University and the University of Queensland (see <http://www.anu.edu.au/Physics/vrproject/>).
- A 2007–2009 ALTC funded project titled ‘The seamless integration of Web3D technologies with university curricula to engage the changing student cohort’ involving researchers from the University of Southern Queensland and Central Queensland University.
- A 2008 ALTC funded project titled ‘Facilitating flexible, enquiry-based experiential learning through an accessible, three-dimensional virtual learning environment (3DVLE)’ involving researchers from the University of South Australia, Edith Cowan University, Monash University, RMIT University, the University of Sheffield (UK), and the University of Sydney (see <http://www.communitywebs.org/3dvle/outline.php>).

7.6 Summary

This chapter has provided a summary of the experiences and perspectives of 117 respondents to a questionnaire and 24 interview participants relating to the use of virtual worlds for higher education learning and teaching in Australia and New Zealand. In particular, the chapter has summarised the problems and limitations encountered and the solutions to these problems offered by the respondents. Many of the problems and limitations identified by respondents—including ‘time commitment’ and ‘support’—are reminiscent of those that have emerged from other university technology-adoption studies (e.g. Wilson et al., 2000; Kilmon & Fagan, 2007; Samarawickrema & Stacey, 2007), while others relate more specifically to the use of virtual worlds—for instance, ‘limits in the authenticity of the representation’ and ‘student distraction by virtual world or game-like appearance’.

As with earlier studies and reports from other countries (see, for example, Warburton, 2009; Kelton, 2007, 2008), the most frequently reported problems in the present study were technological in nature, with bandwidth and firewall issues along with hardware requirements to use the client software being the most commonly raised. Another issue identified by many respondents related to the learning curve students and academic staff are confronted with as they attempt to become adept at using the software; this mirrors findings from the NMC (2007) survey. Evidence from other studies suggests that these technical and usability challenges will gradually be overcome, and research and development initiatives around the world are yielding useful, evidence-based resources such as practical guides and handbooks to assist academic staff in their use of virtual worlds in their teaching (see, for example, de Freitas & Rebolledo-Mendez 2008; Savin-Baden, 2010). Nevertheless, it is apparent that from a technical perspective, online learning and teaching cannot be undertaken as seamlessly in a virtual world as it can when using other more established technologies provided within institutional LMSs.

The theme of institutional support was also prominent in the questionnaire responses and the academic staff interviews, including both the need for management support and provision of resources as well as the need for ongoing technological support. A related issue that emerged was the need for funding for virtual environment development and additional time allocation for teaching staff. These issues were also emphasised by Warburton (2009), as well as by Kirriemuir (2010a) in his article on UK university and college technical support for *Second Life* developers and users and in the various snapshot reports. It is important to additionally note that the questionnaire was administered during 2010, prior to the decision by Linden Labs to remove educational discounts on the purchase and rental of land in *Second Life* (Linden, 2010). Consequently, it is likely that cost issues are even more pronounced for higher educators now than they were at the time when the questionnaire data were collected.

Similar to the findings of Kelton (2007, 2008), an additional problem commonly reported by the questionnaire respondents and interview participants in the present study was a lack of acceptance by staff and students of virtual worlds as legitimate or 'serious' learning tools. This had implications for a number of respondents, as manifested in a lack of 'buy in' on the part of students and other academic staff. Like Warburton (2009), who described problems with students being unfamiliar with the behavioural norms of virtual worlds, a number of respondents identified anti-social in-world behaviour as a concern. These types of problems are likely to remain while the use of virtual worlds is an activity undertaken only by a small proportion of the population, but could be expected to diminish as usage becomes more mainstream. Bowers, Ragas and Neely (2009), in a study of post-secondary instructors' adoption of virtual worlds, found that 80% of respondents were in either the first ('innovators') or second ('early adopters') stage of Rogers' (2003) five stages of technology adoption. Findings from Kirriemuir's UK-based snapshot reports (see, for example, Kirriemuir, 2007b, 2010b) imply that there are specific issues faced by these early-stage adopters.

Solutions and recommendations for the future offered by respondents included the need for professional development, clear planning from both a technological and pedagogical perspective, and networking with other educators with experience in the use of the technology. It is prudent to note that, despite the emphasis in this chapter on the negative aspects of respondents' experiences, elsewhere in the questionnaire they were asked about the degree to which a series of possible learning benefits actually occurred during the implementations of virtual worlds they described. Their responses to these questions were highly favourable; for example, 93% of respondents expressed agreement with the statement "the use of 3D immersive virtual worlds was motivating and engaging for students", 84% agreed with the statement "the use of 3D immersive virtual worlds led to more effective collaborative learning", and 87% agreed that "the use of 3D immersive virtual worlds allowed learners to learn through experiences in context". There is evidence to suggest that many of the problems and obstacles respondents faced were to a large extent surmounted and, from their perspective, valuable student learning can and in fact did occur.

8.1 Summary of findings

As described in detail in Chapter 3, the scoping study consisted of three distinct phases of data collection, as follows:

1. Literature searches and searches of institutional web sites leading to the establishment of a database of 179 higher education staff (135 in Australia and 44 in New Zealand) with an interest or involvement in using 3D immersive virtual worlds for learning and teaching;
2. An online questionnaire completed by 117 respondents, including 82 from Australia and 35 from New Zealand, to obtain detailed information about the ways in which 3D immersive virtual worlds were used, and about the perspectives of the teaching staff involved;
3. Interviews to gather more detailed information and perspectives from 13 academic staff who had implemented virtual worlds in their teaching, from six educational design staff and from five Information Technology (IT) support staff.

Of the 117 questionnaire respondents, 62 indicated that they had used 3D immersive virtual worlds in their teaching, and these respondents reported on a total of 125 individual subjects in which they had used the technology, including 201 individual subject offerings. Details were provided about the use of virtual worlds in 100 of these 125 subjects and, of these, the majority used *Second Life* (78.0%) as the virtual worlds platform, followed by *Active Worlds* (5.0%) and *OpenSim* (4.0%).

There was a fairly even distribution of subjects using virtual worlds across disciplines, although the Science discipline was somewhat underrepresented. Specifically, 29% were in the Arts and Humanities, 21% in Education, 18% in Information Technology, 10% in Legal and Business Studies, 9% in Health, 4% in Science and 9% in other discipline areas.

Respondents provided 53 detailed descriptions of the way in which virtual worlds were used in their teaching, and from these descriptions ten categories of learning design were identified, with a number of subjects including learning design features fitting into more than one category. The most commonly used learning designs were role-plays (43% of subjects), followed by learning designs centred on communication (40%), and learning designs centred on instruction/presentation (23%) and, then, designs incorporating place exploration and building/scripting (each 17%).

Fifty-five respondents provided more detailed information about a specific virtual world implementation and, of these, 55% indicated that the virtual world, island or space was developed specifically for the purpose of the subject they taught. Twenty-two per cent of these 55 respondents indicated that an important aspect of the learning task was familiarisation with *Second Life* and, consequently, these respondents indicated that students were required to explore the environment more broadly, rather than using a space developed for a specific pedagogical purpose.

There were mixed views emerging from the questionnaires and interviews in relation to assessment of, or compulsory use of, virtual world-based tasks/activities. The questionnaire results showed that within the 100 subjects for which detailed information was provided, the virtual world-based tasks were compulsory and assessed in 41%, compulsory but not assessed in 16% and neither compulsory nor assessed in 43% of the subjects. The interview data allowed for elaboration on the reasons for this diversity, with some participants stating that they made the activities optional because they couldn't guarantee that students would have access outside of class time, while some made the tasks assessable but provided alternative tasks for those without convenient access to appropriate hardware and software.

Interview participants described a number of different virtual spaces that had been developed to meet the specific needs of their particular learning context, including a virtual hospital emergency department, a virtual classroom and a simulated street with retail outlets allowing students to undertake a business role-play. Others described the development of spaces designed for various types of online teaching, including amphitheatres, boardrooms and informal student meeting spaces. Some of the spaces developed consisted largely of static building and furniture, while others incorporated dynamic features controlled by complex scripts; for example, one participant described a virtual environment containing business outlets controlled by a complex back-end economic simulation. Other spaces relied on user interface enhancement allowing avatar control beyond that provided by default within the viewer software.

Of the 55 respondents to the questionnaire describing in detail an implementation of virtual worlds in a single subject, 55% indicated that they had drawn on the support of non academic staff within their institutions, such as Information Technology or educational design support staff. Fifty-five per cent also indicated that they had drawn upon dedicated funding to support the implementation, with this funding coming from a variety of internal and external sources.

With respect to evaluation, little systematic evaluation was described in the interviews, with participants mainly describing informal feedback mechanisms and some types of formal but not systematic evaluation. Most commonly, participants described informal student feedback or informal observation of student activity as the main evaluation mechanisms. Formal evaluation procedures predominately included student subject evaluation forms that were included as part of a university reporting system. Of those who did mention systematic evaluation, many referred to research projects associated with the virtual world implementation.

Respondents to the questionnaire mentioned a number of problems they had encountered in their attempts to integrate virtual world activities into their teaching in the areas of technology, support, funding and time, usability and familiarity, equity and ethics, inherent limitations of virtual worlds, acceptance of virtual worlds, and management and planning. Interview participants also provided more detailed descriptions of many of the problems identified, and a number of recommendations for others emerged from both the questionnaire and interviews.

Other perspectives emerging from interviews included identification of a lack of specific funding for, and an absence of, institutional policies relating to virtual worlds, an acknowledgement of the need for substantial time commitment by staff considering the adoption of virtual worlds, and noting of the value of working with others through informal and formal networks. Academic staff members interviewed highlighted the increased engagement of students that had occurred through the introduction of virtual worlds-based tasks and the fact that the process of introducing virtual worlds into their teaching had led to new reflections on their teaching practice. Some educational design/development and IT support staff interviewed commented that usage of virtual worlds within their institution was confined to a relatively small number of teaching staff. In some cases, this was used as an explanation for the absence of institutional policies and dedicated support, while in other cases they expressed frustration at the lack of interest by teaching staff and indicated that the support and infrastructure for the use of virtual worlds was available but there was insufficient interest in making use of it.

8.2 Recommendations

Recommendations emerging from the study have been categorised into recommendations relating to institutional policy, teaching staff adoption of virtual worlds and research, and these are discussed in turn within the following sections.

8.2.1 Institutional policy recommendations

From an institutional policy perspective, a number of recommendations emerged relating to the Information Technology support needed by academic staff within an institution when adopting leading edge technologies such as virtual worlds. The first relates to the problems encountered by many with firewalls and blocked Internet Protocol (IP) ports:

Recommendation 1. Institutions need to establish a clear mechanism for teaching staff wanting to adopt a new online technology to request that certain Internet Protocol (IP) ports are opened for access by devices connected to the campus network either wired or wirelessly.

Recognising that, at this stage, the number of people integrating virtual worlds into their teaching is not large enough at most institutions to devote substantial IT support resources to this area specifically, we instead propose that institutions provide more generic support for people adopting any leading edge technology:

Recommendation 2. As well as providing technical support for teaching staff using specific institutionally sanctioned technologies, institutions should ensure that technical support is also available for teaching staff attempting to trial new technologies.

Many participants mentioned the value of networking and sharing of experiences with others, especially when first starting to explore the use of virtual worlds in their teaching. Often the networks that people tapped into were beyond their individual institutions; however, many of the problems reported were institutionally specific. It may be that if the institutions were able to provide better mechanisms for early adopters of technology to share their experiences within the institution, some of the problems with campus networks, firewalls and IT support would be able to be more quickly resolved through help from others with similar experiences. This leads to the following recommendation:

Recommendation 3. Institutions should provide mechanisms for teaching staff exploring the use of new technologies to share their experiences with others so that they can collectively work to resolve the barriers they encounter.

A number of participants reported problems with the hardware platform provided in academic staff offices or in student computer labs being unable to run virtual worlds platforms like *Second Life*. This is somewhat worrying because basic 3D graphics capabilities have been available as a standard component of desktop and notebook computers for quite a few years now, and the absence of this capability indicates that it has not been included in the standard specifications when new computers were purchased, even though the cost of including it would be very small. It is even possible that some IT departments are deliberately not providing this capability on the basis that it might encourage staff or students to use the computers for game

playing, although there is no evidence of this from the data collected during this study. Generally, the desktop computers being purchased now have sufficient graphics capabilities but this is not always the case for notebook and netbook computers. The need for this capability within the specifications of computers purchased within institutions, especially given that it is generally acknowledged that an increasing array of software making use of these capabilities will emerge in the next few years, leads to the following recommendation:

Recommendation 4. In defining the specifications for new desktop computer hardware, institutions should ensure that the graphics capability is taken into account and appropriate 3D graphics processing, RAM and CPU specifications are included.

8.2.2 Recommendations for teaching staff adopting virtual worlds

A recurring message from both the questionnaire responses and the interviews was that the use of virtual worlds for learning and teaching requires a substantial time commitment in becoming familiar with the environment before designing learning activities for students to undertake. This leads to the first recommendation for teaching staff considering adopting virtual worlds:

Recommendation 5. Teaching staff should expect to devote considerable time to familiarising oneself with the virtual world platform and, in particular, developing a clear sense of its limitations and affordances before designing the learning activities or embarking on building work.

Given the large number of reports of IT problems within institutional networks, early engagement with IT support staff is important:

Recommendation 6. Teaching staff planning to use virtual worlds in their teaching should engage with Information Technology support staff early.

In order to prevent problems occurring due to teaching colleagues showing a lack of interest, lack of knowledge or cynicism about virtual worlds, it is important that teaching colleagues are also engaged early:

Recommendation 7. Staff leading the adoption of virtual worlds should set up activities such as workshops to familiarise teaching colleagues with the virtual world platform and its educational potential early.

The value of networks was a recurring theme, leading to the following recommendation:

Recommendation 8. Teaching staff should seek mentors or join a network to obtain help from more experienced others as they conceptualise their learning design and in attempting to resolving the problems that will inevitably be encountered.

Questionnaire and interview participants had differing views on the question of which platform to use, but in general those using *OpenSim* tended to be people who had already had experience with *Second Life*, with others feeling that the *OpenSim* platform was perhaps not yet sufficiently stable or easy to use to allow first time users to begin with it:

Recommendation 9. Using a well established commercial platform such as *Second Life* is the easiest entry to the use of virtual worlds, but consideration of a move to an open platform such as *OpenSim* in the future is recommended.

Some participants whose educational objectives were primarily focussed on the students obtaining familiarity with virtual worlds were able to use virtual worlds in their teaching without investing in development of environmental features or the building of new spaces. For most others, there was a cost involved in obtaining land and developing a space suitable for their specific pedagogical purposes:

Recommendation 10. There are likely to be costs involved in any use of a virtual world aligned to specific curriculum outcomes because such uses typically require labour costs for the building of environmental features, and either land rental or server infrastructure and support costs, so budgetary planning is important.

Based on the comments of interview participants, it would appear that the most successful projects involving the development of spaces in a virtual world have been those where experienced virtual world builders have been employed to undertake the work. A number of participants gave examples of experienced people being able to build the spaces very quickly, while it is clear from other comments that the learning curve for doing this kind of work is very steep, and so there is likely to be a big overhead in having less experienced people undertake this work:

Recommendation 11. In planning for the development of new environmental features, teaching staff should consider employing a person experienced in development for the chosen platform, because even if the cost per hour is greater, the productivity is likely to be substantially greater.

8.2.3 Research recommendations

A number of participants in the questionnaire and interviews identified issues they had encountered relating to the stability of the virtual world platforms, the complexity in configuring the platforms and client software for initial use, and the usability problems encountered by first time student and academic staff users of the tools. Additionally, a number of participants identified limitations in the fidelity of the representation, which might be addressed by enhancements to the virtual world hardware and software platforms. This leads to the following recommendations with regard to research:

Recommendation 12. Ongoing technological research is needed to improve the capabilities of virtual world platforms and also their stability and usability.

Aside from technological research that continues to develop and evolve these technologies and tools, we believe, as argued in Dalgarno and Lee (2010), that there is an ongoing need for research that explores the relationship between the unique capabilities of virtual worlds, the learning activities they can potentially afford, and the ensuing learning outcomes. One aspect of this is the undertaking of studies that test basic assumptions and link the characteristics of virtual environments to their pedagogical affordances. Such research would set out to validate or refute the basic, underlying assumptions implicit in the design and use of virtual worlds, and determine the relationships between the unique characteristics of virtual worlds and the anticipated learning benefits that arise from the tasks afforded by these environments. This is captured by the following recommendation:

Recommendation 13. Continuing fundamental research is needed to improve knowledge of the affordances of virtual environments for particular types of learning tasks and the possible learning benefits which might ensue.

In addition to this fundamental research, we call for applied studies—perhaps using design-based research method, carried out in a higher education context—that study the design and development of virtual worlds and associated learning tasks and their implementation at scale, and derive guidelines for best practice. This research might be open-ended and qualitative in nature in order to identify emergent issues from these implementations in context, or it might be more structured in order to test out the degree to which theorised afforded learning tasks and expected benefits actually occur, and the additional variables impacting on the situation.

Recommendation 14. Applied research is needed to evaluate implementations of virtual worlds in an authentic higher education context in order to assure the highest possible learning outcomes and to derive best practice guidelines for others.

Stemming from this body of research which would provide higher educators considering the adoption of virtual worlds into their teaching with sound evidence-

based guidelines to inform their work, it is hoped that additional exemplars of the successful application of virtual worlds will emerge which will provide educators considering exploration of the use of virtual worlds for teaching with the confidence to move into the somewhat risky territory associated with the use of such environments.

8.3 On the horizon

This section discusses some of the emerging technological developments and some of our predictions for the future with regard to the use of virtual worlds in higher education.

One of the most significant developments in the use of virtual worlds in higher education during the life of this project has been the rapid emergence of *OpenSim* (see http://opensimulator.org/wiki/Main_Page) as an alternative to *Second Life*. *OpenSim* is an open source platform that allows institutions to host their own virtual worlds platforms without having to pay for monthly land rental, while also having access to a network of worlds hosted on other servers. The potential advantages are summarised well by Livingston (2011):

OpenSim offers institutions greater control over their virtual worlds and greater ability to make backups of and share their virtual assets using XML-based archive formats. Institutions can mix private areas for teaching and research and open areas for public engagement and can use the hypergrid to exploit rich possibilities for cooperation and collaboration across institutional boundaries.

However, there are additional overheads involved in self-hosting, including server infrastructure and IT management and support costs, and some interview participants in this study noted the lack of stability and the complexity of use of the *OpenSim* platform compared to the more established alternative of *Second Life*. Probably, the key event that led to a sudden increase in interest in *OpenSim* was the decision by Linden Labs, in late 2010, to end educational discounts for the use of *Second Life*, which essentially doubled the cost of usage for higher education users. In the latest Virtual Worlds Watch report, which described the use of virtual worlds in higher education in the UK (Kirriemuir, 2012), there were many reports of moves from *Second Life* to *OpenSim*; however, there were also many respondents indicating that they were staying with *Second Life* for the time being.

The competition to *Second Life* caused by the emergence of an alternative open source platform with compatible messaging protocols in *OpenSim*, along with the emergence of a number of alternative viewer applications (see http://opensimulator.org/wiki/Compatible_Viewers for a comprehensive list), may ultimately stimulate growth in the use of virtual worlds. The ability to install *OpenSim* on a server within the university

network to create a private grid tends to be attractive to those with technical skills or access to good technical support, but without ongoing funding. Alternatively, there is an increasing number of public grids available based on the *OpenSim* platform (see, http://opensimulator.org/wiki/Grid_List for a comprehensive list), and these are increasingly seen as a viable alternative to paying for space in *Second Life*. It would be reasonable to expect a gradual rationalisation in the number of grid providers, so that one or two large platforms with reliable infrastructure and high quality documentation and support emerge as the most popular and that these become the main competitors to *Second Life*. It would, also, be reasonable to expect that public free platforms that attract large numbers of users will become targets for corporate takeovers and that their access policies change to fit with the new business models that emerge. It may turn out that competition in the commercial provision of virtual worlds may stimulate growth in usage through different ways of promoting their usage. This will particularly be the case if commercial partnerships are formed between virtual worlds providers and other social networking platform providers, such as *Facebook* or *Google+*.

The other emerging virtual world platform that is attracting attention in higher education in Australia and New Zealand is Unity 3D (see <http://unity3d.com>), which is essentially a game engine allowing development of 3D virtual environments or games for a variety of platforms, including Mac, PC, web browser, iPad, Android and a number of different game consoles. This platform is likely to be particularly attractive to educators developing virtual world activities with a particular pedagogical purpose and with particular environmental characteristics. The quality of the graphics and the interactive capabilities arguably exceeds those of *Second Life* and *OpenSim*, while the key disadvantage would be the lack of access to the huge network of spaces developed by others that *Second Life* and the *OpenSim* hypergrid offer. Other emerging platforms mentioned by respondents in the most recent Virtual Worlds Watch report in the UK (Kirriemuir, 2012) include Open Wonderland (see <http://openwonderland.org/>) and Kitley (see <http://www.kitley.com>), but there were no reports of the use of these platforms within our study.

One of the barriers to adoption of virtual worlds by educators within compulsory or assessable activities has been concerns that not all students had access to the required computer hardware and the required broadband network bandwidth at home and/or on campus. The gradual availability of high speed broadband in Australia through the National Broadband Network (NBN) is expected to remove one of these barriers to adoption, in that eventually we will get to the point where it will be reasonable to assume that all students have access to sufficient network bandwidth at home.

As base levels of computer hardware improve, it might be reasonable to expect that, within the next few years, all would have access to a computer with the 3D graphics capabilities required for running a virtual world viewer. However, in recent years, despite the affordability of such graphics hardware, manufacturers have continued to make some computers tailored for office applications without such capability, and so some students with brand new computers have found that they are still unable to run a virtual world viewer with a usable level of performance. The current tendency for

many students to purchase smaller netbook computers or tablet computers, which typically do not have the graphics processing capabilities required for running a virtual world viewer, is likely to further exacerbate this problem.

Additionally, Linden Labs, proprietors of the *Second Life* viewer, have tended to regularly upgrade the software to make use of the leading edge of graphics hardware, which has often meant that use on older hardware has required tweaking of settings to turn off features requiring specialised graphics processing features. It does appear that mainstream use of virtual worlds will require a philosophical shift from companies like Linden Labs to cater for the average user rather than the high end user in the first instance. The problems faced by many on-campus users of *Second Life*, due to the need to open up access to specific internet ports that tend to be blocked by default by system and network administrators, is another key barrier to adoption. Again, a philosophical shift by the companies making the viewer and server platforms, so that they use standard internet ports and protocols to cater for mainstream users without the need for technical intervention, may be required to allow more widespread use of virtual worlds in higher education.

Looking at the leading edge of virtual worlds technology, we can see a number of key areas of development in the coming years, and we have grouped these into the areas of mobile virtual worlds; blending of real, virtual and online spaces; and user interface enhancements.

Consistent with the inclusion of mobile apps within the key list of emerging technologies in the most recent Horizon Reports (see Johnson, Adams and Cummins, 2012a, 2012b), we believe that there will be substantial interest in mobile access to virtual worlds in the coming years. Mobile viewer software for virtual world environments such as *OpenSim* and *Second Life* has already begun to emerge, although such software tends to have less functionality than the alternative desktop computer alternatives. One of the strengths of the Unity 3D development platform is the ability to author for multiple platforms, including iPad and Android. The availability of virtual world viewer software on mobile devices will also begin to open up the possibility of augmented reality applications involving blended combinations of virtual spaces and real spaces.

More broadly, the blending of virtual and real world spaces is becoming increasingly possible as is the use of a blended composition of multiple communication technologies. For example, Bower, Cram and Groom (2010) report on trials of the use of combinations of virtual world and videoconference technology to bring together on-campus and geographically dispersed students, and this idea is being further pursued in the OLT funded Blended Synchronicity project (Bower, Kennedy, Dalgarno & Lee, 2011). The integration of virtual worlds into social networking technologies, such as *Facebook* and *Google+*, and into university Learning Management Systems is another area predicted to take off in the future and likely to lead to some interesting applications.

There are a number of virtual world user interface enhancements that have begun to emerge in recent years, some of which are mainstream versions of tools that have existed in research and high end Computer Aided Design (CAD) environments for many years, while others have emerged within a consumer gaming context. The following are some of the more noteworthy:

- Haptic systems, which, at a simple level, provide basic tactile feedback (such as vibrating consoles in many games systems) or, at a more advanced level, provide styluses with force feedback, allowing complex tasks such as surgery to be simulated in a virtual world;
- Voice recognition and natural language processing, which allow spoken or type written commands to be used to operate features within a virtual environment or to communicate with system controlled characters or 'bots'; and
- User control devices aside from the conventional mouse or keyboard, such as 'wands' (similar to that used on the Wii games console), data gloves (used in older 3D workstation systems especially in a research context), Head Mounted Displays (which usually include head tracked view changes) and sensory input (similar to that used by the xBox Kinect games console).

One of the other predictions of various Horizon Reports (see Johnson, Adams and Cummins, 2012a, 2012b) is an increase in applications of games technology in learning and teaching, or gamification. Our perspective is that there is still a great deal of confusion amongst educators and educational designers about what it is that makes computer games engaging and how to leverage this engagement within learning in a higher education context. It is clear to us that purely using games technologies is not sufficient to obtain this kind of engagement unless an actual game element is involved in the activity, but there is still a lot of research needed about how best to integrate a game element into a learning activity aligned with a specific curriculum outcome. There are also issues which need further exploration regarding the assumptions being made about whether university students tend to be extrinsically motivated or whether they really do need activities that are intrinsically motivating in order to engage with their studies.

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Appendix A: Annotated bibliography

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OVERVIEW

The following sections present an annotated bibliography of articles authored by Australian and New Zealand higher educators describing the use of 3D immersive virtual worlds in teaching and learning within their institutions, as well as related evaluation studies and research. Additionally, Table A1 provides a summary of the higher education institutions in Australia and New Zealand using virtual worlds in teaching and learning and the year in which such environments were first adopted, according to the information collected during this study.

Much of the text within the annotated bibliography which describes the use of virtual worlds within each institution has been based on the following papers written by members of the Australian and New Zealand Virtual Worlds Working Group between 2010 and 2012:

Gregory, S., Lee, M. J. W., Ellis, A., Gregory, B., Wood, D., Hillier, M., Campbell, M., Grenfell, J., Pace, S., Farley, H., Thomas, A., Cram, A., Sinnappan, S., Smith, K., Hay, L., Kennedy-Clark, S., Warren, I., Grant, S., Craven, D., Dreher, H., Matthews, C., Murdoch, D., & McKeown, L. (2010). Australian higher education institutions transforming the future of teaching and learning through 3D virtual worlds. In C.H. Steel, M.J. Keppell, P. Gerbic & S. Housego (Eds.), *Curriculum, technology and transformation for an unknown future. Proceedings ascilite, Sydney, 2010* (pp. 399–415). <http://www.ascilite.org.au/conferences/sydney10/Ascilite%20conference%20proceedings%202010/Gregory-full.pdf>

Gregory, B., Gregory, S., Wood, D., Masters, Y., Hillier, M., Stokes-Thompson, F., Bogdanovych, A., Butler, D., Hay, L., Jegathesan, J.J., Flintoff, K., Schutt, S., Linegar, D., Alderton, R., Cram, A., Stupans, I., McKeown-Orwin, L., Meredith, G., McCormick, D., Collins, F., Grenfell, J., Zagami, J., Ellis, A., Jacka, L., Campbell, J., Larson, I., Fluck, A., Thomas, A., Farley, H., Muldoon, N.I., Abbas, A., Sinnappan, S., Neville, K., Burnett, I., Aitken, A., Simoff, S., Scutter, S., Wang, X., Souter, K., Ellis, A., Salomon, M., Wadley, G., Jacobson, M.J., Newstead, A., Hayes, G., Grant, S., & Yusupova, A. (2011). How are Australian higher education institutions contributing to change through innovative teaching and learning in virtual worlds? In G. Williams, P. Statham, N. Brown & B. Cleland (Eds.), *Changing demands, changing directions. Proceedings ascilite, Hobart, 2011* (pp. 475–590). Retrieved from <http://www.ascilite.org.au/conferences/hobart11/downloads/papers/Gregory-full.pdf>

Gregory, S., Gregory, B., Hillier, M., Jacka, L., Schutt, S., Ellis, D., Stokes-Thompson, F., Wood, D., Masters, Y., Farley, F., Orwin, L., Stupans, I., Scutter, S., Warren, I., Steel, C., Neuendorf, P., Bower, M., Miller, C., Butler, D., Merle Hearn, M., Mathews, S., Garcia, J., Jegathesan, J.J., Brown, R., Meredith, G., Eimear Muir-Cochran, E., Flintoff, K., Grant, G., Atkins, C., Gaukrodger, B., Giovanangeli, A., Le Rossignol, K., Larson, I., Cram, A., Linegar, D., Wang, X., Muir, T., Cleland, B., Paillat, E., Grenfell, J., Hay, L., Gu, N., Anthony Williams, A., Simoff, S., Bogdanovych, A., & McCarthy, A. (2012). Sustaining the future through virtual worlds. In M. Brown, M. Hartnett & T. Stewart (Eds.), *Future challenges, sustainable futures. Proceedings ascilite, Wellington, 2012*. http://www.ascilite.org.au/conferences/wellington12/2012/images/custom/gregory_sue_-_sustaining.pdf

Hearn, M., Diener, S., Honey, M., Cockeram, J., Parsons, D., Champion, E., Schott, G., Falloon, G., Thompson, D., Bell, T., Grimley, M., Green, R., Cochrane, T., Davis, N., Morrow, D., Corder, D., U-Mackey, A., Clear, T., Philpott, A., Davies, R., Loke, S.K., Atkins, C., & Gregory, S. (2011). He ara hou ka tū mai: NZ institutions of higher learning unpacking demands and facilitating change. In G. Williams, P. Statham, N. Brown, B. Cleland (Eds.), *Changing demands, changing directions. Proceedings ascilite, Hobart, 2011* (pp.571–579). <http://www.ascilite.org.au/conferences/hobart11/downloads/papers/Hearn-concise.pdf>

Table A1: Year each institution began teaching and researching in virtual worlds

Year	Institution
1997	Charles Sturt University
1998	University of Western Sydney, University of Sydney
2005	University of Southern Queensland
2006	Victoria University, University of Auckland, Nelson Marlborough Institute of Technology
2007	Griffith University, LaTrobe University, Monash University, Queensland University of Technology, Swinburne University of Technology, University of New England, University of South Australia, Canberra Institute of Technology, Massey University
2008	Central Queensland University, Curtin University, Deakin University, University of Canberra, University of Queensland, University of Newcastle, Australian Catholic University, University of Technology Sydney, Auckland University of Technology
2009	RMIT, Southern Cross University, University of Western Australia, University of Ballarat, Manukau Institute of Technology, Victoria University of Wellington
2010	Macquarie University, University of Adelaide, University of Tasmania, Flinders University, University of Melbourne, University of Otago
2012	James Cook University



Australian Catholic University

The Australian Catholic University began teaching and researching in virtual worlds in 2008. They use a half island for simulations to complement teaching of professional ethics and decision making. Distance students use these simulations during their internship and for role-plays that simulate professional experience. Academic staff reported that student responses were tempered by a fear of being ostracised and concern about disclosure and welfare when dealing with particularly sensitive issues during face to face role-plays, while sharing of ideas and collaboration has been greater using the simulations in the virtual world. According to ACU teaching staff, this provides the off-campus students an engaging online medium and students feel part of the university. The School of Education is developing similar teaching tools to use as part of their Religious Studies course.

See: Campbell, M. (2009a); Campbell, M. (2009b); Campbell, M. (2009c).

Australian National University

See: McGrath, D. et al. (2008); McGrath, D. et al. (2010); Savage, C.M. et al. (2006); Savage, C.M. et al. (2007); Savage, C.M. et al. (2009); Savage, C.M. et al. (2010).

Canberra Institute of Technology

The Canberra Institute of Technology began teaching and researching in virtual worlds in 2007. Students practise communication skills. Another cohort of students undertakes a Great Health Challenge in *Second Life* (using a private island) through a scenario focused on an elderly lady being admitted to hospital, promoting inter-disciplinary learning and development skills. Students learn how to develop a sustainable health plan. Finally, a virtual room containing ten categories of hazards have been created using *Unity 3D* for OH&S training. This is used for students to simulate their area of

training such as a gym or hospital. The Canberra Institute of Technology is also currently developing an IV medication scenario to minimise incorrect medications being given to patients.

See: Neuendorf, P. (2009a); Neuendorf, P. (2009b); Neuendorf, P. (2010); Neuendorf, P. et al. (2010a); Neuendorf, P. et al. (2010b); Neuendorf, P. et al. (2011).

Central Queensland University

Central Queensland University began teaching and researching in virtual worlds in 2008. Activities have been focussed on producing machinima for learning support rather than facilitating student interaction with virtual worlds. Machinima is created for advanced auditing courses where authentic practices and values within the profession could be demonstrated for the students. A series of machinima provided students with various scenarios, including ethical dilemmas, enabling them to respond through follow-up activities such as collaboration with team members to prepare a weekly audit paper. Students deal with the ethical and legal issues by formulating strategies and then reflect on these experiences in an online journal. A welcome area was opened to signpost for spaces and events.

See: Kofoed, J. et al. (2008); Muldoon, N.I. et al. (2008); Muldoon, N.I. et al. (2009a); Muldoon, N.I. et al. (2009b).

Charles Darwin University

See: Fassbender, E. et al. (2012); Richards, D. et al. (2008).

Charles Sturt University

Charles Sturt University began teaching and researching in virtual worlds in 1997. Text-based and graphical virtual worlds were used in the early years, with *Second Life* being incorporated in 2009 providing immersive, synchronous learning experiences for students. Online discussions, presentations, group work and visits to other campuses were the foci of the use of virtual worlds. There are also several spaces and facilities to support socialisation and community building. The virtual space is also being used as part of students' professional learning network once they have graduated. Across a range of subject areas and disciplines, virtual simulations are used for such things as refining interview skills, fire investigation and providing ways in which to deal with domestic violence. Librarianship subjects use *Second Life* for distance students who are

encouraged to join a range professional educator groups, professional development activities, visit university library campuses, and meet with their lecturers. *Second Life* is the preferred virtual world as academic staff perceive that there is a greater breadth and richness of professional and informational learning experiences to be gained from its communities.

See: Dalgarno, B. et al. (2001); Dalgarno, B. (2002); Dalgarno, B. et al. (2002); Dalgarno, B. et al. (2003a); Dalgarno, B. et al. (2003b); Dalgarno, B. (2004); Dalgarno, B. et al. (2004a); Dalgarno, B. et al. (2004b); Dalgarno, B. et al. (2004c); Dalgarno, B. (2005), Dalgarno, B. et al. (2009); Dalgarno, B. et al. (2010a); Dalgarno, B. et al. (2010b); Dalgarno, B. et al. (2010c); Dalgarno, B. et al. (2011); Davies, A. et al. (2008); Davies, A. et al. (2009a); Davies, A. et al. (2009b); Hay, L. (1998); Hay, L. et al. (1999); Hay, L. et al. (2009); Hay, L. et al. (2010); Hay, L. et al. (2011a); Hay, L. et al. (2011b); Lee, M.J.W. et al. (2011); Murdoch, D. et al. (2011); O'Connell, J. (2010); O'Connell, J. et al. (2010); Scott, J. et al. (2001).

Curtin University

Curtin University began teaching and researching in virtual worlds in 2008. A business case study was modelled in *Second Life* due to a decline in interest and performance in Information System Development. The case study was based on the Business School's Automated Assessment Laboratory facilitating automated essay grading of large numbers of students. They have also been used for role-play assignments involving buyers and vendors. Bentley Campus recreated iconic buildings and Student Central so that students could find information about courses, faculties and services and were able to contact Student Services. A virtual clinic was established for the School of Nursing and Midwifery to enable all students to participate in activities such as management and patient interaction. Authentic and engaging assessment was created through the School of Science in Quantitative Biology classes. A special interest group was established to formalise and collaborate on approaches to teaching and learning in virtual worlds. In 2012, the use of virtual worlds has vanished in some areas whilst re-emerging in others. *OpenSim* alternatives were considered but were found to be too immature and technically demanding. There has been a refocus on the needs of oil, gas and mining in virtual worlds to model the physical environments. Learning simulations are being considered.

See: Dreher, C. et al. (2009a); Dreher, C. et al. (2009b); Dreher, H. et al. (2009); Dreher, N. et al. (2009); Dreher, N. et al. (2010); Dron, J. et al. (2011); Flintoff, K. (2007); Flintoff, K. (2009); Reiners, T. et al. (2008); Reiners, T. et al. (2009a); Reiners, T. et al. (2009b); Reiners, T. (2010); Reiners, T. et al. (2011a); Reiners, T. et al. (2011b); Reiners, T. et al. (2011c); Watts, R. et al. (2010).

Deakin University

Deakin University began teaching and researching in virtual worlds in 2008. Four separate islands are housed on Deakin Island and are used for both active and inactive scenarios in arts education, criminology, nursing and occupational therapy. Research has been undertaken around regulatory models for dealing with virtual worlds within the criminology and anthropology sectors. Regulatory options within online environments are being used through *Second Life* to educate students to enhance their understanding of social control methods, including the information and normative methods of encouraging social cohesion without recourse to formal law. Critical thinking about the role of law, rules and norms that relate to everyday life are undertaken through a variety of in-world activities. The arts and education students are using interaction through the display of artistic and musical work where students engage in authentic learning experiences in *Second Life*. Blended synchronous and asynchronous activities are undertaken to link online learning activities with real world workshops. Student-led problem solving and role-play are being used to identify, explore and discuss art teaching and learning issues. Students present their artwork at virtual exhibitions. Students are provided with insights for designing urban spaces using a virtual world, taking into consideration the dynamics of criminal activities. Portfolio exhibitions are displayed in the virtual world. *Thursdays Fictions*, a surreal dance fantasy where students become one of the characters in the story, is hosted by Deakin Island and is also using *Second Life*. The medical discipline uses *Second Life* for case studies and to develop a virtual suburb, providing the context of a low socio-economic area for health science students working in communities.

See: Grenfell, J. (2008); Grenfell, J. (2010a); Grenfell, J. (2010b). Grenfell, J. (2011a); Grenfell, J. (2011b); Grenfell, J. (2011c); Grenfell, J. (2011d); Grenfell, J. (2012a); Grenfell, J. (2012b); Grenfell, J. et al. (2010a); Grenfell, J. et al. (2010b); Grenfell, J. et al. (2011); Le Rossignol, K. (2008); Le Rossignol, K. (2009); Le Rossignol, K. (2010); Le Rossignol, K. (2011); Warren, I. et al. (2008); Warren, I. et al. (2010).

Flinders University

Flinders University began teaching and researching in virtual worlds in 2010. Due to staff reluctance to use virtual worlds or undertake training, the poor bandwidth experienced and general resistance to change, Flinders has stopped using virtual worlds in 2012. In the past, they have used *Second Life* for creating machinima and these materials will continue to be developed.

See: Muir-Cochrane, E.C. et al. (2010)



Griffith University

Griffith University began teaching and researching in virtual worlds in 2007. The School of Education use the *Appalachian Education Technology (AET) Zone*, their own *Second Life* island, *Quest Atlantis*, *MineCraft* and *Cryengine*. *Second Life* is being used with pre-service teacher preparation experience through various simulated classroom teaching environments comparing spatial arrangements, and space is also available for individualised, collective and collaborative learning. They also undertake role-play activities exploring student and teacher stereotypes and how these can influence teaching practicum. Students also create collaborative constructions in the virtual world to improve communications. Arts education use *Quest Atlantis* to meet curriculum goals by undertaking virtual excursions, performance and installations. They also participate in an international multi-university. Online course discussions are enhanced by the use of *Second Life* and *AET* by postgraduates.

See: Zagami, J. (2008a); Zagami, J. (2008b); Zagami, J. (2008c); Zagami, J. (2010a); Zagami, J. (2010b).

James Cook University

James Cook University began teaching and researching in virtual worlds in 2012. *Unity 3D* has been used to create a medical ward environment using avatars and medical models created in AutoDesk Maya. Time stamped log files of interactions record intelligent conversations with virtual patients using a networked supervisor observation console. In the Health Faculty, students are using *OpenSim* for teaching public health. Health information for children and use in a Public Health Resource Centre in South Africa use bots (non-player characters) to interact with. Screen casting technology is being used to enable students to interact by sharing their computer screen with students at other campuses. This provides the students with a feeling of presence where they can demonstrate their work.

La Trobe University

LaTrobe University began teaching and researching in virtual worlds in 2007. Based on LaTrobe's bush campus and laneways of central Melbourne, the Faculty of Humanities and Social Sciences used *Second Life* for a series of learning, teaching and meeting spaces, including using an amphitheatre, sandpit and campsite. Students' work in photojournalism is showcased in a virtual art gallery. Nursing, Education and Law and Management also use virtual worlds in their teaching.

Macquarie University

Macquarie University began teaching and researching in virtual worlds in 2010. Curriculum-specific units have been developed in *OpenSim* to assist classroom teachers in primary and secondary schools to maximise student learning outcomes and cyber-citizenship through engaging students in design and construction activities. Students have completed sculpture, sustainability, learning spaces and architecture. The aims are to engage students' design tasks with real-world implications through rapid testing of ideas, sharing and collaboration in the virtual world. Pre-service teachers visit sites within *Second Life* and use paired work to create a virtual world learning design by pre-service teachers.

See: Bower, M. et al. (2010); Bower, M. et al. (2011); Cram, A. et al. (2009); Cram, A. et al. (2010a); Cram, A. et al. (2010b); Cram, A. et al. (2010c); Cram, A. et al. (2011); Cram A. et al. (2012).

Monash University

Monash University began teaching and researching in virtual worlds in 2007. Chinese Island in *Second Life* simulates a township containing a restaurant, farmer's market, railway station, medical clinic and transport infrastructure and is used for beginner level Chinese language courses. Learning activities range from role-play to quests, to the making of television chat shows and news-desk reporting. Real world scenarios are used where learners interact with bots through text-based conversation in a free-form manner. Arabia is a simulation of a university and residential environment in Cairo, Egypt. Lessons are focussed on immersing beginner level students in aspects of everyday Arabic culture and family life. Behavioural Studies use virtual facilities that simulate a formal university environment. Students are taught fully online with weekly live sessions in *Second Life* looking at how identity, privacy, communication, teamwork, commerce and community are affected by digital mediation. Pharmacy use problem-based learning modules including a tablet manufacturing facility, a compounding dispensary, two biotechnology laboratories and a sterile products manufacturing facility. Digital Selves focusses on equipping students with theoretical and applied knowledge and experience of the implications for identity, privacy, communication, teamwork, commerce and community that are affected by digital mediation.

See: Collins, F.E. (2008); Collins, F.E. et al. (2011a); Collins, F.E. et al. (2011b); de Zwart, M.C. et al. (2008); Grant, S. et al. (2010); Grant, S. et al. (2011); Henderson, L. et al. (2009); Henderson, L. et al. (2010); Henderson, M., et al. (2009); Henderson, M. et al. (2012); Jeffery, A. et al. (2011); Lindsay, D. et al. (2009); Meredith, G. et al. (2012); Miller, C. et al. (2011); Roth, K. (2009); Roth, K. (2010); Willems, J. (2009); Williams, A.P. et al. (2011).

Queensland University of Technology

The Queensland University of Technology began teaching and researching in virtual worlds in 2007. QUT Island uses a closed sim in *Second Life* for staff and students with a community plaza and auditorium. It is mostly used as a film set for the creation of machinima for law practice scenarios. Students in the School of Design created a virtual space station and environmental landscape area, while Business conduct virtual field trips to explore consumer psychology and brand return on investment issues. Students of advertising, marketing and public relations use the island to appreciate 3D implications for marketing including branding, public relations, advertising and sales perspectives. *OpenSim* is used to teach Game AI and is also used in a postgraduate nursing course at Austin Hospital in Melbourne to teach students proper ICU handover processes.

See: Brown, R.A. (2010); Brown, R.A. et al. (2006); Brown, R.A. et al. (2008); Brown, R.A. et al. (2009a); Brown, R.A. et al. (2009b); Brown, R.A. et al. (2010); Brown, R. et al. (2011a); Brown, R.A. et al. (2011b); Brown, R.A. et al.(2012a); Brown, R.A. et al. (2012b); Butler, D. (2008a); Butler, D. (2008b); Butler, D. (2009); Butler, D. (2010); Butler, D. (2011); Butler, D. (2012); Butler, D. et al. (2008); Foth, M. et al. (2009); Guo, H. et al. (2011); Guo, H. et al. (2012); Joslin, S.S. et al. (2006); Joslin, S.S. et al. (2007); Mathews, S. et al. (2012); Nantes, A. et al. (2008); Nantes, A. et al. (2010); Poppe, E. et al. (2011); Rasmussen, R. et al. (2012); West, S. et al. (2010).

Royal Melbourne Institute of Technology (RMIT)

RMIT began teaching and researching in virtual worlds in 2009. The School of Electrical and Computer Engineering developed a virtual TV studio learning environment where students learnt to design and create multimedia content, use advanced audio/video editing, mixing tools and the RMIT TV studio. The City Campus TV studio is a fully operational facility with avatar interactivity. The virtual studio mirrors the studio and control rooms (and communications/feeds), props, cameras, and DMX lighting rig with static and intelligent lights. It is also currently being integrated into coursework repositories using Sloodle for alignment with course material. Students can communicate with teachers and student peers, keep a record of their studio setups for class sessions and save the 'film' that they have created in the virtual studio for assessment.

See: Neville, K. et al. (2010).



Southern Cross University

Southern Cross University began teaching and researching in virtual worlds in 2009. A Second Life island was created as a recognisable and interactive version of the Lismore campus, to provide a range of features and activities for academic staff, administrative staff and students. It provides a 'boot camp' environment for training in the use and possible application of virtual world environments. Visual Arts Education uses the virtual world so that the creative process of being able to draw, build and change texture objects in-world are utilised. A Law Users Group develops activities in a virtual Moot Court. Commerce Town was created for business simulations, to support teaching scenarios. The buildings have been realistically constructed to facilitate role-playing and teaching scenarios. The School of Education uses Commerce Town for pre-service teacher courses in visual art, science and technology, and learning technologies. The International Doctor of Business Administration Program brings students together in-world. The School of Education created an Early Childhood Centre for role-playing activities, an interactive maths playground and an eco space for science. Education students build objects and spaces that they can potentially use in their own teaching. Some education students are successfully integrating virtual worlds into a number of local schools using *Sim-on-a-Stick*.

See: Ellis, A. et al. (2009); Ellis, A. et al. (2010); Jacka, L. et al. (2010); Jacka, L. et al. (2011).

Swinburne University of Technology

Swinburne University began teaching and researching in virtual worlds in 2007. Students use a real virtual e-commerce environment to analyse hands-on the business environment. They compare and contrast online business models using web 2D and 3D virtual worlds, interacting with real time people and life events whilst exploring the usage of space, formulating strategies for marketing, sales, product delivery, logistics, advertising and commerce transactions. Koala Island in *Second Life* is used alongside Exit Reality to explore virtual worlds. The island is being used for group discussions and exploring. Several cubicles were built to be used by students.

See: Saeed, N. et al. (2008); Saeed, N. et al. (2009); Salomon, M. (2007a); Salomon, M. (2007b); Salomon, M. (2009a); Salomon, M. (2009b); Salomon, M. (2009c); Salomon, M. (2010); Salomon, M. et al. (2010); Sharp, D. et al. (2008).

University of Adelaide

The University of Adelaide began teaching and researching in virtual worlds in 2010. A project, 'Transforming Assessment' was used to improve academic assessment practice

within virtual worlds using *Second Life*. In-world and web content techniques were applied using Sloodle (*Second Life* and *Moodle*—Learning Management System) to provide quizzes, awards, 'touch to answer' exercises and chat bots. 'Getting a MUVE On' trialled and evaluated recreation of part of eighteenth-century London using *Second Life*. It was used to illustrate lectures, run in-world tutorials and design learning tasks.

See: Crisp, G. et al. (2010a); Crisp, G. et al. (2010b); Ellison, K. et al. (2010).

University of Ballarat

The University of Ballarat began teaching and researching in virtual worlds in 2009. The creation of an online campus includes interactive lecture theatres, meeting rooms, promotional literature and orientation simulations for the different schools. Nursing students are exposed to possible real life scenarios through a simulated emergency room. It has also created a virtual stuttering support group where groups present and meet with other interested people. A virtual art gallery houses artwork of academics. Educators are encouraged to experiment, and staff and student project groups support the use of virtual worlds. Capstone student projects are able to use the virtual world and IT students learn about virtual worlds from both an education and computer technology viewpoint.

See: Meredith, G. et al. (2012); Miller, C. et al. (2011); Peck, B. et al. (2010); Rogers, L. et al. (2011).

University of Canberra

The University of Canberra began teaching and researching in virtual worlds in 2008. *Second Life* is used largely for research into virtual world environments and sustainable ecosystems and as a platform for scripting and demonstrating artificial intelligence. The virtual world also supports postgraduate research and training projects. There is interactive art and free-roaming artificially intelligent objects.

See: Cox, R.J. et al., (2009); Fletcher, G. et al. (2006); Greenfield, G. et al. (2006).

University of Melbourne

The University of Melbourne began teaching and researching in virtual worlds in 2010. Online games and the impact of voice communication on user experience are a

focus of research. Other areas include collaboration and mutual awareness problems, building and studying network games on exertion, and rules and conventions for users of virtual worlds.

See: Ducheneaut, N. et al. (2008); Ducheneaut, N. et al. (2009); Wadley, G. (2007); Wadley, G. (2008); Wadley, G. et al. (2007a); Wadley, G. et al. (2007b); Wadley, G. et al. (2009a); Wadley, G. et al. (2009b); Wadley, G. et al. (2010).

University of Newcastle

The University of Newcastle began teaching and researching in virtual worlds in 2008. *Second Life* has been used for design learning through a collaborative architectural studio. Students, through a concept of a virtual home, explored the design potentials in a virtual world where collaborative and creative possibilities were achieved.

See: Gu, N. et al. (2007a); Gu, N. et al. (2007b); Gu, N. et al. (2009a); Gu, N. et al. (2009b); Gu, N. et al. (2011); Gül, L.F. et al. (2007a); Gül, L.F. et al. (2007b); Gül, L.F. et al. (2008); Merrick, K.E. et al. (2011); Nakapan, W. et al. (2009).

University of New England

The University of New England began teaching and researching in virtual worlds in 2007. The *Second Life* island of Australis 4 Learning uses several virtual primary school classrooms and a playground for education students. Students meet to discuss assessment tasks and explore learning and teaching opportunities through guided discovery. They participate in virtual excursions and interact with guest lecturers from a variety of national and international higher education institutions, as well as high school practitioners and virtual world consultants, to enlighten them on how they might use virtual worlds in their teaching. Virtual tours, excursions, role-play, web quests, basic building, scripting, experimentation, reflection and fun are other ways in which the students interact with the virtual world. Students are also introduced to different in-world tools, including 'holodecks' (scene changers), interactive bots and clickable breakout areas. Research is also being undertaken to explore assessment strategies to aid in professional experience preparation. Synchronous and asynchronous role-plays provide practise with peers and bots. Machinima have been created for assessment. The School of Science and Technology and the School of Health use machinima of typical counselling scenarios with multiple endings in social work and pharmacy for students to critically review examples, and engage in discussion and reflection.

See: Gregory, S. (2009); Gregory, S. (2011a); Gregory, S. (2011b); Gregory, S. (2011c); Gregory, S. (2012); Gregory, S. et al. (2009a); Gregory, S. et al. (2009b); Gregory, S. et al.

(2010a); Gregory, S. et al. (2010b); Gregory, S., et al. (2010c); Gregory, S., et al. (2011a); Gregory, S. et al. (2011b); Gregory, S. et al. (2011c); Gregory, S. et al. (2012); Masters, Y. (2010); Masters, Y. et al. (2010); Masters, Y. et al. (2011a).

University of Queensland

The University of Queensland began teaching and researching in virtual worlds in 2008. A virtual trading environment is used for the Foundation Year Business students providing them with access to a virtual trading environment in *OpenSim*. Education, using *Second Life*, demonstrates the features and possibilities to pre-service teachers. Religious Studies have used The Religion Bazaar that housed buildings from a variety of religions to teach first year classes and for supervising distance postgraduate research students. The UQ Religion Bazaar Island in *Second Life* has been de-commissioned and is now used as an orientation area for students in languages and educational technology classes prior to virtual field trips. The *Second Life* version is still available online but is no longer used for teaching. Pharmacy use a virtual compounding dispensary on the Pharmatopia, now located on Unity 3D, which was built to enable students to practice pharmaceutical calculations. The *Second Life* component of the 'Transforming Assessment' project (originally UniSA, now RMIT and UQ) has been transferred to an off-line *OpenSim*.

See: Campbell, C. (2009); Campbell, J. et al. (2007); Campbell, C. et al. (2008); Campbell, C. et al. (2009a); Campbell, J. et al. (2009b); Campbell, J. et al. (2011); Wegener, M. et al. (2012).

University of South Australia

The University of South Australia began teaching and researching in virtual worlds in 2007. *Access Globe* is being used due to specific features that make it more accessible to people with disabilities, such as enhanced accessibility menus, alternatives to a mouse-driven interface and an audio notification system to assist those with visual impairment to login and follow online conversations. Three different platforms are being used: *OpenSim*—for trialling the use of the virtual worlds for career planning and preparation and for defence simulations; *Reaction Grid*—for trials of health sciences role-play simulations, as a test bed for accessibility testing, for a project involving intermediality in performing arts courses and as a replica of careers for broader application; and *Second Life* —for trialling several media arts courses. The Schools of Communication, International Studies and Languages are using virtual worlds with a focus on journalism and professional communication. *OpenSim* is being used by Career Services to assist students in identifying and articulating their employability skills. The students' avatars interact with chatbots (simulating a conversation using audio or text) in panel interview and staff meeting situations.

See: Bloustien, G. et al. (2009); Fewster, R. et al. (2009); Fewster, R. et al. (2011); Hickey-Moody, A. et al. (2008a); Hickey-Moody, A. et al. (2008b); Hickey-Moody, A. et al. (2009); Hickey-Moody, A. et al. (2010); Stokes-Thompson, F. et al. (2011); Wood, D. (2007); Wood, D. (2008a); Wood, D. (2008b); Wood, D. (2008c); Wood, D. (2008d); Wood, D. (2009a); Wood, D. (2009b); Wood, D. (2009c); Wood, D. (2010); Wood, D. (2011a); Wood, D. (2011b); Wood, D. et al. (2008); Wood, D. et al. (2009); Wood, D. et al. (2011); Wood, D. et al. (2012).

University of Southern Queensland

The University of Southern Queensland began teaching and researching in virtual worlds in 2005. Two islands are used: the first is for a virtual careers fair, student interviews for teaching the microskills of counselling, social marketing campaigns of public relations students, meetings for language students to practise conversational skills, the Encke Virtual University Collaboration and virtual courtroom trials for criminal law students; the other is RejuveNation, used to measure the effectiveness of restoring virtual compared to natural environments trialling bots.

See: Albion, P.R. (2008a); Albion, P.R. (2008b); Albion, P.R. (2008c); Albion, P.R. (2009); Albion, P.R. et al. (2010); Farley, H. (2008a); Farley, H. (2008b); Farley, H. (2009); Farley, H. (2010a); Farley, H. (2010b); Farley, H. (2011a); Farley, H. (2011b); Farley, H. et al. (2009); Farley, H. et al. (2010); Farley, H. et al. (2011); McKeown, L. (2009); McIlveen, P. et al. (2009); Orwin (2012); Sanders, R.L. et al. (2007a); Sanders, R.L. et al. (2007b); Sanders, R.L. et al. (2007c).

University of Sydney

The University of Sydney began teaching and researching in virtual worlds in 1998. A central gathering space was established as an entry point for new students, as a meeting place for students and staff to promote cross faculty communication, as a space to construct their own work, as a general conference centre space and as a common classroom space which is equipped with the range of *Second Life* teaching tools for all staff to use. Education students role-play and story tell. Engineering use a virtual laboratory space for experiential learning. Medicine use a virtual surgical ward populated with bots for students to practise history taking and clinical management skills. Pharmacy use a virtual space for familiarisation with cross-cultural health settings. *Second Life* is being used for lectures, demonstrations, tutorials, exhibitions, interactions and discussions where students collaborate on design, presentation and exhibitions in the Faculty of Architecture. The Faculty of Engineering and IT facilitate teaching instrumentation, process dynamics and process control concepts. Oil refinery equipment with simulated behaviour was used for practical learning. A scientific

inquiry skills project in virtual worlds was used in secondary school science education using *Unity 3D* to design the Omosa Virtual World which investigated the mystery of a plummeting population of megafauna in a scenario inspired by Australia's unique natural history. Macquarie University and Sydney University have explored how virtual worlds can be used to develop scientific inquiry learning in secondary school science education using *Virtual Singapura*, a scenario-based MUVE that explores disease epidemics in 19th-century Singapore.

See: Abbas, A. (2010); Jacobson, M.J. (2006); Jacobson, M.J. et al. (2007a); Jacobson, M.J. et al. (2007b); Jacobson, M.J. et al. (2008a); Jacobson, M.J. et al. (2008b); Jacobson, M.J. et al. (2010a); Jacobson, M.J. et al. (2010b); Jacobson, M.J. et al. (2010c); Jacobson, M.J. et al. (2011); Kennedy-Clark, S. (2009); Kennedy-Clark, S. (2010a); Kennedy-Clark, S. (2010b); Kennedy-Clark, S. et al. (2009); Kennedy-Clark, S. et al. (2010a); Kennedy-Clark, S. et al. (2010b); Kennedy-Clark, S. et al. (2011a); Kennedy-Clark, S. et al. (2011b); Tanti, M. et al. (2010); Thomas, A. (2008); Thompson, K. et al. (2011).

University of Tasmania

The University of Tasmania began teaching and researching in virtual worlds in 2010. New Media Literacies explore avenues to explain ways to incorporate virtual worlds. Themes and new literacy practices such as play, performance, transmedia, remix, appropriation, simulation, collaboration, participatory culture, distributed cognition and multimodal authoring are all researched by students in and around virtual world spaces and social networking sites. Postgraduate students are exploring the potential for use in their own teaching contexts and engaging in ethnographic research of textual, discursive and social literacy practices. In particular, English teachers and their classes are exploring how complex, esoteric and poetic concepts of texts can be constructed and examined critically using *Virtual Macbeth* in *Second Life*. Students express ideas and storylines by creating structures and themed environments in *Designing Virtual Worlds* courses. In sociology and social work courses, students explore people who make their living in *Second Life* and explore differences between values in real life and *Second Life* in relation to work and happiness. Education pre-service teachers undertake role-play of teacher and child avatars as a practical means of preparing pre-service teachers for the challenges of undertaking practicum. Chat features and machinima are used for authenticity and reflection.

See: Deray, K. et al. (2009); Fluck, A. et al. (2011)



University of Technology Sydney

The University of Technology Sydney began teaching and researching in virtual worlds in 2008. They use *Second Life* to supervise research projects for foreign language teaching. Virtual space activities are linked to other in-class activities that were developed through course design, delivery modes and learning strategies. The learning explores the design, atmosphere and tempo of how virtual spaces affect the process of learning. Academic staff felt that this learning increased students' motivation to exploit learning materials more fully.

See: Davis, D. (2009); Leigh, M. et al. (2010a); Leigh, M. et al. (2010b).

University of Western Australia

The University of Western Australia began teaching and researching in virtual worlds in 2009. They use an amphitheatre for activities such as art, teaching, visualisation, research, architecture and machinima. In architecture, the building creators have created models for the Office of Facilities Management for long-term campus planning. Within research, initial tests have been conducted across many fields including nanotechnology, chemistry, physics and mathematics, allowing for actively working on 3D data sets with collaborators around the world. Art and machinima challenges have seen some of the richest prizes in *Second Life* and have attracted inspirational creators from around the world. Teaching and learning activities carried out are primarily focussed on marketing and business.

See: Halvorson, W. (2011); Halvorson, W. et al. (2011); Jegathesan, J. (2010); Jegathesan, J. (2011); Soheli, F.A. et al. (2011).

University of Western Sydney

The University of Western Sydney began teaching and researching in virtual worlds in 1998. Virtual worlds have been developed and utilised for educational purposes. Research is focussed on technology for electronic trading, cultural studies, tourism and emulation of processes in hospitals. *Second Life* is used for teaching, developing new methods of human-computer interaction, game technologies, social informatics and professional communication. A *Second Life* project recreates humanity's first city in ancient Mesopotamia and simulates daily life using Artificial Intelligence. *Second Life* is also used for experiments in creating immersive teaching materials, in particular, history. Students learn about the daily life by 'living' in the virtual world and interacting with virtual 'inhabitants' who are bots aware of where they 'live', hence the history learning happens through interacting with them. The team has developed technology

for controlling avatars via a motion capture suite for applications in sports, health informatics and tele-health.

See: Ancona, M. et al. (2010); Berger, H. et al. (2006a); Berger, H. et al. (2006b); Bogdanovych, A. (2007); Bogdanovych, A. et al. (2004a); Bogdanovych, A. et al. (2004b); Bogdanovych, A. et al. (2005a); Bogdanovych, A. et al. (2005b); Bogdanovych, A. et al. (2005c); Bogdanovych, A. et al. (2006a); Bogdanovych, A. et al. (2006b); Bogdanovych, A. et al. (2007a); Bogdanovych, A. et al. (2007b); Bogdanovych, A. et al. (2007c); Bogdanovych, A. et al. (2008a); Bogdanovych, A. et al. (2008b); Bogdanovych, A. et al. (2008c); Bogdanovych, A. et al. (2008d); Bogdanovych, A. et al. (2008e); Bogdanovych, A. et al. (2009a); Bogdanovych, A. et al. (2009b); Bogdanovych, A. et al. (2009c); Bogdanovych, A. et al. (2009d); Bogdanovych, A. et al. (2009e); Bogdanovych, A. et al. (2010); Bogdanovych, A. et al. (2011a); Bogdanovych, A. et al. (2011b); Rodriguez, I. et al. (2008); Drago, S. et al. (2007); Ijaz, K. et al. (2011).

University of Wollongong

See: Barwell, G. et al. (2011); Holloway, D. (2012).

Victoria University

Victoria University began teaching and researching in virtual worlds in 2006. Student engagement in construction, hairdressing, multimedia, design and building have been used by the VET sector at Victoria University, as well as piloting virtual worlds for VicHealth. *OpenSim* has mostly been used since 2009 where teachers use multiple choice or yes/no questions in-world to answer queries. An unsafe constructions site was used to trigger questions exploring unsafe workplace practices. Pharmacy has also been trialling *Pharmatopia*. *Unity 3D* is now being used for construction training for students to gain building site White Card certification. A sustainable building simulator is available for students to choose different building materials to see the impact on energy consumption. A biotechnology simulation of drug creation processes is also used.

See: Schutt, S. et al. (2007); Schutt, S. et al. (2009).





Auckland University of Technology

Auckland University of Technology began teaching and researching in virtual worlds in 2008. Students studying intercultural competence modules have been using *Second Life* to explore each other's cultural framework through group work based on selected themes such as identity, friendship and tandem ethnographic activities. They use a range of islands to challenge their values, beliefs and assumptions. Students use the resources available on the islands to provide a powerful catalyst for raising awareness of cultural similarities and differences, self-assessment and reflection. Cultural exchanges with students from a Japanese university also occur. *Xbox Kinect* has been used by students using web cameras and algorithms to interface *Unity 3D* to explore contexts such as rehabilitation, advertising, interactive art, design and town planning. Stereoscopies in film and interactive 3D have been explored for complex data visualisations of events such as the earthquakes in Christchurch.

See: Clear, T. (2004); Clear, T. (2007); Corder, D. et al. (2010); Corder, D. et al. (2011).

Manukau Institute of Technology

Manukau Institute of Technology began teaching and researching in virtual worlds in 2009. They participated in the SLENZ (Second Life Education New Zealand) Project, 'Engaging with Second Life; real education in a virtual world' funded by the New Zealand Tertiary Education Commission Encouraging and Supporting Innovation Fund. Manukau Institute of Technology used a specialised build on Kowhai Island to train students in interview skills. Nursing students use exercises in *Second Life* to improve vocabulary, reading and writing skills. Kowhai in *Second Life* use a holodeck (scene changer) for a clothing store, a runway for modelling outfits for student discussion, a demonstration interview room and a media room. The interview rooms include a general room, pathway rooms (nursing, policing, teaching), rooms that are representative of real companies in the Auckland area, and a whānau room designed for Māori and Pacific Island cultures. A job board houses advertisements for real jobs and a Stairway of Learning provides information on interviews and interview preparation.

See: Lemon, M. (2009); Lemon, M. et al. (2009); Hearn, M. (2011); Hearn, M. (2012); Hearn, M. et al. (2012).

Massey University

Massey University began teaching and researching in virtual worlds in 2007. *Second Life* was used for interactive learning materials and observations. A more targeted project, using *Open Wonderland* as the virtual world platform, was used to enable teams of participants, acting as software developers, testers and stakeholders, to explore various techniques of agile software development in a game based activity. A biofeedback socket was used to enable participants to indirectly affect the bots, music and graphic shaders (cinematography) with their galvanic skin response and with their heartbeat. Also, a curved mirror and code to allow virtual environments to be projected onto several walls, ceiling or floor simultaneously have been developed. Character sketching recognition in Flash to recognise and mark the learning of Chinese writing characters has also been created.

See: Champion, E. et al. (2010); Champion, E.M. et al, (2011); Parsons, D. et al. (2008); Parsons, D. et al. (2009); Parsons, D. et al. (2010); Parsons, D. et al. (2012).

Nelson Marlborough Institute of Technology

Nelson Marlborough Institute of Technology began teaching and researching in virtual worlds in 2006. The 'Kiwi Educators' group is housed on the Koru sim. The SLENZ project was developed to explore the potential for teaching in virtual worlds and led to the ONGENS project that eventually became established as the NZVWG. The Skills Mastery Hyperdome and The Birth Place were developed by the SLENZ project, are still hosted on Kowhai and are freely available. Students create applications as well as understanding and appreciating the communities and the potential benefits and issues of working in virtual worlds. *Second Life*, *OpenSim*, *Sim-on-a-Stick* and *Minecraft* are used for teaching. Courses in virtual worlds are taught by remotely located teachers where students build, script, create and run an event in *Second Life*, create machinima, or create and maintain a virtual world-focussed community.

See: Atkins, C. (2007); Atkins, C. (2009); Atkins, C. et al. (2009); Salt, B. et al. (2008).

Otago Polytechnic

See: Stewart, S. et al. (2009).

University of Auckland

The University of Auckland began teaching and researching in virtual worlds in 2006. A virtual health clinic with an intensive care unit, ambulance, cubicles, beds and a range of medical equipment was created in *Second Life*. Nursing students were able to participate in a haemorrhage simulation. The virtual health clinic has been used for a number of teaching events, including simulations for paediatric bereavement, nursing and pharmacy. An area for architecture students was also created so students could have an easy first engagement with a virtual world that contrasted with the difficult packages normally used in the discipline. Virtual worlds have assisted in developing collaborative, scripting and 3D modelling skills in students previously focused on 2D work. An *OpenSim* production environment has been created to replace the *Second Life* space.

See: Diener, S. et al. (2009); Honey, M.L.L. et al. (2009); Honey, M L.L. et al. (2010); Honey, M.L.L. et al. (2012); Keymer, D. et al. (2009); Marks, S. et al. (2008); Marks, S. et al. (2009a); Marks, S. et al. (2009b); Marks, S. et al. (2009c); Marks, S. et al. (2009d); Marks, S. et al. (2009e); Marks, S. et al. (2010); Marks, S. et al. (2011); McMeel, D. et al. (2011); Thomassen, A. et al. (2010); Wünsche, B.C. et al. (2010).

University of Canterbury

The earthquakes in Canterbury have affected both the researchers and the schools involved in virtual world activities. Virtual worlds activities are being used to provide students with disabilities participation when they are not able to participate fully in physical activities. An *OpenSim* prototype is being developed so that surveyors can produce a traffic management plan for when they are working on a road.

See: Basu, A. et al. (2008); Bell, T. et al. (2009a); Bell, T. et al. (2009b); Marghitu, D. et al. (2009).



University of Otago

The University of Otago began teaching and researching in virtual worlds in 2010. The Otago Virtual Hospital was created to support medical education. Through role-playing junior doctors or housemen, open-ended clinical cases that are written by practitioners and drawn from real-life events are solved by medical students. Students undertake role-plays reflecting the practices in emergency departments. To gather the patient's history, students communicate with patients and peers via text chat and interpret chest sounds by undertaking patient examinations. They also have to order laboratory and radiology tests from an extensive list and check the results of these tests by viewing X-ray images or ECG results and sharing these with their peers. They then have to prescribe a range of medicines that are available at emergency departments. Handover notes, admissions and discharges also have to be written up by students.

See: Blyth, P. et al. (2010).

Victoria University of Wellington

The Victoria University of Wellington began teaching and researching in virtual worlds in 2009. *Second Life* has been trialled to supplement in-class language study and prepare oral presentations using in-world resources. Research is undertaken through the virtual world examining locations relevant to their language on cultural, social, political or historical aspects. To acquire a sense of belonging to an international community of language users, tutors, speakers and developers in the target language meet in-world. Academic staff feel that in doing so, they develop a greater contextual understanding of the cultural and social dimensions of language-learning, can relate their learning to their specific interests and experiences and obtain access to resources that enable them to extend their experience beyond the framework provided by the course itself, as well as technological expertise related to virtual worlds.

See: Rive, P.B. (2008); Rive, P.B. et al. (2008); Rive, P.B. et al. (2012).

Wellington Institute of Technology

Wellington Institute of Technology uses *OpenSim* for teaching and learning and collaborative research in dance and modes of corporeality. Students have used the virtual world to develop a 3D interactive environment. Another virtual worlds environment is being used to learn how to prepare for natural disasters. A collaborative project is investigating different modes of interaction as a way to understand how humans cope with different ways of being. Existing interfaces such as the Wii-mote, live 2D image processing from web cams, 3D depth sensing (using *Kinect*) and human

data sensed from a network attached to the body are being used to transmit data into the virtual world and back into the physical environment.

See: Cochrane, T. et al. (2008)

University of Waikato

Machinima is regularly used to provide students with a distinct aesthetic and visual medium for communication. Students who have created machinima have had their works accepted into film festivals. Virtual worlds have been used in schools to promote higher level thinking and relating to others using *Marvin*. This virtual world is used for communication, discussion, debate, critique and social interaction.

See: Falloon, G. (2010).

Whitireia Community Polytechnic

See: Chard, S.M. (2004a); Chard, S.M. (2004b); Chard, S.M. (2006); Chard, S.M. (2009); Chard, S.M. (2010); Chard, S.M. et al. (2005)



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Appendix B: Glossary of terms

3D Immersive Virtual World: A computer-based, simulated environment in which users are able to immerse themselves and within which they are able to, through their avatars, experience, manipulate, interact with and/or create virtual objects and places that are graphically depicted in three dimensions. The objects and places within a 3D immersive virtual world may be modeled according to those in the real world or may be fantasy-based. Most current 3D IVW applications allow for multiple users and include facilities that enable users to communicate and interact with one another within the virtual environment (Lee, 2010).

ASCILITE: Australian Society for Computers in Learning in Tertiary Education.

Avatar: In a 3D immersive virtual world, a visual representation of a user's real or surrogate identity and appearance. Through his/her avatar, a user consciously or unconsciously creates a virtual portrayal of him/herself (or of an alternative self) within the environment and, in doing so, builds an online identity that is projected to others. Users are typically able to control their avatars' actions in real time, in addition to modifying their characteristics and appearance.

Distance Education Hub (DEHub): A cross-university research consortium that serves as a central research institute for investigation into best practices in distance education. It is funded by the Australian Government's Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE) and based at the University of New England (UNE) in Armidale, New South Wales. In addition to UNE, DEHub involves Charles Sturt University, Central Queensland University and the University of Southern Queensland in Australia, as well as Massey University in New Zealand.

Exploratory learning: Exploratory learning, as defined by the authors in the context of the exploratory learning model, relates to experiential learning, and extends from this to include virtual experiences as valid forms of learning supported within open-ended learning environments but filtering back into abstract conceptualisation and testing (see de Freitas & Neumann, 2008 for full explanation).

HUD (Heads-Up Display): Any transparent display that presents data without requiring the user to look away from his or her usual viewpoint (Winter, 2010).

Massively Multiplayer Online Role-Playing Games (MMORPGs): Massively Multiplayer Online Role-playing Games (MMORPGs) such as Everquest and Guild Wars have very large user numbers and provide immersive role-playing for gamers. The 3D environments utilise collaboration in-world and often centre upon quests (de Freitas, 2008).

Mixed reality: Mixed reality is the ability to use different media forms to bring together digital information with real-life physical experiences. Increasingly, the blend between real and virtual spaces is becoming possible through use of multimedia tools, sensors in the environment and physical experiences. In terms of games, the term Alternate Reality Games (ARGs) has been coined and, in virtual worlds, the use of mash-ups between different applications can be considered to be part of creating mixed reality experiences (de Freitas, 2008).

MUVEs Multi-User Virtual Environments (here regarded as synonymous with Virtual Worlds) (Winter, 2010).

OpenSim: An open-source server platform for hosting 3D immersive virtual worlds that is growing in popularity as an alternative to Second Life. It uses the Second Life protocol for client-server communication and is compatible with Linden Lab's client software ('viewer') for Second Life. OpenSim is able to operate in either 'standalone' mode, in which a single server process handles the entire simulation, or in 'grid' mode, in which various aspects of the simulation are divided among multiple processes, which can run on different server machines, thereby permitting a more scalable configuration. OpenSim uses an architecture known as 'Hypergrid' that enables users to teleport between multiple OpenSim-based virtual worlds.

Problem-based learning: Problem-based learning is a learner-centred and problem-centred approach to learning that focusses upon collaborative approaches. The approach fits well with exploratory learning and virtual environments due to its collaborative and social emphasis (de Freitas, 2008).

Second Life: A popular 3D virtual world platform developed by Linden Labs, in which users, called 'residents', can customise avatars that they use to perform a range of in-world activities. Second Life residents can explore, meet other residents, socialise and interact with one another using voice and text-based chat/messaging tools, participate in individual and group activities, and create and trade virtual goods and services with one another. Other key features of Second Life include its economy, which incorporates an internal currency, the Linden dollar (L\$), as well as the ability to purchase or rent land on which to erect buildings.

Virtual Worlds Working Group (VWWG): A group established by DEHub in 2009 to assist in facilitating cross-institutional collaborative research into 3D immersive virtual worlds, with a focus on their use in online/distance and blended learning. Members of the group include staff, students and affiliates of tertiary education institutions across Australia and New Zealand.

Appendix C: Publications coming out of this study

To date the following publications have emerged from this study:

Dalgarno, B., & Lee, M.J.W. (2012). Exploring the relationship between afforded learning tasks and learning benefits in 3D virtual learning environments. In M. Brown, M. Hartnett, & T. Stewart (Eds.), *Future challenges, sustainable futures. Proceedings ascilite, Wellington, 2012*. http://www.ascilite.org.au/conferences/wellington12/2012/images/custom/dalgarno_barney_-_exploring_the.pdf

Dalgarno, B., Lee, M.J.W., Carlson, L., Gregory, S., & Tynan, B. (2011). An Australian and New Zealand scoping study on the use of 3D immersive virtual worlds in higher education. *Australasian Journal of Educational Technology*, 27(1), 1-15.

Dalgarno, B., Lee, M.J.W., Carlson, L., Gregory, S., & Tynan, B. (2011). Institutional support for and barriers to the use of 3D immersive virtual worlds in higher education. In G. Williams, P. Statham, N. Brown & B. Cleland (Eds.), *Changing demands, changing directions. Proceedings ascilite, Hobart, 2011. Australia*. <http://www.ascilite.org.au/conferences/hobart11/downloads/papers/Dalgarno-full.pdf>

Dalgarno, B., Lee, M.J.W., Carlson, L., Gregory, S., & Tynan, B. (2010). 3D immersive virtual worlds in higher education: An Australian and New Zealand scoping study. In C.H. Steel, M.J. Keppell, P. Gerbic & S. Housego (Eds.), *Curriculum, technology and transformation for an unknown future. Proceedings ascilite, Sydney, 2010* (pp. 104–109). <http://www.ascilite.org.au/conferences/sydney10/procs/Dalgarno-full.pdf>

Lee, M.J.W., Dalgarno, B., Gregory, S., Carlson, L., & Tynan, B. (2013). How are Australian and New Zealand higher educators using 3D immersive virtual worlds in their teaching? In J. Willems, B. Tynan, & R. James (Eds.), *Outlooks and opportunities in blended and distance learning* (pp. 169-188pp. 170-189). Hershey, PA: Information Science Reference. (This paper was originally presented at the DEHub and ODLAA Education Summit 2011–2021, which took place in Sydney in February 2011.)

