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Using Scenario Planning to Inform Pedagogical Practice in Virtual Worlds in Schools: Collaboration and Structure

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The learning affordances of virtual worlds have long being trumpeted; the barriers to the "take up" of virtual worlds in mainstream education have also been explored, with emphasis being placed on technical problems, lack of time and money. Yet, a challenge for future learning is how one *teaches* in a virtual world, and what research has been undertaken has focused largely upon tertiary education. Much less is understood about how school teachers should structure virtual lessons, and what level of collaboration or independent work is necessary to guide students towards attainment of learning outcomes. This paper will provide a theoretical review of teaching and learning in virtual worlds, and offer an initial discussion of the role and importance of structure and collaboration in virtual worlds in a school-based environment. This has been validated through four case studies using scenario-planning methodology, and drawing upon real-world practitioner-based examples.

Keywords: affordances, collaboration, pedagogy, schools, structure, teaching, virtual worlds.

Introduction

Virtual worlds are multi-user creative spaces that are ideally suited to learning activities such as simulations, artistic performances, modelling and role play, and can lead to increased motivation, engagement and collaboration (Senges & Aller, 2009; Dalgarno & Lee, 2010). The design of the virtual environment is only limited by imagination and technical skill; examples include virtual university campuses to fantasy landscapes (Prasolova-Førland, 2008). In these 3D spaces a person has a virtual embodiment in the form of an avatar. As identified by Warburton (2009), the key element to successful learning in virtual environments is the ability of both teachers and students to project themselves, *via* their avatar, into the world and become immersed in a shared learning space. In short, by using a virtual world and adopting an avatar, there is sense of "being there" in a shared 3D space and the ability to experience the immediacy of interactions which take place between users and objects in real time.

Researchers and practitioners have focused on defining the learning which takes place in virtual worlds and simulations (Bares, Zettlemoyer & Lester, 1998), pedagogical approaches for the use of Second Life (SL) in the classroom and resources to support immersive activities and ways of exploring the potential of virtual worlds. Others have investigated ways to measure the changes in learners' attitudes, interests, attention and behaviour (Molka-Danielsen, 2009). Where research has been conducted in an education setting, the focus has been upon tertiary education, teaching undergraduate courses and the development of skills such as problem-solving (Lee, Dalgarno & Farley, 2012 offer an Australian perspective).

With a few notable exceptions (Twining, 2009) less attention has been paid to the affordances of virtual worlds in a secondary and primary-school setting, and how a teacher should structure and lead (or not) their teaching in these spaces. David Deeds, an IT and language teacher in Changchun American international school in China, however, does offer some practical guidelines and notes that since introducing OpenSim into his classes, the results have 'been nothing short of phenomenal' (Deeds, 2011, p.7). Indeed, to date there is 'no primer for how to teach in a virtual world', despite extensive research been undertaken on both teaching and learning in this area (Thackray, Good & Howard 2010, p.140; Chandler, Collinson, Crellin & Duke-Williams, 2009; de Freitas & Veletsianos, 2010). This presents a major challenge to practitioners and might inhibit the future uptake of teaching in virtual worlds in schools.

This paper investigates structure and collaboration in virtual worlds, and how these should aid the design of teaching curricular interventions in-world in a school-based context. However, it must be stressed that we do not intend to offer a "one-size-fits-all" model or value judgement of different teaching styles – we argue that when teaching school children, a degree of flexibility is required and that one scenario or technique will not always be appropriate in all situations. Moreover, further research remains to be undertaken, and we offer here our initial findings based on a review of the current literature and validated through the observations of four scenarios based on the methodology of scenario planning (Snoek, 2003; Snoek et al., 2003). The paper is organised as follows: we first review the literature and set out our research questions; the second part discusses the methodology and application of scenario planning; the third section outlines four scenarios and case studies; the fourth part reviews the evidence and offers a discussion.

Research Questions and Literature Review

It has been argued that virtual worlds offer an ideal platform for the 'engagement of learners in constructivist-focused educational practice', and that student-centred learning, as opposed to teacher-led lessons, is appropriate in these contexts and environments (Moschini, 2010, p.34). Others have argued that teaching in such an environment should emphasise active collaboration and co-operative learning, interaction and activities to encourage immersion and presence (Lim, 2009; Roussou, Oliver & Slater, 2004). Further, research has demonstrated that 3D learning environments that blur the distinction between education and entertainment have the potential to produce learning experiences that are motivating and enhance student learning (Bares et al, 1998).

Dalgarno and Lee (2010) have also identified the learning affordances that virtual worlds can bring about, and how virtual worlds are suited to collaborative learning, communication and co-operation. They note that virtual worlds afford five types of learning tasks (see Table 1): (1) spatial knowledge representation; (2) experiential learning; (3) engagement; (4) contextual learning; and (5) collaborative learning. Hew and Cheung (2010) have also identified three uses of virtual world environments which are specific to learning: (1) communication spaces (that is, a place where people can communicate information in both verbal and non-verbal forms); (2) simulation spaces (a place where simulations and re-enactments can take place); and (3) experiential spaces (an environment where students can learn by doing and observe their outcomes and reflect on their own learning).

Table 1: Learning Affordances and Key Words from Delgarno and Lee (2010)

Affordance	**Key Words**
1. Representation/Fidelity	Enhanced Realism, Sense of Presence, Spatial Knowledge
2. Learning Tasks	Embodied Learning, Risk, Cost, Abstract Representations
3. Motivation and Engagement	Personalisation, Individual Goals, Game-Based
4. Interfaces	Context, Interactivity, Situated Learning
5. Collaboration	Collaborative Learning, Discourse, Communication, Co-Operative

Yet, as Dreher, Reiners, Dreher, & Dreher (2009) have identified, it is not enough to sit students in front of technology to enable them to learn. As Mcloughin and Lee (2008, p.17) acknowledge, 'the technologies themselves do not directly cause learning to occur but can afford certain learning tasks that themselves *may* result in learning or give rise to certain learning benefits'. Dalgarno and Lee (2010, p.25) call for more data to redress the fact that 'efforts in this field are largely hit-and-miss, driven by intuition and "common-sense" extrapolations rather than being solidly underpinned by research-informed models and frameworks'. Questions remain about the extent to which existing pedagogical frameworks and virtual world scenarios formed from observations and research in tertiary education are relevant to, and are suitable for, teaching school children in compulsory school settings. For instance:

1. *How far do teachers structure learning in 3D virtual worlds in Schools?*
2. *What are the Implications of Students Learning Collaboratively or Individually within a Virtual World?*

In other words, what degree of structure should be pre-designed into the virtual environment and the specific tasks set for learners; should collaborative learning always be the default option for school teachers; and to what extent should emergent learning be facilitated as opposed to prescribed learning which is more common in face-to-face contexts (Williams, Karousou & Mackness, 2011)? In their study of virtual worlds for learning communities, Senges and Alier (2009) identified that with the first generation of these worlds**,** educators did what came naturally: they 'replicated' their real world classroom teaching to the virtual world. Teachers often drew upon traditional teaching models and relied on prescriptive learning outcomes and expectations. However, it is best if content is co-constructed with learners rather than simply delivered to them. In short, teaching methods should be focused on collaboration, group work and shared contextual tasks (Molka-Danielsen, 2009; Moschini, 2010).

Yet, it does not follow that this is the only approach that should be adopted and that structured lessons might not be more suitable for certain students and particular tasks; more research needs to be undertaken concerning individualised learning, and learning which takes place outside of the classroom and the teacher's presence in virtual worlds and how this contrasts with more formalised settings. In fact, the requirement of a teacher's presence in a virtual classroom is a pertinent issue that has yet to be fully resolved. As discussed by Crook (2008), power structures in Web 2.0 technologies are still being evaluated, and it would appear that the authority of knowledge is being transferred from teachers to students; teachers are fast losing their status as all-knowing experts.

To conclude, our survey of the literature has identified key research questions that focus on how a lesson should be structured, and the importance of collaboration and co-operative learning *vs.* individualised and personalised learning. What is more, the key affordances of virtual worlds as set out above appear to align with these research areas. The next step is to frame these questions into a research methodology, and to validate this with real-world scenarios.

Methodology and Making of Scenario Writing

The research methodology adopted here was based on a review of the literature on virtual worlds (see above), and scenario-planning methodology. This draws on the work of Snoek (2003), Snoek et al (2003) and Cautreels (2003), and the critical and theoretical reflections of Linde (2003). Such a methodology has been used in business planning to enable large-scale organisations to plan for different possible futures and to take an active part in designing the future they think is desirable (Snook et al, 2003; Benammar et al, 2006). In an educational context, Snoek has argued that the making and use of scenarios stimulate the imagination of people involved, increase awareness of decisions and important factors that influence education, and enable teachers to be pro-active (Snoek et al, 2003).

It is important to reinforce that in designing different scenarios for teaching in virtual worlds, that no one scenario will emerge in a 'pure' form; and that the scenarios selected and keywords characterising each scenario are described in their extreme in order to underline differences and reinforce variables. Further, as suggested by Snoek (2003), in undertaking scenario planning we have not attached a value to each of the different scenarios - we have not assumed that one scenario is more preferable or 'better' than another. In other words, each scenario carries equal weight.

To develop and write the scenarios for teaching in virtual worlds the research team followed Snoek et al (2003) by taking four main steps. These steps took place in four Google+ video chat meetings and e-mail exchanges in 2012 between experts in the field who included staff in Academy 360, Sunderland (an all-through school in the United Kingdom), the University of Hull (United Kingdom), Department of Education and Communities, New South Wales (Australia) and Macquarie University (Australia).

Step 1: we drew upon our experiences of teaching and researching in virtual worlds, and our discussions with teachers who had taught a lesson or course in a virtual environment. At this stage we were interested in how to embed more fully the use of virtual worlds in schools, and to identify the main affordances and challenges of teaching in a virtual world.

Step 2: we reflected upon the literature review and the experience of practitioners. Following this, we followed the advice of Snoek who recommends listing of the most significant drivers dictating how teaching in a virtual world might occur, labelling these the 'push-pull' factors. *Push* factors include Social Learning, Individual Learning, Learning Outcomes and Freedom of Teaching Style, and *Pull* factors Technology, Time, Assessment and Resources.

Step 3: we concentrated on which of these factors had the most impact on teaching in a virtual world, those which were most unpredictable and those that could be used to differentiate between different scenarios. In the discussions that followed we selected two of the most import factors which could be each represented on a continuum with two possible extremes to emphasise the differences between the scenarios. For the 'x' axis we selected the continuum between teacher-centered and student-centred classes; and for the 'y' axis, the continuum between collaborative and individual learning. This then enabled us to identify four different scenarios, each scenario representing one quadrant of the two-dimensional matrix. Again, in line with the work of Snoek et al (2003), these two dimensions were not considered as opposite to each other. From this four keywords were selected to characterise each scenario (see Fig. 1):

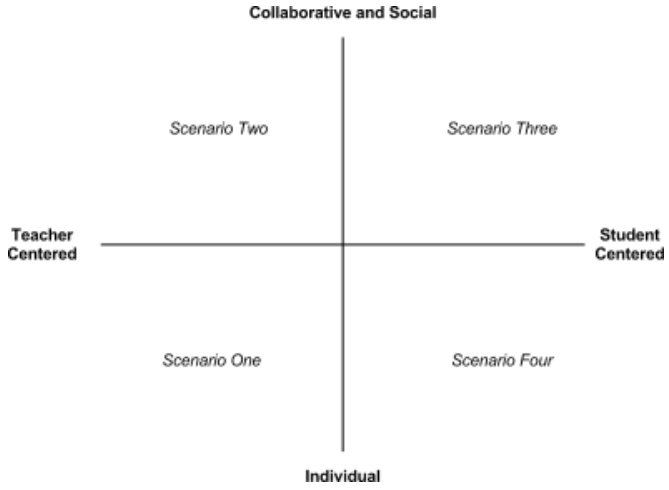

Fig. 1: Two-Dimensional Matrix Representing Four Different Scenarios

Step 4: finally, we worked on bringing the scenarios to life. In a slight departure from the methodology of scenario planning, we decided to illustrate scenarios with real-world examples that are already happening today. However, it is important to note that each of these examples do not represent a current trend amongst practitioners; they are 'one-offs', experimental and collectively do not represent a single pathway into the future. Consequently, although drawn from the present, they nonetheless permit us to offer a projection into the future; and as Snoek himself found (2010, p. 12), 'probably elements of different alternative scenarios can be found in reality', and in planning scenarios one can better reflect on current trends. To ensure consistency between each of the four scenarios, a format was made: Scenario; Discussion; and Affordances and Limitations. Each of the four scenarios, and their real-world counterparts, are described below.

Scenario One: Teacher-Led Individualised Learning

Scenario

Scenario one examines the work of Derek Robertson, National Adviser of New and Emerging Technologies, Scotland. This scenario called CANVAS (Children's Art at the National Virtual Arena of Scotland) was a teacher-asciliteled project in a virtual environment, created by Second Places. The intention was to exhibit and celebrate student created artwork in the form of still or moving images. Each artwork was accompanied by an audio recording of the learner explaining his or her concept and/or design. Thirty-two Scottish local authorities participated in this project, led by the Consolarium (Education Scotland, 2006).

Discussion

CANVAS was hosted on the Education Scotland's servers. This allowed full control over who was able to enter or view the virtual world. Teachers from each Local Authority were given the same brief for this project:

> We believe that the participative nature of the (CANVAS) design will offer a context in which young learners experiences, thoughts and understanding of their own work and development can be enriched and enhanced by the proposed opportunity for dialogue and discussion that the world offers. (Robertson, 2009)

Canvas was designed so that learners would work individually, but could interact through text chat with each other and with selected audiences, who would visit the virtual art gallery through their avatars. Learners could study the exhibition design and make deliberate choices with their teacher and peers on the appropriate placement of artwork for display. Teachers set up the initial virtual environment, and were 'present' in-world with students but adopting a supervisory role. Teachers provided opportunities for learners to critically reflect on their art making process by creating accompanying audio recordings. The objectives of the project were based on structured activities with minimum in-world collaboration opportunities. Teachers were not required to have deep technical knowledge of OpenSim and concentrated on helping students to achieve learning outcomes. The goal of Learning and Teaching Scotland was for larger scale implementation of OpenSim.

Affordances and Limitations

This scenario affords student creativity in one space. Robertson's goal was to provide opportunities for students to experience being in a virtual world while being observed by a teacher; a shared space for groups of students to exhibit, critically reflect and have a dialogue with their audiences was also offered. The artworks were created by students in real-life but exhibited in a pre-designed virtual world. The main success was that many school districts could participate in this project and teachers were able to implement this technology with a small learning curve. The innovation lies in the idea of: creative participation in one space, enabling learners to engage with dialogue about their own artwork and the work of others within a dynamic and contemporary digital setting; permitting students to curate their work knowing that this would be accompanied by a video and give the viewer information about their piece and their progress as an artist; to develop an awareness of practical and purposeful use of a range of digital tools and be part of a collegial learning community. The main project limitations included the difficulty of maintaining continuity because of firewalls. Chat functions and certain avatar customisation features were disabled due to concerns about inappropriate use by learners. Therefore, the full rich experience of a virtual world was not available to learners in this scenario. Large-scale implementation proved to be too challenging when trying to change the mindset of teachers to be responsible to maintain and populate their galleries. The intention that learners should engage with their audiences in a virtual world was clearly specified, but there were more challenges associated with this than envisaged.

Scenario Two: Teacher-Led Collaborative Learning

Scenario

Scenario two examines River City, a multi-user virtual environment aimed at developing learners' expertise in socio-scientific inquiry. This virtual world was designed by a team of academics and implemented with over 15,000 school students (Clarke & Dede, 2009). River City provides learners with a simulation of an industrial nineteenth century city, including a hospital, hotel, university, shopping, residential areas and a river (Clarke & Dede, 2009). Through interactions with residents, parts of the environment and embedded data, learners work in groups to conduct a scientific inquiry into the spread of disease throughout the city. The socio-scientific inquiry involves students: making observations; posing questions; examining books and other sources of information to see what is already known; using tools to gather, analyse, and interpret data; planning investigations; reviewing what is already known in light of experimental evidence; proposing answers, explanations, and predictions; and communicating the results (Ketelhut, Nelson, Clarke & Dede, 2010). The narrative is non-linear, with learners deciding their own trajectory in terms of what contexts they visit, to whom they talk, and what data and tools they use. The learners engage with the simulation across four time scales (seasons), allowing them to construct understandings of how the problem changes over time. To finish their inquiry, students write a letter to the Mayor of River City, which includes an authentic lab report (Ketelhut, Nelson, Clarke & Dede, 2010). Students then compare their research with other groups, to discuss and reflect on the 'many potential hypotheses and causal relationships embedded in the virtual environment' (Ketelhut, Nelson, Clarke & Dede, 2010, p.60).

Discussion

Learner experiences in River City are tightly controlled by the design of the virtual world, with students' intended learning trajectories and outcomes being broadly predetermined by the academic design team. Learners work in groups, allowing them to experience scientific teamwork and to complete more extensive challenges than would be possible individually. Cross-group collaboration is also used at the end, to give students insight into the different interpretations and results obtained by each group.

Affordances and limitations

This type of scenario allows educators to carefully design a learning experience for students (*cf.* Squire, 2006) which targets learning outcomes relating to teams and collaboration. In this scenario, the collaboration adds an element of authenticity, allowing students to experience conducting scientific inquiry in teams, including problem solving in groups and social negotiation. As the design of the virtual world is predetermined, appropriate scaffolding can be considered prior to learner engagement, as can rigorous assessment of learning. The design is also re-usable, and can be regularly evaluated and refined based on learner outcomes and feedback.

Many interactions within the virtual world are predetermined, including the provision and use of tools and the conversations that may be performed. This allows the narrative to respond to students' actions and represent the consequences. One limitation of this design, however, is that students make decisions from the provided options rather than experiencing the complexity of generating their own choices. To mitigate this limitation, some learner activity may be conducted 'outside' the world using alternate technologies or blended approaches.

Scenario Three: Student-Led Collaborative Learning

Scenario

Scenario three examines Marianne Malmstrom's work at the Elizabeth Morrow School in New York (United States), and student-led activities in Minecraft - a massively multiplayer online role-playing game. An eighth-grade student who had been using Minecraft both in school and at home instigated the scenario. The student requested if the class could role-play the young adult novel *The Hunger Games*; students worked in pairs and groups to fight to the virtual death in an arena, until one student remained as victor. The rules for the virtual game were set entirely by students; so too was the planning and organisation. The teacher was invited to act as an in-world overseer of the games. As a result of the activity's success, the students organised an after-school social event for grades five to eight, designing posters and flyers; this is the first time, Malmstrom recalls, that students entirely conceived, initiated and executed such an event themselves.

Discussion

Students, who worked together and shared knowledge in order to make meaningful interpretations, organise and communicate ideas, led the scenario. They had to contribute significantly to the trajectory of the scenario, plan and communicate roles and responsibilities. Students also had to create their own resources collaboratively to support tasks. The teacher was only present in-world in order to observe and to ensure e-safety. In short, an authoritative adult 'voice' was absent, tasks were open-ended, the lessons left unstructured in order to enable experimentation, and students worked collaboratively on a shared task.

Affordances and Limitations

Malmstrom reflected on the affordances of unstructured collaborative learning in a virtual world, noting that:

> Students love the opportunity to stretch their imagination and show what they have created … it is amazing to watch how freely they share their newly gained knowledge. … The community only thrives when each member contributes his/her area of expertise to the group. Arising conflicts and disagreements become part of the learning process, as students negotiate and resolve their own problems (Malmstrom, 2011, p.3).

The success in this area has also led to the school running a summer camp, during which goals are suspended and the school explores new platforms, tests ideas in learning theory and investigates new curriculum (see student work at KnowclueKidd, 2011). In terms of limitations, another Minecraft teacher in New York, Joel Levin (2012) has blogged on the limitations of unstructured tasks for some learners, noting that some of his children 'feel overwhelmed by the sheer number of options available to them in an open world, and need constant direction'. He recommends that 'the best designed lessons and activities provide options and multiple paths to success, catering to various play styles. This lines up nicely with traditional classroom practices of embracing a wide variety of learning style'.

Scenario Four: Student-Centred Individualised Learning

Scenario

In this scenario a single student at Elisabeth Morrow School, New York, elected to work alone in the immersive game Minecraft. Despite the collaborative nature of this game, the player demonstrated high levels of independence, persistence and resilience to build an entire world and characters. In his personal log, recorded as a machinima, he discussed working through his summer holidays to complete the world, frequently setting himself seemingly impossible high goals to achieve (e.g. completing a full scenario in a single day). Although there are occasional prompts and advice from outsiders, such as his class teacher who asks him to incorporate more screen shots in his log, this is minimal and most of the construction, activity and learning is undertaken alone. There is, therefore, little evidence of social contact and interaction in this scenario: the student works almost alone on an immersive task which is engaging and engrossing. All of the activity and learning occurs away from, and beyond the sight of, formal education, although in this case it is recognised by the class teacher who has identified this form of learning as worthy of further investigation:

> The one thing you are not covering in your paper (and what I'm personally finding the most compelling these days in terms of kids learning) is the learning that is happening beyond the classroom. We run a 24/7 server to give our kids a safe place to play after school. That is where the really cool things are happening. We are have done this for over a year for grades 5-8. We are just about to wipe their work of the last 6 months to start over with 3 fresh worlds they have designed because we are allowing students from grades 3 & 4 to join the server. This is due to student and parent request. (Malmstrom, personal correspondence, May 2012)

Discussion

Like the previous example (see above), this scenario is distinctive for the lack of a traditional authority figure or authoritative voice that is normally that of the teacher. It bears many resemblances to the previous scenario, lacking formal and predetermined input from a teacher. Hence there are no assigned learning outcomes, targets or set activities driving the learning and it is highly emergent rather than prescribed (Williams, Karousou & Mackness, 2011). However, in this scenario there is no requirement to collaborate or share with other students, and this shifts responsibility and indeed motivation entirely to the individual player. This scenario requires high level of independence, self-regulation and resilience to succeed, and for some learners this is an ideal environment or context to demonstrate their own capability without the hindrance of others who may be less inclined to work in this manner.

Affordances and Limitations

This scenario exploits the affordances of motivation and engagement whilst minimalising the collaborative affordances so often signalled as hallmarks of immersive world learning (Delgarno & Lee, 2010). It highlights learner dispositions and characteristics, such as resilience, persistence and self-regulation, which are highly desirable but often bemoaned for their absence in formal learning (Heikkilä & Lonka, 2006). The absence of a formal authority figure such as a teacher will lead many to question the value and validity of this scenario since it has limited immediate application in formal school contexts. However, this may be changing as educators such as Malmstrom begin to explore and highlight the value of these contexts and the intensity of learning related activity often undertaken in them by lone students.

Discussion

In reviewing the scenarios set out above, we do not intend to offer here definitive statements on structure and collaboration in virtual world lessons. Instead, using scenario planning has enabled us to examine alternative teaching models, and to offer suggestions to help plan for future challenges in learning and teaching in a virtual world. However, we acknowledge that our findings are based on narrow observations, taken from selective examples, and further research is required in this area. We offer a set of suggestions for further research; a starting point to better understand, reflect and inform an ongoing strategic conversation about the future role and importance of structure and collaboration in virtual worlds in a school-based environment. On the basis of scenario planning we suggest that a better way of looking at our original research questions of (1) *How far do teachers structure learning in 3D virtual worlds*?, and (2) *What are the Implications of Students Learning Collaboratively or Individually within a Virtual World?*, is through a theoretical perspective – a lens which

focuses on a central issue: the teaching model(s) adopted by teachers in 3D worlds. In line with our scenario matrix, this has two axes: the Teacher-Student axis, and the Collaborative-Individual Learning Axis.

Teacher-Student Axis

First, our findings have demonstrated that teachers are best advised to adopt, as they already do in the 'real world', a 'best-fit' approach to the structure of lessons in virtual worlds, adopting a flexible approach dependent on the nature of individual students, the class, the teacher and the ethos of the school. For instance, scenario four worked because there was a teacher who had the experience and confidence to allow a highly unstructured approach to learning – but such a scenario would not suit everybody. Teachers, for example, who initially adopt teaching in virtual worlds are by their nature 'risk takers' and are perhaps are more confident to adopt lessons which are more unstructured; in contrast, teachers who are more resistant to technology and change might require more control initially. Indeed, teachers (and other stakeholders) may need to revise their attitudes and beliefs about prescribed and emergent learning as many of the apparent learning gains in immersive worlds occur when there is less prescription and teachers are happy to go with the flow; this of course raises the conundrum of how do you plan for emergent learning!

Furthermore, research should be undertaken which questions to what extent the term 'structure' actually transfers from the world of face-to-face teaching to the virtual world. For example, in the 'real world' spatial structures, such as walls, chairs and equipment, and temporal structures, such as fixed lesson times, influence how teachers plan and deliver lessons. In a virtual world, temporal structures are, perhaps, more transferable as a server can be turned on and off, and the environment can be changed from day into night. However, space is probably harder to structure in a virtual world – there are issues surrounding class room management, and 'control' of avatars in a space in which they walk, talk and fly. A 3D virtual space, it goes without saying, is not the same space as a physical classroom, and teachers will need to plan accordingly. In short, there is probably no one ideal solution to structure – as each scenario demonstrated, each has positive and negative values for teaching as it currently stands, although some are far more likely to be appropriated and assimilated into formal learning than others.

Collaborative-Individual Learning Axis

The findings from the four scenarios demonstrate that both individual and collaborative tasks have the potential to lead to rich learning experiences, depending on the students and teachers' abilities to use a virtual world effectively. We suggest that although an enriched and motivated learning experience can be achieved in each of the four quadrants, teachers need to be aware of a number of critical issues. First, the teacher needs to take into consideration students' personal ability and motivation to use virtual worlds, and learn either individually or collaboratively. Watulak (2012) notes that students who have lower abilities and less interest in technology may feel anxious and ostracised when a high level of importance is placed on it by their educational institution. Therefore, those students who have an initial low-level of technical ability might struggle if their first lesson is highly unstructured, collaborative and the teacher is 'absent'; in such cases the teacher should ensure that each student is sufficiently supported in developing the necessary expertise to effectively participate in the learning. As a point of good practice (Gardner et al, 2010), it is recommended that teachers use formative assessment to adjust teaching and to allow students to have an understanding of their strengths and next steps, as is appropriate in face to face teaching. As teachers have found in the classroom, one of the best ways to engage students in the virtual world is to begin the sequence of lessons (even when they do not intend to be present) with a 'tutorial' type introduction in a similar style to computer games, as this will address the issues of the basic technological skills which allows students time to become acclimatised to the new environment (Malmstrom, 2011; Levin, 2011).

In addition, student motivation to learn in virtual worlds should also be taken into account. Shen and Eder (2009) used the Technology Acceptance Model (TAM) to identify the receptivity of users to using virtual worlds in teaching and learning. For acceptance to take place, they measured the combination of 'perceived usefulness' and 'perceived ease of use'. Further, Calongne (2008, p.38) identifies that it is important to capture the student's imagination with the possibilities of what the technology can achieve and use 'cool technology, exciting research, entertainment, and great visuals to inflame students' imagination.' Before embarking on any type of teaching in a virtual environment, be that individual or collaborative, teachers might find that it is important for students to have a good understanding of how using technology can enhance their overall learning, and in turn that they reflect on themselves as learners and on the learning process.

As a final observation, a teacher does not need to be present in a virtual world for learning to take place. Yet, teachers need to be aware of the different pedagogical affordances of virtual worlds in order to maximise the use of these spaces for teaching and learning. It is perhaps reassuring, therefore, to end the paper with the observation that a teacher is required, even in a very decentralised, student-centred environment, in order to recognise the learning which takes place, to support learners and to undertake assessment.

References

Bares, W. H., Zettlemoyer, L. S., & Lester, J. C. (1998). Habitable 3D Learning Environments for Situated Learning. *Proceedings of the Fourth International Conference on Intelligent Tutoring Systems*, 76-85.

Benammar, K., Dale, L., Poortinga, J., Schwab, H., & Snoek, M. (2006). *The Scenario Method for Education: Facilitator Manual (version 6.2)*. Retrieved May 28, 2012, from http://du.onderwijsontwikkeling.net/download.php?id=950

Bower, M. (2008). Affordance Analysis—Matching Learning Tasks with Learning Technologies. *Educational Media International, 45*(1), 3–15.

Calongne, C. (2008). Educational Frontiers. Educase. Retrieved May 28, 2012, from: http://net.educause.edu/ir/library/pdf/ERM0852.pdf

Cautreels, P. (2003). A Personal Reflection on Scenario Writing as a Powerful Tool to Become a More Professional Teacher Educator. *European Journal of Teacher Education, 26*(1), 175-80.

Chandler, J., Collinson, T., Crellin, J. & Duke-Williams, E. (2009). Using Virtual Worlds for Teaching and Learning [Special issue]. *Innovation in Teaching And Learning in Information and Computer Sciences, 8*(3)

Clarke, J., & Dede, C. (2009). Design for Scalability: A Case Study of the River City Curriculum. *Journal of Science Education and Technology, 18(*4), 353-365.

Crook, C. (2008). What are Web 2.0 Technologies and Why do they Matter? In N. Selwyn (Ed.), *Education 2.0? Designing the Web for Teaching and Learning* (pp.6-9). London: University of London.

Dalgarno, B., & Lee, M. J. W. (2010). What are the Learning Affordances of 3-D Virtual Environments? *British Journal of Educational Technology*, *41*, 10-32.

De Freitas, S. & Veletsianos, G. (Eds) (2010). Crossing Boundaries: Learning and Teaching in Virtual Worlds [Special issue]. *British Journal of Educational Technology, 41*(1).

Deeds, D. (2011). *OpenSimulator: School Quick Start Guide*. Changchun: Changchun American International School. Retrieved from http://www.scribd.com/doc/57959626/OpenSimulator-School-Quick-Start-Guide

Education Scotland (2006). *Education Scotland and Game Based Learning*. Retrieved May 28, 2012, from http://www.educationscotland.gov.uk/usingglowandict/gamesbasedlearning/consolarium.asp

Gardner, J., Harien, W., Haywood, L., & Stobart, G. (2010). *Developing Teaching Assessment*. Maidenhead: OUP.

Garrison, D. R., & Cleveland-Innes, M. (2005). Facilitating Cognitive Presence in Online Learning: Interaction Is Not Enough. *American Journal of Distance Education*, *19*(3), 133-148.

Heikkilä, A. & Lonka, K. (2006). Studying in Higher Education: Students' Approaches to Learning, Self-Regulation, and Cognitive Strategies. *Studies in Higher Education, 31*(1), 99-117.

Ketelhut, D. J., Nelson, B. C., Clarke, J., & Dede, C. (2010). A Multi-User Virtual Environment for Building and Assessing Higher Order Inquiry Skills in Science. *British Journal of Educational Technology*, *41*(1), 56-68.

KnowclueKidd (2011). *Community Housing (Snowkit & Friends Tour MorrowCraft)*. Retrieved May 28, 2012, from http://www.youtube.com/watch?feature=player_embedded&v=LwayqRejGDs

Lee, M. J. W., Dalgarno, B. & Farley, H. (Eds), Virtual worlds in Tertiary Education: An Australasian Perspective. *Australasian Journal of Educational Technology, 28*(Special issue, 3)

Levin, J. (2011). *Teaching Minecraft - Episode 1 (pt. 1)*. Retrieved May 28, 2012, from http://www.youtube.com/watch?v=sb4PYDTfSbQ&feature=relmfu

Levin, J. (2012). Trending Topic: Structured vs. Unstructured Play. *The Minecraft Teacher*. Retrieved May 28, 2012, from http://minecraftteacher.net/post/18912962011/trending-topic-structured-vs-unstructured-play

Lim, K. Y. T. (2009). The Six Learnings of Second Life: A Framework for Designing Curricular Interventions In-World. *Journal of Virtual Worlds Research*, *2*(1), 1-5.

Linde, G. (2003). The Use of Two-dimensional Models in Social Science: An Autocritical Review. *European Journal of Teacher Education*, *26*(1), 37-45.

Malmstrom, M. (2011). Game to Learn. *The Apple Tree*.

McLoughlin, C., & Lee, M. (2008). Future Learning Landscapes: Transforming Pedagogy through Social Software. *Innovate*, *4*(5). Retrieved May 28, 2012, from http://www.innovateonline.info/pdf/vol4_issue5/Future_Learning_Landscapes-__Transforming_Pedagogy_through_Social_Software.pdf

Molka-Danielsen, J. (2009). Learning and Teaching in the Virtual World of Second Life. In Eadem & Deutschmann, M. (Eds.), *The New Learning and Teaching Environment* (pp.13-26). Tapir Academic Press.
Moschini, E. (2010). The Second Life Researcher Toolkit – An Exploration of Inworld Tools, Methods and Approaches for Researching Educational Projects in Second Life. In A. Peachey, J. Gillen, D. Livingstone, & S. Smith-Robbins (Eds.), *Researching Learning in Virtual Worlds* (pp.31-51). London: Springer London.
Prasolova-Førland, E. (2008). Analyzing Place Metaphors in 3D Educational Collaborative Virtual Environments. *Computers in Human Behavior*, *24*(2), 185-204.
Reiners, T., Dreher, C., Dreher, H., & Dreher, N. (2009). Virtual Worlds as a Context Suited for Information Systems Education: Discussion of Pedagogical Experience and Curriculum Design with Reference to Second Life. *Journal of Information Systems Education*, *20*, 211-224.
Robertson, D. (2009). CANVAS: Scotland's First Schools Based Virtual World for Learning. Retrieved May 28, 2012, from http://ltsblogs.org.uk/consolarium/2009/08/25/canvas-scotlands-first-schools-based-virtual-world-for-learning/
Roussou, M. (2004). Learning by Doing and Learning Through Play: An Exploration of Interactivity in Virtual Environments for Children. *Computers in Entertainment*, *2*(1), 10.
Senges, M., & Alier, M. (2009). Virtual Worlds as Environment for Learning Communities. In M. D. Lytras, R. Tennyson, & P. Ordóñez de Pablos (Eds.), *Knowledge Networks: The Social Software Perspective* (pp.181-98). IGI Global.
Shen, J., & Eder, L. Intentions to Use Virtual Worlds for Education. *Journal of Information Systems Education*, *20*(2), 225-223.
Snoek, M. (2003). The Use and Methodology of Scenario Making. *European Journal of Teacher Education*, *26*(1), 9-19.
Snoek, M., Baldwin, G., Cautreels, P., Enemaerke, T., Halstead, V., Hilton, G., Klemp, T., et al. (2003). Scenarios for the Future of Teacher Education in Europe. *European Journal of Teacher Education*, *26*(1), 21-36.
Squire, K. (2006). From Content to Context: Videogames as Designed Experience. *Educational Researcher 35*(8), 19-29
Thackray, L., Good, J., & Howland, K. (2010). Learning and Teaching in Virtual Worlds: Boundaries, Challenges and Opportunities. In A. Peachey, J. Gillen, D. Livingstone, & S. Smith-Robbins (Eds.), *Researching Learning in Virtual Worlds* (pp.139-158). London: Springer London.
Twining, P. (2009). Exploring the Educational Potential of Virtual worlds - Some Reflections from the SPP. *British Journal of Educational Psychology*, *40*(3), 496-514.
Warburton, S. (2009). Second Life in Higher Education: Assessing the Potential for and the Barriers to Deploying Virtual Worlds in Learning and Teaching. *British Journal of Educational Technology*, *40*(3), 414-426.
Williams, R., Karousou, R., & Mackness, J. (2011). Emergent Learning and Learning Ecologies in Web 2.0. *The International Review of Research in Open and Distance Learning*, *12*(3), 40-59.

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