Higher education teaching in virtual worlds: A snapshot

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INTRODUCTION

Immersive virtual worlds can be defined as three-dimensional online environments that aim to simulate real life and provide an alternate means of interaction. They were first developed for gaming – the well known World of Warcraft uses this technology – but they soon came to have serious uses, particularly in education. A user of a virtual world will first create an “avatar” or alternative, virtual version of his or herself to move around the world and interact with it and other users or players. The concept of serious games, which are games that are designed to support a purpose other than just entertainment (most often educational) is closely related to that of virtual worlds but not in any sense synonymous: serious games do not even have to be computer-based, although they often are. Many such games are based in virtual worlds, and self-contained worlds have been developed for specific games.

By far the best known and currently the most popular virtual world is Second Life (http://secondlife.com/), which was developed and launched in 2003 by a San Francisco-based Internet company, Linden Lab. Millions of people have set up Second Life avatars, and it seems that about 50-60,000 people are online and using this system worldwide at any given time. It offers an enormously rich and varied environment in which it is possible for advanced users to build almost whatever they choose. Many universities have, or at one time have had, their own, freely accessible mini-environment there.

One disadvantage of Second Life for educational (and other not-for-profit) users, however, is that Linden Lab is a fully commercial organisation. Basic use of Second Life is free, but many other activities, including building permanent installations, attract charges. Educational discounts are always available, but their level, and therefore their use, has fluctuated. A few years ago a sudden, temporary hike in academic / educational fees led to many such users abandoning Second Life for open source alternatives, the most widely used of which is OpenSimulator, more generally known as OpenSim (http://opensimulator.org/wiki/Main_Page). Strictly speaking, OpenSim is a server that is used to create virtual worlds, rather than a single, standalone world, but it incorporates some of the same protocols as Second Life and experienced users can use it “out of the box” in a similar way.

Between 2007 and 2012, John Kirriemuir of the consultancy Virtual World Watch published a number of “snapshots” describing the extent and types of use of virtual worlds in UK higher education (e.g. Kirriemuir, 2007). The tenth and last of these snapshots, from August 2012 (Kirriemuir, 2012) suggested that although virtual worlds are still believed to have applications that are useful in higher education, and they have prominent supporters in the UK, there has been some diminution in their use. One reason for this is undoubtedly financial, as the temporary hike in fees for educational users coincided with the ongoing squeeze
in government contributions to education. However, it also seems likely that this technology, like so many others, suffered from over-hype when it was launched.

The take-up of many new technologies has followed a pattern termed the Gartner Hype Cycle, in which an initial “peak of inflated expectations” is followed by a “slough of despond” and, eventually, a “plateau of productivity”.

![Figure 1 - A Gartner hype cycle](image)

In 2007, during what was possibly a peak in the popularity of Second Life, the Gartner consultancy itself estimated that “by the end of 2011, 80 percent of active Internet users (and Fortune 500 enterprises) will have a ‘second life’ [that is, will be active in virtual worlds] but not necessarily in Second Life”. The worldwide population of active Internet users in 2007 was estimated to be about 330 million, so that estimate puts an absolute lower bound on predicted virtual world use in 2011 at over a quarter of a billion. Even anecdotally, this feels like a wild over-estimate.

During 2007, also, I was awarded a small grant from the Centre for Distance Education under its Teaching and Research Award scheme to investigate a range of web-based technologies, including Second Life, for enhancing Birkbeck College’s MSc programme in structural molecular biology by distance learning. I recruited a focus group of past and present students to meet in Second Life and discuss the topics in the course curriculum, and I encouraged them to take part in some of the scientific activities taking place there. At the time, the journal *Nature* had established a Second Life presence (the Elucian Islands) that was used for scientific lectures and discussions of its latest papers. As Birkbeck’s MSc course dealt with structural biology – one of the most visual of sciences – I also explored the practicality of building interactive molecular models within Second Life with interested colleagues including Peter Miller from the University of Liverpool. This part of the project, however, did not get very far due to the short time that could be set aside for the project and Second Life’s notoriously steep learning curve for developers.
My pilot exercise drew mixed reactions from the focus group participants, and also from some students who had been unable to access the software and take part. This course, which is entirely Internet-based and is taught part time over two or three years, attracts two very different types of student who found they were always or almost always unable to access Second Life for course related activities. Students who were sponsored by their employers (typically in the pharmaceutical and biotech industry) could not access the system through powerful company firewalls, and students from developing countries supported by Commonwealth Scholarships found their hardware and Internet connections to be inadequate. In contrast, one student with Asperger’s syndrome who had chosen to study this MSc because it offered only computer-based interaction found Second Life particularly rewarding. This fits in with published research on the value of virtual environments in helping people with autistic spectrum disorders make sense of the real world (e.g. DeAngelis, 2009). A physically disabled student also found it helpful.

Now, six years after this project, Gartner’s prediction begins to seem like a wild over-estimate. The probability that there was ever a time with over 250 million people involved in virtual worlds seems vanishingly small. Some institutions, such as Nature, have abandoned any presence there, and others including the Open University have scaled theirs down. Yet some teaching applications using these environments have proved to be both popular with students and pedagogically powerful, and a few HE institutions have expanded their support for the technology.

So, if this technology is indeed following the Gartner hype cycle and 2007 represents its peak, where on the cycle is it now and is it possible to discern the pedagogical approaches and types of application for which it is particularly appropriate (that is, to identify its “plateau of productivity”)? My aim in this short snapshot of virtual world use in mid-2013 (which is necessarily far less comprehensive than John Kirriemuir’s) is to investigate the current state of play among academics regarding the pedagogical uses of virtual worlds and, by extension, serious games.
For this survey, I conducted eight in-depth interviews with experienced users and developers of virtual worlds and virtual world based serious games for use in higher education teaching. All interviews were conducted between May and August 2013 and only a few points updated during the editing process; it therefore represents a “snapshot” taken in the middle of that year.

Seven of my interviewees were senior members of academic staff, most working largely on the teaching side, and only one was based outside the UK at the time of the interviews. My remaining interviewee was a representative of a UK-based software company, Daden Ltd., that specialises in developing “immersive visualisation and learning solutions” and has many clients in higher education. I also conducted a short review of the literature.

Names and affiliations of my interviewees are given at the end of this report.

Interview questions

All the extended interviews were loosely based on the following seven questions:

- What options are out there for "serious" and education-based virtual worlds both commercial and open access? Which have you used?
- What is your and your institution's current practice in the use of virtual worlds in teaching, and how, if at all, has it changed during (say) the last 5 years?
- Can you cite any successful - or not so successful - case studies of the use of virtual worlds in your own or your colleagues’ teaching?
- Which teaching scenarios and pedagogic approaches (if any) do you think are supported most effectively by this approach?
- What are the most significant challenges to virtual world use in education?
- What are the main competitors to virtual worlds in education?
- How do you think virtual worlds, and their use in higher education, will develop within (say) the next 5 years?
The available options and those taken up

Not surprisingly, Second Life still appears to be the most widely used virtual world in higher education, and by a significant margin. All those who participated in the extended interviews have significant experience of Second Life as both a user, and a majority have also developed Second Life applications. Several have tried OpenSim as an open source alternative to Second Life, but relatively few applications developed in Second Life have been moved there. Although the range of options available is actually extremely wide – Sara de Freitas (Serious Games Institute, Coventry at the time of the interviews) knows of at least 100 separate virtual worlds, and Austin Tate (University of Edinburgh) has personal experience of about 20 – the only other option that was mentioned by more than one participant was Unity 3D. This is not a virtual world itself, but an “engine” that is used to build standalone virtual environments.

It was particularly interesting that no-one I talked to mentioned Minecraft. This is a relatively new world, first released for the PC in 2009, but it is rapidly growing in popularity. It is a multi-player game with similarities to the well-known World of Warcraft, and its players’ main object is building and creating objects out of textured cubes. Characters can also explore the world and interact with other players and non-player characters. However as goals for players to accomplish are not necessary for the game-play it can be used for many purposes including educational ones. It is particularly popular among pre-teens and young teenagers and MinecraftEdu was formed in 2011 with the aim of introducing it into schools. In mid-2013, at least, it seemed that teachers in higher education were reluctant to take advantage of the level of interest shown by their colleagues in the secondary education sector.

Several participants suggested reasons why Second Life, despite its increased charges for academic developers, continues to be so widely used. One important advantage of Second Life is simply that it is so widely used, in what might be seen as a kind of ‘virtuous circle’. Liz Falconer (University of the West of England) echoed several others’ views when she said “the [Second Life] grid is very rich, and there is a lot of experience to build on there”. Mark Childs (Coventry University) cited continuity as another advantage of Second Life: “If you build something they can guarantee that it will always be there”, while criticising the frequency of temporary outages of the Second Life grid.

The main open source alternative is OpenSim. Miller was one of those who moved there from Second Life in the few years when Linden Lab’s educational discounts were greatly reduced, and he has become an enthusiastic advocate of this platform. Many recent applications developed there were presented and discussed at the first OpenSimulator Community Conference in September 2013 and these presentations have
been archived on the conference website\(^1\). However, OpenSim has also been criticised for a learning curve for developers “even steeper” than Second Life’s, and it suffers from something of the reverse of the Second Life ‘virtuous circle’: it has fewer users, so the overall users’ experience is less rich, and there are fewer experienced developers around to advise novices.

In both Second Life and OpenSim a large environment is made available for new environments and applications, and there are very few restrictions (apart from legal ones) on what can be built there. However, not all virtual worlds used for educational applications are of this type. David Burden of Daden Ltd. and his colleagues have designed about 40-50 applications for higher education clients; some of these use Second Life but others are standalone applications developed using the game engine Unity 3D. This game engine is also widely used at the Serious Games Institute. The environments created in this way can be completely open to all participants (as is Second Life), or, alternatively, closed to anyone other than those who are taking part in the exercise or simulation; the cost of development using Unity 3D is similar to that using Second Life. It is possible to design a completely closed application within Second Life or OpenSim, but it is not always easy. Teaching staff in one Department of Health Sciences tried to do this in OpenSim but found it too difficult.

Jim Gritton, who is investigating the affordances of virtual worlds for leadership development, has attempted to identify the underpinning axes or independent dimensions that characterise both these concepts. Following a focus group conducted with a number of virtual world users in the summer of 2013, two prototype frameworks were produced, one each for virtual worlds and leadership development, using the underpinning axes as a basis for construction of a simple 2 x 2 matrix. Gritton’s framework for virtual worlds (Figure 2) is used here to illustrate the demarcation between Second Life (and therefore also OpenSim) and smaller, closed worlds that have been created using Unity 3D and similar “games engines”.

In summary, although Second Life is the most popular virtual world, it is not universally loved. Liz Falconer may have summed up the opinion of the majority of participants by saying “I am not a great fan of Linden Lab but theirs is the best system going.” However, as their preferred system would be, at the minimum, as large and rich as Second Life; free for all educational use; and much easier to learn and use, it seems unlikely that such a system will emerge in the near future.

**Institutional practice**

My interviews with experienced users of virtual worlds within the higher education sector revealed a mixed picture of institutional take-up. This ranges from institutes that have “bought into” the idea of virtual worlds and game-based education in general at the highest institutional level to those with no institutional interest at all. The area in between is exemplified by those where there is a reasonable degree of interest but where, perhaps for financial reasons, there is no longer as much involvement (either by senior management or in day-to-day teaching) as there was maybe five years ago.

The interviewees in my survey who described the highest levels of “buy-in” at institutional level were Austin Tate of the University of Edinburgh and Mark Childs of Coventry University in the UK. Interestingly, these
universities are at opposite ends of one spectrum within UK higher education, however that is defined: one ancient, research-led institution and one post-1992 university.

The University of Edinburgh currently hosts some of the most interesting developments in virtual worlds in the sector. It has set up Vue – the Virtual University of Edinburgh – as a virtual education and research institute that brings together university staff with an interest in this area. Vue (http://vue.ed.ac.uk/), which is coordinated by Tate, has its own island within Second Life and departments within the university build facilities for specific projects or teaching modules there and abandon them if they are no longer required. OpenSim is also used for some applications and Tate estimates that about 120-150 current members of academic staff have some involvement in this work.

Since 2009, the University has duplicated some of its graduation ceremonies within Second Life; Gritton and Tate, who have recently obtained Masters’ degrees from Edinburgh, both took advantage of this opportunity. Distance learning students have reported that taking part in an online graduation ceremony helped them feel connected to their university community. It won an Edublog award for the best educational use of a virtual world and received excellent coverage from mainstream media including the BBC².

² http://news.bbc.co.uk/1/hi/scotland/edinburgh_and_east/8378291.stm
Teaching in virtual worlds in Coventry University covers an impressively broad range of disciplines and pedagogies. At the time of the interviews academics based there with a serious interest in virtual worlds included Professor Maggi Savin-Baden (head of the Learner Innovation Group); Elinor Clarke (midwifery); Graham Steventon (geography); Joff Chafer (performance arts) and Liz Miles (engineering). This breadth seems not to be replicated elsewhere in the country except perhaps Edinburgh. The university’s involvement in innovative computer-based education more broadly is exemplified by its having set up the Serious Games Institute as part of Coventry University Enterprises Ltd and located on Coventry Business Park. Research projects in this institute, led until late 2013 by Professor Sara de Freitas, involve games based in virtual worlds and involving augmented reality. Another of my interviewees, Mark Childs, is a senior research fellow at Coventry with research interests in the technology, psychology and ethics of teaching and learning in immersive virtual worlds.

The only non-UK academic to give a full length interview, Jean-Claude Bradley of Drexel University, Philadelphia, USA, reported that his institution was using Second Life less than it had been a few years ago. He is a chemist who had set up games and simulations in Second Life for teaching molecular structure and interpreting experimental results, and has now moved these to a simpler web-based format that he reports working equally well for the students. The Open University in the UK also has rather less involvement than a few years ago, when I as a part-time Open University Associate Lecturer, participated in a Second Life event involving a presentation by its incoming vice-chancellor, Martin Bean, to all academic staff. Several academics there who have done some work in virtual worlds including have now moved on; most current work at the Open University is being coordinated by one of my interviewees, Shailey Minocha of The Open University’s Centre for Research in Computing.

Other participants report much more modest usage of virtual worlds within their institutions and feel themselves to be individual enthusiasts or trail-blazers for a technology that is yet to gain serious recognition from their senior management. Gritton describes the take-up of virtual worlds at the University of Greenwich, where he is researching Second Life scenarios to teach leadership skills, as “modest” while citing research based there into other types of computer-based serious gaming. One example of this is “Maritime City”, which is used to teach methods of child protection to students from a wide range of professional backgrounds (Flynn et al., 2011).

Case studies

3 Until November 2013; now Associate Vice Chancellor of Curtin University, Perth, Australia
The interviewees reported a large number of case studies of teaching initiatives using virtual worlds. Although these projects encompassed a wide range of topics and disciplines, the successful ones – which formed a large majority of those cited – fell into three main categories. These were, briefly, simulating “real life” scenarios, learning and practising methodology, and exploring digital identity.

**Scenario Simulation**

This type of project, which was frequently cited as being particularly successful, was most often and most appropriately taught in vocational and professional education. These projects involve teaching skills that arise in response to situations that can be simulated in virtual reality but that are very difficult to replicate in a realistic way outside a computer. Scenarios that have been simulated for students in this way include accident scenarios for trainee health and safety investigators (Falconer, 2013a,b) and court procedures for law students. The nearest alternative to a virtual world in scenarios of this type is a complex role-play scenario, quite possibly involving professional actors.

Falconer, who has developed accident scenarios in Second Life, says “you can’t replicate the sense of immersion that [this technology] offers the students even with role play”. She currently takes the role of a manager at the accident scene and lets students interview her in-world, but finds this very time-consuming. She is investigating the use of simulated non-player characters or “bots” in this type of role. Her colleagues in the Department of Law at the University of the West of England have set up court-based scenarios for training law students; these include Clare Chambers-Jones, whose research interests include financial crime and fraud in virtual worlds (Chambers-Jones, 2013). Second Life has its own currency, the Linden Dollar, and some countries have found that they need to modify their financial laws to account for the possibility of “cyber-crime”.

De Freitas was involved in the development of one of the first virtual world-based scenarios, which is still used to train medical students and others in responding to major incidents. In an emergency situation, it is sometimes necessary to adopt the practice of triage: rapidly categorising each casualty as either beyond help, “walking wounded” or in between, and concentrating scarce resources on the last of these. Clearly, this is not something that students can practise “for real”, and a virtual reality based scenario peopled with casualties with measurable vital signs has proved a very useful and stimulating tool (Knight et al., 2010). Gritton (2011) evaluated a range of techniques for teaching leadership skills and concluded that massive multiplayer online role playing games can form a realistic proxy but not an entirely analogous environment for this type of skill development.
Practising Methodology

Minocha mentioned the value of simulations in virtual worlds in preparing students for field or practical work. An induction in a virtual world, in which students are introduced to, for example, the equipment that the students will encounter in the field or the laboratory, can help them to make more effective use of the often limited time they have in the real-world situations. This can be particularly useful at a time when many student cohorts are becoming larger and resources more limited. In 3D virtual environments students do not get tactile feedback, so the students can learn the procedural part virtually but must learn how to manipulate the equipment by using real equipment in real life. For example, medical students can learn when to use a laryngoscope in the induction procedure in a 3D virtual space, and then practice using a real laryngoscope and a mannequin-like patient simulator in a real-life setting. So once they have learned the sequence of steps and the associated decision making in a 3D simulated environment, they can concentrate fully on learning how to physically handle the patient and equipment in the real-world training context without being distracted by the need to learn the sequence. The immersive nature of lab based simulations can also provide students with a sense of collaborative working (Minocha, 2012).

This type of approach can be very useful in experimental sciences such as molecular biology and genetics, where students can do relatively little without using scarce, expensive and often fragile equipment that lecturers are understandably reluctant to put in the hands of untrained students. Staff at Daden Ltd. worked with academics at the Department of Genetics at Leicester University on the SWIFT project (Second World Immersive Future Teaching; http://www2.le.ac.uk/projects/swift/swift) funded by the Higher Education Academy. They have set up a virtual genetics laboratory in which first year undergraduates learn about lab culture, health and safety rules and the procedures for operating equipment before they set foot in the lab. This is designed to precede or complement student experience in a real lab, and add value to often relatively short practical classes, rather than to replace experimental work.
A 3D simulation of a geology field trip has been developed by the Open University and Daden as part of The OpenScience Laboratory⁴ (an initiative of the OU and the Wolfson Foundation). The project used the Unity 3D software to develop the simulation, which was based around Skiddaw in the Lake District⁵. They used a digital elevation model derived from airborne LiDAR data and terrain imagery to reconstruct the landscape faithfully enough to provide a real sense of presence for the user. The application is based around a 10km x 10km low to medium detail model of the terrain around Skiddaw with an overlaid photogrammetry-derived mesh and textual imagery, and augmented with terrain and flora built in using Unity 3D.

In this case, the primary objective of developing an authentic 3D interactive simulation was to provide an immersive experience to the students through a sense of space. The sense of immersion is heightened by ambient audio recorded on location, as well as spoken audio for teaching content. The virtual embodiment of participants in the form of avatars and the multi-user environment give a sense of co-presence and provide opportunities for collaborative learning. The interactions and learning activities within the 3D environment were designed to mirror the experience of a real field trip. The simulation offers different students different benefits: as a preparation for a real field trip; as a replacement for a real field trip for those who are unable to participate due to mobility or other constraints; and as a supplementary field trip in resource-constrained situations where access to real trips is limited.

Digital Identity

Projects that explore students’ digital identity type are more open-ended and harder to categorise. Generally, they involve allowing participants relatively free rein to explore a virtual world while encouraging them to think in a structured way about what they find there and how they respond. This works well in social science disciplines and psychology where concepts such as digital identity will already be familiar to the students. Childs has collaborated with researchers at Newman University College, Birmingham, UK on a module entitled “Digital Culture and Digital Identity”, exploring how undergraduates see their digital identities developing in a virtual world. Student reactions to this work tended to be either very positive or very negative.

A more open-ended approach also works well in education, including continuing professional development for established teachers. The MA in Education in Virtual Worlds (http://www.uwe.ac.uk/eic/virtualWorldsMA/) from the University of the West of England attracts professionals from both education and Web design; Falconer reported that the student with the highest marks from the first cohort was a web developer with no first degree. She studied the group dynamics of the first two cohorts on this course, with seven and 20 widely

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⁴ https://learn5.open.ac.uk/course/view.php?id=2
⁵ https://learn5.open.ac.uk/course/format/sciencelab/section.php?name=skiddaw_1
geographically distributed students respectively (Falconer and Gil-Ortega, 2014) and found students on both cohorts to be enthusiastic, creative learners although they were often insecure in the online environment, particularly at first. Students reported that they particularly valued the platform for collaboration and team building with colleagues located at a distance.

Participants also described projects that had not proved successful. Several mentioned unsuccessful attempts to introduce “lectures” into virtual worlds, with students meeting in a virtual classroom with a whiteboard. Although this does deliver teaching materials simultaneously to students in different locations, there are many other technologies that do this equally well, and any sense of immersion in the environment felt by the students is neither powerful enough nor necessary enough to justify the complexity of setting up such a scenario. Burden has spent a lot of time advising clients against using this approach. Similar considerations apply to using a virtual world for meetings, even when participants are geographically dispersed, although, Burden added “if you have already built a virtual lab for use in teaching, it is easy enough to also use it for meetings”. Simple, open-ended explorations of Second Life – in which the students are just asked to create avatars and explore the system – often disappoint. Gritton quotes one disappointed student participant in such an activity as saying, “I just went into Second Life and wandered around, I didn’t know what to do there”.

Interestingly, one discipline where virtual worlds have proved particularly disappointing is one that is closely related to my own: structural chemistry and structural biology. Jean-Claude Bradley described a project in collaboration with Andrew Lang of Oral Roberts University, Tulsa, Oklahoma, USA to port a successful game for teaching NMR spectroscopy to organic chemists onto Drexel University’s island in Second Life (Lang and Bradley, 2009). The students had no problems with using this technology to access the game, but the overall results were disappointing: the students found that the interface did not work as well as those developed for commercial games. The version of this game that is in current use involves a simple web based approach, which works equally well pedagogically but was simpler to develop and easier to use.

An important addendum to any discussion of successful case studies involving virtual worlds is their popularity and effectiveness in helping students – and educators – with particular disabilities. Chambers-Jones, a colleague of Falconer at the University of the West of England, has difficulties speaking following an operation and has found Second Life’s text chat interface invaluable. Very positive experiences of Second Life reported by students with autism spectrum disorders, who often find computer-mediated communication less stressful than face to face communication echo those of the student with Asperger’s syndrome who took part in my own focus group there.
Several participants cited successful projects involving school pupils or members of the public rather than students in higher education; these have not been included in this survey.

**Virtual world pedagogy**

One commonly used taxonomy of pedagogy identifies four main pedagogic approaches, defined as follows:

- **Associative**, or the transmission of information
- **Cognitivist**, or teaching through problem-solving;
- **Social constructivist**, or forming ideas through discussion
- **Connectivist**, in which learning emerges from interactions between people

Childs made an extensive study of the pedagogy of virtual worlds in his PhD thesis, *Learners' Experience of Presence in Virtual Worlds* (Childs, 2010). In this, he explores the first three of these approaches and concludes that virtual worlds are better suited to the cognivist and social constructivist approaches than to simply transmitting information.

De Freitas agrees with this conclusion (particularly with relation to the cognitive approach) by highlighting the value of game-based learning in virtual worlds: “Students need something to do in the virtual world that is more directed than simply exploring it to see what it is like”. Meta-analyses have highlighted the pedagogical benefits of game-based learning over more traditional approaches, although these are not necessarily linked to virtual worlds.

Several contributors cited virtual world based simulations that are used to introduce beginning students in science subjects to experimental protocols that are expensive or dangerous before letting them loose in a real laboratory. The virtual genetics laboratory at the University of Leicester is a particularly good example of this approach. Bradley did note, however, that slow running of the Second Life software on sub-optimal computer systems can limit this approach: “Students will not want to stare at a computer screen for even two minutes after mixing solutions together”.

Virtual world based simulations that expose students to situations that are difficult, dangerous or even impossible to practise in real life are another example of cognitivist pedagogy that works well. These can provide a safe environment that enables students to learn from their mistakes. Published or widely quoted examples include simulations of accident investigations for trainee health and safety managers and simulations of trial procedures for law students; Clare Chambers-Jones at the University of the West of England has studied the use of virtual worlds in teaching law. Falconer, a colleague of Chambers-Jones’, stresses that this scenario-based approach also provides a social environment with students working in teams to solve a problem, and
that this can help widely distributed small groups of learners to gel. Minocha agrees, quoting a student participant saying about his experience of attending a tutorial in Second Life: “it seems as if I met my tutor today” (Minocha and Morse, 2010; http://oro.open.ac.uk/23512/). A necessary caveat to the intrinsic attraction of situation-based pedagogy in virtual worlds was provided by Falconer, saying “I wouldn’t like to be in an aeroplane flown by a pilot who had only been in simulators”.

Tate made an extensive analysis of the pedagogy of this type of situation-based learning in Second Life during his MSc in e-learning at the University of Edinburgh. Starting from the principle that an ideal approach will be neither entirely teacher-led nor student-driven but combine the two, he identified a range of effective learning methods, simulated tasks and events that could be used in training military and other service personnel to respond appropriately to emergency situations.

A different approach to analysing the pedagogy of virtual learning has been taken by Bob Stone at the University of Brighton, who has developed a model of fidelity for characterising and classifying computer-based learning (CBL) exercises. This states that an effective CBL exercise will be characterised by three types of fidelity, of the environment, of the task (that is, of the sequence of events) and of the interaction between participants. Virtual worlds can provide all three types of fidelity but are perhaps more effective in providing task fidelity, particularly if the task to be learned has both spatial and collaborative aspects.

Tate’s experience with using virtual worlds in distance education as a student as well as a teacher was not unique in this group of interviewees. Gritton used Second Life to give a presentation and take part in discussions there while studying for his MSc in e-learning. He reported feeling that the audience for his presentation was “present”, but, more generally, that student attendance at some of the sessions he attended had been poor. The students were very widely dispersed so it was difficult to set times that were convenient in all students’ time zones, a problem that was exacerbated by the low number of students on the course. Virtual worlds can also be used to bring staff together for meetings, as well as students for tutorials, but although this is a good secondary use for facilities that already exist there (e.g. the University of Leicester’s genetics laboratory) it cannot be cost-effective to build a simple meeting room in Second Life – or any other virtual world – for this purpose, when an e-conferencing program or even Skype will work equally well at a much lower development cost.

Minocha summed up this part of the discussion by stressing again the importance of design. It is important to first think carefully about what the students are expected to learn and achieve; whether a virtual world is appropriate for the pedagogy concerned; and, if it is, to select an appropriate learning space design to match with the design of the activity. Despite the fact that spaces in virtual worlds can be designed to “feel like” a wide range of mundane, exotic and even imaginary locations, there will not always be a virtual space that is...
appropriate for a particular pedagogy. Educators need to see a virtual world as one computer-based tool among many that they have available, and to let the pedagogy drive their choice of technology.

Furthermore, different virtual worlds suit different approaches. In Gritton’s Framework of Virtual Worlds (Figure 2) such worlds are classified using two dimensions, self-directed versus goal-directed and singular versus collective. In this model, Second Life is collective but self-directed; there are many participants, but each is free to explore the world as he or she (or it) chooses.
Challenges to virtual worlds in higher education

Educators planning to introduce virtual world based activities into their teaching face a number of important challenges regardless of their choice of virtual world, the appropriateness of the pedagogy and the design of the activity involved. These can be grouped into three areas: technical; institutional and financial; and student-(and teacher-) related.

Technical

In general, virtual worlds are not regarded as easy to design for or even just to use. De Freitas pointed out that avid users of computer games like the idea of learning in a virtual world but find the ones available “clunky” and difficult to learn. The word “clunky” was often applied to Second Life and almost all participants mentioned its steep learning curve for teachers and developers. Burden’s experience at Daden Ltd. echoes this: “the software is still difficult and time consuming for the teaching staff I work with to develop content in”. Bradley mentioned that Second Life had seemed very promising when it came out, but early adopters like him had expected the technology to improve – to get faster, more immersive and easier to learn and use – much more quickly than it has done. Childs agreed while remembering a similar experience when VLEs, which are now very widely used, had been first introduced.

Educators are, rightly, more focused on their subjects, their students and perhaps their pedagogy than on technical aspects of activity design. De Freitas suggested that they would be more much likely to get involved and particularly to build applications for themselves if appropriate “middleware” could be designed and made available to them to make such work more intuitive.

Falconer pointed out that distance learning can present a particular challenge as students need to use their own (or their employers’) computers and that these cannot have a standard specification. Students still need access to up to date, high specification computers and very fast Internet connections to run virtual world software, and this can rarely be ensured. Appropriate specification machines are not always available in campus PC rooms, and students using machines at their own workplaces often find that they cannot access servers running virtual worlds because of firewalls.

Institutional and Financial
A second series of challenges arise from the institutions in which educators are based. Several participants mentioned that senior teaching and administrative staff were simply not interested, although the main reason for this may well be lack of knowledge or experience. This disinterest was, however, described variously as “ideological opposition” (Childs), “lack of take-up” (Gritton) and “scepticism” (Falconer).

Institutions’ reluctance to invest in innovative but risky technology for teaching can be explained to some extent by the financial pressures that the sector has been experiencing in the UK and many other countries. Childs and Minocha are among those few who are lucky enough to still have grant funding for projects based in Second Life, but Childs has noted a diminishing “community of practice” as other institutions he has worked with have dropped out due to lack of funds. “Students now find workshops introducing Second Life less interesting as they meet fewer people when wandering around.” Anecdotally, it seems that a few academics who were previously keen and innovative developers in virtual worlds have abandoned this work entirely due to finance-led institutional pressures.

Even temporary changes to the generous system of educational discounts offered by the developers of Second Life, Linden Lab, have presented serious challenges to many educators working with it. A few years ago, a steep hike in the cost of building in Second Life for educational institutions led to many educators abandoning it. Although the discount was quite rapidly reinstated, and, as Falconer reports, “the cost for an institution that makes extensive use of Second Life is now comparable to that for a VLE such as Blackboard”, a number of those who left the platform had already found alternatives and failed to return, This is undoubtedly one of the causes of the “diminishing community of practices” reported by Childs.

**Student (and Teacher) Experience**

Even when students have no difficulty accessing virtual worlds, their response to the idea of learning in one is always extremely varied. Students tend to opt in and out; any class will tend to include both those who are really keen and those who simply don’t like it. Gritton has worked with teachers and students with a very wide range of responses “ranging from zealots who can’t see the problems all the way to those who can’t see any point”. Admittedly, some students will be put off by technical difficulties such as slow and clunky performance on inadequate machines, but others simply dislike this way of communicating. Minocha mentioned that in a part-time distance education setting, there could often be a low student turnout for virtual world based collaborative learning exercises as students tend to work in their own time. Further, if the activities in the virtual world are not compulsory, regular attendance in the virtual world activities cannot be imposed: “with distance learning I have found it impossible to ensure that all members of a student group attend synchronously to take part in an activity”.

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Gritton mentioned a related but slightly different point concerning teaching staff. He has observed that many of his lecturer colleagues are not particularly digitally literate and in particular that they know little about technology supported learning: “Many of my colleagues still struggle to do much more than post their PowerPoint presentations to the VLE”. Similar challenges were noted at other participants’ institutions, and lack of confidence can also prove to be a problem with students. While some very confident ones can find the software frustrating, others are reluctant to dip their toes in the water. Most institutions now offer training to lecturing staff in basic computer skills, including the use of their chosen VLE, but training in more innovative e-learning technologies is not as widespread.
Competitors to virtual worlds in higher education

Many different technologies are seen to be competing with virtual worlds, with various degrees of applicability and success, and this depends on the application that the virtual world is being used for. Virtual worlds can be used for synchronous communication at a distance (e-conferencing). As I have discussed, this is not the most appropriate use of this technology and there are many easier to use alternatives. Lectures can be given more easily using tools such as Blackboard's Collaborate, which offers a shared whiteboard facility. More simply still, if only discussion is required, the ubiquitous Skype is only one of many excellent tools available. Tate pointed out that he uses both these products often despite the ready accessibility of the University of Edinburgh's facilities in Second Life, though he prefers the quality and ease of use of voice in the latter.

Many participants pointed out the number of students who rely on their smartphones and seek out applications – including learning applications – that work on these devices. Bradley said “These are what the students want to use, and they work everywhere; an immersive virtual world that works well on a small screen and can be used everywhere would be very popular, but the technology for this is years away.” Students are therefore keener to use resources that can be easily accessed from their phones, such as those available through iTunes. Burden is confident that it will be possible to combine virtual worlds with mobile technology seamlessly before too long, however; he points out that some game engines such as Unity 3D’s can already work on a PC as a download with no need for an Internet connection. The “augmented reality” presented by the wearable computer Google Glass has some similarities to a virtual world and similar technologies may well be used to develop mobile virtual worlds.

De Freitas mentioned the current popularity of the MOOC (Massive Open Online Course). This is a very different type of technology from the virtual world; MOOCs offer unlimited access to open educational resources for self-study but there is often little interactivity. Burden is currently investigating whether it would be possible to add a virtual world to a MOOC for student interaction and whether this would add educational value to a popular technology that is now perceived as perhaps “over-hyped” (perhaps at its own peak of inflated expectations).

A different perspective was provided by Hannah Dee, a lecturer at the University of Aberystwyth and an educational technology enthusiast who has investigated virtual worlds but chooses not to use them in her teaching. She finds that an “involved” interface such as that provided by a virtual world comes between her and her students. She is much happier using teaching technology in which students represent themselves directly rather than via avatars and immersive environments, and cites some simple, low bandwidth tools such as Twitter and discussion forums as being particularly useful for this.
The future of virtual worlds

It was interesting that most comments on future developments in virtual worlds, particular for education, focused on evolutionary change involving practical, small scale improvements to address the challenges mentioned in the previous section rather than true “blue skies” innovations. This may be because of the inherently conservative institutions in which teachers of higher education work and of the further pressures of very limited funding opportunities. However, I may have erred in specifying a time-scale of only 5 years; asking participants to think ahead 10 or 20 years may have produced more ambitious suggestions. Childs imagines virtual world-based teaching settling down into a “niche” with relatively few expert teachers and developers working on a small number of carefully selected scenarios and applications.

Several participants looked forward to the development of a technology that would provide immersive learning on any mobile device. Such a virtual world would be very popular with students, and Burden’s work with Minocha on (e.g.) the Virtual Skiddaw geology field trip is developing some of the technology that is needed for this (Daden Ltd., 2013a). However, it is still likely to take many years to produce a truly versatile, multi-user, mobile virtual world.

Burden pointed out that the current virtual worlds, at least those most used in higher education, are still visually inferior to commercial games. In fact, Second Life still uses the same type of technology that it used when it was set up ten years ago. There is no “second generation Second Life” as yet, but one of the original team involved in creating Second Life Philip Rosedale, founded a startup company, High Fidelity, to develop one. When or if such a world is developed in might be possible to create a complete, fully functioning virtual environment as complex as a complete “virtual city for students of planning and similar disciplines to work – or play – with (Daden Ltd., 2013b). This, however, is likely to take more than just five years.

Improving the technology should also allow virtual worlds to become more integrated into other forms of learning, including face-to-face learning, and it will become easier to incorporate more real data into simulations of e.g. geology field trips. Dunwell and his colleagues at the Serious Games Institute are working on a type of “augmented reality” involving overlap between the real and digital worlds, but there is still a long way to go. The resulting technology is likely to be wearable, like Google Glass.

Gritton sees the development of more data-rich and immersive learning environments as perhaps providing a “tipping point“ to increase the take-up of the technology by teachers and students, although this is again more likely within 10 years than 5. It is important to get the basics right first, and particularly to improve the speed and reliability of university broadband networks.
Minocha looks forward to a time when an ability to collaborate and work in a virtual world would be seen as an important transferable skill for graduates that will be imparted as part of the digital literacy portfolio.
Virtual worlds – at least their use as tools for teaching in higher education – are a little more than a decade old. Their use grew extremely fast in the first few years, and by the mid-2000s can be said to have reached Gartner’s “peak of inflated expectations”. Since then, they have fallen somewhat out of favour in UK higher education, and the number of practitioners has undoubtedly decreased. I have, however, found plenty of evidence in this short survey to suggest that the technology has now passed its “slough of despond”: if, indeed, it ever reached those depths.

Second Life is still the most popular and widely used virtual world in the higher education community, although its use has diminished somewhat in recent years and it is (and perhaps has never been) universally loved. It is praised for its versatility and the still quite large community of educators based there which provides a useful base of advice for newcomers. It is, however, famously difficult to learn to use with expertise and both beginners and experienced gamers can find it slow and clunky, particularly with suboptimal hardware and Internet connections. OpenSim provides a useful open source (and therefore free) alternative, and many standalone educational applications have been developed using games engines, particularly Unity 3D. It will be interesting to see whether and how the growing popularity of Minecraft in schools will impact the higher education sector in the next few years.

The experiences of the main survey participants, all experienced and enthusiastic practitioners of teaching in virtual worlds, have shown that this technology is far more appropriate for certain pedagogies and applications than others. Applications based on the cognitive pedagogy (teaching through problem-solving) and/or the social constructivist pedagogy (forming ideas through discussion) work much better than those based on the simple transmission of information (associative pedagogy). Therefore, reproducing a straightforward lecture in Second Life for distance learners is a poor use of the technology, particularly now that basic teleconferencing facilities are widely available including through the VLEs that are ubiquitous in universities and colleges.

Two types of virtual world application that can be extremely successful are those based on simulating scenarios and practising methodology. In the first, students’ avatars can be immersed in a virtual scenario that is difficult or impossible to reproduce in “real life”, such as an accident or courtroom scene. In the second, they are exposed to the steps involved in running a complex and expensive piece of scientific equipment, or performing an operation, in a virtual world before their first experience of the procedure in the real world. Virtual worlds are also useful in teaching students about digital identity, but only if the exercises are well designed and the students well prepared; it is easy for this type of exercise to be too
open-ended, leaving the students just to “wander round” in the virtual environment knowing little of what they are expected to do or learn.

Higher education institutions in the UK and elsewhere currently differ enormously in their interest in virtual worlds. It is not surprising that this has diminished in many since the mid-2000s; it always harder to invest in risky ideas and technologies when funding is tight. Some practitioners find themselves in the position of individual trail-blazers in their institutions, while other institutions have embraced the technology wholeheartedly. In the UK, Coventry University and the University of Edinburgh are two that stand out as having adopted the technology wholeheartedly, and both these have developed a wide range of virtual world applications across the whole range of disciplines.

Even enthusiastic users of virtual worlds – early adopters among teaching staff, and avid gamers among their students – find Second Life and its current competitors technically “clunky”, slow on any but powerful machines, and difficult to learn and use. It is disappointing that Second Life still uses the same technology as it did when it was developed over 10 years ago. Enthusiasts look forward to the development of a “second generation Second Life” but have a detailed “wish list” for how this should look: it should look and feel like the best current games, be easier to use, work on a much larger range of devices including mobiles, and, crucially, educational use should be very cheap or preferably free. There are some very interesting developments under way but these will not be readily available very soon: practitioners feel that improvements in the next few years, at least, are likely to be incremental.

For every student (or teacher) virtual world enthusiast there is another who will reject the technology out of hand. Many participants reported this complete range of responses among students in their classes. It has proved difficult, if not impossible, to ensure 100% student participation in a virtual world, particularly in distance learning (a mode in which virtual worlds might be particularly valuable) as these students often have to contend with variable schedules, heavy workloads and sometimes time zone differences. Nevertheless, and for perhaps a majority of students and educators working at a distance, virtual worlds provide a uniquely valuable sense of presence and immersion that can even continue outside formal teaching, as evidenced by the University of Edinburgh’s graduation ceremonies.

My conclusion from this survey, therefore, is that virtual worlds in higher education are approaching a “plateau of productivity” with useful applications in simulating and demonstrating complex activities and in exploring ideas around virtual reality. The undoubted value of this technology can be maximised if the pedagogy is allowed to drive the technology, the software chosen to match the discipline and application and high quality advice and training made available to all interested staff.
## PARTICIPANTS

### Main interviewees

- Jean-Claude Bradley, Drexel University, USA
- David Burden, Daden Ltd. ([http://www.daden.co.uk/](http://www.daden.co.uk/)), UK
- Mark Childs, Coventry University, UK
- Sara de Freitas, (then at) Serious Games Institute, Coventry, UK
- Liz Falconer, University of the West of England, UK
- Jim Gritton, University of Greenwich, London, UK
- Shailey Minocha, The Open University, UK
- Austin Tate, University of Edinburgh, Scotland, UK

### Other Perspectives

- Clare Chambers-Jones, University of the West of England, UK
- Hannah Dee, University of Aberystwyth, Wales, UK
- Ian Dunwell and colleagues, Serious Games Institute, Coventry, UK
- Peter Miller, University of Liverpool, UK
NOTES AND REFERENCES


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