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3D Multi-User Virtual Environments (MUVEs) for Real World Learning

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Introduction

A virtual world is a 3D computer environment in which users are represented onscreen as themselves or as made up characters and can interact in real time with other users. These representations are called avatars. Avatar creation and customisation can be viewed as a purposeful projection of one’s own identity or an experiment with new identities.

Virtual worlds such as Quest Atlantis (Hickey, Ingram-Goble & Jamieson, 2009) and River City (Ketelhut, Dede, Clarke et al., 2006) have been successfully used in the primary and secondary school context to facilitate student learning. These virtual worlds present students with predominantly pre-designed virtual worlds, which engage students in problem solving activities. This approach has been used by SCHOME (Gillen, 2008; Twining, 2009; Twining & Footring, 2008); Schoolaborate (2010); MacICT (Cram, Hedberg, Lumkin et al. (2009) and Forminykh and Prasolova-FØrland (2011) at a tertiary level. The emerging research from these initiatives indicates that student design and construction is an engaging and effective method of facilitating learning. However, further research is required for increased understandings of how students engage with these activities and conditions of success.

**3D Multi-User Virtual Environments (MUVEs) offer the potential for:**

* + Students to learn through design and construction, thereby facilitating the NSW Quality Teaching Framework (QTF) model of pedagogy including higher order thinking, engagement, social support, inclusivity and connectedness;
  + Students to learn problem-solving skills and acquire deep knowledge through collaboration;
  + Flexible learning through asynchronous and synchronous delivery[[1]](#footnote-1) and
  + Meaningful learning through interdisciplinary and community focused projects.

Study focus

The focus of this study is to further investigate **MUVEs** and their potential application within teaching and learning contexts through visits to leading practitioners in ICT education centres, schools and institutions in the UK and USA.

This study will:

* + Identify exemplary and innovative methods that utilise 3D MUVEs to enhance education outcomes across curriculum;
  + Increase awareness of new and emerging technologies being used in classrooms and experiential learning environments across K-12 and higher education;
  + Inform Australian educators, administrators and policy makers of other innovative education systems and research underway to improve student learning outcomes; and
  + Extend the opportunities for students and teachers to develop skills in the use of new and emerging technologies to identify issues, solve problems and make conclusions as they increase their skills for 21st century learning.

Significant learning

**Coventry University, Coventry UK**

[Innovative Research in Virtual Worlds (IRVW) 3-4 November 2011 Conference,](https://ispr.info/2011/09/29/call-innovative-research-in-virtual-worlds-2011-conference/) Coventry University:

IRVW 2011 provided an opportunity to interact, discuss and collaborate with academics and experts from around the world on the topic of innovative research in virtual worlds. Highlights of this conference included three keynote speakers: Professor Mike Sharples, Dr. Gary Priestnall and Professor Judith Molka-Danielsen who discussed the benefits and challenges of using MUVEs in teaching and learning at higher education levels.

I presented our MacICT project on ‘Learning by Designing in Virtual Worlds’ at this conference. This was the only school-based presentation at this conference. The presentation outlined two case studies that described the learning trajectories of one class of secondary students who have completed a unit of work of ten weeks duration on designing sustainable architecture for the future. In particular, how using design and construction activities for student learning is impacted by conducting such activities in a virtual world with specific focus on the:

* 1. Decisions that students make when completing the design and construction activities within a virtual world.
  2. Social interactions that influence how the students completed the activities;
  3. Architectural representations constructed by the students within the virtual world and the use of avatars and multiple perspectives to test and refine design ideas.

**CANVAS Project (Scotland)**

Derek P. Robertson, National Adviser for Emerging Technologies and Learning, Learning and Teaching Scotland had a major role in organising the range of school visits in Scotland. Robertson and I have been in contact since 2010, through Skype and Twitter due to my interest in his CANVAS (Children’s Art at the National Virtual Arena of Scotland) OpenSim project. CANVAS was featured in Stephen Heppell’s [*Be Very Afraid*](http://www.heppell.net/bva/) conferences in the UK. The Community School of Auchterarder (2009) was subsequently included in the Be Very Afraid [Series 6](http://www.heppell.net/bva/bva6/auchterarder.htm) (BVA6) and our MacICT project “3D Virtual Worlds Learning Spaces” was part of the Be Very Afraid [Series 7](http://www.heppell.net/bva/bva7/sylvania) (BVA7) “Listen 2 Learners” with Sylvania High School (2010).  
  
CANVAS was hosted on the Education Scotland’s servers. This allowed full control over who was able to enter or view this virtual world. Teachers from each Local Authority were given the same brief for this project.

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

The intention was for students to be able to interact with each other and with selected audiences, who would visit this virtual art gallery using enabled chat through their avatars. Learners could study exhibition design, collaborated and made deliberate choices with their teacher and peers on the appropriate placement of artwork for display. Teachers were ‘present’ in-world with students in a supervisory role.Teachers provided opportunities for learners to critically reflect on their art making process through their accompanying audio recordings. The objective of this project was based on structured activities with minimum in-world collaboration opportunities. Teachers were not required to have deep technical knowledge of OpenSim and could concentrate on helping students to achieve learning outcomes. The goal of Learning and Teaching Scotland was for larger scale implementation of OpenSim.

CANVAS celebrates student creativity in one space. Robertson’s goal was to provide opportunities for students and teachers to experience being in a virtual world, in a shared space for groups of students to exhibit, critically reflect and have a dialogue with their audiences. The artworks were created by students in real-life but exhibited in a pre-designed virtual world. The main success was that many school districts could participate in this project and teachers were able to implement this technology with a small learning curve. The innovation lies in the idea of creative participation in one space, enabling learners to engage with dialogue about their own artwork and the work of others within a dynamic and contemporary digital setting; to curate their work knowing that their video would accompany their work and give the viewer information about their piece and their progress as an artist; to develop an awareness of practical and purposeful use of a range of digital tools and be part of a collegial virtual learning community.

The main project limitations included the difficulty of maintaining continuity because of firewalls. Chat functions and certain avatar customisation features had to be disabled because there were concerns about inappropriate use by learners. Therefore, the full rich experience of a virtual world was not available to learners in this scenario. Large-scale implementation proved to be too challenging when trying to change the mindset of teachers to be responsible to maintain and populate their galleries. The intention was for learners to engage with their audiences in a virtual world were clearly situated but there were more challenges associated.

**Linlithgow Palace Project, Scotland, UK**

Linlithgow Palace (c.1564) was the second virtual world constructed by Second Places for [Education Scotland](http://www.educationscotland.gov.uk/). Alex Duff (Education Manager, Emerging Technologies at Learning and Teaching Scotland) conducted a virtual tour of Linlithgow Palace and GLOW (Scottish Schools National Intranet) at Dundee University. The virtual tour of Linlithgow Palace is available on [YouTube](https://www.youtube.com/watch?v=uqZx1lIUG_k).

Pupils from Linlithgow Academy had the opportunity to interact with the virtual reconstruction of Linlithgow Palace in their hometown on June 21, 2012.

Students produced artwork prior to the event, which had been organised and scanned by the history department, and placed within the reconstruction in a web gallery. Students completed a task sheet during scheduled sessions to reveal a key date and a special location within the palace by locating facts and interacting with historical characters in the virtual palace. Students then voted for their favourite artwork in-world and used three imaginative words to describe the reconstruction.

Throughout the scheduled sessions students and staff had the opportunity to drop in for free form explorations. The sessions proved very popular and created much excitement within the library where the event was taking place. Alex Duff from Education Scotland selected the winner of the most imaginative words.   
  
Through GLOW, state schools (that I visited) such as Garnock Academy, Kilbirnie; Gavinburn Primary, Kilpatrick; Loirston Primary School, Kinkorth Academy, Aberdeen and Newburgh Primary, Newburgh in Scotland benefit from:

* + A trusted and safe environment for pupils, practitioners and parents
  + A space to create personalised programmes of work and share thinking and curricular resources
  + A variety of online tools to enhance learning experiences
  + Virtual learning to share information and take part in a lesson
  + Tools to enable you to communicate and collaborate across the network
  + Communities of practice that offer practitioners rich opportunities to share and collaborate
  + Innovation in learning and teaching approaches by engaging and immersing young people in powerful and relevant learning experiences
  + Motivation and support for individualised learning, personalisation and choice
  + Students using GLOW were able to develop ICT skills and a personalised portfolio of work over the course of their primary and high school education.

Highlights from my visits to the above innovative schools included Matt Reid, an English teacher at Garnock Academy who has been experimenting with game design with his S1 Narrative Games Development class using RPGII programming. Students in his English classes were motivated to develop their narratives into games with multiple players. Reid found that game design was a way to challenge and engage his students. His classes found new meaning in reading and writing. Matt Reid’s class [blog](http://teacherreid.wordpress.com/)

Gillian Penny is Head Teacher, Gavinburn Primary School in West Dunbartonshire and an Apple Distinguished Educator. The school has a national reputation for best practice in the use of a variety of technologies to support learning and makes extensive use of mobile technologies. Penny spoke about how she has embedded game based learning in her school with particular emphasis on the planning stage. She has been working with her staff and students in projects such as ‘Band in a Box’ and game design with Microsoft Kodu[[2]](#footnote-2).

Karl Barrs is a passionate teacher at Newburgh Primary School, Fife who has been teaching his class with a programming language called [Scratch](http://scratch.mit.edu/). Scratch is based on a collection of graphical ‘programming blocks’ that learners can snap together to create programs. He has embarked on other projects using QR codes[[3]](#footnote-3) and geocaching[[4]](#footnote-4).

Although the above schools were not using MUVEs, they did demonstrate how new and emerging technologies are being used in classrooms.

**Academy 360, Sunderland, UK**

Academy 360 is a comprehensive school catering for 4-17 year olds, with the school divided into three groups, pre-school, primary and secondary. The local community had injected funds to develop the state of the art classrooms for teaching and learning. The school with sweeping open plan designs, sunlight infused rooms from the large expansive glass panels and advanced technology equipment are inclusive of the school landscape. The school is fully equipped with Apple computers and mobile learning devices. Denise Green (Librarian and Learning Resource Manager) gave a tour of this state of the art school.

I had met Christopher Bonfield and Kevin Burden, from the University of Hull, at the IRVW 2011 conference. Kevin Burden is the Director of post-graduate professional development (PPD) in the Faculty of Education and works to support the professional learning needs of educators across the region. Christopher Bonfield’s (Knowledge Transfer Associate) work includes assisting to create mobile applications for use in schools, and developing virtual world scenarios (Second Life) to engage and enrich the student experience. The project that Bonfield is working on is called a Knowledge Transfer Partnership, which is a linkup between Academy 360 and the University. The Technology Transfer Board and Academy 360 have provided funds for this project. The University provides academic expertise, and the school acts as the work-based partner. The idea of the scheme is to transfer academic knowledge into the workplace and to build partnerships with businesses for the community to gain a better understanding of the 'real world'.

This collaborative project is being developed for teachers at Academy 360 as a proof of concept to examine how teachers will be able to integrate virtual worlds in teaching and learning. This project is in its early stages and University of Hull who are working with [DADEN](http://www.daden.co.uk/) to create a virtual world user-authoring tool, called OOPAL (Object-Oriented Programming and Array programming Language integration). The tool allows people to create 3D virtual world spaces for any 3D platform by using a web browser. 3D objects need to be created externally but once this is completed, the user is able to drag these objects into the workspace and the software automatically creates the 3D scene in OpenSim or Second Life. The project is currently on hold due to management changes.

**Bromley College of Further and Higher Education, North Bromley UK**

Bromley College of Further and Higher Education has two campuses, Bromley and Orpington. The college is an institution for vocational education, catering for 14-15 year olds to adults and has partnerships with schools, universities and local employers. I met with Clive Gould (FdEng Programme Leader) and Barry Spencer (eLearning Development Coordinator). Both teachers have been experimenting with MUVEs for innovative teaching and learning of Information Technology using [Second Life](http://secondlife.com/) and [OpenSim](http://opensimulator.org/) and have contributed widely to the [OpenSim Users group](http://opensimulator.org/wiki/Useful_Queries). The college had a couple of dedicated servers on the premises that were maintained by Gould and Spencer. Their goal was to examine ways to teach information technology for student engagement and found that MUVEs offered students opportunities to learn programming languages in a more purposeful manner through scripting. Gould and Spencer had created interesting learning spaces using OpenSim and Second Life for students to learn about, and apply software languages and computing.

**Elisabeth Morrow School, New Jersey, USA**

Elisabeth Morrow School is a private co-educational school located in New Jersey, USA and caters for students from three year olds to Grade 8. Marianne Malmstrom is a technology teacher at the school and has 30 years’ experience as a classroom teacher and administrator. Malmstrom draws on her extensive teaching experience to create innovative learning environments designed to develop essential 21st century skills and literacies. On my visit to Elisabeth Morrow School, students were immersed in LEGO Universe. LEGO Universe was a [massively multiplayer online game](http://en.wikipedia.org/wiki/Massively_multiplayer_online_game) (MMOG) developed by [NetDevil](http://en.wikipedia.org/wiki/NetDevil) released on October 26, 2010 but has now closed. Malmstrom and many educators around the world including Steven Caldwell (ICT Leader (Middle School, MLC, Sydney), fought to keep LEGO Universe open as they saw many learning opportunities for their students. Students in her classes were encouraged to experiment, use their imagination and find new ways to problem solve using MMOGs such as [MineCraft](http://www.minecraft.net/). Unstructured activities in a virtual environment provided scenarios for students to develop skills in finding creative solutions in a limited timeframe.

Malmstrom also demonstrated how lessons could be structured using [3D GameLab](http://3dgamelab.org.shivtr.com/), an online quest-based learning platform for teachers and students. Her current work is focused on using virtual worlds and MMOGs to foster positive online communities, while giving students opportunities to collaborate and solve problems in highly creative spaces.

**Suffern Middle School, New York, USA**

Suffern Middle School is a co-educational school in the Ramapo Central School District, located in Suffern with a population of 1,200 students in grades 6-8. The school offers a variety of interesting subjects, including languages, performance arts, and media arts.

**Peggy Sheehy is an Instructional Technology Facilitator and Media Specialist at Suffern Middle School and founder of MetaVersEd Consulting Ltd.**  In 2006, Sheehy established Ramapo Central’s educational presence in Teen Second Life (now closed since 2010): “Ramapo Islands,” and put Suffern Middle School on the map as the first middle school to use the virtual world for education. Ramapo Islands has hosted close to 1000 students and their teachers and supports all curriculum areas.

[World of Warcraft](http://us.battle.net/wow/en/) (WoW) is a multi-person online fantasy role-playing game in which individuals and groups (Guilds) complete quests in order to achieve equipment, points and skills. During my visit at Suffern, I had the opportunity to observe how Sheehy integrates multi-modal literacy in her WoW lessons. Students develop skills in communication, collaboration, goal setting, responsibility, decision-making and team work. Her vision encompasses a globally collaborative 3-D virtual world campus where learning is student-centred, product-based, playful, and creative.

**Ballarat Grammar School, Melbourne, Australia**

Ballarat Grammar School is an independent co-educational Anglican school with boarding facilities located near Lake Wendouree, Ballarat. Lucy Barrow is a STAFF ICT Trainer and has been implementing a range of innovative ICT strategies at the school, including MUVEs such as Quest Atlantis and OpenSim. The OpenSim grid at Ballarat Grammar was hosted by [Reaction Grid](http://reactiongrid.com). Students were able to collaborate and create in this virtual environment. Activities were unstructured and students were encouraged to be creative and imaginative. Barrow says that she monitored and supervised the students in the virtual world, called [Begonia Island](http://begoniaisland.edublogs.org/). OpenSim was not integrated with the curriculum but was made available to students who wished to experiment with this type of learning. Lessons were held in the school library at lunch times and students were instructed to follow a code of conduct for online learning.

**Northern Beaches Christian School, Sydney, Australia**

Northern Beaches Christian School (NBCS) is a private, non-denominational co-education Christian school that includes a pre- school, primary and high school located in Terry Hills, Sydney. Steven Collis is the Director of Innovation at NBCS and a pioneer of MUVEs at this school such as Second Life, OpenSim and Minecraft. He encourages a community of practice within these virtual environments where students have opportunities to explore on their own, collaborate with their peers and reach their own potential.

The first virtual world at NBCS was in Second Life (Teen Grid). This learning space ended when Second Life closed down Teen Grid in 2010 and the school moved to their next virtual world using OpenSim. Reaction Grid hosted this OpenSim grid and the virtual environment was called Booralie Island. More recently, NBCS has been exploring MineCraft and similar to Malmstrom, the school encourages students to explore and experiment.

Conclusion

Findings and further recommendations:

* + MUVEs can offer opportunities for 21st century learning skills such as design, play, communication, collaboration and problem solving.
  + In the cases studies presented in this report, there was limited professional learning for teachers using MUVEs for teaching and learning. However, other research shows that there are notable exceptions (Barab, Scott, Siyahhan, Goldstone, Ingram-Goble, Zuiker & Warren, 2009; Ketelhut, Nelson, Clarke & Dede, 2010; Twining, 2009; Cram, Lumkin & Eade, 2010).
  + In some cases, MUVEs were learning spaces where the emphasis was on student exploration, experimentation and discovery learning rather than teacher direction.
  + In other cases, MUVEs were learning spaces for exhibitions, historical simulations, creating scripts, participating in challenging quests and places for socialisation with the goal to provide rich learning experiences for students.
  + This begs the question whether learning activities using MUVEs should be structured or unstructured (or combinations of both) and what kinds of scenario planning methodologies can be explored for best practice in teaching and learning.
  + Other questions include: How does one teach effectively using 3D MUVEs? Should teachers scaffold and lead (or not lead) the virtual learning?
  + Therefore it is recommended that further research into structured and unstructured learning in virtual worlds will assist Australian educators, administrators and policy makers of other innovative education systems to gain a better understand the worth of using 3D MUVEs in education.

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1. Synchronous delivery is when the student and teacher are in the same learning space at the same time. Asynchronous delivery is the opposite. Teachers provide materials, lectures, tests, and assignments that can be accessed at any time. [↑](#footnote-ref-1)
2. Kodu is a new visual programming language made specifically for creating games. It is designed to be accessible for children and enjoyable for anyone. The programming environment runs on the Xbox, allowing rapid design iteration using only a game controller for input. [↑](#footnote-ref-2)
3. QR or Quick Response Codes are two-dimensional barcodes that can be read using smartphones and dedicated QR reading devices. [↑](#footnote-ref-3)
4. Geocaching is an outdoor activity in which the participants use a [Global Positioning System](http://en.wikipedia.org/wiki/Global_Positioning_System) (GPS) [receiver](http://en.wikipedia.org/wiki/GPS_receiver) or mobile device and other navigational techniques to hide and seek containers, called "geocaches" or "caches", anywhere in the world. [↑](#footnote-ref-4)