iVERG 2011 Proceedings -
International Conference on Immersive
Virtual Technologies for Learning:
Virtual Implementation, Real Outcomes

Stewart Martin

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Editor

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Preface

It gives me great pleasure to welcome you to this issue of the conference proceedings of the International Virtual Environments Research Group. This issue is dedicated to the publication of selected papers written by researchers in Australia, Europe, Japan and Singapore from the 2011 *International Conference on Immersive Technologies for Learning: Virtual Implementation, Real Outcomes*. Delegates to the conference came from institutions across the world and created a relaxed, enjoyable etmosphere within which a wide range of exciting and innovative papers were presented on topics from across the educational, training and theoretical spectrum.

The iVERG 2011 conference would not have been possible without the work of the local organizing committee, session chairs and editorial review team including Michael Vallance and Paul van Schaik to whom especial thanks are due for their dedication and hard work.

March 2012

Stewart Martin
Chair, iVERG

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Dynamic visualisation of data for more knowledgeable interpretations

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Abstract. In our recent research entitled 'Designing Effective Spaces, Tasks and Metrics for Communication in Second Life' TRANSANA software was used to transcribe 60 hours of recorded video data of participants (N=8) communicating the programming of LEGO robots in Second Life and face-to-face. The transcription was then coordinated with the respective video capture data using TAMS Analyzer software. The codes determined in our research were the Cognitive Processes and Knowledge Dimension taxonomic elements of Bloom's revised taxonomy. The coded data was then viewed in a Google Motion Chart in an attempt to dynamically visualise and interpret the learning process. This paper will demonstrate the use of the inexpensive software, in particular providing some practical applications of the Google Motion Chart.

Keywords: data visualization, Motion Chart, Bloom's taxonomy, Second Life

Introduction

Virtual worlds provide an opportunity to explore new educational contexts for analyzing and measuring the cognitive processes that support learning. In this research the Second Life virtual world served as a medium and tool for remotely located students to communicate in the collaborative construction and programming of Lego robots to follow pre-defined circuits. Iteratively designed and quantifiably measured tasks to delineate neo-Bloomian Cognitive Processes and Knowledge Dimensions are implemented (Bloom, 1956; Anderson et al., 2001). There is widespread use by many educators of assessment schemes based on an ordered hierarchy of cognitive activity, where the judgments of educators on the learning progress of students is expressed using either percentage marks or ranked alphanumeric grades, which possess high face-validity because they appear to represent common-sense descriptions of learning progression.

Table 1. Bloom's taxonomy grid (Anderson *et al.*, 2001)

Knowledge	Cognitive Process					
	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual						
Conceptual						
Procedural						
Meta-cognitive						

The language found in many commonly used assessment structures and marking guides reflects the hierarchy within a revised Bloom's Taxonomy (see Table 1) where, in the cognitive domain, evaluation and synthesis is privileged beyond analysis or application and above memory or understanding. The observations from 60 hours of transcribed data suggests that the descriptors and associated scores derived from assessment schemes may not correspond closely to the development and mastery of cognitive ability, particularly so in the 'higher order' realms.

Challenges and solutions

In terms of data collection, collation and analysis a number of challenges were apparent. Four researchers at three universities in two countries needed to share the transcribing, coding, and analysis of 60 hours of video-taped communication data. Financial constraints limited the amount of money that could be spent on research analysis tools. For example, only one of the three universities involved had a site license for the nVivo qualitative analysis software (http://www.qsrinternational.com/). At US$650 per license per computer, nVivo was deemed too expensive. For digitally capturing, categorizing, analyzing and distributing the communication data, Studiocode (http://www.studiocodegroup.com/) is considered exceptionally reliable and flexible. However, this software was also considered too expensive; pricing is not available online and a quote must be obtained directly from the company. Another early challenge was that two computer operating systems (Mac OSX and Windows) were in use by the researchers. As two universities used Macs and one used Windows, plus further considerations such as technical development and support by one of the researchers, it was decided to work exclusively on Apple Mac computers with OS X 10.5. Using one system ensured that technical issues would be limited and researchers could focus on research and not be distracted by unnecessary computer administration. These technical challenges may be familiar to researchers worldwide.

The research data consisted of video-taped recordings of real life communication and virtual world screen captures (in movie format) of all the tasks' processes. Sony HD cameras were used for capturing real life communication while Snapz Pro X (http://www.ambrosiasw.com) was used for capturing on-screen recoding of task process. Snapz Pro at US$69.00 was only required on one computer.

Once the research data had been collected, it had to be shared with the researchers in the UK and Japan. The decision was to record all data on video tapes. This data was then imported to Apple's free iMovie software and then exported in Quicktime format. This resulted in 650 MB files per each 45-minute, full quality video. The Quicktime videos were categorized per task and then uploaded to a dedicated space on a university server for one month to allow researchers to download to their local hard disks.

Transcribing hours of communication is a challenge researchers worldwide often face. Our research had 60 hours of video-taped communication. As mentioned above, nVivo software and Studiocode are excellent tools but were outside our budget. We therefore decided to purchase TRANSANA software (http://www.TRANSANA.org). TRANSANA is reasonably priced at US$65 per user and operates on Mac and Windows. We found that the TRANSANA files transferred across platform seamlessly when tested (as one part time transcriber used a Windows laptop), had intuitive keyboard controls for transcribing, and the use of time stamps allowed one to link back from transcribed text to point in video (see Figure 1). A research assistant was paid for transcribing the communication.
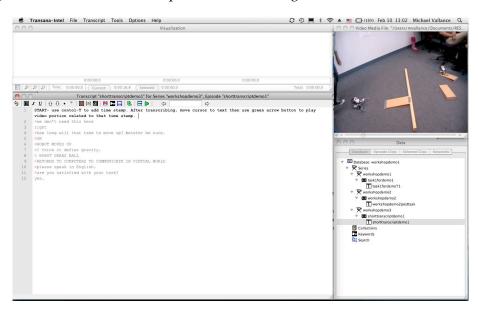
Figure 1. TRANSANA interface

The augmented data was then coded in TAMS Analyzer software (http://TAMSys.sourceforge.net/) using the Cognitive Processes and Knowledge Dimension taxonomic elements of Bloom's revised taxonomy. TAMS has a number of features which may be of interest to researchers conducting linguistic analysis, tracking communication for turn-taking, etc. However, our needs only required the researchers to tag communication for evidence of Bloom's cognitive processes and knowledge dimensions, and then export associated numbers of occurrences. To add transcribed text to TAMS we first saved data from TRANSANA as a RTF file and then imported to TAMS. Assigning keywords to portions of text was simply just highlighting the text and clicking the Bloom's descriptors. An output report of 'Co-coding' illustrated the number of times specific descriptors linked to others (see Figure 2). The Co-coding file was then opened in Excel and copied to a spread sheet in Google Documents.
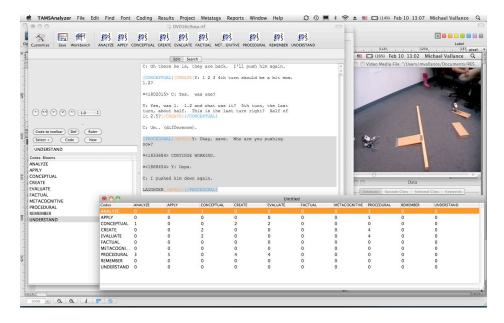
Figure 2. TAMS Analyzer interface

Two researchers coded and regularly compared results for inter-rater reliability. Contentious coded transcripts were re-imported to TRANSANA and online synchronous discussions held. The data was periodically updated to our Google spread sheet template.

As the analysis was a collaborative effort, Google Documents was utilised to share the updated data codes in real time. The data was subsequently viewed in a dynamic chart called a Motion Chart or Motion Graph (Rosling, 2009). This enabled us to look at the effect of one cognitive function on a particular knowledge domain, and attempt to draw conclusions from the 'processes' rather than just the 'outcomes' (see Figure 3).
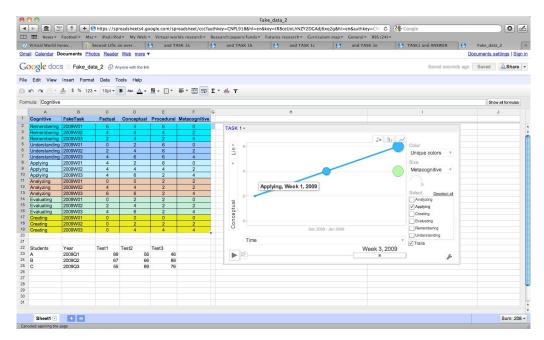
Figure 3. Data and Motion Chart in Google Documents
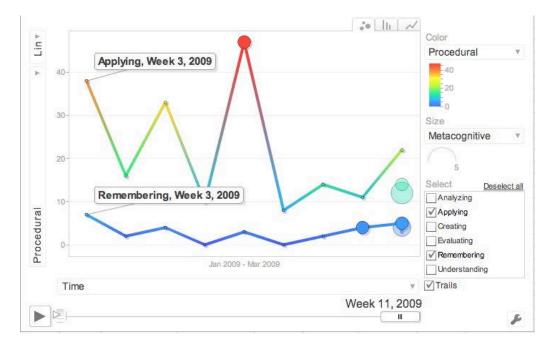
Figure 4. A Motion Chart revealing dynamic data

Initial indications from our data suggest that the nature and defined difficulty of learning tasks can, together with measures of communicative constraint and of the information provided about the task, be used to create metrics for designing and evaluating learning scenarios in immersive virtual environments that can be articulated within Bloom's revised taxonomy. We propose that the revealed dynamics between these taxonomic elements and the developed metrics will provide insights into the nature of effective pedagogy in these new learning and teaching environments (Vallance & Martin, 2011).

A Motion Chart can be created using the following steps and considerations:

Firstly, data needs to be formatted in a Google spread sheet in a particular way. Figure 5 shows how some data about sales of fruit across continents has to be formatted in order to create a Motion Chart.

	A	B	C	D	E
1					
2					
3	fruit exports	year	Europe	Asia	Americas
4	apples	2010Q1	70	40	60
5	bananas	2010Q1	60	40	20
6	oranges	2010Q1	50	50	50
7	apples	2010Q2	90	50	80
8	bananas	2010Q2	70	50	40
9	oranges	2010Q2	80	60	70
10	apples	2010Q3	90	60	90
11	bananas	2010Q3	80	60	50
12	oranges	2010Q3	50	70	60
13	apples	2010Q4	70	70	40
14	bananas	2010Q4	50	70	50
15	oranges	2010Q4	40	80	40
16					
17					
18	Column 1 includes the items under consideration. The items must be arranged to match the TIME layout in COLUMN B.	Notice the arrangement of the data. Column B is the TIME and has to be formatted by YEAR and WEEK (or here as QUARTERS). You can be creative to include TASK NUMBER in a 'TIME' format (e.g TASK 1 = 2009W1).	Columns C to E include the variables and associated data.		

Figure 5. Table of data formatted in a Google Doc (spread sheet) for Motion Chart.

Next highlight the data, including the headings (cells A3 to E15 in the example above). Right click (or control click) and select Insert Gadget from the pop-up list. Then select Motion Chart - Add to Spread sheet (see Figure 6). Finally, type a Title and then select 'Apply and Close'.
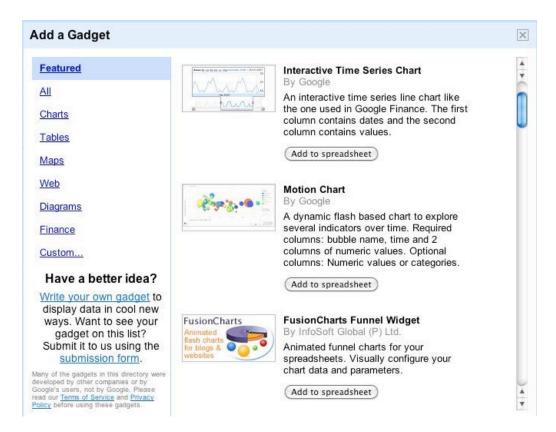
Figure 6. Select Motion Chart

A Motion Chart will be created (see Figure 7). By moving the slider on the X axes one can visualize exports over four quarters. Figure 7 illustrates exports of oranges and bananas to Europe compared to exports to Asia. This can be altered by selecting and comparing other continents and exports.
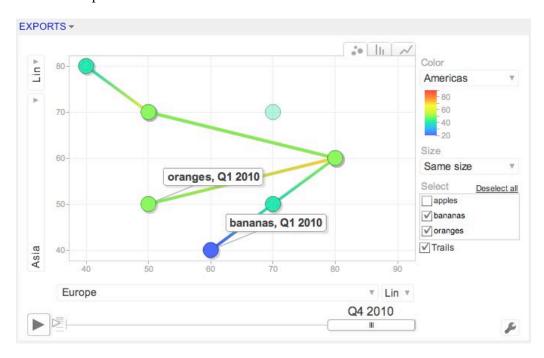
Figure 7. Motion Chart of exports in 2010

The above example is available for free access in Google Documents at URL http://tinyurl.com/6kdn7dm

Note: It is requested you copy the tabled data and create your own Google spread sheet; thereby leaving the example data for other users.

In the spirit of sharing data as researchers, please feel free to look at our virtual worlds data in our Google Document and associated Motion Chart at URL http://tinyurl.com/45pdzsb Comments and questions from researchers will be most appreciated. See Figure 8. Again, it is suggested you copy the tabled data and create your own Google spread sheet; thereby leaving the example data for other users.
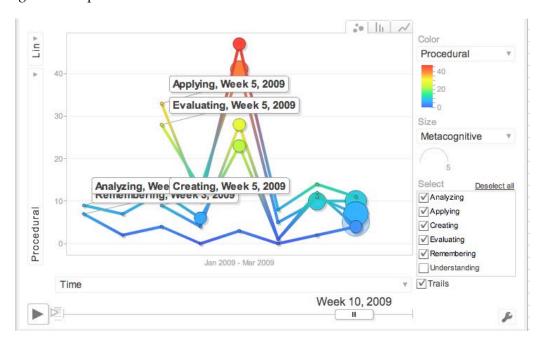
Figure 8. Motion Chart data from virtual worlds research

Motion Charts reveal data relationships which may be difficult to visualize in traditional charts and graphs. To view the data represented in a Motion Chart may have necessitated drawing several graphs in traditional modes (such as in Excel). Correlations between variables may become more apparent if presented in this visually appealing way. For example, researchers can use a Motion Chart to consider observations and hypothesis during the research process rather than as an end product.

Conclusion

Tufte (2006) remarks in his seminal work 'The visual display of quantitative information': "The use of abstract, non-representational pictures to show numbers is a surprisingly recent invention, perhaps because of the diversity of skills required – the visual-artistic, empirical-statistical, ad mathematical. It was not until 1750-1800 that statistical chartics – length and area to show quantity, time-series, scatter plots, and multivariate displays – were invented, long after such triumphs of mathematical ingenuity as logarithms., Cartesian coordinates, the calculus, and the basics of probability theory. Modern day chartics can do much more than simply substitute for small statistical tables. At their best, chartics are instruments for reasoning about quantitative information. Often the most effective way to describe, explore, and summarize a set of numbers – even a very large set – is to look at pictures of those numbers. Furthermore, of all methods for analyzing and communicating statistical information, well-designed data chartics are usually the simplest and at the same time the most powerful." A Motion Chart provides the 'visualisation' sought by designers such as Tufte. We posit that due to the increased volume and complexity of data, a Motion Chart may indeed help researchers make sense of and explain the complexities.

To summarise, in our research TRANSANA and TAMS Analyzer served as effective, inexpensive tools for conducting transnational analysis. The Motion Chart enabled researchers to 'explain' the data in accordance with task processes rather than task outcomes. As elucidated by Al-Aziz, J., Christou, N. & Dinov, I. D. (2010): "Active data visualization is a critical component of any data understanding, as it provides visual, informative and quantitative cues to the data behaviour and the intrinsic data characteristics. These features, in turn, drive our subsequent protocols for data modelling, quantitative analysis and rigorous interpretation. In addition, dynamic data visualization enables non-experts to navigate, explore and formulate hypotheses about the data, as well as identify data patterns, trends and challenges without high-level scientific and technical knowledge." In conclusion, we strongly recommend researchers explore the tools described in this paper.

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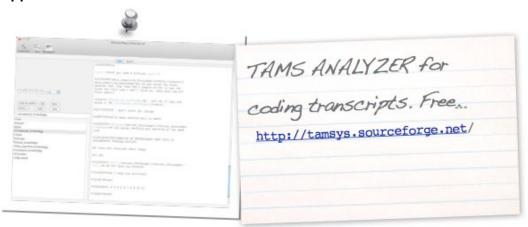
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Vallance, M. & Martin, S. (2011). A methodology for determining relationships between cognitive processes and the knowledge dimension when implementing tasks in virtual worlds. In *Proceedings of the First International Virtual Environments Research Group (iVERG) conference. Immersive technologies for learning: a multi-disciplinary approach.* Teesside University, UK. (pp. 76-86).

Appendix

TAMS ANALYZER for coding transcripts. Free...
http://tamsys.sourceforge.net/

TRANSANA for transcribing, linking text to video (and vice versa). US $165 per computer
http://www.transana.org/

GOOGLE DOCS for sharing updated data. Free.
http://www.google.com

Motion Chart examples may be viewed and tried online at:

- Gapminder at URL http://www.gapminder.org/
- SOCR Motion Charts at URL http://www.amstat.org/publications/jse/v18n3/dinov.pdf

Facilitating immersion, engagement and flow in Multi-user Virtual Environments

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Abstract. Virtual worlds are providing myriad opportunities for the development of innovative curricula for tertiary educators. They provide a virtual meeting space for those students and lecturers who are geographically remote from one another, rendering distance irrelevant and facilitating the formation of community. This paper will look at those factors – physical, social, virtual and those related to pedagogy – which facilitate immersion in virtual worlds; that suspension of disbelief which generates the feeling of presence or "being there", crucial to promoting student engagement and ultimately, flow.

Keywords: MUVE, virtual worlds, immersion, presence

Introduction

Many institutions are becoming more flexible in how they deliver their courses and programs, as their student cohort grows ever more diverse, (see Ritzema, 2008, p. 110). Many students are electing not to travel to their place of study but rather participate in learning at times convenient to them, in the comfort of their own homes or workplaces. Though this mode of education has the considerable benefits of convenience and accessibility, many challenges remain for students. These include altered motivation, lack of feedback and teacher contact, student support and services, alienation and isolation, a deficiency of experience and training (Galusha, 2001). In order to overcome these challenges, educators need to exploit the affordances of new technologies (Garrison, 2000). At first glance, the use of virtual worlds (VW) – otherwise known as Multi-user Virtual Environments (MUVE) – would seem to have the potential to address many of these issues, yet spaces such as Second Life are populated with builds that are deserted; unappealing to both educators and students alike.

The Reasons for Using Virtual Worlds

For educators, the appeal of virtual worlds is enormous. The diversity of educational contexts afforded by these environments provides an assortment of experiences that are able to accommodate a variety of learning styles. Neil Fleming identified four types of learning: (a) visual; (b) auditory; (c) reading/writing; and (d) kinaesthetic, tactile, or exploratory, resulting in the acronym VARK (Fleming & Baume, 2006, p. 6). Beyond recognizing that these learning styles exist, learners born after the mid-1970s expect that learning will be

responsive to their preferred styles (Bonk & Zhang, 2006, p. 250). Kinaesthetic learners are difficult to cater for and authentic movement in 3-D worlds may help to meet this need. Kinaesthetic learning activities compel students to move, sometimes requiring significant exertion (Begel, Garcia, & Wolfman, 2004, pp. 183-184). This exploits what Jean Piaget called "sensori-motor learning," in which physical activity transforms into representative mental symbols (Piaget, 1999, pp. 37-38). Given the diversity of students attending university, it seems prudent to seek out an environment where all learning styles can be accommodated.

Ideally, design for learning in a virtual world would imbed more authentic learning through collaboration, teamwork, problem-based and adaptive learning, in alignment with those trends identified by Bonk, Kim, and Zeng (2006, pp. 550-568) and Bonk & Zhang (2006, p. 251). This in part could be achieved in MUVEs through content creation in accordance with the learner's own ideas, learning goals and interests. This approach necessitates the acquisition of certain requisite skills which could be incorporated into educational designs favouring collaboration, peer-to-peer teaching and the creation of new types of "learning communities" for both students and educators, underpinned by mediated immersion (Ondrejka, 2008, pp. 229-230; Clarke & Bede, 2005, p. 1; Tashner et al., 2005, p. 2117).

For tertiary educators, being able to incorporate these attributes into Second Life, Open Sim or Active Worlds, would allow them to provide their students with authentic learning experiences that resembled real life tasks and scenarios. A prospective surgeon will learn best by performing surgery on a patient that cannot die, and a student of history will more fully understand historical events if they could take on a role and wander around a battleground. What better way to train an architect than to let him or her design and construct a building; walk around in it when completed and then go back and correct any deficiencies or experiment with alternatives? For some disciplines, the educational affordances of a virtual environment such as Second Life are obvious (Salmon, 2009, p. 529). Virtual worlds are extremely useful when training students to perform tasks that are too expensive or too hazardous to perform in real life (Adams, Klowden, & Hannaford, 2001). Well-designed simulations implemented in these environments can provide risk-free and cost-effective simulations of authentic contexts that can facilitate optimal learning. An obvious example would include learning to fly. Flight simulator training, in conjunction with training with an aircraft, has been found to be more effective than training with an aircraft alone (Hays, Jacobs, Prince, & Salas, 1992). Another example is learning to perform surgery. In surgical education, it has been reported that the student learns from immediately seeing the consequences of his or her own actions (Gorman, Meier, & Krummel, 1999). Such a scenario can be recreated in a virtual world. These scenarios can result in significant cost savings. The cost of training chief residents in the operating room was estimated to be approximately $USD 53 million dollars in the US over ten years ago (Bridges & Diamond, 1999). Thus the fiscal incentive for developing virtual training is substantial.

Immersion

Immersion is the necessary condition to promote student engagement with a program, course or activity in a virtual world environment. It has been defined as the "the subjective impression that one is participating in a comprehensive, realistic experience" (Witmer &

Singer, 1998), and is seen as essential for "presence", the psychological sense of actually being in the virtual environment (Franceschi, Lee & Hinds, 2008, p. 5). Engagement refers to the focus of a user's attention on the task at hand, and given sufficient involvement and mental clarity can lead to the optimal learning state of "flow". This term was first coined by Mihaly Csikszentmihalyi (1990) and refers to a mental state that athletes equate with "being in the zone" (Aldrich, 2009, p. 5).

Chris Dede (2009) further breaks immersion into three subcategories, namely: actional, symbolic and sensory immersion. Dede describes actional immersion as empowering the participant to instigate actions not possible in the real world that have novel, intriguing consequences. In turn, symbolic immersion involves triggering powerful semantic associations via the content of a virtual environment. Finally sensory immersion involves manipulating the human senses in order to create the feeling that one is located in a different physical space to the space where the body is actually physically located. This requires the participant to feel that he or she is actually in the environment as opposed to looking through a window into the virtual world (Dede, 1995, p. 50).

When the human brain perceives something – regardless of whether it actually exists in the world or in a virtual world – it is inclined to act as if that thing were real. Edward Castronova posits that this is because for the vast majority of human history, virtual objects did not exist and hence there was no evolutionary necessity to develop the ability to distinguish between the real and the virtual. In fact, it takes significant additional effort for the brain to keep reminding itself that something is not real (Castronova, 2001, pp. 27-28). Even though the learner's current experience is generated by and/or filtered through human-made technology, part or all of that learner's perception fails to accurately acknowledge the role of technology in the experience. At "some level" and to "some degree", the learner's perceptions overlook that knowledge and objects and events within the virtual world are perceived as if the technology was not involved in the experience (Schuemie, et al., 2001, p. 185). This is an important realization; if simulations in virtual worlds are sufficiently immersive and realistic, then the motivation for distinguishing virtual from real is sufficiently low that for all intents and purposes, learners *are* actually engaged in practising authentic skills with corresponding application in the "real" world. As a result of this immersion, engagement is enhanced, flow is supported, and collaboration becomes both possible and supported (McKerlich & Anderson, 2007, p. 37).

Every component and participant of a learning interaction can influence a learner's immersion and emergent feeling of presence in a virtual world. Relevant factors include the visual representations of avatars (Nowak & Biocca, 2004); isolation from the physical environment; using one's natural mode of movement and control (Stanney & Salvendy, 1998, p. 156); the ability to interact with the environment and with other autonomous actors (Slater et al., 1994, p. 131); decreased lag time between user action and environment reaction (Zhu, Xiang, & Hu, 2007, p. 265); the participant's experience using a virtual environment (Vinayagamoorthy, Brogni, Gillies, Slater, & Steed, 2004, p. 149); the motivation of the learner (Robertson, de Quincey, Stapleford, & Wiggins, 1998, p. 2); behavioural realism (Blascovich, et al., 2002, pp. 111-112); the level of skill of the users and the technical difficulties encountered (Aldrich, 2009, p. 89; Jones, 2005, p. 421); among many others which are well-represented in the extensive literature pertaining to both immersion and presence.

The interaction between those factors that influence immersion and presence are both subtle and complex. Even so, there are four main groups of factors that are important when considering immersion in virtual world environments. These are those factors relating to the physical environment, the social environment of the participant in the virtual world, the virtual world environment itself; and those relating to pedagogy and learning activities. These will be considered in more detail.

How the physical environment can influence immersion

For many students studying at a distance, the immediate physical environment is most likely to be a room – an office or bedroom perhaps – or place of work. Presence in a VW requires a simultaneously low level of presence in the real world and *vice versa* (Slater, et al., 1994). Many of the distractions in the learner's physical environment will undermine presence and engagement in the virtual world. Typically, such distractions would include children seeking the attention of their parents, a noisy neighbour or sitting on an uncomfortable chair. This is substantiated by the work of Billinghurst and Weghorst (1995) who looked at users' level of presence when using virtual reality (VR) equipment. They found display comfort and quality to be predictive of reported presence (Sadowski & Stanney, 2002, p. 797). This is explicitly elaborated by Biocca who states that "at one point in time, users can be said to feel as if they are physically present in one of only three places: the physical environment, the virtual environment, or the imaginal environment. Presence oscillates between these three poles" (Biocca, 1997, p. 21).

In addition to more general factors in the learner's environment, there is the hardware user-interface, acting as an extension of the physical environment. For users of virtual worlds, these interfaces can be said to bridge the physical and the virtual. In their current form, navigation around virtual spaces using a keyboard and mouse moving in two dimensions means that users encounter a range of physical challenges. These include:

- the functional isolation of participants (Xin, Watts, & Sharlin, 2007),
- the restriction of intuition and freedom of movement (Fassbender & Richards, 2008),
- challenges for children, elderly people or those with disabilities who may lack the ability to precisely coordinate keyboard strokes and mouse actions (Cardoso, Melo, Gomes, Kehoe, & Morgado, 2007; Kim, Roh, & Kim, 2008), and
- the limitation of the way educators can capitalise on the common knowledge that people possess from their everyday physical interactions in the real world (Xin et al., 2007).

These factors may create sufficient distraction in the physical environment to detract from the feeling of presence in the VW. Enabling more natural movement would overcome these kinds of issues and extend both the inclusiveness and capability of these environments for education and training.

Immersion and Social Presence

Presence can be considered to be resident in that place which holds the attention of a student. In the previous section, it was discussed how activities happening in the real world environment can hold a user's attention and hence presence, outside of the virtual

environment. Presence in the virtual world can be similarly enhanced by creating engagement in that context. "Social presence" is the notion that if other people – via their avatars – can inhabit a virtual environment then the virtual environment is more likely to exist. Correspondingly, if other people in that environment acknowledge one's presence, it offers further affirmation that one actually "exists" in that environment. Social presence may result from communicating with others verbally (using VoIP), via text chat, scripted gestures, or by otherwise interacting with those in the environment (Sadowski & Stanney, 2002, p. 795). Even so, collaborative efforts that require some face-to-face encounters – as with intensive residencies for distance students – facilitate engagement more readily than efforts that do not, since there is an actual association with the physical person and not just his or her avatar. Visually identifying the other parties enables a sense of belonging and feelings of trust to evolve more quickly. In addition, visually identifying peers helps in the group management of roles and responsibilities. Future interactions among team members will build upon these face-to-face encounters. The relationships are considered more personal by the learners since they have already met each other. This face-to-face acquaintance engenders a sense of group presence even when the parties are not occupying the same physical place. As Franceschi and colleagues explain, the learners "have the psychological sensation that their collaborative efforts bring them to the same place" (Franceschi, et al., 2008, p. 7). Social presence is further heightened by the use of voice communications in the VW. Voice chat adds a personal element to the communications, seeming to psychologically shorten the physical distance between the learners. It will increase the learners' impression of sharing a space with their peers, resulting in enhanced engagement with collaborative activities (Franceschi, et al., 2008, p. 8).

Those learner experiences most likely to engender immersion leading to social presence are those that require synchronous participation of learners and teachers in the same virtual space. Given the substantial demands on the time of both learners and teachers, and given that not all participants will share a single time zone, this can be difficult to arrange. The temptation in such situations is to design asynchronous activities that can be accessed at any time, yet given the dangers of social isolation, some effort should be made towards scheduling some synchronous activities. In addition, learners that have met in the physical world will establish social presence sooner than those who have not and so if possible, physical introductions should be made. Educators should be aware of the potential issues arising when some learners have met while others have not. This situation may lead to the formation of a clique which may be difficult for a remote learner to penetrate. Last, the use of voice chat can further heighten social presence. Though it is tempting to abandon voice when it is not working reliably, in favour of text chat, it is worth persevering. One way to minimise voice problems is by running "voice tutorials" whereby learners test their internet connection, hardware and mastery of the software before they engage in the learning activities.

How the Virtual Environment can Engender Immersion

Though there are multiple factors that impede or facilitate immersion, one of the key factors is the ability to engage multiple senses. Chris Dede (2009) has described this as "sensory immersion" (p. 66). It has been shown that the more sensory information provided by the virtual environment, the higher the sense of presence (Franceschi, et al., 2008, p. 6) and that

as more sensory modalities are stimulated presence is similarly increased (Steuer, 1992). It can therefore be expected, that MulSeMedia (Multiple Sensorial Media), engaging a range of senses, should enhance presence. Evidence can be extracted from the extensive literature pertaining to gaming and presence, and the work surrounding user interfaces enabling haptic feedback, tactile precision and engaging other sensory modalities. The interaction of the various sensory systems generates cross-modal effects, such that large amounts of information perceived by one sense may be selectively disregarded when competing with data from more dominant sensory inputs (Chalmers & Zányi, 2009, p. 9). Put simply, when confronted with multimodal stimuli, humans are unable to attend to all of them at one. Those stimuli considered to be "not pressing" are at least temporarily disregarded (Chalmers, Debattista, Mastroropoulou, & dos Santos, 2007, p. 2). It is therefore desirable that all of the sensory systems be *selectively* stimulated such that there would be no noticeable deficit in the overall amount of stimulation that is received via the various sensory systems. No matter what the source or nature of the sensory stimulus, immersion is best achieved if there is no indication that the stimulus is produced by an artificial device or via a display (Slater, et al., 1994, p. 131).

It is also important to recognize that factors other than those derived from the range of human senses are important in achieving immersion and in fact, it has been widely acknowledged that they are not reliant on total photo- and audio-realism within the virtual environment (McMahan, 2003, p. 68). With any given virtual scene, to accurately recreate realism in any one of the sensory systems requires computational power, techniques and knowledge not yet available. Instead, researchers and designers need to develop a thorough understanding of the factors that facilitate immersion and more subtly probe that mysterious connection between immersion and presence. To avoid redundancy – while recognizing that some remains desirable - limitations on human perception need to be exploited. For example, for anyone in the operating in the real world, cross modal effects can render large amounts of sensory data useless; ignored in the presence of data from other stronger senses (Chalmers, Debattista, & Ramic-Brkic 2009, p. 1102). This redundancy can be exploited so that only sensory information that will be actually noticed would be supplied, with a corresponding decreased demand for computational power. The challenge remains in knowing exactly what data can be eliminated and which is crucial to maintaining immersion and the feeling of "being there", i.e. presence.

Pedagogy for Immersion

Little research exists about the use of virtual worlds to support distance learning, but abundant research from similar technologies would suggest that virtual worlds may support constructivist learning activities (Dickey, 2003, p. 106). Enhanced input devices would further augment the experience within the VW such that simulation could become a metaphor for authentic experience (Gorman, et al., 1999, p. 1206). Realistic simulations using authentic 3-D movement within virtual environments employ a constructivist approach to learning. Learners actively construct knowledge from experiences which have relevance, significance and meaning to them. They test ideas and concepts, derived from prior experiences and knowledge, before applying them to new situations. In this way new hypotheses are formulated and the learner generates knowledge, (Rousseau, 2004, p. 4). The more links that can be found between new information and old information, the better it is stored (Lang, 2006, p. S60).

Simulation may be one of the two most powerful tools available to those who design online instruction; gaming would be the other. Both approaches engage and challenge the learner in a very direct and personal way. In order to succeed in these situations, the learner must work at a higher cognitive level than the recognition and recall associated with traditional didactic methods. Instead, the learner must immerse in the situation and apply novel knowledge as well as old skills to meet the challenges set before them. Though not all games and simulations are instructional, instruction that exploits the techniques of gaming and simulation has a good chance of capturing the learner's attention for extended periods of time (Rude-Parkins, Miller, Ferguson, & Bauer, 2005), facilitating the emergence of presence, and subsequently flow. In addition, by making the experience directly relevant, learners gain an emotional stake in the content, inducing their brains to release those chemicals in the amygdala and hippocampus that are necessary for memory formation (Aldrich, 2009, p. 6).

Central to the idea of gaming and simulation is the concept of "interactivity". Steuer (1992) defines interactivity as "the extent to which users can participate in modifying the form and content of a mediated environment in real time" (p. 84). Instruction that requires nothing of learners except their passive absorption of knowledge is the very antithesis of this idea. The act of directly manipulating a virtual object should produce clearer mental images than if this information were acquired passively, irrespective of the user's goal. Barker deems interactivity in learning as "a necessary and fundamental mechanism for knowledge acquisition and the development of both cognitive and physical skills" (Barker, 1994, p. 1). For example, allowing students of anatomy to change the perspective shown by rotating the virtual object helps them to develop visuo-spatial representations (Luursema et al., 2006, p. 1126). This ability to conceptualise 3-D shapes is enhanced by the use of haptic technology, making it easier to learn about objects that ordinarily could not be touched in real-life settings (Dettori, et al., 2003, p. 1). Switching to any interactive mode of instruction, such as group projects or participatory demonstrations, easily improves learning outcomes. The evidence suggests that games are the most interactive type of content that exists today (Mayo, 2009, pp. 79-80), and ecological theories especially place a large emphasis on the role of interaction in creating immersion and presence (Schuemie, et al., 2001, pp. 196-197).

Educators considering using virtual worlds in their teaching will possibly need to rethink their teaching strategies. The environment supports constructivist pedagogies whereby learners are responsible for their own learning, linking old knowledge and skills to those newly acquired. Simulation and gaming are very effective strategies, provided they offer a high degree of interactivity. Such a design facilitates user immersion and hence presence; creating the conditions necessary to engender the optimal learning state of flow.

Conclusion

Virtual worlds such as Second Life are becoming increasingly popular in university programs because they provide a cost-effective solution to many of the challenges faced by tertiary students – particularly those studying at a distance. Virtual worlds can accommodate a range of learning styles, afford learning by doing and provide a safe environment for learning dangerous or high-risk tasks. In order for learners to garner these

benefits, they must become immersed in the environment, resulting in the suspension of disbelief that signals presence. Further, presence and engagement can lead to what Csikszentmihalyi (1990) described as "flow", an optimal learning state that enables the learner to maximise the acquisition of skills and knowledge. Though any number of factors can influence the degree of immersion, this paper examines four important areas: 1) the physical environment in which the learner is located, 2) characteristics of the virtual world environment, 3) social factors and 4) the pedagogical approach. In order to fully realize the enormous potential of these environments, these factors will need to be considered in any design for learning in these contexts. Each factor cannot be considered in isolation, but must be balanced and considered in light of the many other factors affecting immersion and presence. The extent to which these factors interplay to facilitate or undermine immersion should be the focus of future research efforts.

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Immersive, interactive, unconventional virtual environments enhance creativity

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Abstract. Digital era allows for a new domain of architectural experience. Within virtual environment designs can be created that go beyond the mere accommodation of literal functions, and that affect and contribute to the human experience by dynamically interacting with and affecting the inhabitants' life. Cognitively, creativity refers to the phenomenon whereby a person creates something new (a product, a solution, a work of art etc.). A key point in "Creativity", considering different disciplines is the role of previous gained experiences, which cause the emerging of intuition. Accentuating the role of new experiences that results in enhancing the intuition, should be gained by designing in an imaginary worlds, stands to be an interesting move. Detached from the real one in sense of time and matter, enables the designer to cross the borderline of reality. The main thesis is that, this new kind of architecture can create emotionally rich architectural experiences through the dynamic and precise manipulation of abstract visual and sonic form in space-time. Eventually with new languages and forms we can stimulate our creativity and push the technology to make it real. It is to be mentioned that this is an on going research in Hyperbody and the authors hypothesis in cognitive point of view is extensiveness of experience gained by surfing in unconventional virtual environments can positively be related to both creative performance (enhance interactivity, lateral thinking, idea generation, etc.) and creativity-supporting cognitive processes (retrieval of unconventional knowledge, recruitment of ideas from unconfined virtual environment for creative idea expansion). As a practical suggestion authors propose starting the design from point cloud in virtual environment that can be manipulated by the designer who immerses there.

Keywords: Virtual Environment, Experience, Enhancing creativity, Point cloud

Introduction

> We make worlds – our global world, our personal worlds, our imaginary worlds.
>
> *- Marcos Novak*

Many of the architects confess that, very gradually and unconsciously they stock in some conventional design approaches, because slowly confinements in construction and conventional stereotypes impose on them, dominate them and prevent them to think innovatively. Now, it is seemingly logical if you got a chance to see and explore some innovative notions in virtual environments, totally free of any limitation, causes a conceptual expansion, since irrelevant pictures are added to old design approaches. This will reverse the process. The confinement, mediocrity, stereotypes diminish gradually;

helping designers to expand their conceptual boundaries and thus eventually help them to enhance their creativity.

Creativity on the other hand is a vague term, and its definition is totally pertaining to the context of study and the discipline. As far back as 1959, Taylor surveyed about 100 definitions in his attempt to clarify the creative process (Taylor 1959). The definitions vary significantly by the content and complexity. Nevertheless, there are two commonly 'universal' attributes of creativity: novelty and appropriateness. For the purpose of this paper, we will consider creativity as a cognitive process that generates new concepts, which are novel and unconventional. This study accentuates the experience, identifying its way of operation and pointing out its existence and relevance. Experiences indirectly affect creativity. The more inventory of experiences, the more and better combination of ideas are possible.

Being in varied or diverse environments can train individuals to encode information in multiple ways, building a myriad of associations between concepts. For example, bilinguals, who have been exposed to two languages are more creative than monolinguals (Nemeth & Kwan, 1987; Simonton, 1999). Creativity is found at relatively high rates for individuals who are first or second generation immigrants and for individuals who are ethnically diverse or ethnically marginalized (Lambert, Tucker & d'Anglejan, 1973; Simonton, 1997, 1999). At the group level, creativity is facilitated within collaborative groups that contain diverse members (Guimera et al., 2005; Levine & Moreland, 2004) and in groups in which heterogeneous opinions are expressed (Nemeth & Wachtler, 1983; Simonton, 2003). Even at the societal level, creativity increases after civilizations open themselves to outside influences and when geographic areas are politically fragmented and relatively diverse (Simonton, 1997).

Considering the brief introduction on creativity and role of experience and diversity, the authors propose designers surf in virtual environment to gain novel experiences and broaden their perception of environment to enhance their creativity. In this article, we define the Virtual Environment as a real-time interactive and fully immersive virtual 3-D environment in contrast to the definition of Virtual Reality which is somehow an imitation of the physical world (consider flight simulation), also emphasizing the unconventional virtual environments within which an emergent spatial pattern can dynamically evolve in time with respect to user interactions, a variety of spatially intriguing concepts such as: Multiple dimensions, Dematerialization, Infinite depth, Continuous change, Multiple scales etc. can be experimented with (Figures 1 and 2).
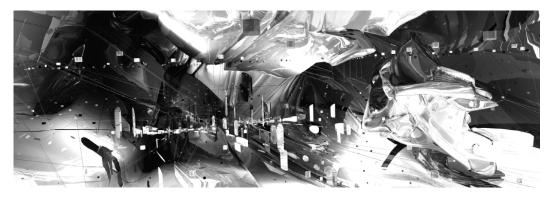
Figure 1. Courtesy of Marcos Novak-V4D_Visio4D

Figure 2. Courtesy of Marcos Novak-V4D_Visio4D

Another important role of implementing virtual environments in design is trying to define a new criterion for evaluating architecture. It has been widely believed that what are now important in the architecture discipline are unified concepts and objects with clear function and performance. Reality, ironically, compels partiality, discontinuity of space, discontinuity of experience and conciseness. Finally, constructability, speed of procedures, etc. in designing in the physical world comprise evaluating parameters for architecture. Designing in virtual environments uses the same tools of expression as architecture, however it is free from the consequence of the built, technology, material etc. As such it can suggest an opposing value system: interaction, immersion, fragmentary, adventure, joy, innate stimulus, infinity, continuous change, etc. Thus virtual environment are positioned in opposition to realistic architecture as polemical, critical and experimental.

Designing in virtual environments is an ongoing practice that is built into the language of architecture. The utilitarian disciplines of architecture requires a system to value them especially in a paradoxical way, negative or dichotomy to its main development course, though it can refurnish itself. Also the new evaluation criterion can be a stimulus to push designers to think out of box. Defining this criterion deeply related to cognitive aspects and perception of environment is out of scope of this paper.

The ongoing research on the relationship between experiencing virtual environments and creativity is expected to answer the following questions:

(a) What types of virtual environments are needed for enhancing creative performance?
(b) How does surfing in virtual environment benefit creativity?
(c) How does the brain perceive such immersive environments? (Does it use a reductionist point of view or is it an emergent phenomenon?)
(d) In terms of topology, can this mathematical term be applicable in visual perception of environment? (Can the brain define certain characteristics of space even when the space deforms?)

As an overview of the major speculations in this paper, we can are seeking to prove that:

(a) Surfing/Exploring Virtual environment enhances creative performance and creativity-supporting cognitive processes (e.g., recruitment of different ideas and retrieval of unconventional knowledge);
(b) The connection between experiencing virtual environments and creativity is most apparent when individuals have had the experience of deeply 'immersing' themselves in virtual environment and 'interacting' with the environment;
(c) Adapting and opening themselves to new experiences and actively interact and compare the differences they encounter between unconventional environments and the physical world can boost the benefits of this experiencing;
(d) A weaker relationship between experiencing virtual environments and creativity emerges in contexts where one confines oneself to limitations of the physical world, such as construction limitations, material limitations etc.

What Is Creativity?

Creativity is typically defined as the process of bringing into being something that is both novel and useful (Sawyer, 2006; Sternberg & O'Hara, 1999; see also Amabile, 1996). The creative process is often a mysterious phenomenon, with sudden insights seeming to work at an unconscious and inaccessible level (Schooler & Melcher, 1994). The magical "aha" moment of discovery, the point at which an idea leaps into consciousness, is part of what makes creativity seem sudden, without logic, and elusive (Leung et al., 2008).

Because of its apparent unpredictability and elusiveness, creativity may seem difficult to study scientifically and systematically. However, psychology based literature now can provide a wealth of evidence depicting the psychological factors that facilitate creativity; elements of personality, affect, cognition, and motivation can either facilitate or impair creativity (see Amabile, 1996; Csikszentmihalyi, 1996; Sawyer, 2006). For example, personality studies have demonstrated that creative people tend to be nonconforming, independent, intrinsically motivated, open to new experiences and risk-seeking (for reviews, see Simonton, 2000, 2003). Large-scale studies and meta-analyses have found that intelligence, tolerance of ambiguity, self-confidence, and cognitive flexibility also tend to be found in creative people (Feist, 1998; MacKinnon, 1978). Now it seems logical that if we approach from the other side of the spectrum and push designers to encounter new experiences we can enhance their thresholds of ambiguity, self-confidence, cognitive flexibility, etc. It has been proved that a number of contextual factors related to motivation,

cognition and affect, facilitate creativity. Individuals who pursue tasks for intrinsic rather than extrinsic purposes show enhanced creativity (Amabile, 1985, 1996; Amabile, Hennessey & Grossman, 1986; Eisenberger & Cameron, 1996; Hennessey & Amabile, 1998). Especially in design we consider it largely intrinsic rather than extrinsic. A distant future focus, compared to a near future focus, has been shown to lead to more creative negotiation outcomes (Okhuysen, Galinsky & Uptigrove, 2003) and to enhanced creative insight (Förster, Friedman, & Liberman, 2004). Focusing on potential gains rather than losses increases the accessibility of unconventional ideas and thus enhances fluency in generating creative ideas (Friedman & Förster, 2001; Lam & Chiu, 2002). Finally, creativity seems to flourish when people are in positive or neutral affective states rather than negative affective states (Amabile et al., 2005; Fredrickson, 2001; Fong, 2006).

Types of creativity

There are two main types of creativity (Boden, 1990): 1) improbabilist, that assumes that nothing has to be created de novo but existing elements are brought into a distinctive relation to each other by establishing new connections among them, which is the current definition of creativity in architecture, indeed this is not a defined accepted definition of creativity, however informally this is the way creative architects follow, and 2) impossibilist, a deeper type that is based on transformation of conceptual spaces. The difference between these types is determined by the mode of creative thinking. Improbabilist creativity stipulates thinking in the associative mode, adherence to rules, logic, and boundaries of the current conceptual (mental) space that is a conceptual packet or network built up for purposes of local understanding and action (Fauconnier, 1985). If we extrapolate this definition to architecture, obeying conventional rules and the role of confinements in architecture in terms of material, technology, even perception of new spaces become clear. Impossibilist creativity is subject to the bisociative mode, in which the conceptual space is transformed, yet frequently regardless of the existing rules and disciplinary boundaries (Koestler, 1967). As Boden puts it in *Creativity and unpredictability* a theory of creativity is to be a theory about the exploration, mapping, and transformation of conceptual spaces (Boden, 1995). It is presumed that a product of impossibilist creativity cannot be generated without transformation of the corresponding conceptual space. The first step here for creativity in design is enhancing the perception of space. Since we are used to the environment around us in terms of scale, depth, dimension, etc., changing the characteristics of the conventional environment around us would be the right choice for transformation of the corresponding conceptual space.

The Creative Cognition Approach

Recently a scientific approach to studying creativity—the creative cognition approach—was proposed for understanding and specifying the cognitive processes that produce creative ideas (Amabile, 1996; Bink & Marsh, 2000; Finke, Ward, & Smith, 1992; Runco & Chand, 1995; Wan & Chiu, 2002). The central argument of this approach is that creative processes are not much different from those cognitive processes that produce our everyday mundane activities.

Every person has the potential to become creative as long as he or she effectively utilizes ordinary cognitive processes to produce extraordinary creative outcomes (Finke et al., 1992; Ward, Smith & Vaid, 1997; Weisberg, 1993). Specifically, the creative cognition approach identifies two kinds of cognitive processes implicated in creative thinking—generative processes and exploratory processes (Finke et al., 1992). First, people actively retrieve or seek out relevant information to generate candidate ideas with differing creative potential (the generative processes). Next, they survey these candidate ideas to determine which ones should receive further processing, such as modification, elaboration, and transformation (the explorative processes), (Leung et al., 2008). One strategy that makes effective use of generative processes is conceptual expansion, which takes place when attributes of seemingly irrelevant concepts are added to an existing concept to extend its conceptual boundary (Hampton, 1987; Wan & Chiu, 2002; Ward et al., 2002; Ward et al., 1997).

Experiencing unconventional virtual environments and the role of creativity

As mentioned before, defining the term creativity is a hard task. Every designer has the bias that he/she is creative. Now there is not an objective measurement or measurement tool to evaluate creativity. On the other hand, it seems obvious that the learned routines and conventional knowledge of a discipline may limit his or her creative conceptual expansion. Prior knowledge and highly accessible exemplars are a major constraint on imagination and creative conceptual expansion (Ward, 1994). For instance, when people generate exemplars in a novel conceptual domain (e.g., animals on the planet Mars), even the most creative examples resemble highly accessible exemplars (e.g., animals on Earth with eyes and legs or known science fiction exemplars (see Kray, Galinsky, & Wong, 2006; Rubin & Kontis, 1983; Ward, 1994; Ward et al., 2002). It happens exactly on design process as well. Thinking out of box would become an impossible task. To overcome the constrains, experiencing virtual environments is a solution. When individuals encounter an unconventional virtual environment, they may experience a shock, anxious feeling and disorientation in the absence of spatial perception, scale, depth, material etc., which are generally all conventional norms. People typically take these familiar things for granted and can thus suddenly become lost and inaccessible when immersed in a virtual environment (Figures 3 and 4).

Figure 3. Courtesy of Marco De Gregorio – Unconventional virtual environment

Figure 4. Courtesy of Marco De Gregorio – Unconventional virtual environment

Although this shock has its dark side, once the initial difficult adaptation stages have passed it can also provide a great opportunity for acquiring new perspectives to approaching various tasks and learning new ways of thinking. Whereas old, conventional design approaches may constrain creativity, the experience of virtual environments may foster the creative expansion of ideas. Thus, we hypothesize that virtual environment experiences can contribute to creative expansion in at least four ways:

First, architects learn new ideas and concepts from surfing and designing in these environments. Through these experiences, people are also exposed to a range of behavioural and cognitive scripts for situations and problems. These new ideas, concepts and scripts can be the inputs for the creative expansion processes because the more new ideas people have, the more likely they are to come up with novel combinations (Weisberg, 1999).

Second, although architecture pedagogy's established conceptions and conventions provide the architect with structured and routine responses to the design, these cognitive structures may be destabilized as people acquire alternative conceptions through their experiences in other environment, in terms of new perception and cognition and interaction with it, particularly as people adapt their own thoughts and behaviours to the new environment. Immersing in multiple virtual environments may even lead individuals to access unconventional knowledge when back in the physical world (Figures 5 and 6).
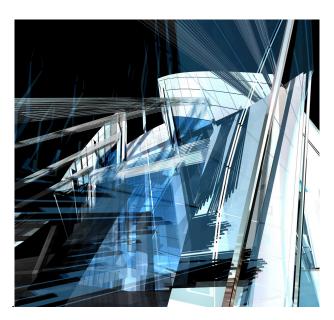
Figure 5. Screenshot (authors) – new cognitive perception of virtual environments
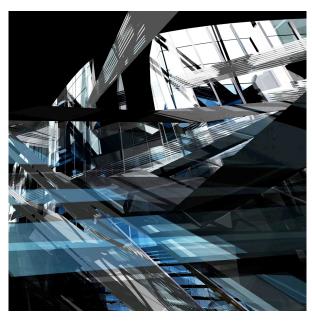
Figure 6. Screenshot (authors) – new cognitive perception of virtual environments

Third, having acquired and successfully applied incongruent ideas from these new experiences, designers may show an increase in psychological readiness to recruit and seek out ideas from diverse sources and use them as inputs in the creative process, allowing for continued exposure to a wide range of new ideas, norms, and practices.

Fourth, it is obvious that implementing formal shape, characteristics, etc. directly in the physical world is not the purpose, however incongruent concepts provoke exploration into their interrelations and the process of implementing incongruent ideas may lead to greater cognitive complexity; this challenge may finally help them to think out of box. Higher creativity is most likely when concepts involved in conceptual expansion that are not normally seen as overlapping with each other are being associated with two distinct worlds

(Hampton, 1987; Wan & Chiu, 2002). In short, the experience of virtual environments may foster creativity by:

(a) providing direct access to novel ideas and concepts in (unconventional) virtual environments,
(b) creating the ability to see multiple underlying functions behind the same form,
(c) destabilizing conventional knowledge structures (design approach), thereby increasing the accessibility of normally inaccessible knowledge,
(d) creating a psychological readiness to recruit ideas from unfamiliar sources and places,
(e) supporting synthesis of seemingly incompatible ideas from another environment.

Implementation in pedagogy

Design thinking harnesses tacit knowledge rather than the explicit knowledge of logically expressed thoughts. Designers operate at a level of complexity in the synthesis of constraints where it is more effective to learn by doing, allowing the subconscious mind to inform intuitions that guide actions. Perhaps the mind is like an iceberg, with just a small proportion of the overall amount protruding above the water into consciousness. If we operate above the water line we only have a small volume to use but if we allow ourselves to use the whole submerged mass we have a lot more to work with. If a problem has a large number of constraints the conscious mind starts to get confused but the subconscious mind has a much larger capacity. Designers have the ability and the training to harness the tacit knowledge of the unconscious mind rather than being limited to working with explicit knowledge. This makes them good at synthesizing complex problems with large numbers of constraints; it also makes them bad at explaining or defining what they are doing or thinking. They will describe process and results because they are not consciously aware of their own rationale *(*see Moggridge, *Designing interactions).*

In his book *To Understand Is to Invent* Piaget said the basic principle of active methods can be expressed as follows: "to understand is to discover, or reconstruct by rediscovery, and such conditions must be complied with if in the future individuals are to be formed who are capable of production and creativity and not simply repetition. Humans generate knowledge and meaning from an interaction between their experiences and their ideas". Accentuating the role experience in education, the virtual environment exploring totally fits into this educational program.

In interactive workshops participants first build their environments with specific software's like Max/Msp/Jitter/Cosm, Virtools, Blender, etc., and then manipulate their environment as they follow the path of their choice. It is important to achieve the right balance between the degree of structure and flexibility that is built into the learning process. Savery (1994) contends that the more structured the learning environment, the harder it is for the learners to construct meaning based on their conceptual understandings. Instructors first introduce the basic approaches that give life and form to any unconventional designs in virtual environments, and then revisit and build upon these repeatedly. Each group examines different tasks in terms of material, depth, interactivity, etc., which is their personal subjective interpretation of the unconventional. In the next step groups exchange their

environments with each other and try to perceive the environments of other groups. Since explaining some cognitive science seems boring, theoretical and not understandable in some cases, involving students directly is a proper idea. In this way students become active participants instead of passive sponges and the teacher takes on the role of facilitator as he/she gives them guidance on their creation. Learners should constantly be challenged with tasks that refer to skills and knowledge just beyond their current level of mastery. This captures their motivation and builds on previous successes to enhance learner confidence (Brownstein 2001). Of course proper discussion methods and exchanging ideas like *Edward Harkness* method would be implemented in between and students become familiar with each other's approaches and senses.

As been mentioned before for the next step of this ongoing project, a collaborative research is being performed between neuropsychologists and the Faculty of Architecture in TU Delft, to run tests like EEG and FMRI on the brain to see the function (activation nodes) of it. Specifically when the brain experiences, surfing and interacting with virtual environments, with specific characteristics enumerated before. Trying to quantify the amount of brain enhancement in creativity and learning is the core idea.

Conclusion

This speculations reviewed here demonstrate that virtual environment experience predicts both creative outcomes and creative processes. Virtual environment experience is positively related to conceptual boundary in design that requires insight to produce creative ideas without being confined to the widely known. It also predicts creativity supporting processes such as the tendency to access unconventional knowledge from memory and to recruit ideas from new experiences for creative idea expansion. Moreover, it is conspicuous that the relationship between virtual environment experience and creativity is stronger when people adapt and are open to these new experiences. The authors believe that creating a new perception of environment in the first steps of architecture pedagogy would be a broad help on expanding educator's ideas.

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Immersive learning: The use of a virtual simulated newsroom on Second Life

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Abstract. The study main purpose is to identify in what extent a virtual simulated newsroom in Second Life could influence the practical knowhow of the journalism students. All the students involved took pre and post surveys and underwent direct observation. The results analysed showed that in spite of many technological handicaps students had a better performance concerning best newsroom practices, the results also indicated that online students learned just as much as in a face to face situation and also that students enjoyed the teaching and learning experience better than the traditional way. The investigation took under consideration some of the latest studies concerning e-learning and b-learning strategies. The teaching/learning experience selected for this case study provided a good opportunity to evaluate some different online teaching/learning methods. As the main study focus was about practical behaviours this popular virtual 3-D platform showed to be a very handy tool to develop some of the Journalism course curricular.

Keywords: Journalism, Second life, teaching, learning, technology

Introduction

In the information age, marked mostly by technological advances in communications, there's an urgent need to create courses with high-quality interactive interfaces with emphasis on student interactions with content, tutors and peers. However, technological resources are not enough to ensure those interactions in a successful way. There's also a necessity to break paradigms and change traditional teaching and learning environments. It is time to learn how to be aware of the future as learning now comes from multiple sources and acquired knowledge is never enough.

The simplicity offered by modern technological development is changing online interaction possibilities by making available to teachers and students safe interfaces, interactive and efficient communication. Online environments put together various interfaces that allow greater interaction strategies. These tools are classified into synchronous and asynchronous. Synchronous interfaces are communication spaces that require the participation of students and teachers in scheduled events with specific times, such as chats, video conferences or conference calls. According to literature these tools have benefits such as: motivation, interaction and feedback in real-time collaborative environment.

As for asynchronous interfaces they do not depend on time or place meetings. Examples of these platforms can be pointed out discussion forums, email, blogs, wikis, etc.. Some asynchronous tools benefits are time management flexibility (allowing anytime and anywhere access) as well as time to reflect and contextualize the information and discuss ideas. These interfaces have been shown to be extremely important for the teacher who, from that information, can better follow student learning process. Based on an innovative suggestion for collaborative learning, teachers and students can help each other in adapting to this new methodology. The intervention, the exchange of information, the collective knowledge building between students and teachers is of vital importance.

Learning through this methodology moves from an individual perspective to group learning. It puts aside the overrated assessment of independent work and rather focuses on collaboration. As so, this interface strategy for technology education is focused on solving planned activities that may require participation, cooperation, interaction and collaboration. These teaching strategies must address the student predisposition to learn and expand experience skills.

It is also important to understand that in order to develop new teaching approaches and methodologies teachers need to work on their own continuous training as well as some basic pedagogical skills. According to Market (2009) it is essential to always do a good educational process planning; to find new ways to introduce topics for discussion; to provide some minimum necessary resources for students to organize the construction of their own knowledge; to successfully deal with previously established schedule to meet the students; to provide a continuous learning atmosphere; to maintain constant interaction with participants throughout the course; and to gain insight on the technical and educational resources it uses.

The changes performed by digital technologies in education have brought a great deal of impact on teachers and students. Both teachers and students need to be prepared to act in this new educational format. As so in spite of using new interaction, cooperation and collaboration strategies, participation and intervention success for a course of this scope will depend on the postures adopted by those involved, and especially their willingness to take full advantage of the course.

The most appropriate and traditional learning and knowledge building environment is, of course, the school. However, historically, school has been proven to be a traditional and conservative stage so that new technologies arrival created somewhat resistance to the regular use of these digital media. Adopting new teaching and learning techniques is a challenge that inevitably will cause a change in the lives of both students and teachers. Naturally the experience says that any change requires an adjustment phase but it is always necessary in the construction of new knowledge.

The new forms of teaching and learning are opening a new paradigm in education. Considering these changes, this study main purpose is to identify in what extent a virtual simulated newsroom in Second Life could influence the practical knowhow of the journalism students.

As students are increasingly asking for more flexible educational experiences (being able to take classes on a computer from home or work) researchers have been asked to investigate whether teaching an online class is a benefit or an obstacle to the educational experience for students. The course selected for this study provided a great opportunity to explore the value of online teaching methods. This new teaching and learning way take full advantage of the fact that virtual worlds present a combination of a video game interface with social connections and this mean there was a great improvement of the students' practical skills as they had the chance to face real problems as if they were working on real life.

The investigation took under consideration some of the latest studies concerning e-learning and b-learning strategies and mostly learning strategies through Second Life. As previously said the teaching/learning experience selected for this case study provided a good opportunity to evaluate some different online teaching/learning methods. As the main study focus was about practical behaviours, this popular virtual 3-D platform showed to be a very handy tool to develop and at some extent evaluate a few of the Journalism course procedures. Using a new environment the study tried to evaluate the use of a 3-D platform – like Second Life– for teaching and learning on higher education as well as evaluate the use of a 3-D virtual simulation on a journalism course.

A group of 3rd year undergraduate students participated on online classes and traditional classes in a b-learning environment. All the students involved took pre and post surveys and underwent direct observation. The results showed that in spite of many technological handicaps students had a better performance concerning best newsroom practices, the results also indicated that online students learned just as much as in a face to face situation and also that students enjoyed the teaching and learning experience better than the traditional way.

Literature overview

Second Life- 3-D virtual world

According to the official site, Second Life (a real life simulator in 3-D) is a virtual world entirely built and inhabited by its own residents. It was opened in 2003 by Linden Lab which was founded in 1999 by Philip Rosedale. Second Life was produced with the purpose of creating a new form of shared experience in which individuals inhabit a 3-D environment and build a world around them. Its interface simulates a virtual world and was originally created to be a game. However, as a game, has atypical characteristics as there are no predefined objectives, there are no opponents nor missions. In this interface, you create a virtual character called an avatar and interact with other surfers' electronic characters. This digital alter ego can walk, talk, date, work and even make money. Residents can buy, sell and trade with other residents. This virtual world has also its own currency called Linden Dollar (L$) which can be converted into U.S. dollars, respecting its daily currency (Au, 2008).

In Second Life the only limit is the imagination of everyone. Thus, the strength of the simulator is to enable individual or collective activities development, which only depends on the creativity and insight essence of each one. To Moita (2008), Second Life is a virtual 3-D environment entirely built and inhabited by avatars. It allows each user to develop

activities which they have affinities with and success will only depend on the creativity and initiative of each one. Since its opening in 2003, it has massively grown and today there are about 20 million registered user accounts (May 2011 updated figure) interacting socially and living in the virtual world. However, these numbers are not reliable figures for actual consistent usage and Linden Lab has just recently released 2011 first quarter Economy Users and Usage Metrics showing the numbers of the average monthly repeated logins which stands for up to 794 thousands.

Players of both genders, different ages and from around the globe use the grid to work, for educational purposes, looking for fun and the ability to easily relate with others. It is a parallel world, where young adults can live freely and are given a second life, assuming the appearance they want, delivering and carrying out their plans so far impossible to be achieved in the real world. Currently many academic institutions from various parts of the world are present in this immersive 3-D environment. As so institutions and organizations like NASA eEducation, University of Porto, Oxford University Computing Services, Columbia College Chicago, Harvard University, Tasmanian Polytechnic, The Hong Kong Polytechnic University, among many others, are a few examples of academic institutions that have already virtual classroom facilities in SL.

To Mattar Neto (2008), Second Life can be used as a teaching and learning environment and it allows students, tutors, contents and objects to create spaces for entertaining and interactive learning using simulations. Second Life allows users to perform a diversity of roles and participate in simulations, developing real life skills in a virtual space. In some cases, Second Life allows different situations exploration that students could not complete safely and easily in the real world, like watching tragedies, simulations of high-risk surgeries, simulated trips to contexts of difficult access, etc..

The above mentioned aspects are somehow an assurance that the exploration and use of virtual worlds like Second Life in a higher education classroom is a new educational opportunity that will enable both teaching and learning, will surely allow discussing the benefits of simulation through technology and will implement a collaborative and interactive learning in the classroom.

Second Life as a learning tool

All these technologies, which include so many different utilities such as social networking, blogs, podcasts or virtual worlds, are being taken under consideration for their potential utility in building more interactive and participatory learning environments from which all students may benefit. Many studies showed that these new learning environments have the potential to improve the understanding of different perspectives on a given subject through discussion and exploration (Bennett, 2005).

Having this under consideration 3-D virtual worlds like Second Life are now being used in a regular basis by teachers to provide simulation of real life environments and allow students to discover more creative and more realistic ways to improve their skills.

Second Life is free to access and allows its virtual residents (or avatars) to build their own creations, allowing for an imaginative and personal virtual world. To use the words of Dudeney (2007), online-education consultant, "Second Life brings immersive, immediate and - more importantly - supportive, social and truly constructivist - potential to distance learning". We have also to agree with Prensky (2001) when he refers to this younger generation as "Digital Natives". As they have grown up within a digital world they see digital technology as a natural place to learn and play.

However, it has to be considered that Second Life has not primarily been developed as a learning tool. Nevertheless it can be adapted and used to support learning environments. Second Life offers many features that can be used in learning contexts. Hayes (2009a) has released a study showing how most Second Life users exploit the immersive environment for teaching and/or learning activities. According to this author (Hayes, 2009a) Second Life is a highly resourceful tool for the learning process. Education becomes evenly distributed as everyone can contribute and learn in the same way; distant immersive learning is far more compelling, cool and fun. Second Life can be explored as an online match to physical classroom or even to set a course at a distance. Meetings, lectures and conferences as well as scenarios facilitating modelling, simulation and emulation can take place in the grid.

In any case the evaluation of the real benefits of a Web-based immersive instruction is still inconclusive. Some authors like Maki (2000) found that in an online version of the course "Introduction to psychology" students scored significantly higher grades than students using a traditional teaching methodology. Also Twigg (2003) observed that students with different scientific backgrounds and pursuing their studies based on a digital platform performed better in national exams. Following this point of view a 2005 study by Conolly stated that "online students performed consistently better than the face-to-face students."

Many other studies revealing the benefits of web-based education could be mentioned nevertheless there are as many others investigations that showed there is hardly any advantage in this online based learning. Instead for these investigations teaching based on the traditional format can be much more productive and effective. Rodrigue (2002) for example, in a study conducted in 2002, concludes that students in a situation of face-to-face felt much more encouraged and achieved better performances.

A third strain argues that either the traditional format or the format based on a model online showed no significant differences in learning outcomes by students. Validating this point of view we should refer to Shelley's work from 2006 which presents "no significant differences between the two formats with regard to student satisfaction and student learning" after comparing the two models of teaching in a course of Business Law.

As for this study after the initial shock of being confronted by a new educational strategy, students responded well and quickly incorporated this new learning format, since most were already well acquainted with the technologies of communication in real time. The big difference in the whole process was the fact that students had then the possibility to make their time management schedule all the tasks requested even comfortably from home. Another online learning advantage is that it can overcome much faster any communication barrier resulting from personality traits such as shyness.

Second Life as a practical teaching strategy

The methodology used in technology education is focused on activities that require participation, cooperation and initiative to solve problems. As such the curriculum must be open, flexible and give secure access to updated information. It should consider experience as a source of learning and criteria for judging the relevance of what is learning to students' professional and everyday life. The curriculum should also promote cooperative learning, encourage creativity and promote knowledge sharing.

Teachers in order to adapt themselves to a flexible curriculum need to invest in their own training by developing some basic skills to easily move through technology education. According to the literature some of the basic procedures go on planning the educational process to:

(1) introduce topics for discussion;
(2) forecast information and the minimum resources necessary so that students can guide their own knowledge construction;
(3) organize classes in a virtual learning environment;
(4) deal with strict compliance with the established timetable to meet the students;
(5) encourage the reduction of anonymity in the class;
(6) establish an atmosphere of continuous learning;
(7) maintain constant interaction with participants throughout the course;
(8) develop a communication method that goes beyond the purely academic.

The teacher should also be familiar with the pedagogical resources of online education such as online authoring interfaces, interaction, mediation and educational online collaborative knowledge production. Teaching should therefore be focused on the quest for meaningful information, research and development projects in a collaborative learning environment, which involves knowledge, skills or attitude gaining. This should result from interaction within the group in which each student has knowledge and individual experience to offer and share with other members. Teaching and group management should consider that when working together, one member helps another to learn. To build a team, each member should have a role to fulfil in the group mission. Also, roles exchanged within the group adds value to the team work because each student can carry out the role with which they feel more familiar in any given situation.

Another key issue in online teaching is interactivity. According to Thomas (2001) "It is believed by many educationalists that interactive courseware which allows 'learning by doing' arouses interest and generates motivation providing a more engaging experience for the learner." Thomas (2001) also considers "Simulations and modelling tools are the best examples of complex, meaningful interactivity .… With such applications, learners can construct and test hypotheses and receive feedback as a result of their actions. There are great benefits to the learner if a static image such as a diagram in a text book is replaced with a simulation". And so collaborative participation from both tutor and student generates the message as a co-creation openly connected. The interactive communication process involves multiple network connections and free swapping of associations and meanings.

The study

Methodology

In similar studies the main variable that could most influence the results relates to the sampling; for this investigation we have to add the technological skills of each individual as well as Internet access off campus for each student involved. Having this pointed out as the first major study concern we have to access the following research questions:

RQ1: Is there a significant enhancement of journalism students' practical skills using a virtual simulation of a real newsroom?

RQ2: In what extent these virtual environments provide better basic journalism proficiency like news gathering, writing and reporting skills?

RQ3: What are the students' expectations prior and after using a new online teaching and learning methodology?

The main focus of the procedure was to virtually create a newsroom where students and their teacher could gather together and decide the agenda. The group met periodically foreseeing the problems and discussed collaboratively ways to solve those issues so all together prepared news gathering strategies in a collectively manner. Those meetings provided that the teacher could closely accompanying the students' work progress, since getting in touch with the sources, getting interviews, news gathering, organizing information, and reporting.

In-world meetings aimed as well to support students and in real classes the group usually discussed problems they had faced and new strategies for success stories. As a motivation goal all the students were told that they had to publish their stories on a real e-zine. The teacher was seen as an editor-in-chief and communication in world was basically made by voice. In short:

- Online classes were mostly concerned with reporting teams for the real e-zine.
- In world meetings were also focused on the best approach choice for the articles.
- All the news gathering, source interviews and reports were prepared collaboratively.
- Course key words: skills, work, preparation, support, feedback.

Before online sessions started all students got used to the Second Life platform as - except for one - all of them had no experience with this virtual 3-D platform.

Online teaching methods were developed over four *in-world* 60 minute sessions and these sessions had each been themed to focus on specific aspects of the journalism curriculum content. Prior to each online session there was 30 minutes real life class mainly for technological preparation and to discuss solutions for the issues students had been facing. Newsroom meetings took 60 minutes but students had to return back in-world whenever they needed in order to get the interviews and the news gathering done as they were depending on sources' agendas.

After each four in-world 60 minute sessions there was a 90 minute session of real life class. These real life sessions were used to support the news gathering and to improve writing and reporting skills. So all the writing work was made during these face-to-face sessions and after being reviewed by the editor/teacher the articles were published on a real life e-zine. For this investigation there was a class once a week for 180 minutes. The same instructor taught all the sessions during October 2009.

Survey

Pre/post test survey design was used to get students' feedback for expectations and attitudes toward learning experiences in traditional face-to-face and online journalism courses. Respondents included 53 undergraduates taking the journalism course via face-to-face and online instruction. The survey was used as a guide and it was taken by the students prior and after the online teaching period. The test conducted answers on four sections:

- Demographics: questions querying students about gender and age.
- Computer literacy: to assess technology skills and confidence using those skills. At the same time students were invited to rate their internet access off campus.
- Attitudes: students had to rate their expectations and feelings towards the course.
- Perceived knowledge: students were asked to rate the course content as well as teaching procedures.

Results Discussion

Under direct observation results suggested that students' experience in a journalism online course showed favourably when combined with traditional face-to-face instruction. Results also showed that 3-D multi-user environments can provide a highly immersive and very rich socially interactive way of enhancing students' skills. Results also showed a great enhancement concerning foreseeing problems and communications and interaction showed a great improvement.

Students reported significantly better than they did at the beginning. However the course format appeared to have no impact on perceived knowledge gained. This means that the averages were virtually identical for these students and for previous year's students where only a face-to-face class was taken. Nevertheless students showed a lot more interest in the subjects matter. Also by encouraging student group work the results showed that in combination online and face-to-face instruction can be a very useful way of improving the teaching and learning experience.

Students' expectations prior to online sessions: the survey results showed highly motivated and mainly curious students in spite of their poor Second Life literacy (Figure 1).
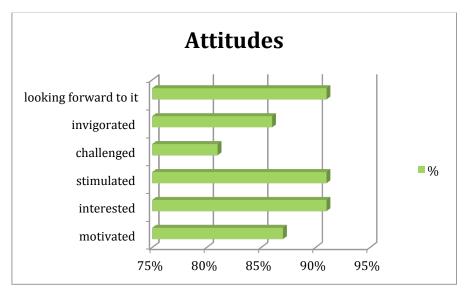
Figure 1. Students' expectations prior to online sessions

Students' behaviours after online sessions: the survey results showed students felt inspired and find the virtual newsroom useful and very important for better journalism practices (Figure 2).
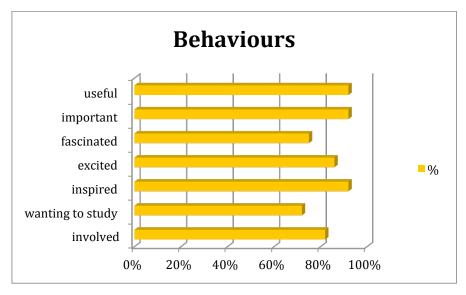
Figure 2. Students' behaviours after online sessions

Student strategies for the use of Second Life, such as thinking about creative solutions to problems and planning the use of time among others point to a better integration of curricular matters and seemed to be successful tasks. Also the surveyed group of students seemed to be informed about the advantages and disadvantages of specific skills that these technologies can provide in their learning outcomes. This has already been pointed out on previous studies from Munguba, Matos and Silva (2003) which confirm that electronic media can help structuring strategies improving awareness, attention and motivation.

The strategy performed in this virtual environment was developed in order to meet the expectations of young people in the classroom and in their academic preparation. And so students assessed that discussing the strategies according to the new methodology and study time which included topics such as optimization of the time, healthy work and educational skills in identifying and solving problems, promoting analysis and synthesis, proposed a different study, capable of promoting a better reflection and the successful execution of tasks. These results pointed out the need for schools to reflect on their teaching practices and study strategies improvement. Taking advantage of the use of virtual environments, such as Second Life would provide students with *metacognition* skills, helping them to self-regulate their learning. These are some of the challenges faced by schools in the future moving towards the implementation of new technologies to overcome and reconcile tradition with participation curriculum contexts that will allow knowledge to make sense.

Conclusions

Second Life has been shown to be a great platform that can be used to make teaching and learning experiences more creative and participatory. Towards this objective, this research proposed a way to use this revolutionary tool in order to put into practice individual and collective intelligence increasing opportunities for group experiential learning, multiple perspectives exploration and using collaborative learning to develop and share alternative views. This was possible because Second Life provides a virtual experience to individuals with a high degree of similarity with the experience they would have if the activities were to be performed in the real world.

As Second Life is a 3-D virtual world with high resolution graphics it allows real interaction between users. The interaction is the basis of communication. Therefore, Second Life has been proven to be highly motivating and engaging for our students. This study also showed that educational work in Second Life requested a few requirements:

- Technical requirements on bandwidth, processor speed and most important a good graphics card.
- Users should get familiar with the use of new technologies.
- Teachers should be able to at least solve some minor technical problems.
- Technical manager to assist users if needed.

It should be noted, however, that the uses of Second Life in education are not limited to lectures, conversation and discussion of issues. On the contrary, in the *metaverse* it is possible to do other virtual interaction experiences as differentiated practices on various educational topics with positive outcomes. As has been reported by the students, they enjoyed the experience and they appeared to learn the information. Overall, this technology was positively received, although some students expressed concerns over the technology challenges associated with its integration into classes. The dominant presence of the exploration frame suggests that Second Life is both a new technology with much to be examined and a tool that can encourage the exploratory aspects of the practical learning process.

With students requesting more flexible teaching schedules and more creative learning experiments, virtual environments like Second Life are necessary in the development of the teaching methods. Future investigations should attempt to isolate the key factors that may influence the effectiveness of online instruction.

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An exploration of social-networking sites as a virtual learning environment

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Abstract. The popularity of social-networking sites such as Facebook, particularly among university-students, has prompted research to explore ways in which social networking can be adapted into virtual learning environments. In particular, this study uses the think-aloud technique to examine university-students' use of and interaction with Facebook. Twenty-six Teesside University students who were also Facebook users took part in the study. From participants' observation, three major factors, which could be mapped on to three psychological needs: relatedness, pleasure-stimulation and, popularity-influence, were identified as their reasons for using the Website. Future research should investigate social networking in the context of immersive environments and ways in which they can be best supported for in a virtual learning environment.

Keywords: immersive environments, virtual learning environments, social networking, Facebook, think-aloud

Introduction

The use of virtual reality in education has in recent years become more commonplace. Advances in virtual-reality technologies, however, are opening doors to a broad investigation of the potential for collaborative, multi-user virtual learning environments designed to enhance educational experiences (Jackson & Fagan, 2000). An example of such practices includes the collaboration between virtual reality and social networking which can be valuable in helping students clarify ideas and concepts through processes of articulation and discussion (Steeple & Mayes, 1998). In the context of this study a social networking site is defined as a 'web-based service that allows individuals to:

(1) construct a public or semi-public profile within a bounded system,
(2) articulate a list of other users with whom they share a connection, and
(3) view and traverse their list of connections and those made by others within the system' (Boyd & Ellison, 2007).

While social-networking sites such as, Bebo, MySpace, Ning and Facebook are widely used for non-academic purposes, they can also be used in learning. Indeed, social networks and online communities, such as virtual learning environments, are becoming increasingly similar as places where students and scholars work, collaborate, plan and share (Mitchell & Watstein, 2007). For example, Websites such as Moodle, a free Web application used by educators to create interactive online learning sites and Blackboard, a commercial learning

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management system used in delivering online classes, are widely used in universities and classrooms around the world.

With over 700 million users worldwide, the global importance of Facebook as a social networking platform is beyond doubt. Facebook's popularity particularly among university students has prompted research to explore ways in which social networking can be adapted into virtual learning environments. Increasingly researchers are exploring ways to take advantage of the access that Facebook offers to both seek information about user needs and preferences and promote services and resources to students and others in the community (Mitchell & Watstein, 2007).

Virtual learning environments

According to Mitchell and Watstein (2007), virtual learning environments are software systems designed to facilitate teachers in the management of educational courses for their students. Virtual learning environments are not limited to higher education and are used in learning and teaching across the academic spectrum, from primary schools and beyond, in many disciplines at most colleges and universities. These e-learning systems are sometimes also called Learning Management Systems (LMS), Course Management Systems (CMS), Learning Content Management Systems (LCMS), Managed Learning Environments (MLE), Learning Support Systems (LSS) or Learning Platforms (LP), among others.

Although virtual learning environments are frequently used in distance learning as most virtual environments overlap with physical environment they are not restricted to distance education. In addition to distance learning, virtual learning environments can also be used to enrich classroom activities through the integration of a set of equivalent virtual concepts for tests, homework, classes, classrooms and other external academic resources (Dillenbourg et al., 2002). Thus universities and other institutions are increasingly turning to the use of virtual learning environments in order to save cost on teaching staff, provide services for long-distance students and/or those on different campuses, and to ensure that quality control requirements are met by providing a standard vehicle for collecting required information. In the following section, similarities between virtual learning environments and social networking sites will be discussed.

Virtual learning environments and social networking

Research has shown that cooperative learning solutions can promote students' achievement within problem-solving settings as well as higher productivity, greater social skill development, and increased self-esteem (Johnson & Johnson, 1989, 1994). Recent Web applications are integrating virtual worlds and learning tools in a new way. For example, Sloodle (Figure 1), an open-source system, bridges the communication gap between Second Life objects and Moodle assignments so that students can take quizzes or surveys, submit assignments, record chat conversations and keep track of their progression through a points-based system that can be viewed directly from Second Life.

Figure 1. Sloodle, a virtual learning environment

Similarly, Edusim, a three-dimensional multi-user virtual-world platform and authoring toolkit can be extended to allow multiple classrooms connect their interactive whiteboards for collaborative learning sessions. Therefore, this paper describes an approach that could be used in studies that involve collaborative learning processes in immersive virtual learning environments such as Second Life and social networking sites such as Facebook.

Comparison of Second Life and Facebook

Second Life is an Internet-based virtual world that offers novel and intuitive ways to browse information spaces / document collections in 3-D virtual libraries, visit and sample new culture, interact with other people via customisable, realistic, fully textured and animated 3-D avatars and attend and participate in live events such as lectures, conferences and festivals (Dillenbourg et al., 2002). Since Linden Lab released Second Life in June 2003 its popularity has increased significantly. For example, the total number of resident signups of Second Life has more than doubled since October 2006 when the one-millionth resident joined. As of October 2011, Second Life's total population has been reported to be over 25 million registered virtual citizens or 'Lifers', all of whom has signed in at least once with their own fully textured, customisable high-resolution avatar (Second life grid survey, 2011). Second Life's popularity could be attributed to various qualities including its host of advanced technologies such as having a unique in-world weather system, with realistic day-night cycle support system.

While a set of conventional two-dimensional Web sites does not constitute a virtual learning environment, social-networking sites such as Facebook can be compared to Second Life as a result of the social interaction about or around the information it provides (Dillenbourg et al., 2002). According to Boulos et al. (2007), 3-D virtual worlds such as Second Life can be considered as 3-D versions of social networks - for example Facebook - where people can collaboratively create and edit objects in the virtual world, besides meeting each other and interacting with existing objects. In addition, Mason (2006) argues that Facebook shares many qualities of a good 'official' education technology in its reflective element to use mechanisms for peer feedback and goodness-of-fit with the social context of learning. In

particular, the conversational, collaborative and communal qualities of Facebook are seen to "mirror much of what we know to be good models of learning, in that they are collaborative and encourage active participatory role for users" (Maloney, 2007). Furthermore, in terms of being a network of participation, Second Life and Facebook could be seen as helping learners build communities of practice, collaborate with peers in group work, create and share content. Other similarities between online social-networking environments such as Facebook and immersive virtual environments such as Second Life can be summarized as follows.

- Online community of users.
- Dynamic and interactive content.
- Internal use of multimedia images and videos.
- Informal setting for exchanging information.
- Communication/Social interaction.
- Synchronous communication for example, through the use of chat rooms.
- Asynchronous communication for example, through the use of group discussion and/or bulletin boards.

Think-Aloud to study interaction with Facebook

This study used the think-aloud technique to examine university students' use of and interaction with Facebook. The use of the think-aloud technique in research was supported by Stratman and Hamp-Lyons (1994) who suggested that there is little research in this area particularly in relation to computer applications. The think-aloud technique involves the recording and later analysis of users' spoken thoughts while engaging in a practical and interactive activity (Young, 2005).

The basic principle of think-aloud is that participants' are requested to constantly verbalise their thoughts, feelings and opinions while interacting with an artefact, solving a specific problem or performing a task as they use a product, device or manual (van den Haak et al., 2003; Nielsen & Chavan, 2007). This request is only repeated if necessary in order to encourage a participant to always say what he or she is thinking while performing the task at hand, should they lapse into silence. By thinking aloud while performing a task, participants can explain their method of attempting to complete the task and report any difficulties they encounter in the process without much disturbance in their thought process.

Method

Design

A think-aloud study was conducted in individual sessions. During this process, participants were told to think-aloud while browsing a popular social-networking site (Facebook) for a maximum period of 30 minutes. More details of the think-aloud study are presented in a separate publication. Following the think-aloud task, each participant was asked to complete a questionnaire measuring acceptance of and interaction experience with Facebook.

Participants

Twenty-six participants were recruited for the study through an advertisement on the Department of Psychology's research-participant management system. Eligibility requirements were being enrolled for full-time or part-time study at the Teesside University and having a social-networking (Facebook) account. The sample consisted of nineteen female (73%) and seven male (27%) participants, with an average age of 23 years (mean = 22.88, *SD* = 8.37). There were twenty-four undergraduate and two postgraduate university students, all of whom were studying full-time courses and had access to the Internet. Mean years of experience using the Internet was 8.58 (SD = 2.50, range: 4-15 years). Only one participant did not own a computer.

Participants' experience of using social-networking sites ranged from 1 to 8 years, with an average of 4.15 years. Most participants used social-networking sites either 5-7 times a week (36%), 10-15 times a week (27%), or more than 15 times a week (18%). More than half of the participants used social-networking sites at home (n = 13) or at university (n = 2). Fifteen per cent (n = 4) visited social-networking sites at home and university, while the remaining 27% (n = 7) used these sites in public places such as an airport. All participants used social-networking sites at least once a week with most using such sites either 5-7 times a week (36%), 10-15 times a week (27%), or more than 15 times a week (18%). One-third of participants (35%) spent between 1 and 4 hours per week on social-networking sites, 19% spent 13 hours, 8% spent up to 24 hours and 7% spent over 24 hours on social-networking sites.

Materials

Materials used for the study included a desktop computer (Intel Pentium 4, 3.20 GHz, 0.99Gb of RAM, Microsoft XP operating system and 17 inch monitor) and a Web browser (Internet Explorer 6). Other materials include a screen capture program (Camtasia Studio 6) and a microphone.

Procedure

Each participant was asked to complete a consent form and the first questionnaire, requesting demographic information. After completing the first questionnaire, an introductory video was shown to the participants followed by a short practice task, which involved the use of a virtual learning environment (Figure 2). Verbal and paper instructions were then given to the participants on how to perform the think-aloud task.
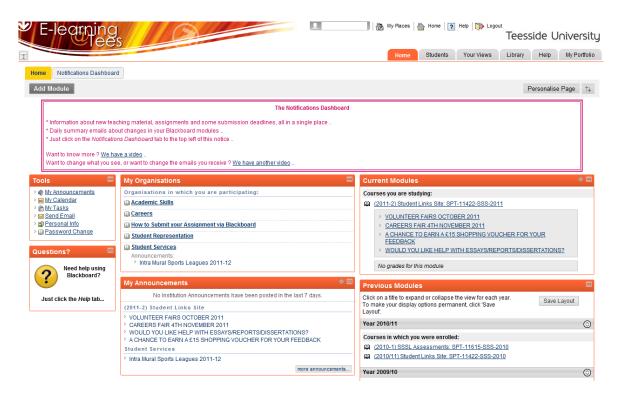
Figure 2. Blackboard Website, a virtual learning environment

Main task: using Facebook while thinking aloud

Once the think aloud task was completed, each participant was asked to complete the second questionnaire measuring their interaction experience with the online social networking site, Facebook. Finally, each participant was thanked for his or her time once all the tasks were completed.

Results

In order to analyse the think-aloud data that were collected, the video recordings were observed and the audio files were transcribed. According to Young (2005), typing out complete verbal protocols as verbatim as possible is very important in order to be able to apply reliable interpretations. Therefore, all verbalisations were typed out, including utterances by the participants that had no bearing on the activity. The recordings were watched repeatedly and the transcript was divided into 500 units of thought (Riffe et al., 2005). The units of thought are referred to as comments later on. Interpretative notes were also made alongside the transcriptions so as to identify the types of thinking evident in the think-aloud data (Miles & Huberman, 1994).

Motivation for using social-networking sites

Following the think-aloud task and transcription, three components were identified as participants' motives for using social-networking sites (see Table 1). Staying in contact with friends, family and the university was the most prominent factor observed in most participants (73%) for using social-networking sites. This was summed up by one of the

participants who stated that his/her reason for using social-networking sites was "to keep in touch with friends/family and to keep up to date with things going on at uni".

Table 1. Motivation for using social-networking sites

Reason	Frequency	Percentage %	Psychological need (Sheldon et al., 2001)
To stay in contact with friends and the University	19	73	Relatedness
To have fun and for entertainment	5	19	Pleasure-stimulation
To gain attention from others	2	8	Popularity-influence
Total	26	100	

Participants also used social-networking sites for fun and entertainment. This motive was observed in about one-fifth of participants (19%) with the following comment examples "to play games when I am too tired of reading" and "something to do if I am bored". Furthermore, a smaller percentage of participants (8%) used social-networking sites to gain attention from other people by sharing their thoughts and feelings with others.

Motivation analysed as psychological needs

Sheldon et al. (2001) analysed 10 human needs (autonomy, competence, relatedness, self-actualisation-meaning, physical thriving, pleasure-stimulation, money-luxury, security, self-esteem and popularity-influence) in an attempt to determine which are the most fundamental for humans. They demonstrated that psychological needs are particular qualities of experience that all people require to thrive. Therefore, participants' motivation for using social networking sites was analysed in relation to the universal human needs proposed by Sheldon et al. (2001). The following three psychological needs were found to be particularly related to participants' motives: relatedness; pleasure-stimulation; and popularity-influence.

Relatedness

Relatedness was particularly prevalent, with 73% of participants indicating the need to stay in contact with friends and family as a major reason for using a social-networking site. According to Deci and Ryan's self-determination theory of motivation (1985, cited in Sheldon et al., 2001), relatedness occurs when people want to feel a sense of closeness with some other which, in this case, could be their classmates, family or the university.

Pleasure-stimulation

Pleasure-stimulation was observed in 19% of participants as motivation for using social-networking sites. According to Sheldon et al. (2001), the need for pleasure-stimulation, derived from Epstein's (1990) model, encapsulates the single most basic motive for hedonistic philosophies. This need encapsulates a feeling of pleasure and enjoyment which was also observed when participants listed the need to have "fun" and "entertainment" as one of their motives.

Popularity-influence

The need for popularity-influence was observed in about 8% of participants' responses as another important motive to use social-networking sites. Popularity-influence was described by Sheldon et al. (2001) as a feeling of being liked, respected, and having influence over others rather than feeling like a person whose advice or opinions no one is interested in. Thus, when participants mentioned gaining attention from others as one of their motives for using social networking, they manifested a psychological need for popularity-influence as described by Sheldon et al. (2001).

Discussion

This study examined the similarities between social-networking sites and immersive virtual learning environments. Connections were found in ways in which students interact socially, work, plan and share information on both platforms. Also, the informal and collective qualities of Facebook were seen to mirror that of three-dimensional virtual worlds such as Second Life. Although Second Life boasts of several million registered users who have used it at least once, only a fraction could be classified as active Second Life users. This is in contrast to Facebook which has a more significant number of registered and active users. Thus, more research should be conducted to reflect carefully upon how to better engage young people particularly students through functions and activities that link both worlds in future studies.

In addition, participants' interaction with popular social networking site, Facebook was studied using the think-aloud technique. Three motives were observed in participants as their reasons for using social networks with communication being the most prevalent. The three motives of staying in touch with family, friends and university, fun and entertainment and gaining attention from others were then mapped into three psychological human needs (relatedness, pleasure-stimulation, popularity-influence respectively) as described by Sheldon et al. (2001). Due to the similarities between social networking sites and virtual learning environments, the question arises how similar the motives shown by participants would be in relation to immersive environments. As a result, the role of human needs should be investigated in other to find out to what extent psychological needs are related to immersive virtual environments.

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Extending collaborative learning beyond the boundaries of the physical classroom through virtual environments

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Abstract. In this paper we outline some of the potentialities and barriers of 3-D immersive virtual worlds when used in a learning context combined with other online tools. Classrooms can be extended from physical to virtual space in order to fulfill students' needs and to facilitate a more collaborative learning style. Immersive learning allows us to learn in 1st person, allows us to have control over what we want to learn, how and when. The use of immersive 3-D virtual worlds allows students to participate in richer interactions at times that are more convenient to their work / study patterns, with no physical restrictions. Online web 2.0 tools, by being available at anytime and anywhere and user friendly, can enhance students' collaboration and sharing, promote students' socialization and improve classroom cohesion.

Keywords: Virtual Worlds, Second Life, Immersive and Social Learning, Tutoring, Higher Education

Introduction

There is a growing trend in education and training towards the use of online and distance learning courses. This delivery format provides flexibility and accessibility; it is also viewed as a way to provide education in a more effective way to a broader community. Online courses are comfortable, they are built under the missive of 'anyone, anywhere, anytime'. Everyone can participate from home or workplace.

Online courses can be developed in a variety of ways, for example, using a LMS (Learning Management System), a LCM (Learning Content System), or a Web 2.0 tool (or some mixture). These options, however, show limitations in terms of communication and interaction levels that can be achieved between students and between students and teachers. Most learning systems are asynchronous and do not allow an effective real-time interaction, collaboration and cooperation. Whilst they typically have synchronous chats and whiteboards, these capabilities are often sterile and do not stimulate the appropriate interactions that enhance learning. A rich interaction does not necessarily involve just verbal exchange since there is huge learning value to be gained from interacting with the learning

content in a more visual and practical way. For instance, imagine the learning benefits from collaborating on a 3-D construction jointly and in real-time. Imagine watching the impact of soil erosion, or building and walking inside an heart model or a car engine. All this is possible in a 3-D immersive virtual world. Students can engage at a distance building content in real-time, collaboratively and interactively. On the net there can be found an array of virtual worlds, however we have chosen Second Life to show how teaching and learning can be enhanced through the use of this methodology. Second Life is immersive, enabling users to interact, communicate and collaborate as if in the real world. Second Life is a model of the real world, it shows an accurate physics simulation and it includes a meteorological and gravitational system; as such, anything can be modelled and simulated. Each user in the environment is represented by an avatar with all the features of a human being and avatars can manipulate the environment. Scientific experiments can be held in a very safe and controlled environment, and can be directly conducted by the scientist, teacher or tutor in charge. Scientific fields such as architecture, history, medicine, biology, sociology, programming, languages learning among many others can all be tested and researched through this virtual world. In next section we will outline some examples of the above mentioned features and potentialities.

Virtual Worlds - immersive experiences

In a virtual world such as Second Life people can have immersive experiences. It is a multi-user, collaborative or shared virtual environment. These environments or systems allow users to experience other participants as being present in the same space, they can interact with each other; this creates the feeling of being there together (Schroeder, 2008). This definition is focused on sensory experience. In a virtual world "Interaction with the world takes place in real time. When you do something in the world, you can expect feedback almost immediately. The world is shared. The world is (at least some degree) persistent" (Bartle, 2004), so there is an interaction between users despite not being physically in the same space (Wankel & Kingsley, 2008), stimulating immersive learning. A virtual world is also called as metaverse. The term metaverse was coined in Neal Stephenson's 1992 novel *Snow Crash*. Many of the virtual worlds we know today are based on Stephenson's metaverse concept, where "humans, as avatars, interact with each other and software agents, in a three-dimensional space that uses the metaphor of the real world" (Wikipedia, 2008). American National Standards (2007) defines a virtual world as a simulated environment that appears to have the characteristics of some other environment, and in which participants perceive themselves as interactive parts. For Bell (2008), a virtual world is a synchronous, persistent network of people, represented by avatars and facilitated by computers. PCMagazine's encyclopedia defines a virtual world as a "3-D computer environment in which users are represented on screen as themselves or as made-up characters and interact in real time with other users. Massively multiuser online games (MMOGs) and worlds such as Second Life are examples" (PCMagazine, 2011).

Virtual worlds already have an impact in real world society, particularly at business, art and education levels. For instance, as PCMagazine notes, "there are countless Second Life cultures and subcultures organized around arts, sports, games and other areas. Groups can be formed that simulate mini-companies and mini-communities. Even real companies, such

as Coca-Cola and Adidas participate in Second Life as a marketing venue. Numerous universities, including Harvard, Princeton and Vassar, offer online classes. Religious organizations hold meetings and starting with the Maldives and Sweden, countries have created virtual embassies. People find partners, have virtual sex and even get married in Second Life. In other words, Second Life is the virtual real world" (PCMagazine, 2011). Taking in account our experience, literature review and the research that is being developed, the virtual world we believe offers better features and more potentialities for educational use is Second Life.

Connecting learners through Virtual Worlds

Social technologies, like virtual worlds and web 2.0 tools, can bring an amount of benefits for learners (Kreijns, Kirschner & Jochems, 2003; McLoughlin & Lee, 2007) that can be summarized in five clusters:

- Participatory learning - foster participation in creation/editing of content;
- Collaborative learning – collaborative knowledge construction (information shared by individuals can be recombined to create new forms, concepts, ideas, mash-ups and services);
- Autonomous learning - share, communicate, and discover information in communities;
- Communication and interaction capabilities - richer opportunities for networking
- Lifelong learning (join the wisdom of the crowds) - develop digital competences and support lifelong development.

Despite the benefits, some challenges should also be considered. For learners to connect and take benefits they need to be motivated to interact. Social interaction will not automatically occur just because technology allows it. Therefore it shouldn't be taken for granted learners' capabilities and motivation to interact. The borders of the learning environment become diffused, therefore a careful planning and management is mandatory. Virtual worlds and Web 2.0 tools have their own dynamics and are transient environments - moderation becomes a requirement. Students are free to learn according with their own patterns, however a teacher or tutor should be a constant presence to guide and moderate.

Another aspect to consider is the difficulties in designing the new models of teaching and learning (Instructional Design). On the other hand higher level of anxiety are often associated with computer-mediated communication which may limit the degree of social interaction. In order to build group relationships and dynamics, students need to trust each other, feel a sense of belonging; and feel close to each other before they engage in collaboration and sharing - sense of community belonging.

Second Life as learning environment

Second Life is a free to use 3-D multi-user virtual world, immersive, imagined, designed, built and created by its users (residents or avatars). It is considered a playground for our imagination, a limitless platform – design, build, code, perform and collaborate, expanding the boundaries of creativity. It is a real life simulator (Loureiro & Bettencourt, 2010).

The immersive nature of SL allows walk through contents and information - students can learn by living or experiencing. With a 3-D representation of 'self' – the avatar - learning can be done in the 1st person. Features like communication, cooperation, collaboration, interaction and information sharing are in real time. Students can learn by doing and they can more easily engage with content (Loureiro, Wood & Bettencourt, 2010). SL is also a major social network and a wide community of practice (Wenger, 1998). SL is not a game but it offers the attractiveness of 3-D gaming and therefore the sensation of learning by playing (Loureiro, Wood & Bettencourt, 2010). As Lim (2009) suggested there are six learning styles that can be applied within SL:

- Learning by exploring - students can learn by visiting and explore buildings, landscapes, communities that are simulated and modelled;
- Learning by collaborating - students can work in teams, collaboratively and in real-time on common projects or on problem-solving tasks, discussions can also be made in group and collaboratively;
- Learning by being - students can immerse in role-playing and performance activities, they can also explore the self and experiment different identities through avatar customization and by creating different characters;
- Learning by building - students can with no restrictions build any kind of objects or environments and experiencing in real-time the results;
- Learning by championing - students can get involved into activities and causes related and with an impact in real-life (such as cancer campaign, earthquake victims support);
- Learning by expressing - students can show and present their in-world activities to out-side world audience, by authoring blogs, machinimas, papers, posters or by participating in conferences and meetings.
-

By exploring those potentialities, virtual classrooms can emerge and learning can be enhanced.

One particularly interesting feature of version 2.0 of SL viewer is the possibility of adding shared media to an object. This means anyone can add web-based media content to the surface of any object and place it in-world or attach it to an avatar. For instance, it is possible to be inside SL, running, adding and modifying contents in an external web site and the audience in-world can watch it in real-time. These tasks can be made collaboratively.

Another interesting feature, especially for those who use Moodle as a LMS is the possibility of connecting and integrating it into SL - through Sloodle (Simulation Linked Object Oriented Dynamic Learning Environment). The use of LMS in e-learning has limitations as the students only have to deal with specific activities (Yasar & Adiguzel, 2010) but Sloodle provides a variety of tools for supporting learning contexts in immersive virtual environments, providing experiences and opportunities for students to collaborate, cooperate and interact with the objects. By connecting Moodle and SL it is possible, for instance, to have the same chat session running in real-time on both platforms – students can chose in which one to be, or connect at both. Chat logs are also saved in the Moodle database. A tool, called Web-intercom, can be used "to enhance the communication between learners who are involved in the activities within both SL and Moodle" (Yasar & Adiguzel,

2010) and is important to students as "an aide-memoir and to help them reflect later on their experiences in the virtual world" (Livingstone, Kemp & Edgar, 2008). Another feature of Sloodle is that SL and Moodle accounts can be linked. This feature provides a better management of students' progress, allowing teacher to track students by their avatar names (Yasar & Adiguzel, 2010). It is also possible to set quizzes - QuizChair - where students "attempt a standard Moodle multiple-choice quiz inside SL, with the answers being stored on Moodle" (Kem, Livingstone & Bloomfield, 2009) (in Yasar & Adiguzel, 2010). Students can create 3-D objects and deliver their assignment using the drop-box tool and teachers can review their work and provide feedback in Moodle (Livingstone, Kemp & Edgar, 2008). It also has the Presenter tool with the possibility of showing slides and/or webpages, for students and teacher share their work. For those who like to have a more close control over participants it is also possible to set (via a Sloodle toolbar) a function to collect a list of avatars or Moodle users connected at a certain time/date.

In next section we will describe a study that is being carried out and how learning was orchestrated in an extended classroom.

Second Life & Web 2.0 tools as an extended classroom - the case study

The main research motivation came up from a problem detected in classes. There were students with different levels of confidence; full-time (day class) and part-time students (night class); only meet each class once a week. Teacher wanted students to work in groups and to actively participate and collaborate in class activities. The dilemma came up when teacher started to wonder how to engage all students and how to support all students. Create an extended classroom by using virtual worlds and web 2.0 seemed to be a way. A case study was outlined and set to gain experience of the use of virtual worlds (Second Life) and social web tools (namely Facebook and Diigo) in learning contexts and therefore to encourage collaboration, sharing and class cohesion 'out of hours' by providing means for students and teacher to interact. With this experience teacher wanted to:

- cover some theoretical subjects as part of the course curriculum in a more creative way;
- help students to understand the importance of sharing and discussing information in an open manner;
- provide tutorial support to the part-time class through a virtual environment.

As a major goal teacher (which is also the researcher) wanted to evaluate the effectiveness of blended learning as a format to achieve the teaching goals.

The study research question was to understand if there are best practices orchestrating learning in virtual and immersive environments and if they will enhance blended learning through knowledge sharing. Study components are related with construction and knowledge sharing; interpersonal relationships/interactions; collaborative virtual environments (CVE). The premise is that socialization is a key factor for collaborative and social learning - and that means connecting, communicating, interacting and establishing relationships. Main background theories that underpins research are Connectivism

(Siemens, 2004; Downes, 2006) and Social Constructivism (Prawat & Floden, 1994; McMahon, 1997).

Methodology

This is a qualitative study, with an inductive and exploratory nature where the researcher is a participant observer. Participants are Portuguese higher education students from a faculty of education. Students belong to two different groups, undergraduate regular day classes and undergraduate mature night classes (ages > 23 years old). They follow exactly the same syllabus in an identical curriculum. This is a non probabilistic sample (by convenience).

Data has being collected through direct observation, questionnaire and electronic records (snapshots and log chats). Analysis is quantitative over qualitative data - content analysis. The study goals are to:

- identify the variables that might influence knowledge sharing;
- contribute for richer learning contexts through the use of online tools (Diigo, Facebook) and virtual worlds (Second Life);
- provide tutorial support to night class through a virtual world;
- encourage collaboration 'out of hours' by providing means for students and teacher to interact;
- learn what advantages we can find in an online tutorial implemented using an immersive virtual world;
- understand how and which students engage with an immersive 3-D world and how effective it is as a proxy for face-to-face interaction;
- understand how well online tools and virtual worlds promote knowledge sharing and enhance socialization in order to contribute for classroom cohesion;
- provide some insights for better online teaching strategies.

The tools used in the now extended classroom are Moodle (official faculty LMS); Diigo (prescribed by teacher); Second Life ("selected" by students) and Facebook (on students request).

In Fig. 1 we present an image showing how learning was orchestrated in the extended classroom in order to enhance knowledge sharing and socialization among students.
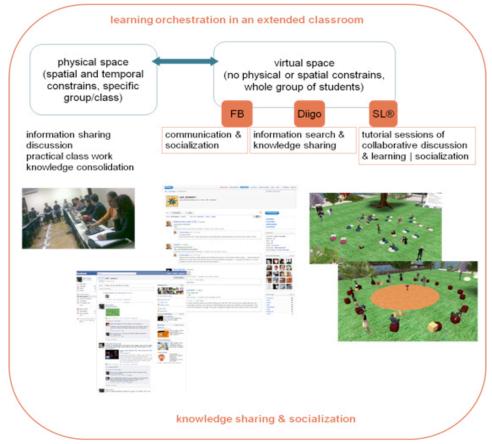
Fig. 1 - learning orchestration

Physical classroom was enhanced with a virtual classroom by adding extra spaces for students to share, interact, collaborate, socialize and communicate - extended classroom.

Findings

Although the study is ongoing some findings can be outlined:

- initial set up cost of starting SL is high (time);
- students engaged in-world beyond tutorial hours;
- tutorial sessions were considered as a success for the mature night class;
- students didn't use the support hours available at school (physical space);
- night students shared more information at Diigo ;
- day students created a Facebook page for a more direct communication;
- night students elected email as primary way for communication;
- students posted more information than teacher, with relevance for night students;
- the quality of shared information was high (relevant) – development of search competences;
- posts were moderated (by teacher and students) - development of critical analysis and reflection skills;
- students prefer in-world sessions out of official school islands – informal places not perceived as an extension to the 'bricks and mortar' university;
- night (mature) students are more independent as learners;
- night students have less time and more desire to learn in the most effective way;

- night students are more motivated since they have stronger reasons to study in their spare time;
- day students are taking full advantage of the social side of university;
- virtual spaces support the work patterns of mature students in particular.

We can summarize saying that the contrast of behavior between day and night students is a function of maturity; level of independence as learners and intrinsic motivation. The motivation aspect needs further and deeper evaluation - where free will is involved. In that way we may say that an online tutorial established in a virtual world might suit better the mature students and this might be a way to help them to keep in touch with the teacher and to maintain class cohesion.

Final reflection

Design and implement an extended classroom through the use of online tools and virtual worlds requires preparation, time and means. We cannot take participation in computer-supported collaborative learning (CSCL) environments for granted, there is the need to ignite and maintain it. Students have to be prompt and reminded about their roles, they should be able to embrace autonomy but teacher needs to provide the right incentives. Interactivity has to be improved (two way connection between distributed students) by organising social interaction, collaboration and shared activities - otherwise it is unlikely to occur or be meaningful. In an extended classroom, teacher also has to foster a sense of community and encourage development of a social presence.

Do not replicate traditional classrooms in online environments, it is pointless if what only changes is the place/space (I mean there is no point having students sit in rows listening to lecturers in a virtual environment for instance) - take advantage of the potentialities of the virtual space in use. Employ designs that focus on collaborative, networked communication and interaction which seems to be what students expect nowadays – without losing the informality. It is crucial to focus more on the actors and their needs rather than the technology (it's all about people after all).

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Facilitating creativity in pre-service teacher education courses through their engagement in Virtual Worlds

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Abstract: Creativity has been put on the agenda of national school curriculums globally. Pre-service teacher education courses need to develop approaches to incorporate opportunities for creative thinking into all subject areas. The use of virtual worlds as a unique environment in which to facilitate teaching and learning activities presents one way to address this problem. The virtual world of Second Life was used in two pre-service teacher courses at a regional university in Australia. The courses involved were curriculum specialisation: visual arts 1 and science and technology education foundations. The reflections of staff and students in these two courses provide some insight into the potential that virtual world technologies can have in the development of creativity and creative thinking.

Keywords: Creativity, Second Life, Virtual Worlds, pre-service teacher education

Introduction

In 2008 the Australian Curriculum, Assessment and Reporting Authority (ACARA) began the process of developing a national curriculum for Australian primary and secondary schools. Central to the process is the premise that education should support "all young Australians to become successful learners, confident and creative individuals and active and informed citizens" as outlined in the Melbourne Declaration on Educational Goals for Young Australians (2008). The draft Australian curriculum documents emphasize creative thinking as one of the 'general capabilities' that will assist students in the 21st century "to generate and evaluate knowledge, ideas and possibilities, and use them (in combination with critical thinking) when seeking new pathways or solutions" (ACARA, 2010, p. 19). From the late 1990's when many nation-states' schools and pre-schools undertook educational reforms the resulting new curricula usually encompassed creativity (Craft, 2003). The National Curriculum in the United Kingdom emphasized creative thinking skills and defined these as follows: 'Creative thinking skills … enable pupils to generate and extend ideas, to suggest hypotheses, to apply imagination, and to look for alternative innovative outcomes' (National Curriculum Handbook for Primary and Secondary Teachers, 1999 cited in Craft, 2003). In Hong Kong creativity is seen to be one of the three significant generic skills across subject areas (Cheng, 2011). Teachers are expected to provide a classroom environment that enhances creativity where creative thinking and creative problem solving abilities are rewarded and valued (Curriculum Development Council, 2002

S. Martin (Ed.), Immersive Technologies for Learning: A multi-disciplinary approach. pp. 62-76
2010 Conference Proceedings
International Virtual Environments Research Group (iVERG) http//www.iverg.com

cited in Cheng, 2011, p. 68); in Israel creative thinking is an important component of curricula (Zohar, 2008). In fact Craft (2003) saw creativity as a response to our 21st century world where "continual innovation and resourcefulness" are necessary to maintain a healthy economy (p. 114).

The emphasis on creativity in the Australian Curriculum means that practicing teachers, pre-service teachers and University lecturers who are preparing the pre-service teachers for their future 'Australian curriculum' classrooms are required, in all subject areas, to incorporate a range of experiences for their students that will enhance creativity. A number of myths about creativity have been identified by McWilliam, Poronnik and Taylor (2008, p. 230); these myths include: creativity is 'artiness'; creativity is individual genious and idiosyncrasy; creativity is not enoncmically valuable; or not rigorous, systematic or learnable. Although there are considerable efforts to expell these myths (Kaufman & Sternberg, 2007 cited in McWilliam et al.) the specific inclusion of creativity poses a number of challenges for educators outside of what might traditionally be considered 'creative' subject areas such as the Arts.

What is Creativity?

What creativity actually means is unclear (Gibson, 2005). In addition it is sometimes argued as to whether children are active and creative beings (Sawyer et al., 2003 cited in Glˇaveanu, 2011). However Glˇaveanu believed that children should be considered as creative individuals where their form of creative expression is developed through, "interaction with adults, play, and cultural artefacts" (p. 130). Craft (2003) made a conceptual distinction between two different forms of creativity. She referred to "everyday creativity" as being the creativity that is used in everyday life and she described "extraordinary creativity" as "publicly acclaimed creativity which changes knowledge and/or perspective on the world" (p. 114). Furthermore she highlighted the importance of "everday creativity" for the ordinary person and she noted the significance of this when looking at creativity in education. The report in 1999 by the National Advisory Committee on Creative and Cultural Education (NACCCE) used the phrase "democratic creativity" to point out the creativity of the ordinary person emphasizing the concept that all students are capable of being creative. The NACCCE summarised creative thinking as: "imaginative activity fashioned so as to yield an outcome that is of value as well as original" (NACCCE, 1999, p. 29, cited in Craft, 2003).

The Importance of Creativity in Science and Technology Education

Students tend to see careers such as the visual arts as being creative careers and do not generally see science or scientists as being creative (Akerson & Donnelly, 2010; Masnick et al, 2010). However creativity has been identified by scientists, as one of the most important qualities for scientists (Fensham, 2004) and science is thought to be a subject that can develop creativity (Cheng, 2011; Hong & Kang, 2009). Masnick et al (2010) found students' attitudes towards science careers were related to how creative they perceived science to be and Beghetto (2007) identified a link between students' creative self-efficacy (a person's belief about their creative capability) and their perceived science competence. McWilliam et

al. (2008) argued that incorporating creative pedagogies in science curricula could reinvigorate science education. They suggested that students will be more engaged when doing active (creative) tasks with dynamic sources of knowledge in contrast to passive tasks with the transmission of knowledge (static knowledge). They believed that creativity is the "core business of scientific thinking" (McWilliam et al., 2008, p. 228). Mc William et al., discussed how students are using digital media to create, edit and share knowledge in their own lives and how this could mean that they are even less likely to accept a "top down ..authoritarian.. memorisation of facts" approach than perhaps students were in past decades. These authors also highlighted the importance emphasizing "team capacity" in contrast to "individual" capacity where students work collaboratively using creative thinking and creative problem solving. As creativity is a central part of science it is particularly important for teachers and pre-service teachers to pursue practices that will cultivate creativity in their science and technology lessons.

Fostering Creativity by the use of Second Life

If we look at creative industries in the 21st century such as "the Internet, computer consumer technology, design and video gaming" the virtual world (VW) experience contains all of these industries in some way (Larach & Cabra, 2010, p. 168). Larach and Cabra stated that "remote creative endeavours" need to occur in meaningful places or spaces and they believed that VWs are most appropriate technologies to create such spaces. Therefore one of the ways in which creativity might be addressed in pre-service teacher education is through the use of VWs for teaching and learning experiences. The use of VWs such as Second Life (SL) have become increasingly popular in higher education (Warburton, 2009) and provide an environment in which students can participate in teaching and learning activities where there is no predetermined "narrative or plot-driven story line unless one is created or built" (Warburton, 2009, p. 416). Many factors in the VW have the potential to foster processes that demonstrate creative thinking and creativity. These factors include: the profound immersive nature, the extensive modes of communication and the ability to create content and shape the experience in an "almost infinite number of ways" (Warburton, 2009, p. 416). In a small study where a digital creative problem-solving process was facilitated in VWs with IBM associates, the findings suggested that VWs were a superior medium for remote creative collaborations to any other synchronous platform that the participants had experienced (Larach & Cabra, 2010, p. 175). The use of VWs in science and technology education is one way to engage children and provide an opportunity to foster creativity in science. A study in New York City (Turkay, 2010) involved students taking part in a project (science through Second Life) where science lessons in secondary classes were conducted in Second Life over a period of nineteen weeks. During these lessons the students investigated existing ecological problems with "real life data" using a constructivist and collaborative approach where they assumed the role of scientists. One of the units in the project involved fitting out empty houses using sustainable principles. In order to take part in these activities the students used collaborative creative thinking to solve problems and create sustainable environments. Analysis of data revealed the following results: after taking part in the program 14/19 students' interest in science increased; the number of students who were interested in undertaking science, technology, engineering or mathematics careers increased; the students revealed a greater understanding of how scientists work; and the students' self-

confidence in their ability to do science increased. This increase in self-confidence is highlighted by a quote from a student in the study

> …*One thing I learned about science in Second Life is that science is really not that hard. I always thought, "I can't do this," but now I have learned so much. I learned about sustainability and how I can help to make our earth better. I never knew I was this smart…* (Turkay, 2010, p. 252).

Furthermore the following quotes demonstrate the enjoyment experienced by the students during the project:

> *I did not like science before I did this course. I wish I could have Second Life in each class. This is the most amazing thing that I've experienced in high school so far."*
> *"IT WAS REALLY FUN!!!! I enjoyed building a solar/ hybrid car for my project and I enjoyed making a billboard. I would recommend this style of learning for any subject because it keeps us (students) pushing because we are using a game for learning."*(Turkay, 2010, p. 252)

It is important to be aware of the findings of studies looking at the implementation of constructivist strategies and collaborative practices where students solve problems in ordinary classrooms settings, such as Lee & Erdogan's study in 2007 that revealed an increase in students' interest in, motivation towards, and creativity in science. However by using VWs, in addition to first hand experiences in the classroom, students could test boundaries and have the potential to experiment with objects and visit spaces that would be difficult or impossible to do in a real life classroom (such as: the freedom for students design and carry out experiments that would be dangerous in the classroom, teleporting across the world and collaborating with students from other countries in the same space, or experiencing space travel).

Visual Arts Education and Science Education in Virtual Worlds

The disciplines of visual arts and science are well represented in VWs. Art galleries, artist's spaces and simulations such as the Sistine Chapel are recognised and established in Second Life. Environments created in Second Life such as the Exploratorium, Genome Island, the NOAA, International Space Flight Museum, CaltTech's Jet Propulsion Lab, University of Denver's Science School and NASA all provide science experiences. McConaghy (2011) maintains a list that currently contains 92 science related sims in Second Life. However a review of the literature reveals a limited use of VWs for pre-service teacher education in visual arts and science education.

The International Art Education Association (http://www.inaea.org/) meet regularly in Second Life bringing together approximately 190 members across all art forms. Lu (2008a, 2008b, 2009), conducted research on VWs, art and education and created a space in Second Life called Art Café where art students can meet and exhibit their work. Liao and Wang (2010) were using Second Life in their visual culture and art courses to establish links between the makers of the art and those that critique it. Similarly Grenfell (2010) was using Second Life to create authentic learning by connecting students across the disciplines of

visual arts and public relations. The University of Western Australia in Second Life (http://slurl.com/secondlife/University%20of%20WA/118/15/28) has an impressive collection of VW art and design. This university hosts an *Art Challenge* that in the first year attracted 841 entries, including 72 architectural entries and a *Machinima* competition that in 2011 had 50 entries from 16 countries.

Science educators are using a variety of VWs with primary and high school students. These VWs include: Quest Atlantis (Barab et al, 2005), River City (Cram, 2010), Virtual Singapura (Jacobson et al, 2010) and Second Life (Turkay, 2010; Cooper et al, 2009). Research is emerging that supports the effectiveness of VWs in increasing motivation and engagement in science education (Cram et al, 2010).

There is an increasing number of studies reflecting on the use of VWs in education (Albion & McKeown, 2010; Gregory et al, 2010; Kirriemuir, 2007; Messinger, Stroulia & Lyons, 2008; Moschini, 2010; Warburton, 2009) but there is not a large amount of literature specifically relating to the use of VWs in pre-service teacher education. The studies that have been presented tend to focus on describing case studies and reflecting on the process of the lecturer and students (Campbell, 2009; Cheong, Yun, & Chollins, 2009; Gregory & Masters, 2010; Thomas & Brown, 2009). The examples, in the literature, of VWs in visual arts and/or science and technology pre-service teacher education are more difficult to find. Zagami (2008, 2010) and Grenfell (2008, 2010) were using Second Life in creative arts courses undertaken by students studying to be primary school teachers in Australia. There is a lack of documented use of VWs in science and technology education for pre-service teachers.

Background

The reflections and observations of staff and students in two pre-service teacher courses at a regional university in Australia provide some insight into the potential that VWs can have in facilitating creative thinking and creativity. The two courses have been chosen for comparison because of their identification as inherently perceived as creative (visual arts) and non creative (science and technology) courses. They are comparable in the nature in which the VW was introduced and the response that the pre-service teachers had towards the use of VWs. Students in both of the courses were not being assessed by the activities they were undertaking in the VW and hence had little extrinsic motivation to participate.

Second Life was utilized in 2010 as part of the delivery of the curriculum specialisation: visual arts 1 course for students studying to become secondary school teachers and Second Life was used in 2011 to introduce the design process in the science and technology foundations course for students studying to become early childhood and primary school teachers. By incorporating Second Life into these education courses it provided an opportunity for the tutors to reflect on their own and their students' experiences during the implementation of a VW. The cases outlined in this paper did not involve formal research as such but the reflections provide some interesting information highlighting some of the difficulties together with the rich opportunities to foster creativity and student engagement with the use of the VW technology.

The Use of Second Life in Science and Technology Foundations

The process of engaging in technology and design activities requires "a certain level of creativity" and imagination (Fleer & Jane, 2011, p. 89). Incorporating the design process into science lessons is one way to enhance creativity in the science classroom. A study looking at the involvement of primary school students in a sustainable project where students created solar village models was found to promote creative thinking and stimulate interest in science (Hugerat et al, 2004).

As part of the science and technology foundations course the pre-service primary and early childhood teachers were introduced to the design process where they were given the opportunity to design and build a model of a sustainable building or infrastructure; an activity that could be readily adapted for the science and technology classroom. The students were required to work through the stages of the design process, explore the science of sustainable practices (including: passive solar design, renewable energy sources, avoidance of land clearing, decreasing contamination by toxic building waste, awareness of storm water runoff, recycling where possible and planting, and landscaping management techniques to provide wildlife habitat), devise a design statement and a design sketch, and produce and evaluate their sustainable project models. Participating in the design process encouraged the students to use "imaginative and lateral thinking" to design and build their buildings or infrastructure (NSW Board of Studies, 1993, p. 23) and to propose 'alternative innovative solutions' to meet their design objectives for their project and to minimize the impact of the building or infrastructure on the environment. This sustainable design project incorporated into the science and technology course presented an opportunity to integrate the use of Second Life.

Students from three geographically distant campuses were given the choice of attending two weeks of tutorials in Second Life and 16 students volunteered which translated into four groups. As the computer laboratories were unable to be utilized simultaneously across the different campuses, the groups were conducted at different times. The tutor was physically located at one of the campuses and worked with two groups face to face in the computer laboratories–but worked entirely remotely through Second Life with the other two groups. She observed that instructing through her avatar in Second Life resulted in the students solving many of their own problems and sharing solutions collaboratively or through applying their prior knowledge of other similar technologies. One student commented in her reflective presentation:

> … *by being able to explore at my own pace and in my own time I was able to develop knowledge and therefore increase the level of creativity that I could apply in this virtual setting.*

Prior to commencing the Second Life tutorials the tutor sought to create an environment in order to facilitate the students' capacity to understand the design process, design a sustainable design project and build their product. She set the scene by populating the learning space in Second Life with an eco house, bicycles, cows, vegetables, signage, project instructions, a 3D representation of the design process and a variety of 'eco objects' that the students could obtain without cost. These free objects including water tanks, solar panels, fruit, vegetables and building textures were the equivalent to the materials provided to the

students in the RL tutorials for the building of their sustainable models. The tutor was aware that two weeks was a very limited time period for the students to move from novice Second Life users to builders. To facilitate the process she designed a building game in which students could play with the basic concepts of moving objects in 3D without the stress of building for assessment purposes. She also gave each student some linden dollars (Second Life currency) so that the students could buy objects for their build.

The students began their first tutorial inside the eco house where there were a number of resources; such as: a slide show of images from the RL lecture showing sustainable design projects, a slide show of text outlining the design process, a diagram of the design process, and two drawings by primary school children engaged in the design process. The first step was to orientate the students to the design process and foster an awareness of the need to engage in this process while designing their sustainable design project. Before undertaking building the students were required to develop a design statement and a design sketch. While seated in the eco house the students collaboratively brainstormed their ideas about sustainable design, exploring the science of sustainable building practices and what they sought to produce. They used creative thinking and problem solving to formulate a design brief. The use of the chat function, instead of speaking allowed all students to type ideas simultaneously. The chat text was subsequently copied to a 'Google doc' that provided a record of the students' collective thoughts. The students were then able to refine the design brief both 'in world' and at a later date on the 'Google doc'. Students were also provided with the opportunity during this tutorial to change their avatar's appearance, explore the building game and play with objects such as the bicycle. All of these activities assisted the students in developing confidence in the use of Second Life through exploration and play while maintaining a focus on the sustainable design experience.

During the tutorials conducted in the second week the students produced and evaluated their final design products (this meant building their sustainable design project within a two hour period). One of the groups spent time prior to the tutorial practicing building and buying objects to add to the overall product. This group created what appeared to be a cohesive looking product satisfying all of the design criteria (see figure 1 & 2). The remaining three groups demonstrated various levels of skill but all successfully completed the task and created a 3D sustainable design product. One of the affordances of Second Life is the ability to buy pre-made objects. The students who had limited building skills were able to create an environment that looked complete and demonstrated their use of the design process by choosing and placing pre-made objects such as rain water tanks, solar panels, compost bins, vegetables, animals and building. One group reflected in their design statement that:

We took advantage of the Second Life environment and designed the building in the sky to maximise the density of housing and reduce our footprint. Our group discovered that building together required a great deal of problem solving and team work.

Figure 1. The Strawberry Farm built in Second Life by one of the groups in science and technology as part of the sustainable design project. The clear domes bring natural light into the growing areas and the solar panelled walls provide power to the controlled growing environment.
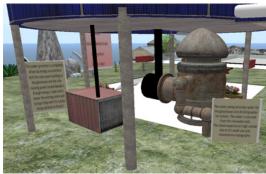

Figure 2. Underneath the Strawberry Farm objects purchased on the market place are added to the main building with signs describing their use in sustainable farm practices.

The group members who appeared to be the most successful in their level of building competence in Second Life and their own perceived level of success, engaged in the planning, organising, self-monitoring and self-evaluation to a very high level. While these students were required to only participate in Second Life in two, two hour sessions, this group chose to spend extra time particularly in the planning phase. The comment below from a student from this group demonstrates their commitment to planning and hence utilising the design process.

We looked at where we would build, the impact on the immediate and wider environment, sustainable practices and any cultural or religious implications. By considering our design potential and the limitations associated with the actual build my team mates and I were ready to proceed to the producing phase.

Furthermore, one student from this group created a slide presentation where she discussed and reflected on the process and the value to her teaching practice. Another student in this group chose to make a number of Machinimas (videos produced using screen recording software) to demonstrate how he had made the design project as well as an introduction to the University's Second Life Island (Milward, 2011). The synchronous, persistent nature of Second Life allowed the tutor and students to provide assistance and share ideas using an informal and collaborative approach across a number of locations. One of the students in particular (from the group discussed previously) became highly skilled at building and mentored other students in Second Life thus honing his teaching practice. A number of students from the Second Life groups commented on how they enjoyed this collaborative approach where they were able to get to know students who were on other campuses. In their design statement one group reflected:

We are all in agreement that it has been a fantastic experience and really emphasised the power of collaborative learning through all stages of the project. We had never worked together as group before but quickly recognised our strengths, were willing to listen to each other and discuss strategies and prepared to put in the extra hours to enable us to create the best possible result within the time frame. It was also discovered, through the learning journey, that this project's educational implications linked many of the KLAs.

The Real Life and Second Life Science and Technology Tutorials

The majority of students (198 students; 43 groups) undertook this course in RL tutorials. They worked through the same stages of the design process as the Second Life students. During the producing stage they were required to manipulate recycled, natural and manufactured materials: such as: cardboard, paddle pop sticks, pipe cleaners, cottonwool, fabrics, wire, pebbles and plant materials resulting in the production of a three dimensional model. Two very creative and innovative structures which were original in nature stood out amongst the RL projects, one was a theme park constructed inside a volcano to make use of geothermal energy and the second a house built above a river using a range of alternative energy sources including hydropower and energy harnessed from lightning. There were other projects that differed considerably from the majority these included a tree house; an underground house; and a hydroponics set up utilising wind power. However the majority of the 43 RL groups (198 students) created buildings that were similar to buildings they were familiar with in RL; such as: rectangular structures with traditional pitched or flat roofs with solar panels, and/or wind generators, water tanks, compost bins and vegetable patches. In contrast the four Second Life groups (16 students) mostly created round buildings with textures, that while not yet available in RL, they imagined as potentially sustainable building materials of the future such as solar cladding (walls made completely of solar panels) as shown in the *Strawberry Farm* in figure 1. One of the buildings was suspended in the sky while another hovered above the land to protect it from potential Tsunamis and a third was constructed on the roof of an art gallery and the fourth was a "kid's camp" situated beside the water. In Second Life it was possible to change the textures as the students progressed with their construction, for example, the walls could be made transparent to provide extra light. All students whether in RL or Second Life worked collaboratively and used creative thinking, imagination and problem solving to construct their buildings and were encouraged to critically reflect and evaluate their efforts throughout the process. A student from a Second Life group commented on his enjoyment of building without the limitations of gravity and how his group needed to use lateral thinking to manipulate the 3D objects in Second Life in order to achieve their objectives. In Second Life it was possible to design and build a structure, which allowed the students (as avatars) to walk into, around and experience within the Second Life environment, providing them with a different dimension for evaluation of their structures (actually experiencing being in the building).

In the third week of the topic as part of the evaluation of the design process, the students (in Second Life and RL tutorials) created videos and power point presentations to enable all students to view and peer evaluate their work across campuses during the lectures (presented across campuses via video link). Although the students enjoyed viewing and evaluating all of the projects, both in RL and Second Life, and recognized the value of the design and make activity in general as a creative activity, some students, who did not participate in the Second Life activity, commented informally on how they were impressed by the outstanding creative, innovative and unique structures that were evident in the Second Life projects.

The Use of Second Life in Curriculum Specialisation: Visual Arts 1

Prior to 2010 the curriculum specialization: visual art 1 course was delivered in face-to-face weekly tutorials across three campuses over ten weeks. The expected outcomes of this course was to prepare students to teach visual arts to secondary school students in years 7-10 (students aged 12-15) with an emphasis on understanding the NSW Years 7 to 10 Visual Arts syllabus (NSW Board of Studies, 2003). The students spent time each week discussing aspects of the NSW Visual Arts syllabus and how to meet the outcomes in the classroom through unit and lesson planning. The redesign of this course to include Second Life was developed with a belief that the students would be encountering a VW as an educational tool for the first time. Because of this, the level of compulsory interaction in the VW was restricted to four tutorial sessions and a number of informal sessions planned to be similar to consultation times in RL. The students were required to meet in Second Life at the same time regardless of their physical location thus bringing together students from three separate campuses. Students were free to meet at other times 'in world' and some students chose to use the VW on weekends and after hours. It was the tutor's belief that visual arts students would find the highly visual environment of the VW both stimulating and easy to use. As the course progressed it became clear that some students' level of interest in the VW was not enough to inspire them to continue as VW users.

The first tutorial was an introduction and exploration of the VW with the students having an opportunity to familiarise themselves with some of the tools for navigation and communication. The second VW tutorial was designed to be in a 'traditional' tutorial format based on discussion directed primarily by the tutor. The initial premise for using the VW was to introduce the students to the potential of this technology for visual arts teaching and to bring the student cohort together from all three campuses. This tutorial began in the 'sandbox' (a place where anyone can build virtual objects - in other parts of the VW only the owners of that island can position or build things). The sandbox was used so the tutor could control the resources without relying on the island owner to upload slides into one of the predesignated lecture spaces. The sandbox area on the University's Second Life island is a simulation of a grassy playing field. The feedback from some students was that it made it more engaging as they were situated somewhere other than a lecture theatre.

On entering Second Life for the third tutorial, students were provided with a note card allocating groups and asking them to find their place on the sandbox. Four painting easels had been placed at different parts of the sandbox so that each allocated group could congregate at a distance from each other. These easels provided two more note cards: one with instructions and one with a step-by-step 'how to'. The students were asked to create their own note card detailing the lesson ideas they had been developing as part of their first assessment task and subsequently talking to each other about these ideas. It was a simple replication of what might occur in a face-to-face tutorial. In this case the tutor and the students endeavoured to find the balance between what they understood to be a teaching and learning activity and what it was to be immersed in a VW. Some students continued to experience technical difficulties, and while some were seeking to overcome these issues, equally some students 'gave up' with little effort. One of the students commented, via email, after the tutorial that:

... this was the first time I managed to attend, so interesting. A lot of time spent on technical difficulties, particularly hearing properly, which causes a bit of chaos. Is it the world, the connection or me causing the problem? Potentially this is a great way to attend tutes and learn computer skills as well as teaching art skills.

The final of the four tutorials was designed to be similar to a practical face-to-face art session using the VW for creating and displaying art works. The students were given instructions via a note card that they received when they initially 'logged in' to Second Life for the tutorial. They were given a series of tasks including: uploading an image, placing it on an object, building an exhibition space and displaying their work. The students who had been visiting the VW in their own time were at a stage where they could competently complete the tasks and develop ways to improve their building skills. During this tutorial the students were at their most active and enthusiastically experimented with objects and textures while offering each other assistance and advice.

Comparison between Visual Arts and Science and Technology

By comparing the visual arts education Second Life experience with that of the science and technology education Second Life experience it is possible to reflect on some of the processes that fostered creativity. Jackson (2008, p. 29) found in his study of creativity in Higher Education that there were a number of processes and behaviours that fostered creativity. Underpining them was the demonstration by the student that they were self regulated and self motivated learners. The visual arts students were required to do very little planning, organising, self-monitoring or self-evaluation in the VW environment. They were expected to experience the VW in a similar way to how they might experience a tutorial in RL. The main difference was that students were gathered in the VW from separate locations to RL. The VW activities were designed to be student centred but the students appeared to be constantly seeking guidance from the teacher as they attempted to manipulate the VW environment.

An important difference between the two cohorts was the self motivation in relation to engaging with Second Life. The science and technology students were all volunteers but the visual arts students were required to attend a minimum of four sessions in Second Life. The visual art education students did not appear to be intrinsically motivated to engage in the VW unless they had experienced VW previously or recognised that their future students may find the VW engaging. Whereas the science and technology students volunteered to work in Second Life and appeared to have high levels of intrinsic self motivation in relation to their learning. They were willing to take the 'risk' and try this new experience. Reasons given by these students for taking part in the Second Life design project sessions ranged from a desire to try something different to having already observed children use VWs and deciding that they '*needed to know more about these technologies.*'

The activity in the VW that most engaged the visual arts education students was the building of an art space and uploading and displaying their own work. In designing the course the tutor believed that the students would perceive this activity as play, and not learning, as it had no explicit connection to how to be a visual arts teacher. However the

students expressed the highest level of satisfaction in the time they spent creating. They believed they were in their domain as makers and doers of the creative process as artists. One of the visual arts students commented that she felt that using Second Life *encouraged us to think outside the box and to get out of our comfort zone to explore other ways of investigating art.'* Some students who did appreciate the usefulness of this technology and overcame any 'ease of use' issues, progressed to design a number of interesting and creative lesson plans for using VWs in the visual arts classroom.

Conclusion

These initial experiences in the use of VWs in the pre-service teacher education courses have been extremely informative for the tutors in relation to developing learning experiences that enhance general capabilities such as creativity and creative thinking. Importantly a number of factors were discovered that facilitate the engagement of students in relation to the use of VWs. Firstly the science and technology students who chose to be involved in VW appeared to be more engaged in the process than the visual arts students. Students in the science and technology tutorials were all volunteers who entered the VW knowing that it was only a small part of their course work and that they were not expected to spend more time with this tutorial than the allocated tutorial times. In contrast the visual arts students were required to attend tutorials in the VW. Secondly the level of technical support, to help develop student confidence in the VW, is very important. The visual arts students when attending whole class tutorials of 20 students, were competing for the one tutor's ability to support them technically in the computer lab and 'in-world'. The science and technology students were in smaller groups in the VW and met the tutor at times convenient to them where assistance by the tutor was easily facilitated thus technology problems did not appear to be such a limiting issue with these students. A number of aspects were observed in this study that facilitated creativity with these students. While visual arts is by its very nature a creative part of the curriculum the use of the VW was not taken up with the same level of enthusiasm by all of these students. The students who did find it useful and easy to use went on to be very creative in terms of how they used the space and how they imagined its use in the classroom. In contrast the science and technology course, that perhaps is not perceived by the students as a creative learning course, engaged the students in creative ways including undertaking the design process, the link with the science of sustainability and using creative thinking to look at alternative innovative outcomes, the products they built and the evaluations they made where they applied critical thinking. Many of the students who chose to work in the VW for the science and technology project were prepared to spend extra time in the VW and solve a range of problems that arose as they worked on their projects. Some of these students commented on their appreciation of the freedom of working in an environment where they could create without the restrictions of RL such as gravity, availability of materials and adequate space (for example: building in the sky). They also appeared to appreciate the collaborative nature of working in Second Life and having the immersive experience (via their avatars) of walking through their creations. This experience particularly for the pre-service science and technology teachers, did highlight for them (and their peers who viewed their work in Second Life) the potential of the use of VW in their future classrooms to enhance creativity, particularly in the science and technology classroom where students could work collaboratively to solve problems such as those

relating to the built environments, or with other science topics involving designing and making activities and/or carrying scientific investigations in a VW.

A number of other considerations need to be taken into account when looking at these observations; such as: the experience of the tutor with the VW technology (where the tutor was more experienced with this technology when working with the science and technology students), the different general nature of the tutorial experiences for the secondary and primary pre-service teachers in different subject areas and the problems associated with the technology in terms of Internet access and computer hardware.

The Second Life experiences outlined in this paper suggest VW technologies hold significant potential for teaching and learning in pre-service teacher education courses and warrant further research. As this paper consisted of reflections of a small number of tutorials for pre-service teachers undertaken in a VW, it would be unwise to generalise from these experiences. However a research project involving the collection of data through observations and interviews, relating to Second Life, is proposed for the future involving pre-service teachers in the same regional university.

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Regarding preservation of nuance:
Virtually impossible human bodies

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Abstract. Understanding and simulating human movement is critical to pedagogy in fields such as dance, theatre, fashion, industrial and medical design, and animation which is now broadly applied in both art and science. Promising advances in movement analysis (motion-capture, eye-tracking, 3D and high-definition digital image capture, and the pressure-plate sensor technology used in sports science and Wii games) are rapidly replacing the perceptual and technical skills of traditional art practice and pedagogy. However, is an eager and perhaps premature reliance on this new technology diminishing our ability to understand and depict the nuances of convincing, naturalistic gesture? As practitioners increasingly rely on computer models with decreasing movement-analysis training to scrutinize them, we face potential loss of the highly specialized pedagogic skills required for identifying, creating and teaching solutions regarding human movement and gesture. This paper introduces five years of movement-analysis research funded by Leverhulme Trust and AHRC research fellowships that merges traditional skills with advanced technology for learning and teaching perception of human movement.

Keywords: Human movement analysis, depiction, highly skilled practitioner.

Introduction

Understanding and simulating human movement is critical to pedagogy in fields such as dance, theatre, fashion, industrial and medical design and animation which is now broadly applied in both art and science. Promising advances in movement analysis - such as motion-capture, eye-tracking, 3D and high-definition digital image capture, and pressure-plate sensor technology used in sports science and Wii games - are rapidly replacing the perceptual and technical skills of traditional art practice and pedagogy. However, is an eager and perhaps premature reliance on this new technology diminishing our ability to understand and depict the nuances of convincing, naturalistic gesture?

For example, motion-capture is a precise tool with the potential to become a valuable pedagogic movement-analysis resource, however much of the accompanying systemic animation software is very substandard when applied to complicated human movement, and systemically difficult to rectify (such as the skeleton model in Figure 1). Such inaccurate and poorly proportioned models provided within the most current and sophisticated motion-capture systems are presented, and often accepted as accurate, even within advanced scientific research and application (Head, 2007).

Training in computer animation has the tendency to develop expertise in the technology used for movement analysis but not the underlying movement perception. Lack of training in the subtlety of movement coupled with general acceptance of substandard models can contribute to a visual culture of deficient movement and synthetic form (Head, 2007). This fundamental disconnection from the skills to perceive, simulate and scrutinise nuanced movement is likely to increase with each generation of learning and teaching. How can pedagogic integration of traditional movement-analysis methodology help to monitor and enhance the quality and application of these new tools that we are so eager to embrace?
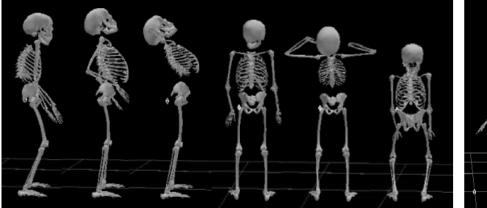

Figure 1. Standard motion capture skeleton model

Acceptance of the inaccuracy and distortion of movement-analysis technology is pervasive in the entertainment industries. The movement required to win Wii sport games can have little resemblance to the sports that they emulate, often teaching models of poor technique and practice required for the game and offering little to prepare for mastering these skills. The most popular animated films feature aliens, robots, animals, fish and toys instead of humans – we can relate to *Toy Story's* 'Woody' but not to the 'real boy' because we have considerably lower expectations of the animated movements of a ragdoll. When a human *is* portrayed, the natural proportion and nuanced movement is frequently replaced by awkward, simplistic, infantile cartoon characters such as *The Simpsons* or *South Park*, or the distorted, robotic, fetishistic avatars such as those featured in *Second Life* (Figure 2).
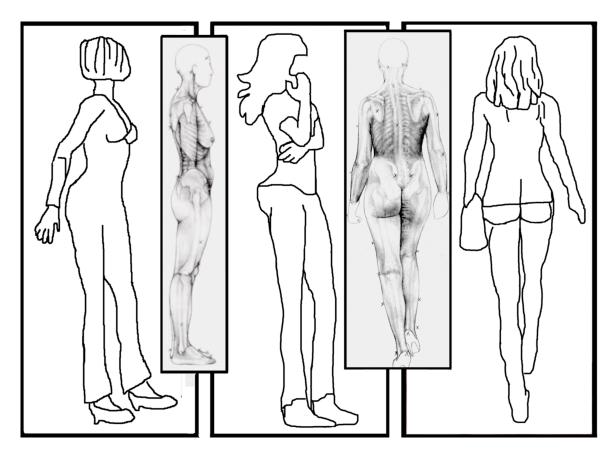
**Figure 2. Traced outlines of avatars from *Second Life* – inserts are
normally proportioned bodies in scale for comparison).**

The sociological implication that such robotic, fetishistic characters represent vehicles for emotional enhancement - in superficial virtual environments presented as replacements for a 'place to connect' in the physical world - is addressed by Stanford University Professor Robert Harrison in an article in *The Washington Post* in 2010, 'Farewell, Natural World'. Harrison states, "… all the evolving devices and apps draw [students] into their blinkered personal realms…. This retreat from the natural world is most evident in the young, but it is not a generational phenomenon. Instead the ubiquity of the computer is changing the very essence of the human animal" (Higgins, 2010; Harrison, 2008).

An article in *The Independent* in July entitled *The Brain Drain* states; "Research recently published by scholars from the University College London suggests that we may well be in the midst of a sea change in the way we think…." (Carr, 2008). Such research suggests that prolonged and constant reliance on computer technology and use of virtual environments has caused our thinking to take on a "staccato quality". We "now expect to take in information the way the net distributes it: in a swiftly moving stream of particles … chipping away the capacity for concentration and contemplation" (Carr, 2008).

This lack of perceptual fluidity is particularly disruptive to accessing the liminal state often associated with the ability to understand and simulate the subtleties of human form with ease and assurance (Tchalenko, 2007). In my experience, as students increasingly struggle to access and sustain focus to understand and simulate figural movement, they also tend to

lose the ability to scrutinise it. If 'the process of thought' is being shaped into perception with less fluidity, it stands to reason that the critical ability to perceive, simulate and scrutinise fluidity of figural movement is likely to decrease with each generation of learning and teaching. As the media theorist Marshall McLuhan pointed out in the 1960's, media are not just passive channels of information – they supply the stuff of thought, but they also shape the process of thought (Carr, 2008). As practitioners increasingly rely on computer models with decreasing movement-analysis training to scrutinize them, we face potential loss of the highly specialized skills required for identifying, creating, teaching and applying solutions regarding human movement and gesture.

Such disconnection from the real world and immersion into virtual environments can have broad psychological implications about body image. For example, early and long-term exposure to the distorted representations of virtual characters has the potential to contribute to a 'virtual dysmorphia' (Ohrbach, 2009), particularly when such distorted models are so prevalent in virtual environments (such as the characters from *Second Life* depicted in Figure 2) and prepubescent games that re/present such models as idealised bodies such as in Figure 3, which features the outline of a games avatar epitomised as a 'beauty queen' in an article in the *Evening Standard* (Littlejohn, 2004). The insert in Figure 3 shows the normal proportions for that body type.
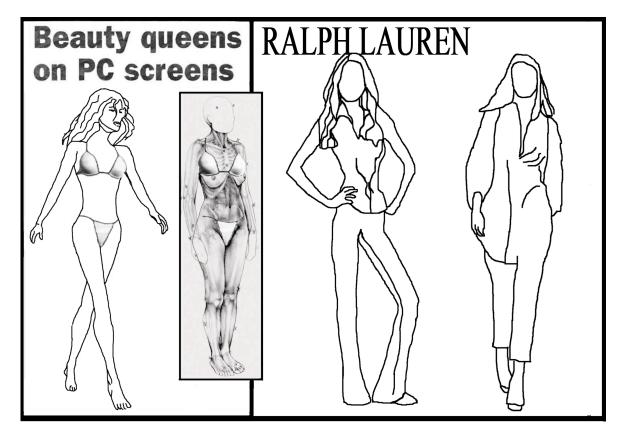

Figure 3. Image of a popular games avatar and 'doctored' image of a Ralph Lauren model next to an unaltered image of that same model on the right.
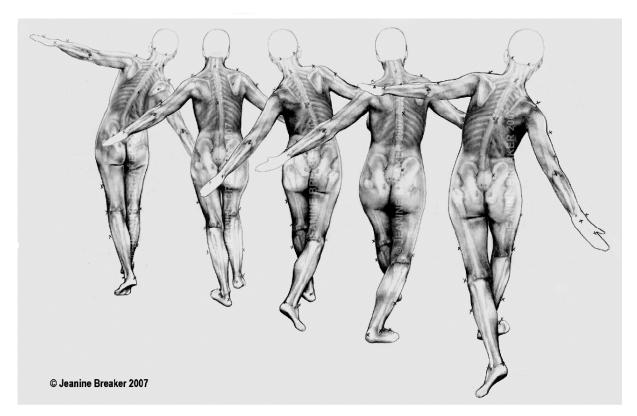
This pervasive virtual body distortion serves to escalate the interminable body dysmorphia already presented by the fashion industry since Twiggy appeared in the 1960's. The advertisement pictured in Figure 3 depicts a 'doctored' image of a Ralph Lauren model next to an unaltered image of the same model, who was "sacked for being overweight" although her weight (UK size 4, US size 8) remained constant during the eight years as a model for the iconic American brand. The emaciated 'doctored' body, with hips as narrow as her head, could make young women 'think that it's normal to look like that - and it's not' (Littlejohn, 2009). Such boneless, emaciated models presented as the norm, if not 'the ideal' help contribute to the pervasive body dysmorphia in the media as well as in virtual environments. Research conducted by the National Institute of Child Health and Human Development states; "Relying on the media to provide adequate information or norms may be akin to letting young adolescent girls hang out with sexually active girls and boys who do not have the best interests of their younger peers in mind" (Brown; Tucker; Halpern; L'Engle, 2004).

Yet, experts such as psychotherapist and psychoanalyst Dr. Susan Ohrbach assure us that such extreme body dysmorphia - "a look that only ten years ago had the power to evoke horror in us … is not the only possible outcome of a digital and hyper-saturated image culture. The very tools that have given rise to a narrowing aesthetic could be redeployed to include the wide variety of bodies people actually have…. Indeed it may benefit these same industries to celebrate diversity and variety and to make it their ethical aim to transform the body distress so many experience today" (Ohrbach, 2009).

Instead of avoiding depiction of the human form - or accepting, even embracing substandard human characters that prematurely sexualise children and infantilize adult audiences - we need to look to new resources that rectify systemic weaknesses in the movement analysis technology upon which we have come to rely.

Movement Analysis Research

This section introduces five years of movement analysis research (Breaker, 2007) motivated by thirty years of visual art pedagogy focused on the anatomy of human movement. The core of this research focused on fusion of new technology with traditional tools - with the aim to create new resources that enhance movement analysis and simulation of the human body. A series of visually 'transparent' sequential key-frame drawings (Figure 4) were created to reveal the anatomy of human movement. These 'keyframes, or selected moments in a movement stream, were based on a Muybridge-style movement sequences and were selected to articulate extreme moments of balance negotiation to reveal anatomical specificity during, and between, these critical temporal moments. These '*moving*drawings' illustrate the nuances of skeletal movement and placement below the skin at key anatomical landmarks.

Figure 4. 'Transparent' key-frame drawings of a walk sequence, by Jeanine Breaker.

Research Methodology

A nude model was simultaneously filmed with video and motion-capture. Motion-capture analyses each movement in three dimensions by interpretation of a series of reflective markers. The filming was conducted at *Vicon* and *AudioMotion*, the largest motion-capture production companies in the UK and Europe, neither of whom was aware of research that used video and motion-capture to film a nude model, as most motion-capture systems require the subject to wear a sensor-embedded bodysuit (Vicon, 2005). Thirty-three markers were attached by a biomechanist onto specific landmarks of the model's body using the *Vicon IQ* motion-capture system - in our case each marker was taped directly onto the model's skin with wig-tape (Figure 5).
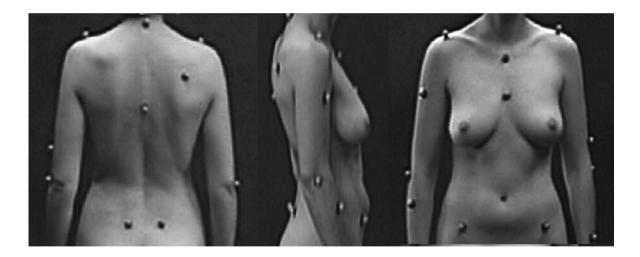
Figure 5. Reflective motion-capture sensor markers attached to a model with wigtape.

The data was then transferred to a 'Polygon' software program to enable analysis of the movement from the marker placement and anthropometric data. As depicted in Figure 1, a very crude virtual skeleton is generated from the standard Polygon software program. The incomplete and inaccurate Polygon skeleton causes great difficulty in adapting it to images of the corresponding film of the subject.

After much experimentation to adapt a range of existing virtual skeleton models (Sudbrack, 2005), collaborative research with Andreas Rohr at the Filmakademie Baden-Württemberg in Ludwigsburg, Germany resulted in a greatly improved virtual skeleton to be used with the motion-capture data (Rohr, 2006). Rohr developed a computer animation plug-in that generates exact digital bone replication from full body MRI-scans of any live model. A full body MRI-scan was created of the model filmed for the research project, outputted in one thousand micro-thin computer generated images. An exact digital virtual replica skeleton was derived from the filmed model's MRI-scan data, which was depicted in a one-hundred-frame turntable (Figure 6.)

Figure 6. One frame of the virtual replica skeleton created from full-body MRI scans.

A bespoke rig was then meticulously fitted to this virtual replica skeleton through which to drive its movements (using *MotionBuilder* software), and integrated with the motion-capture data of the filmed motion sequences. Composites of the replica skeleton and the simultaneously captured video footage were produced into animated movies of the filmed

model's movements. A series of stills from the video/skeleton overlay movies was imported from each selected movement sequences (stills from three composite films are pictured in Figure 7). These composites provide anatomical accuracy derived directly from the subject enabling much more precise movement simulation than that of the crude Polygon skeleton.
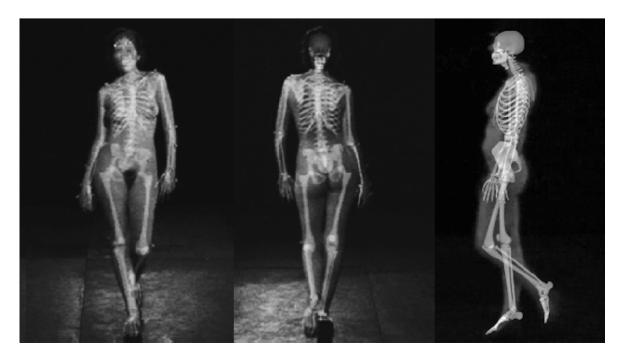

Figure 7. Composites of replica skeleton and simultaneously captured video footage.

In spite of the improved anatomy of the replica skeleton, the subtlety of movement would have been greatly compromised had the image integration relied solely upon current motion-capture technology and the limitations of existing software to accommodate the rig that drives the skeleton. As a result, synchronization of the model's virtual replica skeleton with her simultaneously captured video footage required manual manipulation of the rig by the designer of the plug-in. To accommodate for the potentially subtle, naturalistic movement of our replica skeleton, new motion-capture and/or rig animation software would need to be designed. This represents only one example of the shortcomings of current movement-analysis technology.

The composite stills were used as sources to produce a series of key-frame drawings that describe the anatomy of the model's movement (see Figure 5). The hand-drawn key-frame drawings were animated to describe nuances of basic movements such as bending, reaching, twisting, turning, sitting and walking. The walk sequences were selected as examples of extremity of torso action and axial balance during locomotion. Torso movement during a fast-paced natural gait is generally too subtle for easy detection and the anatomical structure of weight shift in the torso would be difficult for the viewer to decipher, whereas an exaggerated walk sequence (such as the sequence depicted in Figure 5) visually clarifies the manner in which the body's weight redistributes to maintain balance during locomotion.

The benefit of these edited, 'transparent' drawings over the video/skeleton overlay movies is that they describe precise movement of the skeleton at key anatomical landmarks as though seen through the skin without one layer obscuring another.

Conclusion

Depiction and simulation of the human body in the future will undoubtedly be tied with new technology, however new technology never remains new. In fact, as art borrows technology from science, the subtlety, if not the integrity of the craft that it is replacing, can easily be lost. Rapid advances in technology literally at our fingertips often seduce us to narrow our expertise as it deepens. Yet the very tools that have given rise to a narrowing aesthetic could be redeployed to utilise the cumulative knowledge required to preserve centuries of highly skilled practice and pedagogy for nuanced human movement analysis.

Keeping abreast of the plethora of new technology can prevent us from allowing our minds to wander outside of a software program, to feel the curiosity and invention that comes from the 'still time' to think deeply. Yet the practice of practice - unfettered critical assessment and skill - need not be a struggle with the limitations of a computer program. If our tools are not allowed to overbear, if we negotiate with our medium and not be dominated by it, free of an addiction to the keyboard, these tools, whether old or new, simple or sophisticated, can serve the process of creativity and invention, not the reverse.

If we can de-mystify our new tools and not feel threatened by sophisticated use of old ones, learning will be a cumulative process. To elaborate on a John Ruskin quote, if we can balance 'the head, the heart, and the hand' to make work with care and intelligence in a way that need not disavow the past, we can carry its wisdom forward (Ruskin, 1857).

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Using Massively Multiplayer Online Role Playing Games (MMORPGs) to Support Second Language Learning: Action Research in the Real and Virtual World

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Abstract. Massively Multiplayer Online Role Playing Games (MMORPGs) create large virtual communities. Online gaming shows potential not just for entertaining, but also for education. The aim of this research project is to investigate the use of commercial MMORPGs to support second language teaching. MMORPGs offer a digital safe space in which students can communicate by using their target language with global players. This qualitative research based on ethnography and action research investigates the students' experiences of language learning and performing while they play in the MMORPGs. Research was conducted in both the 'real' and 'virtual' worlds. In the real world the researcher observes the interaction with the MMORPGs by the students through actual discussion, and screen video captures while they are playing. In the virtual world, the researcher takes on the role of a character in the MMORPG enabling the researcher to get an inside point of view of the students and their own MMORPG characters. This latter approach also uses action research to allow the researcher to provide anonymous/private support to the students including in-game instruction, confidence building, and some support of language issues in a safe and friendly way. Using action research with MMORPGs in the real world facilitates a number of opportunities for learning and teaching including opportunities to practice language and individual and group experiences of communicating with other native/ second language speakers for the students. The researcher can also develop tutorial exercises and discussion for teaching plans based on the students' experiences with the MMORPGs. The results from this research study demonstrate that MMORPGs offer a safe, fun, informal and effective learning space for supporting language teaching. Furthermore the use of MMORPGs help the students' confidence in using their second language and provide additional benefits such as a better understanding of the culture and use of language in different contexts.

Introduction

Massively Multiplayer Online Role Playing Games (MMORPGs) have increasingly begun to be used as tools to develop learning and teaching across a number of disciplines. Many games have been developed as products to potentially enhance players' learning skills. MMORPG is one of the game genres which could facilitate collaborative learning in language. MMORPGs require players not only to complete a variety of tasks and develop their characters individually but also to participate in teams or guilds to accomplish specific missions. This function of MMORPG plays an important role in player-to-player communication. It requires cooperation and the exchange of information through language and across different cultures. MMORPGs are usually available in countries across the globe and thus open to players from a wide range of nationalities and cultures. The elements in the game play such as rules, goals and objectives, and spontaneous feedback require player' responsiveness and can be practiced and through this, build skills (Paraskeva et al, 2010). The results can lead to multiple learning processes and in-games knowledge and skills learned and practice can be simply transferred across different digital simulation worlds.

"Simulation also allows for students to take an active role; "learning by doing" is another principal tenet of social cognitive theory" (Bryant, 2006 p.3).

The aim of this research study is to investigate whether using popular or commercial MMORPGs in a second language teaching offers a physical safe environment for students to form and function their language skills without the solid control usually found in the classroom. Due to the benefits of MMORPGs' virtual space, second language learners acquire, firstly, self-directed in in-game task. This creates the ownership of self-learning. The role of decision-maker can challenge the learners to a high level of difficulty using trial and error process (Gee, 2003). The learners also control pace, time, and level of difficulty in MMORPGs. Secondly, MMORPGs' world provides an easy way to experience the second language and mix with native speakers, compared to real life. While finding target language speaker to practise seems to be difficult in language education, Bryant (2007) claimed that the environment and active communication within MMORPGs can bring many players from other countries into one combined area. Thirdly, learners can make language mistakes and learn from them in a more informal setting since it is more difficult to identify the individual learners and there is less control and scrutiny by the instructor compared to a classroom setting. The use of MMORPGs for language learning also provides an opportunity for the instructor to use them as the basis for language practice and assignment work within the classroom. (Stanley, 2008).

Background

Language learning using computer games has been discussed as one way to collaborate and facilitate education. There have been many attempts to connect games to educational curriculum since they can potentially provide a teaching method which enhances a student's ability to plan, critically think, and problem-solve. Williamson (2009) defines games as a

'persuasive medium' which can influence players' thought and action as it is 'constructionist' device for learning, and can importantly create a safe environment for practising skills.

Online games offer a suitable safe environment for English as a Second Language (ESL) student to practice drill skills and transfer knowledge (Smeets, 2005). In some countries such as Thailand where English is considered a foreign language, teaching ESL/EFL has been incredibly limited in links to the English speaking world. This lack of real communication with native speakers restricts the students' ability to practice their language skills and master the language. While face-to-face communication in the English language is a difficult opportunity to provide for ESL students, access over the internet via online games creates an alternative social interaction which could potentially support language learning.

According to Eustace et al (2004), supporting hybrid learning through the concept of a microworld and game play can help develop social skills and lead to a better understanding of language and culture. The social setting also helps with problem solving skills to achieve a common group goal. Bryant (2007) claims that MMORPGs are an ideal learning setting for language development since players need to communicate with other players to get involved with communal tasks, and have life-like communication activity. MMORPGs have potential for players to interact towards a meaningful goal and this aspect can develop contextual knowledge which would support language teaching and language acquisition through practice and the need to use repetitive skills to communicate. Taking a virtual identity provides active learning and meta-level thinking (Gee, 2007).

From the perspective of language teaching meta-learning means knowing how to arrange, understand, and use knowledge in new context rather than attempting to memorise every possibility for every context. Crystal (2001) indicates that as the game players are communicating through the game interfaces with other players in their online community, their language skills become more expertise and professional. Online games, especially MMORPGs create multiple-tasks including individual and group tasks. Individual players need to develop their characters to survive and become masters, not only to progress within the game and interact with other players but also to have the charisma to negotiate with Non-Player Characters (NPCs) and other players to complete the goals in each map or scenario. The group task requires multi-players to achieve the mission together so they need to interact with each other to present themselves and what they can contribute to the group. Both tasks allow each player to communicate and exchange information in a particular language. Players share their experiences and backgrounds through social interaction either in virtual or real world. In addition, during the game play, some tasks often need to be repeated when players do not reach the requirements for the next level/stage. These game obstacles create repetitive tasks and the opportunity for players to reinforce their learning through repeated practice and performing of their language and social skills.

What are Massively Multiplayer Online Role Playing Games (MMORPGs)?

MMORPG is described as a fantasy content-based world where players create their own characters (known as avatars), participate in defeating monsters, share activities with others and build social networks both temporary and permanently, trade items and goods and compete in various tasks. It differs from learning environments such as Second Life as the A MMORPG usually has a unique theatrical opening storyline and an overall goal for the game play such as a quest. Jones (2008) mentions that MMORPGs are where live players act in an interactive drama. They are role-playing both competitively and cooperatively. Through the virtual environment and creation of an avatar, MMORPGs offer a fun, fantastic and imaginative world where people can escape from their real world routines. Social interaction in MMORPGs are designed and structured similar to Second life so MMORPGs have both long term and short term community system often called guilds. Guilds are community cultural groups set up in the MMORPG for players to share, act and organise in-game activities. According to Ang et al (2006) guild components comprise members, guild roles, ranking, and goals. The goal of the guild is not always to kill opponents or be the best conqueror. Sometimes guilds are run for economic purposes, such as collecting and sharing raw material to craft in-game rare objects for subsequent sale or barter. As other times it is about combining skills in craft and magic for a particular purpose including healing and solving particular puzzles and riddles. As a consequence the image of MMORPGs should not just be about violence. Each game offers a variety of activities and opportunities for players to contribute though their avatar and guild.

Why use a MMORPG?

There are many genres of game play that could attract players. Selecting a game according to a particular learning approach such as learner-centered for a specific region of learners, needs to be reconsidered as the interactive world has changed rapidly. An environment such as Second Life could have a range of learning interactive environments because it is a simulation of real life, however it is not free and thus not accessible to all. MMORPGs usually offer a free version of the game allowing any player to participate irrespective of their financial status. MMORPGs often charge for 'better' items but this is not a necessity for the majority of players. Advanced players can still engage with the game and become dominate in their social guild through their playing strategy rather than acquiring better goods through actual payment.

MMORPGS were chosen for this study because they are readily available and provide an informal, enjoyable and collaborative environment for learning and teaching. Spring-Keller (2010) claims that a playful environment can have a positive effect on learning development. Playing a MMORPG can create challenge competition and curiosity in the player and this can produce learner *intrinsic motivation* (Malone & Lepper, 1987 in Connolley et al, 2006). In addition, MMORPGs are not solely meant for entertainment. Their goals and objectives offer players serious challenges at the higher levels of game play. These difficult tasks and quests can increase the players' engagement and make them keen to master the game. This serious role of MMORPGs alongside the playful environment is valuable and can contribute to deep

knowledge when used in teaching practice. "Learning is at its best when it deadly serious and very playful at the same time" (Seay (1997) quotes Sara Lightfoot in Kafai (1995, p. 310)**).**

Research Methods

The experiment was conducted with 8 undergraduate students in a Thai university. The study brought in action research method to investigate their performances, experiences, and language skills. The researchers also conducted tutorial exams and activities based upon their virtual world experiences during the language teaching course. A (virtual) ethnography approach was applied in order to understand and monitor the learners' routine in the assigned MMORPGs and also in the related tasks in the classroom. Three main MMORPGs were used: 'Godswar Online', 'Asda Story' and 'Zentia'. However other MMORPGs were introduced and chosen by the researcher and students to supplement these and provide additional language experiences during the project.

Action research method (tutorial work)

Short interviews and MMORPGs workshop were conducted with the participants at the start of the project to identify their knowledge and proficiency in the English language and online gaming. During the interviews it was found that the students have experiences of playing MMORPGs using Thai servers but not of English language MMORPGs using international servers. 'Godswar Online' was introduced as an international MMORPG so students could transform their previous experience of MMORPGs and get familiar with this one. An introduction to 'Godswar' was given by getting the students to read introduction papers via the game's official website in English and discuss these in class. These Real World (RW) tasks were assigned to support their second language performance and acquisition in the game itself. Reading, grammar, and vocabulary can be conducted and tested during the game play as a one-on-one approach between the learner and researcher. The additional performance within these skills was recorded and analysed by using an on screen video capture program 'Camtasia Screen Recorder' (CSR) and 'Camstudio'. MMORPGs require players to complete in-game tasks (quests) in order to progress to the next level. These require the players to read and explore new vocabulary. This reading task was supplemented by encouraging students to visit the official and fan webpages to support their learning. In addition classroom exercises were introduced based on the quest dialogues from the game with missing words for students to complete. This provided vocabulary drill tasks for the students alongside their game play.

Writing tasks and tests can be conducted in two ways; *online* – using the chat channel provided in the game interface and *offline* – using the quests in the MMORPG as a model for writing dummy quests when participating in classroom group work. Listening-Speaking practise was claimed as a lost skill in MMORPG play. However informal discussion sessions were conducted using English as a main language where the learners used their avatar names to lower their identity. This helped enhance their confidence and allow them to make mistakes and learn from them.

The virtual ethnography approach used by the researcher provided a mechanism for observing the natural routine of the students during the game play. This was used to determine what additional learning opportunities should be provided in the classroom. This flexible and tailored approach differed from the conventional classroom language teaching experience which usually follows a lesson plan with set tasks and assignment work and set tasks.

Virtual ethnography

Virtual ethnography was used to observe the learning process, the building of active tasks, and understand the social system being used during the learners' interaction and play in the MMORPGs. This approach can use an extensive range of data collection including observation, note-taking, and interactive communication through texts (Misuishi, 2006). The researchers can gain an in-depth understanding of the online social system, chosen/ edited language, and culture that are being assimilated within each virtual gaming community in each MMORPG. The students were involved in gaming approaches and events with the researcher during two-hour sessions each week. At the same time and without their knowledge, the researcher was also observing them in their virtual world through a teacher created avatar (as passer-by).Learning how to create the avatars, using the interface, interacting with Non-player Characters (NPCs) and getting familiar with the gaming system and community among the subjects was also collected as .avi format used CSR and *Camstudio* throughout the project. This recorded observation allowed the researchers to investigate the learners' routine, attention, and language acquisition when encountering different language code in MMORPGs.

In the first stage of the project, the subjects participated in Godswar. In the mid-session, the subjects and researcher moved to play *Asda Story* which requires advanced play to develop and strengthen their avatar and to keep the interest and attention in the game. In this game, students had more opportunity to explore and participate in virtual society as a group (guild) so that they had to use every possible language skills to be able to communicate with new/old players (non-peer) to survive and success in completing tasks. The level of achievement in *Asda Story* relies heavily on group relations rather than individual play so the researcher's avatar became a language and adventure assistant to help students with their guild acceptance and making progress. At this point, the researcher can closely study the students' interaction among global players and their language improvement.

During the last phase of using MMORPGs, *Zentia* an international MMORPG with Chinese cultural content was used. The researcher's avatar position shifted from assistant into team member since the game has many quests and activities compared to the previous games. *Zentia* does not only provide in-game quest regarding killing monsters to progress to a higher level but also uses world knowledge quizzes as an alternative way to killing monster to get prizes. This aspect can enhance the subjects' language proficiency relating to the actual world.

While playing these MMORPGs, subjects were given tutorial practises adopted from game elements and also exams to test their language acquisition.

Tutorial exams

The exams were introduced in three stages; pre-test, during the game exercises and post-test. After the students were introduced to the game and the basis elements of play the English test was used to measure student's level of English skills as a pre-test. ELLIS placement3 test was chosen. This is a standard computer – based English test used in several Thai universities. This test covers three English skills – vocabulary, grammar, and listening in multiple choice questions. Each part takes 30 minutes maximum. The range of score is between 5 and 605 and the level is between 1 to 12. During each game play, the subjects were assigned to work on exercises/tests after they reached a certain respective level. The tests design was based on the game content and results from the virtual ethnography approach. In *Godswar* session, the subjects were given two dummy tests imitated from the current MMORPG. The first test was consisted of gap-fill and answering the questions related to game play while the second test was creating a quest using *Godswar* NPCs quest as a model. In *Asda story*, the subjects were asked to design and run a tour activity in the virtual world for their peers to participate in. This activity required the students to apply language learnt in the real world for a very specific purpose within the digital world. For example, the guide character told his/her team a direction to a specific place and narrated the background of that land mark by voice speaking as normal talk and conversation instead of typing. In *Zentia*, the game offered world knowledge as part of a quest in order to develop a player's avatar. This type of quest was used to test whether the subject can use their English skills when needed. ELLIS was administered as a post-test on the late session of game play which took place about 6 months after the pre-test.

Results

Attitude and Motivation

One of the key benefits for using MMORPGs is the direct positive effect on student attitude and motivation in second language learning. The game itself supports language practice once players engage in game activities as pleasure learning. The students not only involve themselves in playing the game for entertainment but also to cooperate in the assignments and use teamwork. Less teacher control allows them to design their own direction whether they want to play as individuals or contribute to peers or a virtual group (guild). The students have less hesitation when using English to communicate with other global players and form relationships easily and impressively compared to classroom practise where most second language students seem to hide their mistakes. Some active students immersed themselves with native speakers in the game and got positive responses, thus gaining high acceptance among the guild. The free choice of open role-play within MMORPGs allows students to take a different role and position contributing to the peer/guild. This approach provides ownership of their learning which can carry through to their learning engagement and self-development. Mainly MMORPGs have different jobs (roles) for players to choose:

1. Warrior/Mage, a strong and tough character – mainly highest in self-advancement and anticipation. The warrior/Mage is likely to become a leader of the team

2. Supporting jobs; range shooter, magic healer/buffer, and merchant. These characters are not likely to be focused on individual development and therefore they contribute and have fun helping others as a team. Since strengthening the avatar is not the main point of playing the game, they normally have time to form relationships (romantic, social, economic, trade, and consultant) and a variety of social networks (soulmate – a couple/partner, party – temporary group joined in a particular quest, guild – almost permanent group used in important events in the game).

According to Table 1, students were aware of their individual development in *Godswar*, the first MMORPG. However, after experiencing an international virtual social community system, their playing strategy changed to rely more on teamwork and guild acceptance. Taking the first three students in this table as examples, P shows unchanged character in three games and this results in the best performance in the group. Although the warrior type is acted individually, P contributes to the learning by helping his peers use the real world information (website) and virtual community and by asking other players directly in the game. While P might use his strength to gain acceptance among global players, C's job as a healer is highly demanding. In MMORPGs, any group adventurer finds it is very difficult to complete an advanced task without a healer during the journey. Since C has high healing skills, he was asked by other players to travel with them. In fact, C is a very busy player in the team. Being a tough character may not be necessary as a purpose to play a MMORPG. Mo chose to learn a crafting skill instead of combat in order to become a rich man in the virtual world. He used his crafting skill to produce items such as rare materials, weapons, and armors in order to trade and participate through negotiation in the virtual market. These activities conducted by the students result in higher learning engagement and language improvement.

Table 1. Students chosen roles in three different MMORPGs

	Godswar	*Asda Story*	*Zentia*
P	Warrior	Warrior	Warrior
C	Warrior	Healer	Healer
H	Mage	Warrior	Healer
M	Warrior	Range and Warrior	Warrior
Mo	Mage	Range (Merchant)	Range (Merchant)
Mi	Mage	Mage	Healer
B	Mage	Range (consultant)	Range
K	Mage	Warrior	Warrior

Language development

In order to verify the research model and the language development of the students, the recordings of the students' game play, recorded using the screen video capture software were analysed.

- Reading

To evaluate reading development, results can be monitored spontaneously using in-game questing. In MMORPGs, questing is an essential activity provided by NPCs with the map. The player is expected to talk with the NPCs and the text in quest box will appear for the player to read. Generally the pattern of a questing text box contains; 1) quest description, 2) direction/ location, 3) target quantity and 4) prizes (physical point, money, and items).
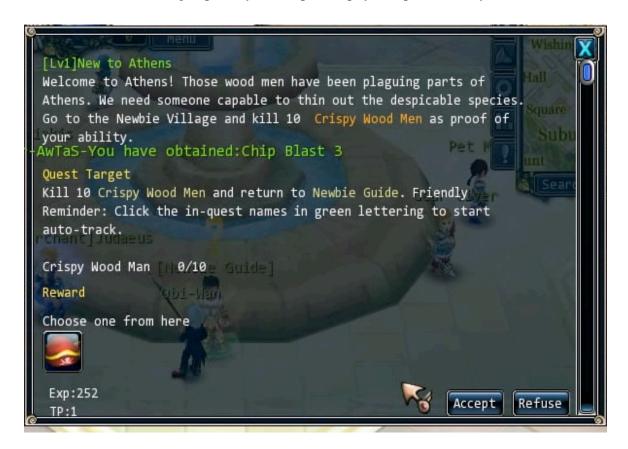

Figure 1. Quest box when taking with NPC.

 After practising reading quests, the students become more comfortable and tolerant when reading English-text. The game also provides spontaneous feedback which the researcher and student can check. If the students read the quest correctly they are more likely to be able to attain the rewards, usually in the form of Physical points (Exp), money, and/or items. In addition, the more advanced players who want to dominate in the game are likely to browse additional information from the game related web pages.

- Vocabulary chunks

Renalli (2008) suggests that ESL learners can explore vocabulary in the game itself through the various sounds, texts, and images and get familiar with them through everyday routines and activity. The students learn and store new vocabulary by repetitive use and becoming familiar with those words used to make progress in the quest or teamwork. Moreover,

MMORPGs offer models of both authentic and casual vocabulary. For example, one student has repeatedly read and memorised 'equipment' from NPCs, and learns how to use 'WM' instead of 'whisper me' when they need to have a private chat.

- Conversational relevance (make sense) to real world

The social networks provided in MMORPGs are key for practising conversational skills in the target language through chatting (Rankin, Gold & Gooch, 2006). The chatting device in the game serves different purposes in learning language as a space and model for constructing conversation while communicating with global/peer players. Firstly, students can observe how players talk to each other through the global chat channel, where everyone can see the dialogue. They can narrow their information providing it only for the guild or one-on-one (private) chats if they afraid of making language mistakes. The visible instant message can provide a pattern to imitate in the beginning of the social interactions in the game. The student finally learns and distinguishes a live and relevant conversation in the current world from the text book in the classroom. The dialogues created by students were varied such as serious talk (planning war strategy), business (trading), greeting, search for advice, or shouting. A chance to encounter global players who are native speakers can help them to practise their conversational skill, thus they gain more confident when using their second language in a real world situation. Notably, the abbreviation words used in MMORPGs dialogue such as 'tq' for 'thank you' do not distort or confuse their real world sentence construction; and they realise and come to know that they should use 'tq' only in the game and social networking and elaborate it to *thank you* in a real conversation.

Figure 2. Student is chatting with another player.

The incentive for students to practise their chatting skills in the MMORPGs was much greater than in the classroom. As mentioned above, the conversation created by students in the game leads to success within the game including development of their avatar, financial reward, acceptance and gains in their virtual social rank.

- Writing

Writing in MMORPGs may be limited since the only way players can write (or type) is through the chat box. However the project adapted elements from the MMORPGs for students to practise writing in different ways.

The researcher used in-game quests as a model for students to practise writing. After students reached a certain level in each game (usually when their level is permitted in in-game main event such as flag-war, allowed only higher level than 24 – *Asda story*), they were asked to create their own quest basically containing the following elements: story (objective), direction, and reward (s). They used their own imagination but the quest was expected to react with in-game geographic area, NPCs, and monsters. Feedback was provided immediately by their peers by seeing if they could follow and complete the given quest. In addition, the peers who participated with the given quest were required to write a journey note in return.

Between the mid and last sessions, the advanced player provided his spread sheet of *Zentia* guidelines for his peers. He wrote about the description of each job choosing in game and his opinions in English. This approach is considered as a positive outcome of using MMORPG in language learning for the real world.

- Public speaking practice

The role of practising speaking can be enhanced by collaborating in the MMORPGs and using it as a tool for language teaching. The project used *Asda Story* for preparing speaking practise since the level of their avatar were considered high enough to travel into the danger area. Each student was assigned to explore a place and land marks in the game for their peers as a visitors. They had two weeks preparation before the presentation. The students used their avatars to travel together in the map. The host (guide) had to tell (make up) the story of chosen land marks and how important they are within the area. The guide needed to react to the visible surroundings such as trees, monsters, or other players. As a result, although the students may not be professional in using English for speaking, they used the MMORPGs' geographical space and surroundings as a supporting device to narrate a tour and help develop their speaking skills.

- ELLIS pracment3 test

To evaluate vocabulary, grammar, and listening skills developed during the project, a standard test – ELLIS was performed by the students. The relationships between leaning language and game play are displayed in the test results for one participant, K.

Table 2. The example of ELLIS result from one of the participants, K

	Pre-test			Post-test		
	Score	Level	Total level	Score	Level	Total level
Vocabulary	260	6		310	8	
Grammar	235	5	5	285	7	7
Listening	210	5		325	8	

According to Table 2, the example student, K, shows the effectiveness of learning language through MMORPGs. K was the lowest performance among the group during pre-test. After the treatment, his overall performance is significantly increased from level 5 to 7. The individual score in each skill has increased impressively. As predicted, second language acquisition had positive effects in both his achievement in the game play and his language learning.

Conclusions and Implication

This study investigates using commercial MMORPGs as a tool for supporting second language learning and teaching for undergraduate students. The games offer digital safe spaces for learners to practise and opportunities to communicate with other players across the globe where they can input their language ability without detection and hesitation. Virtual ethnography methods were used to observe the students in the game and prepare language tasks and tests derived fro the game play. These were then delivered into real world practice using an action research process. Using game play has helped students address some of the issues of using language for real and provided benefits for the teacher in terms of being able to provide help and feedback in a friendly manner. The findings demonstrate that MMORPGs can successfully support language learning as illustrated by the improvements in the standard language tests and the participation and progression in the game itself. The students became more active in using English, showing greater patience in reading, being more motivated to write and also to produce dialogue when speaking and chatting. One of the students, C said that *"Playing online game helps me to improve English skills. I've got many vocabularies from online game and I can practice conversation with the player from online game. They teach me how to speak with them and explain about conversation"*. Motivation in language learning is also generated when playing games since the students can own and control the learning process. Confidence is also boosted through their interactions with other players. Student B commented *"Because of playing MMORPG, I talked a lot with many people from different countries and that helps me to know how to communicate with foreigners"*. Lastly, in the light of using MMORPGs in education, the authors believe that games and technology can significantly facilitate learning when used properly and provided in appropriate amounts.

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iVERG works in collaboration with universities worldwide. Research on virtual environments for use in learning and teaching is diverse and complex and draws upon specialisms in education, computing, sociology, psychology and anthropology. It has an important contributionn to make to the effective uses of these environments which are being increasingly taken up by a wide range of educational and commercial institutions worldwide. Although they have an intrinsic appeal founded upon their origins within gaming and social networking, immersive virtual environments need research informed practice to ensure their effective educational use.

Research projects funded by the Engineering and Physical Sciences Research Council (EPSRC), the British Council and the Japan Advanced Institute of Science and Technology (JAIST) are investigating communication, learning and identity within virtual worlds. From this work, the International Virtual Environments Research Group (iVEREG) was established. It brings together academics and practitioners who wish to study and carry out research in the uses of immersive virtual environments for learning, training and teaching.

Strong interaction between academia and pratcitioners is a major benefit of the group, helping to shape and hone the focus of research more directly on real concerns.