



3D virtual environments: Businesses are ready but are our 'digital natives' prepared for changing landscapes?

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Futurists anticipate that within just three years, 70-80% of businesses and Internet users will have a 3D virtual presence. This should be welcome news to our current 'digital native' undergraduates who have grown up in a digital era, and who are said to prefer environments that are highly interactive, immersive, multi-modal and connected. 3D virtual learning environments not only fulfil these criteria, but also provide increased flexibility for students who are not on campus. It is perhaps not surprising, therefore, that 3D virtual worlds such as *Second Life* (2003), which provide a social space in which students—represented by avatars—can learn, create, explore and gather information collaboratively and individually, have been readily adopted in instructional settings. Yet very few studies have documented the challenges in adapting these technologies to the teaching and learning curriculum. Do we know how prepared our 'digital natives' are for this changing landscape? This presentation will draw on the case studies in which three undergraduate media arts courses at the University of South Australia were trialled in *Second Life*. The challenges experienced by both teacher and students will be discussed and assumptions about the readiness of 'net generation' learners to readily adapt to such technologies debated. The presentation will conclude with a discussion of the strategies required to utilise the potential of 3D virtual worlds for re-engaging students in a flexible, experiential and community-based learning environment so that they are ready to grasp the opportunities afforded by this rapidly changing landscape.

Keywords: 3D virtual learning environments, web 2.0, digital natives, generation-y, business, employability, 3D cve, collaborative virtual environment

Introduction

Students entering universities from 2005 onwards are said to represent a new generation of technoliterate 'Y-ers' (Krause et al, 2005). This generation, also referred to as 'Generation Y', 'Net Generation' (Tapscott et al, 1998); 'Millennials' (Oblinger and Oblinger, 2005); 'Digital Natives' (Prensky, 2001) and 'Homo Zappiens' (Veen, 2004), have grown up with digital technologies and are said to display particular characteristics including the ability to multi-task, a desire for immediacy, preference for multi-modal learning (pictures, sound and video in addition to text), a need to be socially connected through networked activities, respond best to experiential activities and are interested in social issues (Oblinger, 2008).

It is also argued that our digital natives are entering university already equipped with skill in the use of a wide range of Web 2.0 applications such as wikis, social networking, folksonomy sites, blogging, pod- and videocasting and 3D gaming. Not surprisingly, many educators are now turning to these technologies to re-engage their students in the face of growing concerns about student disengagement and high levels of attrition (Krause et al, 2005). 3D collaborative virtual environments (CVEs) such as *Second Life* have also attracted growing interest from educators, who are keen to engage their students in a game-like environment that offers the potential for increased flexibility, enhanced collaborative opportunities and a safe environment for experiential learning activities. These environments are increasingly being used for a range of activities including presentations, discussions, role plays and simulations, historical re-enactments, games design, dramatic performances, creative arts and business modelling.

3D CVEs such as *Second Life* are also attracting businesses. The list of corporations investing in 3D virtual worlds (and there are over 250 of these worlds, with more announced every month (Association of Virtual Worlds, 2008)) is large and growing. According to KZero (KZero Research, 2008a; 200b), companies such as Coca-Cola, Intel, MTV, Penguin and Toyota not only have property and buildings in

Second Life, but are actively engaged in marketing campaigns within it. UK Consultancy KZero (www.kzero.co.uk) is tracking over 100 corporations and brands currently investing in arguably the most well-known but by no means the most populated 3D virtual world, *Second Life*.

We know that virtual environments can be great places to engage customers and have them participate in product testing and development (Füller & Matzler, 2007) and that 'goodwill' can be generated by judicious use of resources that is harmonious with the in-world culture (Herman, Coombe & Kaye, 2006). Lee (2008) looked at early results of research into supply chains in the 3D virtual world, reporting that while supply chains still exist, they are much shorter, compressed, more likely to be vertically integrated and the selection of supplier much simpler; all within a world where the product development cycle is measured in days rather than months or years. According to figures released each month by *Second Life* developer Linden Lab (2008), the large number of hours *Second Life* 'residents' spend in-world each month (females: 41 hours; males: 59 hours) suggests that they find *Second Life* an immersive and somewhat fulfilling environment. If one compares this number of hours to those spent at other Web 2.0 sites such as *Facebook* or *MySpace* (approximately 3 hours per month (CreativeCapital, 2008)), then clearly there is something compelling going on; residents are choosing to spend valuable non-work time interacting in a 3D virtual space rather than, say, watching television. Such a large number of hours spent in-world must also be of interest to brand marketers looking to find ways of having their brands 'stick' longer in the minds of their target market.

In considering this 'target market' *Second Life* resident and blogger Botgirl Questi (2008) created a representation of the porous membranes that separate our offline and online identities, where both the physical and the virtual world are very 'real' to us. Early adopters of technology would easily recognise in themselves the near-seamless, almost unconscious movement between physical and virtual worlds and the rhetoric of popular culture would have us believe that 'Generation Y' are comfortable with this porosity. Clearly, 'business' is 'ready' (at least among a growing number of corporates), the mainstream media believes that 'Generation Y' is 'already there', and within the Academy we believe that there are clear benefits of harnessing the power of 3D platforms to create new learning environments.

3D virtual learning environments

While the use of traditional virtual learning environments has been shown to enhance learning through the provision of flexible, just-in-time information and the exchange of knowledge (Wichert, 2002), it is evident that mere access to teaching materials is unlikely to engage our 'digital native' learners who respond best to multi-modal forms of delivery (Oblinger and Oblinger, 2005; Prensky, 2001). Furthermore, these environments are not sufficient to facilitate the development of students' deeper knowledge of and skills (Rouvrais and Gilliot, 2004) and are limited in their ability to capture the social dimension that characterises learning in the real world (Lombardi & McCahill, 2004). On the other hand, 3D virtual environments such as *Second Life* enable learners to interact with information from a first-person perspective (Dickey, 2005) and offer unique opportunities for students to engage in the kinds of simulated learning experiences in fields as varied as health science (Mili et al, 2008; Cooper, 2007), fashion design (Polvinen, 2007), hospitality and tourism (Penfold, 2008), collaborative story telling (Bakio_Iu, 2007), business (Bloomfield, 2007) and experiential learning activities (Mason, 2007). Such activities can prepare students for future employment without the constraints of 'real world' industry placements (Chen, 2005). Moreover, as several authors note, 3D virtual worlds such as *Second Life* can facilitate communication skills (Robbins, 2007), collaboration and constructivism (Clark and Maher, 2003), and can also increase students' understanding of cultural differences and other aspects of diversity (Lee and Christopher, 2006).

Despite these reported benefits (Carter, 2006; Kemp, 2006; Liu, 2006), however, environments such as *Second Life* were not designed specifically for this purpose as learning environments. They have become 'all things to all people' (Bloomfield, 2008), attempting with difficulty to serve many purposes for many different participants. Very few studies have documented the challenges of adapting these technologies to the teaching and learning curriculum and as Hayes (2006) reminds us, leveraging the benefits of these technologies involves more than providing students with access to the tools. Hayes goes on to caution that participation in learning activities hosted on public servers such as *Second Life* presents 'unforeseen challenges' (p. 159) and depends on 'a complex set of social, economic and legal conditions' (p. 158) that users can only partially control. Such 'unforeseen challenges' identified from a review of the literature include:

- a. a lack of empirical evidence documenting the pedagogical benefits of teaching and learning within a 3D virtual learning environment compared with traditional online delivery;
- b. the accessibility problems associated with the *Second Life* platform (Brewer cited in Qi, 2007; Kawamura cited in Fruchterman, 2007; Peters and Ball, 2007; Abrahams, 2007; Hansen, 2008);
- c. legal and Intellectual Property (IP) issues (Grimes, 2006; de Zwart, 2007; Coates, Suzor and Fitzgerald, 2007);
- d. ethical considerations (Hendaoui 2008);
- e. technology related factors including server stability, technology demands and security concerns (Lee and Warren, 2007) and
- f. the costs associated with purchase of virtual land, monthly maintenance and ‘trading’ within a commercial virtual economy.

Recognising the potential of 3D virtual learning environments, but also mindful of these possible ‘unforeseen challenges’, a research team at the University of South Australia purchased a virtual island in *Second Life* in November 2007, to undertake preliminary trials and document the pedagogical benefits as well as the issues in the use of 3D virtual environments for learning. The findings from our preliminary research were then used to support a competitive grant application to the Australian Learning and Teaching Council (ALTC), for a project that aims to develop guidelines for the use of 3D virtual learning environments in the undergraduate and graduate curriculum, and to design and develop an open source, accessible 3D virtual learning environment. The findings from these trials are reported in the following section.

Trials undertaken in *Second Life*

The three courses trialled in *Second Life* are all undergraduate courses offered in the Media Arts program at the University of South Australia; *Digital Media Techniques*, *Design for Interactive Media* and *Electronic Publishing on the Internet*. A brief overview of the aims of each course and the way in which *Second Life* was incorporated into the curriculum follows.

Digital media techniques

Students undertaking multimedia related majors in the Media Art program are required to complete *Digital Media Techniques (DMT)*, which is a first year course introducing students to all forms of digital media through a combination of theory, practice and research based project. There were 148 students enrolled in the first semester offering of the course. Students were introduced to *Second Life* in a practical session and encouraged to explore the environment; they also attended a formal presentation conducted in *Second Life* by Starr Sonic (Executive Producer of *Second Life* in-world broadcaster *SLCN-TV*) who discussed the convergence of media and the difference between broadcasting in a virtual world such as *Second Life* and broadcasting in ‘real life’. Students were not required to use *Second Life* formally in the course, however, they were encouraged to explore the environment and to consider undertaking their research project in *Second Life* if they were interested in 3D virtual environments. The aim was to use *Second Life* as a means for introducing students to the meaning of convergence of media, and to provide students with a flexible environment where they could meet with each other and the academic staff during formal help sessions, if they wanted to attend sessions conducted off-campus.

Design for interactive media

Students who are majoring in either animation or interactive media are introduced to games design in the second year of their program through the course *Design for Interactive Media (DIM)*. The 90 students enrolled in the course during the first semester worked collaboratively as teams to create an immersive 3D game in *Second Life* using a mix of skills including script writing, storyboarding, interface design and scripting. Students were provided with shell ‘holodecks’; hollowed out cylinder shaped rooms of 35 metres in diameter, which they textured to create a 360 degree simulated environment. All the required scripts were supplied and students were required to customise the scripts and interface to fit their chosen theme for the game.

Students were given the option of completing the course entirely off-campus or attend practicals and lectures on-campus. All lectures on-campus were simultaneously conducted in *Second Life* enabling students who were unable to attend classes, the opportunity to still participate in the course. Twelve students chose to attend lectures externally via *Second Life* and of those, four also attended practicals virtually.

Electronic publishing on the internet

A final year course for students undertaking a major in either interactive media or web design, *Electronic Publishing on the Internet (EPI)* provides the foundations for understanding the principles of electronic publishing on the Internet. The course places emphasis on applying the principles and elements of design to the creation of Web pages, communication skills, team work, and designing a portfolio for online delivery. The topics covered in this course combine theoretical information presented through a series of readings and reflections on theory, with the applied skills required to design and develop a portfolio presence in a 3D virtual world as well as a complementary Website linked to their 3D world 'shop front' portfolio in *Second Life*. As with *Design for Interactive Media*, students were free to attend classes virtually in *Second Life* or on-campus. There were several guest presentations in *Second Life* conducted by business owners and designers, as well as guest presentations on campus (also streamed into *Second Life* for students unable to attend classes).

Outcomes of the trials

Students enrolled in *Design for Interactive Media* and *Electronic Publishing on the Internet* courses were asked to complete an anonymous online questionnaire at the conclusion of the semester. This questionnaire included questions aimed at identifying students' familiarity with and use of Web 2.0 and 3D virtual world technologies, and to assess the extent to which the *Second Life* platform of delivery was perceived by students to support the objectives of the course and enhance their learning. The questionnaire included a mix of Likert-scale and open-ended text field questions. Fifty-two (33%) of the students enrolled in the two courses completed the online questionnaire. Of those students, 32 were enrolled in *DIM* and 20 in *EPI*. Ten of the students who were enrolled in *DIM* were also enrolled in *EPI*, even though *DIM* is a second-year prerequisite for *EPI*, the online enrolment system has no mechanism for preventing students who have not completed pre-requisites from enrolling in courses. This may have influenced the student attitudes given half of their course load in the first semester would have involved activities in *Second Life*. Only three students agreed to a follow-up interview but did not respond to subsequent emails inviting them to meet with an independent evaluator. Since students only had minimal exposure to *Second Life* in the *Digital Media Techniques* course, the feedback gathered from those students was based on their comments in tutorial sessions and anonymous responses in the end of semester course evaluation.

Table 1 below shows that of the respondents to the online questionnaire, 86.5% were in the age group described as representative of the 'digital native' population. Most of the students responding to the questionnaire were male (65.4%) and 86.5% of respondents have access to high speed broadband Internet at home.

Table 1: Age distribution of students responding to questionnaire

Age range	Percent	Cumulative percent
18 or under	5.8	5.8
19 to 24	80.8	86.5
25 to 34	9.6	96.2
45 to 54	1.9	98.1

We were surprised to find so few of our students are regular users of 3D multi-user environments, with only 17.3% of students describing themselves as regular users of online multi-user games such as *World of Warcraft* and only 1.9% being regular users of 3D virtual worlds such as *Second Life*. Forty-two percent of students stated that they never access 3D online multi-user games, and 40% of the students stated that they never access 3D virtual worlds. The most popular application of those listed is chat (such as instant messages, MSN or ICQ) with 61.5% of students stating they are regular or frequent users of these services. Social networking sites such as FaceBook or MySpace were the next most popular with 50% of the students stating they are regular or frequent users (Figure 1).

DIM student ratings (based on a 5 point Likert-scale from 1 strongly disagree to 5 strongly agree) for criteria relating to social interactions were higher for most criteria than *EPI* student ratings; with the highest rating by *DIM* students (3.53) applying to the criterion 'My classmates and I cooperated in completing assignments in *Second Life*' and an *EPI* rating of just 2.28 for this criterion. *DIM* students who enjoyed the social interaction commented 'We spoke more about our assignments, and what was

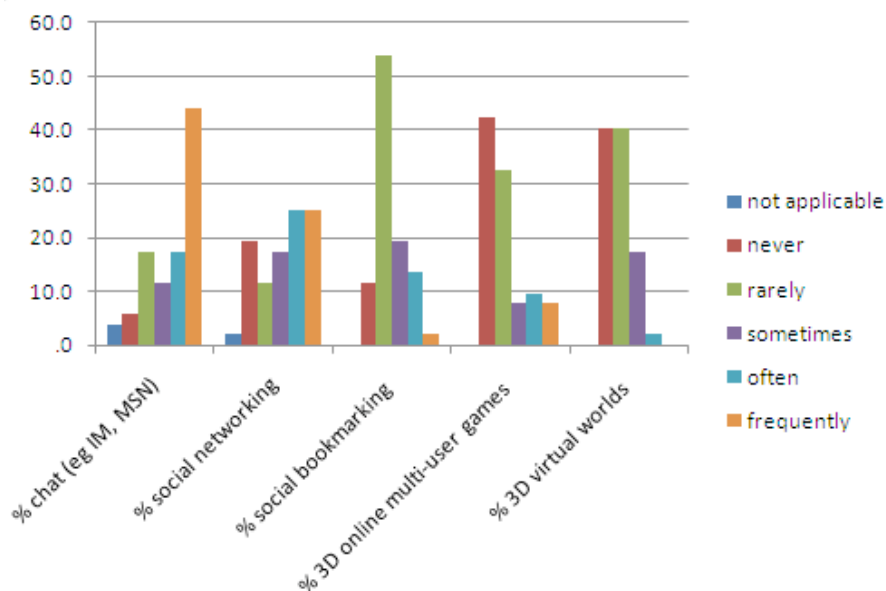


Figure 1: Frequency of use of Web 2.0 and 3D virtual environments

required of each of us' and 'It [interaction] improved, I'm used to doing assignments by myself'. The benefits for DIM students taking the course externally were also evident with comments such as 'It made it easier for me as I didn't have to leave home to have discussions and interactions with my classmates tutors and lecturers'. This finding is not surprising given students worked in groups in constructing their multi-user games in the *DIM* course, contrasting with the individualised assignment undertaken by students in the *EPI* course in which they constructed their own 3D virtual world portfolios. On the other hand, several students clearly did not enjoy the interactions within *Second Life*, with several comments from students echoing the views of one student who stated 'It made interaction with others a little less personal and sometimes hard to follow if you were chatting with multiple people from your group at one time' and one student's comment that interaction in *Second Life* 'made me cringe, because all communication was reduced to cyber slang and waiting for long periods of time for responses' suggests that technical limitations of the chat and IM channels of communication in *Second Life* might have negatively impacted on the benefits to be gained from social interactions in 3D virtual communities. Three students indicated they preferred more traditional asynchronous communication systems such as email and discussion forums as indicated by one of the students who stated 'I think a discussion forum is still better for seeking answers' and another who asserted 'At least with a discussion board you can look over it and revise it and see what other's are asking. *Second Life* just creates a doubling up problem'.

Overall student ratings for criteria relating to the effectiveness of learning activities in *Second Life* were also higher for *DIM* students than *EPI* students, with the highest ratings being given by both groups to the criterion 'The learning activities in *Second Life* required me to think critically in *Second Life*' (3.23 and 3.0 respectively) and 'I was willing to put in the effort needed to complete the learning activities in *Second Life*' (3.38 and 2.70 respectively). The higher rating given overall to criteria relating to learning activities by *DIM* students suggests (as expected) that collaborative learning activities are more effective in engaging students in these kinds of environments than activities focusing on individual assignments. Typical comments from students who enjoyed the creativity in a collaborative environment were voiced by one student who described the learning experience as 'very creative' and another who suggested the learning was more interesting than courses involving 'boring books and essays' and that he/she enjoyed 'creating an interactive and 3D environment'. On the other hand, many *DIM* students were frustrated with the limitations of the platform; as one student put it '[*Second Life*] severely hindered my learning as I felt I could be learning useful skills not playing around in a tacky virtual world making extremely dodgy games' and another who suggested 'It made me further understand that the internet is not ready yet, especially 3D virtual environments, as a distribution tool'. Several *EPI* students also commented that they would have preferred focusing on website design because they regarded *Second Life* as a waste of time and unlikely to have any impact on their future careers in the 'real world'. The average rating given to the criterion 'I would take another course that used *Second Life*' by both *DIM* and *EPI* students was 2.0 (meaning 'disagree').

Both *DIM* and *EPI* students rated criteria relating to the materials provided and the supports available to them in *Second Life* higher than criteria relating to social interactions or learning activities, with an

overall rating of 3.32 (*DIM*) and 3.16 (*EPI*) for supports compared with 2.52 (*DIM*) and 2.27 (*EPI*) for learning activities, and 2.96 (*DIM*) and 2.74 (*EPI*) for social interactions. Yet despite providing three in-world and three on-campus help sessions each week, several students commented that they needed tutor support after normal teaching hours to manage the environment.

While there were some positive responses to the open-ended text questions about the environment, such as 'it was good to expand my knowledge about online environments' and the experience 'broadened my horizons', the majority of student comments were negative; the main issues reported by students being the 'inappropriateness of the platform', 'the lack of stability of the server', 'frustration that the activities distracted them from being able to spend more time on tasks they felt were more likely to enhance their employability' (some students suggested other platforms for game design, such as Flash, would have been more useful).

Several students remarked on the impersonal nature of the mediated communication in 3D environments, preferring 'real' face-to-face communication than mediated through an avatar representation. One student commented that 'It made interaction with others a little less personal and sometimes hard to follow if you were chatting with multiple people from your group at one time'. While students who took the courses externally no doubt appreciated the flexibility and interaction with tutors and class mates, commenting 'It made it easier for me as I didn't have to leave home to have discussions and interactions with my classmates tutors and lecturers', several were critical of the interface and functionality to support this kind of learning as reflected in one comment that 'I enjoyed the remote lectures... but the user interface is appalling. The controlling is sluggish and terrible... that I didn't enjoy'. The limitations of the platform, issues with voice chat and overall performance also impacted on interactive lectures delivered simultaneously on campus and in Second Life, with comments from students attending lectures on campus indicating their frustrations, such as one student who commented that 'it made things more difficult' and some students studying off-campus stating that there needs to be an alternative means for external students to see demonstrations on campus through application sharing (for example students on the virtual island being able to see the tutor using software on campus on their own computer at home). Students who were more positive about the experience commented 'It made it easier to communicate to those who I normally wouldn't have'; 'Gave me an extra outlet with which to communicate with others in the course - other students and also to gain help from the instructors'; 'This is a new ball game and the learning process was tremendous'.

What was most surprising to us were the number of students who were not convinced by predictions that 3D virtual environments will become as pervasive as the 2D Web as we now know it. Despite visiting lecturers and content provided to students indicating the growth in uptake by businesses, it was apparent from student ratings in the evaluation and their comments, that many felt the activities were a waste of time as they could not see the relevance to their future careers in the industry. The following comment by one student reflects the student resistance and lack of acceptance we observed throughout the course:

No matter how you look at it is still a game. It is just a fad and I don't believe the statistics about its uptake. Too hard to access. I would not use *Second Life* because I think it's quite pointless when relating to the web. Sure some people use it as a business medium but you don't see the biggest law firm doing business on there do we now? (anonymous, 2008).

Discussion of the findings

3D virtual learning environments such as *Second Life* offer enormous possibilities for engaging students in ways that maximise flexible learning and foster collaborative learning, communication and problem solving. Despite the limited population participating in the trials reported in the preceding section, it was evident from our observations of students throughout the trials that their resistance to the platform impacted significantly on their capacity to immerse themselves in the learning environment. Some students appeared to be resistant because they had preconceived notions of what sorts of activities are valid for teaching and learning. While playful and informal learning should have been an effective means of engaging the students, several students remarked that *Second Life* was an inappropriate platform for teaching and learning. Some students regarded the activities as a waste of time, even though the skills they gained are directly transferrable to other platforms, because they were focused on wanting to learn a particular application (for example Flash) rather than on the skills (for example team work, collaboration, problem solving) required to create online games. Similarly, many students in *EPI* wanted to spend all their time working on their Website designs, because they regarded a 3D virtual world development platform as of little value to their future career plans to work as Web design professionals.

Several students were uncomfortable with the mediated form of communication, which again surprised us given the large number of students who fit the 'digital native' profile, especially since all of the students enrolled in the courses were students with an interest in digital media. It was evident that technical glitches with the platform contributed to student dissatisfaction with the learning experience and interviews with their teachers confirmed that these issues were of irritation to most students. However, the teachers also noted, 'Sure, some students complained about *Second Life* being buggy, but that is just an excuse. Most of the students in my class were unhappy the minute we told them they would be creating their interactive games in *Second Life* because they had their minds set on creating their games in Flash'.

Nevertheless, the following issues were identified throughout our trials, which may have also contributed to the negative attitudes expressed by some students in relation to their 3D virtual learning experience:

- The lack of server stability throughout the project, which impacted on the ability for students to complete their in-world assignments on time, and in the case of students designing the interactive game in *Second Life*, the technological problems resulted in the loss of their work on several occasions when they were unable to save (take copies) of completed objects and scripts back into their inventories.
- The complexity of the interface and required learning curve, which several students reported was a hindrance to their learning experience.
- The views of at least a few students, that the commercial 3D virtual learning platform was inappropriate.
- The cost associated with uploading work generated by students outside the 3D virtual environment. While students were provided with a bank of virtual (Linden) dollars, several felt it inappropriate that they should be expected to pay to upload work to complete their assignments.
- Our inability to show content in-world that is permissible on campus because we could not guarantee the security of material displayed or hosted on a public server.
- The lack of appropriate on-campus facilities and the limitations of the *Second Life* platform, which meant that we were unable to effectively deliver content shown in lecture theatres to our students attending virtual classes on our University island (for example we were unable to share applications running on computers in lecture theatres with students attending externally via *Second Life*).

The ALTC funded project aims to address several of these identified technical limitations through the design and development of an open source, accessible 3D virtual learning platform and associated pedagogical, technical, legal and IP guidelines to support academic staff in the development of learning materials designed to facilitate learner engagement and experiential learning. The features planned for the open source platform include:

- improved user interface with built-in speech to chat and chat to speech capabilities;
- capacity for users to control size of text and colour contrast;
- ability for all functions to be operated via alternative accessing devices;
- application sharing features enabling teachers and students to view applications remotely;
- stable and robust platform delivered via secure servers;
- interoperability by ensuring the open source software is built to open standards consistent with the protocols established for the emerging media grids;
- Shibboleth authentication enabling universities to access servers across institutions using standardised password authentication protocols;
- built-in accessible open source teaching and learning tools developed in collaboration with partner institutions.

Addressing the technical limitations of existing commercial 3D virtual servers within educational contexts and the development of guidelines to assist academics developing content for 3D virtual learning environments will go some way to address the issues identified in this paper. However, as our trials suggest, the limitations of the *Second Life* platform are perhaps not the only factors impacting on student reactions to the environment. It is also conceivable that not all of our so called 'digital natives' are as ready for these brave new worlds of learning as we have previously believed. Indeed it was our experience that the more mature students, those Prensky (2001) refers to as 'digital immigrants', were the ones who seemed most at home in *Second Life*. Several authors are also more critical of the simplistic distinction made between different generations of learners. Carlson (2005), for example, argues that 'millennials' are not so different from previous generations of learners and questions whether 'educational techniques should change accordingly'. Kennedy et al (2007) also caution against making significant changes to the curriculum to accommodate new generations of learners. On the basis of the findings of their survey of first-year undergraduates' use of new technologies, Kennedy et al assert that 'there is

greater diversity in frequency of use of technology than many commentators have suggested' and further, that the use of Web 2.0 technologies is much lower than we might expect of the so-called 'digital native' population. This is consistent with our own findings from the student evaluations, which indicate relatively low up-take of Web 2.0 and 3D virtual world applications by students who fit the 'digital native' profile.

Oblinger (2008) cautions that while 'digital native' learners show no fear of technology we should not assume that they are technologically proficient. She further suggests that while problem-based learning approaches are effective, students may be resistant because they are impatient and more focused on achievement 'so they can get a good job'. This was certainly consistent with our findings in *DIM* and might explain the reasons that so many students saw the problem-based tasks associated with creating their online multi-user games a waste of time, suggesting skills in Flash would be more valuable for future employment. Similarly, students in *EPI* showed little interest in the tasks associated with building a portfolio in *Second Life*, because they did not believe the projections about business uptake in 3D virtual environments.

Student comments about the inappropriateness of the platform are perhaps also consistent with Mulholland's (2008) suggestion there are two categories of technology; those that are 'assumed' and those that are 'student driven'. According to Mulholland, 'assumed' technologies include the Internet, mobile devices, digital television and traditional virtual learning environments, whereas 'student-driven' technologies are those that students 'discover' for themselves. Web 2.0 applications such as social networking and social bookmarking sites, blogs and virtual worlds like *Second Life*, in Mulholland's terms, are not yet 'assumed' learning technologies. Mulholland further argues that the challenge facing educators is to know when a 'student-driven' technology becomes 'assumed' and when it is therefore appropriate to make the transition.

Conclusion

According to Castells (2007), communication and interaction in the 21st century is increasingly being conducted within an online, almost ubiquitous and exponentially growing network. The popular rhetoric has it that 'Generation Y' is not only comfortable living within a networked world, but actively seeks ways to increase its participation. However, our findings suggest that the 'millennials' aren't all as comfortable with this new participatory environment as we might *prima facie* think.

If we accept Mulholland's (2008) assertion that virtual worlds such as *Second Life* are not yet 'assumed' learning technologies in our students' eyes, then the challenge for us as educators is to know what strategies we should adopt to smooth the transition for our students. Clearly there are advantages for our future graduates if they are prepared for the changing landscape as 3D virtual worlds become more mainstream in business and industry. As one of the *EPI* students commented at the end of the course, students will be more marketable to prospective employers if they can demonstrate their capacity to adapt readily to these new and emerging technologies. The two strategies we identified from the trials reported in this paper to address identified issues are: 1) to provide students with access to an open-source, accessible 3D learning environment that is technologically robust and stable, provides free access and is perhaps more likely to be seen by students as 'appropriate' within a teaching and learning context, while still providing them with the benefits afforded by such 3D simulated environments and 2) to embark on a strategic approach to embedding career planning skills into the curriculum throughout the program, introducing students to the ways in which Web 2.0 and 3D virtual technologies are already being effectively used in industry and also engaging students in strategies to build their own profiles so that they are better market their skills to prospective employers.

While the trials reported in this paper were limited to three courses offered within one disciplinary field and in one University setting, the outcomes from our trials suggest, as Kennedy et al (2007) have advised, further research is needed to better understand how we can assist our students to make the transition from so called 'assumed' to 'student-driven' learning technologies in the changing landscape.

To end, we quote from Lin's substantial and authoritative paper (2008): 'Virtual worlds are here to stay. How we fashion them—and how they fashion us—is largely up to us.'

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