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curriculum, technology & transformation for an unknown future

Australian higher education institutions transforming the future of teaching and learning through 3D virtual worlds

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What are educators' motivations for using virtual worlds with their students? Are they using them to support the teaching of professions and if this is the case, do they introduce virtual worlds into the curriculum to develop and/or expand students' professional learning networks? Are they using virtual worlds to transform their teaching and learning? In recognition of the exciting opportunities that virtual worlds present for higher education, the DEHub Virtual Worlds Working Group was formed. It is made up of Australian university academics who are investigating the role that virtual worlds will play in the future of education and actively implementing the technology within their own teaching practice and curricula. This paper presents a typology for teaching and learning in 3D virtual worlds and applies the typology to a series of case studies based on the ways in which academics and their institutions are exploiting the power of virtual worlds for diverse purposes ranging from business scenarios and virtual excursions to role-play, experimentation and language development. The case studies offer insight into the ways in which institutions are transforming their teaching for an unknown future through innovative teaching and learning in virtual worlds. The paper demonstrates how virtual worlds enable low cost alternatives to existing pedagogies as well as creating opportunities for rich, immersive and authentic activities that would otherwise not be feasible or maybe not even be possible. Through the use of virtual worlds, teaching and learning can be transformed to cater for an unknown future.

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Introduction

The Distance Education Hub (DEHub at http://www.dehub.edu.au/) was established in 2009 as a research consortium comprising the University of New England, Charles Sturt University, Central Queensland University, the University of Southern Queensland and Massey University. From this consortium the Virtual Worlds Working Group (VWWG) was formed in response to growing interest in the educational potential of teaching and learning in virtual worlds. A virtual world is a low cost computer-based simulation providing alternatives for real life and fantasy activities. The VWWG assists in facilitating collaborative research into virtual worlds, identifying research gaps/needs and documenting best practices in the use of virtual worlds for teaching and learning. The group currently consists of academics from 21 Australian institutions who are leaders and innovators in the field, and who meet regularly in *Second Life* (SL) to share ideas and collaborate on joint initiatives.

The most popular virtual world platform for educators at present is SL. Approximately 750 educational institutions now operate their own islands in SL (Cummings, 2010). This figure does not take into account the number of institutions that own smaller parcels of virtual land. SL is one of more than 200 virtual worlds that were available in 2009 (Farley & Steel, 2009; Gregory & Tynan, 2009; Honey, Diener, Connor, Veltman & Bodily, 2009; Lemon & Kelly, 2009). The number of virtual worlds grew from 100 in 2008 (Collins, 2008) and is predicted to rise to approximately 900 by 2012 (Mitham, 2008).

Virtual worlds are beginning to be seen as ideal vehicles for elearning as they are immersive spaces that allow for 3D modelling, simulations, role-play, creativity and active involvement by participants (Gee, 2007; Johnson & Levine, 2008). The term 'immersion' encompasses "both the physical aspects of the environment and the psychological sense of being in the environment" (Dalgarno & Lee, 2010, p. 13). The Australia-New Zealand edition of the *Horizon Report* (Johnson, Levine, Smith & Stone, 2009) suggests that virtual worlds are now firmly established as valuable learning spaces and notes that educational institutions are exploring additional ways of providing immersive experiences in education through "activities that blur the boundary between the virtual and the real, including simulations, augmented reality experiences, and alternate reality games" (p. 5).

Collaboration has taken place in many formats since the VWWGs inception in November 2009, and has contributed to the implementation of an Australia and New Zealand wide study resulting in a published report, the submission of several grant applications, joint papers and the sharing of knowledge between members. The following case studies or 'snapshots' illustrate some of the ways in which academics at institutions that are members of the VWWG are responding to the opportunities created by virtual worlds. They are responding to the opportunities to harness virtual worlds to help prepare students for an unknown future by demonstrating innovative uses of technology to adapt or transform the curriculum for the future needs of learners and teachers.

A typology for teaching and learning in 3D virtual worlds

This section of the paper describes a typology for teaching and learning in 3D virtual worlds based on the work of Porter (2004) who developed a typology of virtual communities, and Messinger et al (2009) who later adapted Porter's typology to focus more specifically on the characteristics of 3D virtual worlds. According to this typology, 3D virtual worlds can be described according to their purpose, place, platform, population and profit model.

Purpose: 3D virtual world teaching and learning can be classified according to the nature of the interactions and the learning objectives, which will in turn determine the kinds of activities most appropriate to achieving those objectives. Educators are exploring the potential of 3D virtual worlds to support a wide range of activities including virtual seminars, experiential learning, supporting synchronous learning for distance learners, virtual field trips, role-plays and simulations, problem solving, design and construction and to facilitate awareness of ethical issues and intercultural considerations.

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Place: According to this typology, place refers to the location in which activities take place both geographically and in-world, and whether the activities are conducted entirely in a 3D virtual world environment or through a blended learning approach. Thus educators may conduct classes in a variety of different locations within a virtual world, across different virtual worlds or through a combination of face to face and virtual classes in a blended learning environment. 3D virtual worlds also make it possible for guest presenters to conduct sessions from anywhere in the world and for students from geographically dispersed locations to collaborate in a shared virtual space.

Platform: The choice of platform for conducting teaching and learning in 3D virtual worlds needs to take into account the purpose and nature of learning activities to be undertaken by students, the place in which these activities will occur and the benefits versus the potential risks associated with teaching via a commercial platform such as SL compared to an open source environment and/or behind the firewall solution. The choice of platform will also determine the nature of interactions possible and the flexibility provided. One of the most popular commercial 3D virtual world platforms is SL, and many institutions are also exploring a range of open source 3D virtual world solutions including OpenSim, which can be hosted on their own servers.

Population: Messinger et al (2009) describe population in terms of the pattern of interactions, the size of groups and the nature of the social ties between group members. In the context of teaching and learning, population also refers to educational level (i.e. high school, undergraduate or post-graduate) and disciplinary field. 3D virtual worlds have been found to be beneficial across a diverse range of disciplinary fields including education, business and commerce, science, medicine, allied health, communication and media, art, architecture and design, law, computer science, language learning, information literacy, history and geography to mention but a few.

Profit model: The profit model refers to whether the 3D virtual world is open source or commercial, hosted on a university or public server and whether the platform supports and operates a virtual economy. Messinger et al (2009) describe the profit model as return on investment and their taxonomy considers whether the world supports a single purchase price or registration fee (i.e. fixed fee); fee per use (i.e., variable fee); subscription based; advertising-based; pay-as-you-go extras (virtual assets including clothing, land, and software); and sale of ancillary products. While membership of many of the virtual worlds used by educators is free, there are costs associated with the purchase and maintenance of virtual space on many public servers such as SL and ReactionGrid. On the other hand, many educators have made effective use of the virtual economy supported by virtual worlds such as SL to help students develop e-commerce and business related skills.

Australian case studies: teaching and learning in 3D virtual worlds

The following vignettes are drawn from case studies of twenty one Australian institutions that are conducting classes and undertaking research in 3D virtual worlds. The case studies describe a diverse range of teaching and learning activities undertaken by educators in different geographical locations on different 3D virtual world platforms and across a variety of disciplinary areas at high school, undergraduate and post-graduate levels. The typology of teaching and learning in 3D virtual worlds is then applied to these case studies as a means for comparing and contrasting the pedagogical approaches employed by educators in 3D virtual worlds to transform their teaching and prepare their students for an unknown future.

Second Life classroom and playground – University of New England
The island of Australis4Learning was created in SL through a three-university partnership. The island is divided into three sections, giving each of the institutions land to use individually with their students. On one section of the island is a virtual primary school classroom and playground. Since 2008, this space has been used by various cohorts of teacher education students from first year pre-service teachers through to Graduate Diploma in Education and Masters students. Students meet inworld each week to discuss assessment tasks and explore learning and teaching opportunities through guided discovery. They participate in virtual excursions and interact with guest lecturers from a variety of national and international higher education institutions, as well as high school practitioners and virtual world consultants, to enlighten them on how they might use virtual worlds in their teaching.

Students are taught basic building and scripting so that they are able to use these skills if desired. They are

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also introduced to different inworld tools and their educational uses, including 'holodecks' (scene changers), interactive 'bots' (automated avatars) and clickable breakout areas. They experience driving cars, planes and bikes within SL and undertaking role-play activities such as those based on de Bono's Six Thinking Hats (Gregory & Masters, 2010a, 2010b). Some students have assessable tasks related to the virtual world-based activities, while others attend and participate purely because they appreciate the value of learning about virtual worlds for their current and/or future professional practice. It is refreshing to have students attend purely to gain knowledge and experience independent of assessment. Will these be our innovative teachers of the near future?

Chinese Island – Monash University
Chinese Island in SL is designed to complement traditional classroom-based learning with context-based, hands on learning in the virtual environment exploring the unique Chinese language and cultural learning environment it offers. Chinese Island provides a range of inworld learning activities, ranging from role-play, to quests, to the making of television chat shows and news-desk reporting (Grant, 2010).

A major focus of the research and development on the island has been the use of automated non-player characters (NPCs) in synchronous lessons to provide a form of semi-naturalistic linguistic interaction for participating students (at this stage mostly beginner level students). A number of benefits have been found to arise from this use of NPCs. As a part of task-based lessons they provide an avenue for meaningful communicative interaction that is integral to the completion of the set task(s), and thus the lesson objectives themselves. The interaction is semi-naturalistic in that while the range of responses is clearly limited, there is a degree of unpredictability built in that requires learners to engage in authentic cognitive activity, that is, they have to think on their feet in a way that is not dissimilar to similar real-life situations.

Inworld lessons have also provided the opportunity to carry out research into self-efficacy and to map the kinds of cognitive skills used by students during inworld lessons. Self-efficacy is self-reported confidence on the part of the learner to be able to cope better with a particular scenario (based on real-life scenarios) in the target language. Results to date have indicated that there is indeed a positive correlation with increased self-efficacy as a result of the inworld lessons. Mapping of cognitive skills has been carried out using the stimulated recall methodology and has shown that a lager percentage of higher level cognitive skills are employed by learners during the inworld lessons than lower level skills. This has implications for future lesson design where triggers may be purposefully built into lessons that will activate these higher cognitive skills.

In 2009 students interviewed a range of Chinese speakers from around the world by conducting interviews; one an informal chat while the second used a formal sit down chat show approach. These were all filmed in SL to produce a test based bilingual news article. This involved cooperate between students in Australia and guest in China, Singapore and the USA together with filming work conducted by students of Boise State University in the USA.

MacICT Virtual Worlds Project – NSW DET and Macquarie University
OpenSimulator (*OpenSim*) platform was used to evaluate NSW Board of Studies curriculum-centred activities involving student design and construction. This targeted both primary and high school students. Cyber-safety, and learning through construction were the guiding themes. Engaging students in design and construction activities within a virtual world has three potential advantages: students may see the value of the content as a tool to resolve design problems (Barab et al., 2007; Brown, Collins, & Duguid, 1989); the construction tools allow rapid testing of ideas, as well as sharing and re-use of objects; and students can collaborate on designs within the virtual world.

Cyber-safety is of critical importance, with three main concerns: *Student behaviour* – students follow a code of conduct within the world. For example, this encourages students to help and respect one another; *Access* – the *OpenSim* server is hosted on site and student access to the server is restricted to class times only; and *Supervision* – the students' teacher must always accompany and monitor the students within the virtual world.

One unit of work has been evaluated, in which Year 9 Visual Arts and Design students used the virtual world construction tools to model site-specific artworks, which were later constructed using physical materials within their school. The evaluation explored students' use of the virtual world to model artwork

ideas and the impact on design processes and development of spatial awareness. One objective is to assist other educator's transform their practice through increased awareness of the possibilities and limitations of virtual worlds as modelling tools.

Access to virtual worlds – University of South Australia
The United Nations Convention on the Rights of Persons with Disabilities came into force internationally in May 2008. The primary aim of this Convention is 'to promote, protect and ensure the full and equal enjoyment of all human rights and fundamental freedoms for all people with disability, and to promote respect for their inherent dignity' (United Nations Convention on the Rights of Persons with Disabilities, 2008). Australia was one of the first Western countries to ratify the Convention in July 2008. The internet can improve communication and increase the independence of people who have disabilities and those who are geographically or socially isolated but despite this potential, Web 2.0 and 3D virtual worlds remain largely inaccessible to many people with disabilities (Wood, 2010).

In response Access Globe was developed, an accessible open source viewer and a Web 2.0 enabled interface to virtual worlds (Australian Learning & Teaching Council, 2010). Access Globe provides an alternative way to access SL and includes specific features that make it more accessible to people with disabilities, such as enhanced accessibility menus, alternatives to a mouse-driven interface and an audio notification system to assist those with visual impairment to login and follow online conversations. Innovations like Access Globe mean people with disabilities will be better placed to benefit from the collaborative and experiential learning potentials of virtual worlds. A series of guidelines focussing on pedagogy, ethical use of virtual worlds in teaching and learning, Intellectual Property and design guidelines for ensuring accessible options for students with disabilities are being developed. The hosted SIMS on three different platforms are: *OpenSim* - trialling use of the virtual worlds for career planning and preparation, defence simulations and under development are simulations in international relations; *Reaction Grid* – used for trials of health sciences simulations, as a test bed for accessibility testing, for a project involving intermediality in performing arts courses and as a replica of their careers for broader application; and SL for trialling several media arts courses. Their objectives are to provide greater accessibility for 3D learning environments for as many people as possible.

Commerce in a virtual world - Swinburne University of Technology
Students are exposed to a real virtual e-commerce environment. They analyse hands-on the business environment rather than textbooks and, being a regional campus, this assists students to understand real life business operations. Class activities are perceived as more fun as it is in 3D and considered cutting edge technology. Students benefit from contemporary concepts and applications making them very vocational and prepared for the work force. This is undertaken by students comparing and contrasting online business models using web 2D and virtual (3D). They interact with real time people and life events whilst exploring the usage of space, such as how customers are treated as part of a space rather than just a visitor on a website. The virtual world is used for building a space and formulating strategies for marketing, sales, product delivery, logistics, advertising and commerce transactions. Students are exposed to different ways of learning not only books or lectures, but by more practical and immersive ways.

Student response and feedback is that 90% of the students truly appreciated the effort and enjoy the class. However, they become very concerned about the lack of information, the challenges of research as part of the unit and the limitation of SL as a platform. 5% of students are not convinced about the technology and another 5% don't understand how to use the technology.

Criminology, Anthropology, Arts & Education in Second Life – Deakin University
Within the criminology and anthropology sectors, research has been undertaken around regulatory models for dealing with virtual worlds in higher education in Australia. This is built on concerns that within the Australian Higher Education sector, platforms such as *Second Life* are currently governed by online codes of conduct that do not adequately cater for their immersive characteristics. Moreover, there are broader difficulties associated with Terms of Service agreements and other formal arrangements to enforce good conduct. The use of SL to educate students on the regulatory options within online environments enhances their understanding of real-world methods of social control, and in particular the crucial informal or normative methods of encouraging social cohesion without recourse to formal law. Through a variety of inworld activities, students are encouraged to think critically about the role of law, rules and norms to encourage good behaviour in various elements of day-to-day life, while questioning the various practical

dimensions of formal law in regulating immersive internet content and conduct (Warren et al., 2008). In addition, the Arts and Education Island in SL is an example of how academics have successfully enhanced student interaction through the display of artistic and musical works (Grenfell &Warren 2010). This ongoing project is a benchmark for adoption by other institutions wishing to explore this technology to improve student engagement, in a context where several E-simulations have been developed for teaching and learning.

Engagement in authentic learning experiences in the Arts Education Centre on this SL Island has been introduced into a number of arts discipline units at both undergraduate and postgraduate levels. This has resulted in the participation of students and educators in immersive and real life teaching and learning experiences in an undergraduate Art Education unit. The introduction of blended "inworld" synchronous and asynchronous and conventional "real world" workshops, and tutorials linked to online elearning materials was designed to increase student engagement in activities such as creating, exhibiting and analysing digital artworks. Student led problem solving and role-play was introduced to identify, explore and discuss arts teaching and learning issues throughout the trimester.

For another cohort, drawn from two different courses across two schools, one from Art Education and the other from Public Relations authentic contexts and activities were experienced by students collaborating on a common assessment task. The group met inworld throughout the trimester to plan, build the gallery environment and mount a virtual exhibition of their digital artworks and to develop and implement a public relations campaign designed to promote and advertise the exhibition in the Virtual Art Gallery.

Ethics in a virtual world – Australian Catholic University
The virtual world is used to complement the teaching of professional ethics and decision making through simulation of classroom learning experiences for students to undertake by distance during their internship and also extending to the use of role-plays as simulated professional experience. The motivation to undertake development of the virtual world emerged from the problem of teaching professional ethics within a classroom with existing social and cultural expectations (Campbell, 2009a). Often student responses were tempered by a fear of being ostracised and also, when dealing with particularly sensitive issues, concern about student disclosure and welfare. The simulations in the virtual world have encouraged greater sharing of ideas and collaboration as well as engagement in thinking ethically (Campbell, 2009b). For students learning off-campus, they have also provided a more engaging online medium and made the students feel more part of the University. The School of Education (NSW) is now beginning to work with a few secondary schools in developing similar teaching tools for use in their teaching as part of the Studies of Religion curriculum.

Education, Engineering, Medicine and Pharmacy – The University of Sydney
A project was established to develop a range of teaching and learning spaces, including a central gathering space for students. There are several functions for the central space: to have a common entry point for new students; a common meeting point for students and staff to promote cross faculty communication; to provide areas where students have a space to construct their own work; a general conference centre space for holding meetings, workshops and potential conference addresses; to provide a common classroom space which is equipped with the range of SL teaching tools for all staff to use (whiteboards, *Twitter* board, message board, presentation screens, *flickr* streams, 'follow-me' tools, 'rez-on-touch' seating arrangements and so on).

Through collaboration, academics trialled a range of innovative pedagogical strategies and monitoring and researching their success and challenges with respect to virtual worlds. Such strategies include: Education: Exploring the value of role-playing and storytelling in 3D environments for teaching English and literacy; designing student projects such as machinima film-making (machine-based cinema); the use of avatars as characters to engage in fictional storytelling and drama experiences; the use of scenarios which require extensive communication skills to resolve, for TESOL students to practice and rehearse English; Engineering: 3D virtual laboratory spaces for experiential learning; Medicine: 3D virtual surgical ward populated with simulated patient avatars for students to practice history taking and clinical management skills, exploring the enhancement of learning and teaching by creating simulated patient avatars and problem based learning (PBL) scenarios in SL in order to provide students the opportunity to rehearse dealing with problem based presentations of surgical disease; Pharmacy: use of virtual space for familiarisation with cross-cultural health settings To make maximum benefit of the virtual world

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transmedia practices, such as posting machinima on YouTube, creating blogs to document work and creating wikis to capture the richness of experiences occurring in the teaching space were encouraged.

Virtual Worlds Project – The University of Sydney and Macquarie University
In another virtual worlds project, the focus is to explore how scenario-based Multi-User Virtual Environments (MUVEs) can be used to develop scientific inquiry learning in secondary school science education. The initial phase of this study uses *Virtual Singapura*, a scenario-based MUVE that explores disease epidemics in 19th-century Singapore, in two Australian High Schools. *Virtual Singapura* provides a virtual environment in which secondary school students learn science inquiry skills, such as proposing research questions, hypothesis formation, identification of dependent and independent variables, analysis of data, and interpretation of findings in relationship to hypothesised outcomes as well as learn about communicable diseases and the impact of humans on the environment. The approach to be used in this research study is to conduct classroom-based, quasi-experimental research studies into the efficacy of MUVEs to help students learn content knowledge and skills in ways that are deep, adaptable and transferable. New MUVEs are currently being developed for the national curriculum in Unity 3D. The first of these new environments will be ready for deployment in 2011. The scenarios will include Australian Megafauna and feral animals and will focus on evolution and ecosystems.

New Media Literacies – University of Tasmania
Even though some academics have considerable expertise, experimentation and exploration is taking place to explain ways in which to incorporate virtual worlds in their teaching of New Media Literacies. This class explores the value of new media in various education contexts. The class engages in ethnographic research of the textual, discursive and social literacy practices that are occurring across a range of new media spaces including virtual worlds and other social networking sites. Students are exploring the potential of virtual worlds to explore great literary works such as Shakespeare (in particular, "Virtual Macbeth" in SL) and Greek mythology. Students are exploring how complex, esoteric and poetic concepts of texts can be constructed and examined critically in virtual worlds. They study aspects of identity and how, through the creation of "other", they might use different kinds of literacy than what they use in everyday life (Thomas, 2007). Students investigate ways in which the remix culture and groups like 4chan (in transmedia spaces, of which virtual worlds like SL is one) are creating and realising subversive social agendas to undermine dominant hegemony and discourse. Themes and new literacy practices such as play, performance, transmedia, remix, appropriation, simulation, collaboration, participatory culture, distributed cognition and multimodal authoring are all researched by students in and around virtual world spaces and social networking sites.

Several pilot projects have been supported within SL including the production of a series of machinima based around improving student presentation skills. A virtual classroom populated with artificial-intelligence-driven student avatars to develop behaviour management skills is being built and others are using SL to explore the issue of body image in contemporary culture.

Second Italy: Teaching International Studies - University of Technology, Sydney
 SL was used to supervise research projects of students in Italy as part of their studies in International Studies during 2008 and 2009. Students interacted in real time with their lecturer and other students. They attended a partner university overseas while conducting independent research. Students and lecturers tested the dynamics of distant supervision using a virtual world and considered the relation between sim design and learning. This learning explores the design, atmosphere and tempo of how a virtual space affects the process of learning.

Machinima for learning – Central Queensland University
Most SL activities at Central Queensland University have been focussed on the production of machinima for learning support rather than facilitating student interactions within the virtual 3D world. The term 'machinima' refers to the use of real-time 3D graphics rendering engines like those used in video games and SL to generate computer animation.

In one instance, a series of machinimas were produced on the University's island in SL as part of the renewal of an advanced auditing course (Muldoon & Kofoed 2009). The project was a response to repeated calls from researchers, employers and professional bodies to provide learning experiences for accounting students that demonstrate authentic practices and values within the profession. The course re-design

involved assigning each student a role at a fictitious auditing firm and giving them opportunities to undertake authentic auditing tasks for a major client. The series of machinimas presented students with various real-world scenarios, including ethical dilemmas, which they could then respond to through follow-up activities such as collaborating with team members to prepare weekly audit papers, formulating strategies for dealing with ethical and legal issues, and reflecting on their experiences in an online journal.

The first offering of the renewed course was delivered to 322 students studying at eight campuses and via distance education. A comparative analysis with previous offerings of the old course pointed to a significantly improved pass rate and a higher level of engagement and participation across all cohorts of students

Transforming assessment and history – University of Adelaide
'Transforming Assessment' is about improving academic assessment practice within virtual worlds (and other online / Web 2.0 / LMS) environments. The presence in SL, in conjunction with an exemplars website at transformingassessment.com, showcases various approaches to e-assessment across a range of discipline areas. Techniques applied in SL include using Sloodle Quiz Chair for quizzes that integrate both inworld and web content, using Sloodle Awards to provide instant and comparative feedback, using a chat logger to link inworld and out-of-world participants, using QuizHUD to establish 'touch to answer' exercises and using chat 'bots' (scripted avatar robots). Work is also progressing on integrating virtual worlds with out-of-world course management systems to facilitate e-assessment workflows.

'Getting a MUVE On' is a project trialling and evaluating a recreation of part of eighteenth-century London using SL. Active use of SL was to determine its pedagogical and practical value as both a learning and teaching environment which has involved the illustration of lectures, running inworld tutorials and the design of innovating learning tasks. Students in the project's pilot course have completed the first university-level History assignment in a virtual world. Students constructed a Research Project displaying and evaluating the research they have conducted during the semester. Students also wrote a Reflective Journal on their experience.

ImmersED HQ for educators – Education Services Australia
A virtual world presence was created using an open source platform on *Reaction Grid*. While it is located on the Internet it can also be hosted on a LAN or individual computer.

Educators are invited to take part in the activities in the virtual world themselves and then to use them with their learners. On arrival at the Welcome Centre, visitors are presented with choices of activities designed to give them hands-on experience. Overview materials on site explain how to acquire some of the skills they will need such as how to walk, sit, text chat, take a photo or dress their avatar. Ready-to-go activities are available on the site: 3D Safari and Role-play. 3D Safari encourages them to visit other islands on *Reaction Grid*, while Role-play gets people to participate in an interview in authentic surroundings. Overview materials describe both the activities and the learning objectives. The Resource Centre is an important feature, allowing visitors to give feedback and make suggestions. All the inworld assets that have been created to support the activities are freely available to constructors. Aimed at educators who have had limited virtual world experience, it attempts to provide a virtual environment that is safe for younger learners. It encourages educators and their pupils to think beyond the square, to plan for futures that have not yet happened.

Information Studies, Chemistry, Social Work, Policing and Fire Investigation – Charles Sturt University
Information Technology and Teacher Librarianship (TL) academics have been using text-based and graphical MOOs (Multi-User Dungeon, Object Oriented) – predecessors of today's virtual worlds – and 2D massively multiplayer online role-playing games (MMORPGs) in their teaching since 1997 (Hay & McGregor, 1999; Eustace, & Hay, 2000; Lee, Eustace, Hay & Fellows, 2005; Eustace, Mason & Swan, 2007). The CSU-SIS Learning Centre was built in SL in 2009 to provide distance education lecturers and students in Library and Information Management (LIM) and TL courses with more immersive, synchronous learning experiences (Hay, McGregor & Wallis, 2009). Students are encouraged to attend online discussion sessions hosted by lecturers and guest speakers; deliver their own inworld presentations, join professional/educator groups and participate in professional development activities; visit a range of educational campuses; and meet with lecturers for individual consultation. The Centre also offers a number of social spaces and facilities to support socialisation and community building, addressing a critical

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dimension of university life that distance students do not commonly have access to. Students are also encouraged to use the Centre as a way of staying in touch with the School and with one another as part of their professional learning network upon graduation (Hay & McGregor, 2010).

Virtual simulations are also being used across a range of subject areas and disciplines. Although they do not involve 3D avatar-based virtual worlds like SL, '*eSims*' developed include a Mental Health *eSim* in which Social Work students refine client interview skills (Murdoch & Johnson, 2009), and one in which Policing students deal with Domestic Violence cases (Bushell, 2010). A virtual simulated environment has also been used in the teaching of a fire investigation subject, to address the challenges of creating an uncontaminated, real-time fire scene in which students perform authentic tasks (Davies & Dalgarno, 2009). In the Science discipline, a 3D Virtual Chemistry Laboratory, developed using the Virtual Reality Modeling Language (VRML), has been used with first-year distance education students in preparation for their on-campus residential schools (Dalgarno, Bishop, Adlong & Bedgood, 2009). While this single-user application provides learners with the opportunity to familiarise themselves with the university's physical lab space and procedures, the potential of extending or porting it to a virtual world platform to incorporate multi-user capabilities is being explored (Lee & Dalgarno, in press). With 75% of the university's students studying in distance or mixed modes, virtual worlds are opening up new possibilities and creating exciting opportunities for the future of teaching for the professions.

A 'boot camp' for the virtual world - Southern Cross University
In 2009 an SL island was designed to create a recognisable and interactive version of the Lismore campus. It aimed to provide a range of features and activities for academic staff, administrative staff and students. The virtual campus environment encourages and supports staff and students with no prior knowledge of this technology to have a safe, varied and motivating "first experience". The design and build aimed to provide a "boot camp" environment for training in the use and possible application of virtual world environments to a wide range of university activities (Ellis, Hassett, & Rowe, 2009; Ellis, Jacobson & Rowe, 2010).

In 2010 the following were taught in SL: Visual Arts Education allowed students on three campuses to meet inworld. SL is an ideal environment for artists as they are "doers" and appreciate the creative process of being able to draw, build and change texture objects inworld. An SL Law Users Group (SLLUG) was formed to develop activities in the virtual Moot Court. Under development are practicum and job interview activities for Tourism students based on the Resort and Exhibition Centre buildings. All university staff are invited to explore SL via regular weekly inworld meetings that involve visiting various interactive features of the virtual campus environment.

In 2010 an international collaborative project, on a second SCU island, was initiated to design and build "Commerce Town", a virtual environment that will be used for business simulations. SL provides an ideal environment and suite of tools to work collaboratively with the local, national and international academics, professional organisations and business partners.

Religion Bazaar: empathy, immersion & engagement – University of Queensland
The Religion Bazaar project was developed through 2008. It consists of an SL island situated in the New Media Consortium educational precinct and boasts a number of religious builds (buildings) including a church, a mosque, a synagogue, an ancient Greek temple, a Freemason's lodge, a Zen Buddhist temple and a Hindu temple to Ganesha. It was used in two large first year classes and for supervising distance postgraduate research students. The religious buildings were constructed in such a way as to allow ritual reconstructions and role-playing. There are a number of non-religious constructions including an amphitheatre, numerous informal meeting spaces and a reconstruction of an iconic Great Court. The main use of this environment is for religion courses that consider practices and rituals in a wide variety of religions and religious contexts. SL provides an immersive experience for students, allowing them to experiment with identity and experience empathy by taking on avatar of a different gender, culture or race. For example, a group of students gained a unique insight into the discrimination which Muslim women wearing the burqa experience in western society by dressing their avatars in that way and going to a public place in SL. Through their avatars, students could explore a religious space with just-in-time information provided by way of notecards at the various places. In addition, they could closely examine religious artefacts and outfits which would be very difficult, if not impossible, for them to access in real life. In this

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way, SL transforms learning from being third-hand as with a typical didactic approach to being first-hand through direct experience.

Business Island - International Education Services (IES)
On the SL platform "Business Island" is an educational learning tool that enables students to develop their business skills. Business Island provides students with access to a virtual trading environment that realistically simulates the business world. Business Island comprises five streets with eight businesses on each street.

Students can meet socially on the ground floor of the main building or attend lectures in the upper floor. Each street contains eight businesses: two coffee shops; two fitness centres; two motels; a nightclub and a cinema. The students manage a business ordering raw materials; producing and pricing products; organising marketing campaigns; selling their products and dealing with changes in their business environment. Students learn about leadership; teams; marketing; change management; strategic planning; customer service; company reports and human resource management. Change can be introduced into the business environment and communicated to the students through gossip, the media or discussions with the taxi cab driver. Business Island comes with a learning management system that provides course content in a multimedia format. The learning management system allows staff to track the progress of the student and to view their work.

The simulation, trialled with 120 business management students, increased class attendance by 30%. All of the students felt that their involvement in Business Island taught them important elements regarding business and how to collaborate in teams. 75% of the students felt that the simulation effectively reproduced reality and communication skills were improved by 85%, whilst 80% felt they had learnt management skills and increased their management knowledge, their ability to work in teams and their general communication skills.

Careers, Law, Sustainable Catchments and Nursing – University of Southern Queensland
The first foray into virtual worlds was by means of bespoke environments created in-house. It was soon evident, given the rapid increase in the availability and usefulness of inexpensive, commercially produced, cross-platform virtual worlds, that in-house production was a prohibitively expensive and time consuming way to make 3D learning environments. In 2007, we became one of the first universities to conduct a careers fair in a virtual world, using the browser-based *Exit Reality*. Given the success of the Careers Fair in a 3D environment, SL was investigated as a readymade but customisable environment for learning and teaching. Limited teaching trials were conducted during 2009 in Criminal Law and the English Language and Culture Program (ELCP) to identify the location-specific requirements, challenges and opportunities for the university. In the Criminal Law course, a machinima was created to introduce the course and advocacy assessment exercises. Students then participated in simulated courtroom presentations before a judge in a lifelike replica courthouse. In SL, staff and distance education students dressed avatars in appropriate court garb and the lecturer in the role of judge asked clarifying questions to simulate an authentic courtroom experience. It was found as an effective method replacing the recorded monologue. In the ELCP role-play activities were set within a lifelike office building. The staff regarded it as a useful addition to their language practice with both students and staff regarding the experiences as being much closer to the real world workplace experience.

"Reinvigorating Information System Development Students' motivation through virtual world business scenario simulations" - Curtin University
In response to an observed decline in interest and performance of Information Systems Development students we have set up a business case study and modelled it in SL. The case is based upon the Business School's Automated Assessment Laboratory (AAL) which facilitates the automated essay grading of large cohorts of students from the various subject domains. Final year students have the option of choosing a system development task to implement a variety of the AALs business processes related to the automated essay grading function. A handful of projects have been completed since 2008 ranging over simulating assignment submission, tracking, and assessment feedback provision, as the core business functions. In addition, numerous support functions have been created to streamline the virtual environment use (eg rapid avatar movement direct to a business activity location), and some interesting ideas implemented to support the systems development process (methodological elements). Students have been delighted with the

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opportunity to work in an exciting new medium – clearly our reinvigorating objectives have been met. There are challenges yet to confront and concern the relative lack of sophistication of the systems development tools available in the virtual world and issues relating to project management such as backup, security, artefact ownership, control, and use, and the packaging of sub-system components into an integrated system. Real world – virtual world interoperation will need to be explored to a much greater extent so that we are able to take advantage of existing systems development methodologies. Interested readers may access a machinima documentary named Australis4Learning_Movie.mp4 at http://eaglesemantics.com/webfm

Applying the typology to teaching and learning in 3D virtual worlds

The typology for teaching and learning in 3D virtual worlds has been applied to the case studies drawn from the twenty-one Australian higher education institutions that are members of the DEHub Virtual Worlds Working Group. The application of the typology enables comparison of the pedagogical approaches, the platform for delivery and associated profit model implemented by these institutions as summarised below.

Purpose: A range of learning activities are undertaken by students including attending virtual discussions and meetings, guided discovery activities, interactions with guest presenters and consultants. Many of the case studies reported in this paper refer to the benefits of virtual world activities involving role-play and simulations (for example University of Adelaide, Education Services Australia, the University of Queensland and the University of New England), scientific investigation (the University of Sydney) and business modelling (International Education Services, Southern Cross University and Curtin University). Other case studies focus on the use of virtual worlds to facilitate creativity through art education (Deakin University and Southern Cross University) and film-making (machinima) (Central Queensland University and Curtin University), while the University of Technology Sydney is using virtual worlds to help improve language learning skills. Others are using virtual worlds to promote greater understanding of ethical issues and intercultural awareness (Australian Catholic University and University of Queensland) through a combination of discussion and role-play. For example, first year students at the University of Queensland undertaking religion studies, role-play religious rituals and historical events in order to gain an understanding and empathy with people of other cultures and religions.

Place: The case studies reported in this paper illustrate the benefits of engaging students from geographically dispersed locations in collaborative learning activities within the virtual world, as well as the effectiveness of using 3D virtual worlds to complement classroom activities through a blended learning approach (for example Macquarie University, Deakin and the University of South Australia). The case studies also provide examples of the different kinds of in-world places in which learning activities are undertaken by students and the advantages that 3D virtual worlds provide in enabling students to experience a variety of situations that they would not otherwise encounter. For example, Monash University conducts classes in Chinese-themed macro environment to provide language and culture learners with a generic representation of sites that one might encounter in China and incorporates task-based simulations of everyday activities requiring the use of Chinese linguistic and non-linguistic skills. Deakin University manages several SIMs including Deakin Criminology Island, Deakin Arts-Education Island and the Deakin Arts Education Centre, incorporating meeting and tutorial spaces for on and off campus students, an art gallery, studios for developing scenarios and simulations and a sandpit for experimental building. Central Queensland University utilises their virtual space to provide students with authentic workplace experiences in their simulated offices of a fictitious audit firm.

Platform: While SL is the preferred 3D virtual world platform by most of the educators whose case studies are reported in this paper, there are also some educators who are exploring a variety of other platforms including OpenSim hosted on their own server (for example Macquarie University, the University of Southern Queensland and the University of South Australia) and ReactionGrid (Education Services Australia, University of New England and the University of South Australia), which is a public server with OpenSim as the underlying platform, Exit Reality (Swinburne University of Technology and the University of Southern Queensland), Active Worlds and Unity 3D (University of Sydney). The case studies illustrate the relative advantages of conducting teaching and learning via these different platforms.

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Population: The case studies report teaching and learning activities undertaken by groups of students across a range of disciplinary fields at high school, undergraduate and post-graduate levels as well as examples of teaching and learning involving groups of students interacting cross-institutionally and across geographical locations. The case studies describe the benefits of using 3D virtual worlds for teaching and learning involving role-play, experimentation, excursions, guest lecturers, demonstrations, games, ethics, evaluation, assessment, showcasing, exhibitions, conferences, meetings, libraries, play, socialisation, transactions, accessibility, language, literacy, accounting, auditing, commerce, business, law, anthropology, arts, engineering, medicine, pharmacy, mental health, policing, fire safety, agriculture, viticulture, chemistry, religion, nursing, sustainability, education and transformation.

Profit model: The majority of case studies describe teaching and learning via SL, which provides free membership for academics and students with fees associated with purchasing or leasing virtual space and maintenance of those spaces. There are also fees associated with uploading content to the public server and purchasing virtual goods. There are some examples of teaching and learning delivered via an open source platform (OpenSim) either on the university's own server (Macquarie University, the University of Southern Queensland and the University of South Australia), or the public server maintained by ReactionGrid (Education Services Australia, University of New England and the University of South Australia), which like SL, has a fee structure associated with purchasing and maintaining virtual land. The advantages of teaching and learning in an environment such as SL, which operates its own virtual economy, are evident from the case studies describing learning activities aimed at developing students' business, accounting and e-commerce skills.

Conclusion

The case studies reported in this paper and described according to the typology of teaching and learning in 3D virtual worlds are drawn from Australian institutions that are using the 3D virtual world to bring together students who are locationally independent, into one space to work together in a collaborative environment for teaching and learning. All are conducting research relating to the pedagogical benefits of teaching and learning in a 3D virtual world. They are mindful of the rapid rate of change in technology and that what we are doing now may be so very different in five or ten years. These institutions are exploring emerging technologies to accommodate an unknown, but challenging and exciting future.

Given the future will undoubtedly see faster, cheaper computers, faster national and global connectivity and bigger and better resolution screens, the application of virtual world technologies to the fields of education, business and entertainment can only increase. What educators are learning today as they explore virtual world technologies using SL can only provide them with a sound foundation for the future. As Jamison (2010, online) states, this technology provides new opportunities for teaching and learning. He also points out that if SL were to disappear, "we will take what we have learned here and transfer it to whatever platform emerges to take its place". Universities need to increase their rate of use and acceptance of digital technologies otherwise they run the risk of being sidelined. They no longer hold a monopoly on information, once locked away in books in membership only libraries. Virtual worlds open opportunities for students to construct new ways of being and exploring knowledge. Portals of the virtual world are now surpassing the doors of the traditional university.

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