"Learning in virtual worlds: The challenges and opportunities"

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Abstract - Virtual environments are revolutionizing almost every aspect of the learning process; the learners live in interactive cyberspaces where they can communicate and collaborate globally in various ways. With the arrival of the Net Generation and the challenges and possibilities that the use of virtual reality brings to learning, the use of virtual simulations extends its possibilities to content access transforming education in a participatory and immersive experience. Virtual reality provides optimal support for information storage, retrieval and manipulation. Capitalizing on the awesome power of virtual reality for educational uses will permanently change the nature and course of how students learn. Virtual reality provides students with an unprecedented chance to explore, engage, and visualize the complex processes like never before. This paper explores the use of Second Life, a virtual learning environment, in higher education systems, and the potential possibilities of such virtual environments for teaching and learning in the 21st Century.

Key words - virtual learning environments, intelligent objects, virtual simulation, learning, constructivism, 3D environments, Second Life.

I. INTRODUCTION

Computer-based virtual environments have been a focus of research interest for a number of years because of their potential applications in training, design, visualization, education and entertainment (Kinshuk et. al., 2006). An important aspect of virtual environment systems is realistic simulation of a 3D environment. Virtual Reality (VR) is emerging as a promising technology to simulate the real world on the computer and is being applied to many fields of industries and academia. The uses of VR not only make us transverse the time and space to learn beyond physical limitations but also in a more interactive environment that enhance the learning ability especially on a complex project/topic.

The role of education in society is also changing, placing new pressures and demands on educational institutes across the globe. Many of the increasing challenges are arising from the emerging generation of new learners who are far more proficient with VR and other computer applications. The trend in professional society is also changing based on new learning tools and modes. Recently, virtual worlds have become an important part of teaching and training, transforming the way people work and learn. As technology allows more and more content to be virtual, so improves the possibility of better learner engagement.

Experiential education is a core component of applied undergraduate studies. In a project based learning environment, students work in teams to solve real-world problems. A virtual world assist such learning in a borderless environment where the students can explore and learn based on real life principles in virtual world. Considering the dynamic nature of new learning environments, the paper presents a perspective on how post secondary institutions in Canada are adopting the new trend of VR for enhancing the learning experience of the students. The discussions in this paper mainly focus on how Second Life, a virtual world, ideally blends with the learning environment that encourages hands-on learning.

This paper presents an analysis of the use of virtual environments for hands-on learning, its challenges and its opportunities. A definition of Second Life as a platform to teach and learn is examined and a case study of a polytechnic institution in Canada using Second Life is presented.

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II. SECOND LIFE: An example of *virtual worlds for education*

Second Life (SL) is "an Internet-based virtual world" (Wikipedia, 2009). It was originally conceived by Peter Rosedale, now the CEO and Founder of Linden Lab, an artist that wanted to "create a masterpiece that represents the world" (Rymaszewski et al., 2006:6). The project started in 2001, beta tested in November 2002, and opened to public access six months later. The beta version of second life contained a teleporting fee and land maintenance costs (this has remained till today). On June 2003, SL went live and in October the same year, a major update introduced new features such as search functions and world maps (Rymaszewski et al, 2006).

With more than 12 million users by 2009, SL allows users (called 'residents') to interact with each other, communicate, and play in an environment that is "100% user owned and created" (http://sleducation.wikispaces.com/). At the time of writing, 122 educational institutions had virtual campuses in SL. These spaces are becoming part of the education community around the world, but using SL to teach and learn is still a new experience and one that needs further testing and research.

Both formal and informal education happens in SL. By formal education, we refer classes, instruction, training and simulations. In the category of informal education, we include immersive museum exhibits, informal chatting on academic topics, role-playing, etc. Furthermore, learning takes place in SL using various forms of knowledge sharing and acquisition - through network and collaboration, in an immersive experience and a participatory culture.

Innovative educators around the world are exploring how virtual worlds can serve as powerful educational tools in instructors' and students' approach to teaching and learning. Use of SL in higher education institutions is relatively new, as mentioned earlier; however, there are already some good examples (best practices) of universities, colleges and polytechnics that have made use of the technology in very interesting ways. In an academic setting, SL has become an accepted virtual platform and a channel of communication between instructors and students, between students themselves, and among faculty, as they have discovered the potential of creating virtual environments for lectures and other course materials. And, since use of SL is not restricted to the classroom limits, its use in a higher education institution context can take the learning process beyond the boundaries of the classroom and can offer anytime/anywhere opportunities for teaching and learning.

However, the novelty of the use of virtual worlds for education brings with it the challenge of developing pedagogical understandings around the relationship between the use of synthetic experiences and the educational context within contemporary society. There are still many questions to be answered in relation to what are the 'new' benefits that instructors and students will receive after using SL for learning or how can we usefully expand the learning opportunities so that SL can become a valuable learning tool.

These connections do not exist yet in the literature (Kervin & Vardy, 2006) and that is why developing case studies of different uses of the technology should be accompanied with a continues search of pedagogical models that could enrich the learning experience, or that could be brought/identify from student's learning experience.

III. SECOND LIFE: Responding to the Learning Expectations of the Net Gen

Today's average college graduates have spent less than 5,000 hours of their lives reading, but over 10,000 hours playing video games (not to mention 20,000 hours watching TV). Computer games, emails, the Internet, cell phones and instant messaging are integral parts of their lives (Prensky 2001; Wesch, 2007). As a result of this omnipresence of technology, today's students think and process information differently than their predecessors. Even more so, their entire beliefs and values are different from those in their previous generation and these differences usually go further and deeper than what most educators realize. These are some of the reasons why today's students have received the title of being "digital natives" as Prensky (2001) has named them. In coining this term, Prensky (2001) is making the analogy of natives to a homeland and in this case he refers to the "digital land", or those who have always known the internet. Others have called this new generation of students the "Net Gen" where net refers to networking or Internet use. Whether digital natives or net-Geners, this generation was born when the computer had become an important part of the dynamics of a home, where the Internet had become an integral part of daily activities.

Some argue that even if the digital natives have slight differences in speech and social interactions, they are fluent in digital communication forms that are prevalent in the new land. Oblinger (2005) characterizes the "Millenials" (as she calls this new generation of students born after 1982) this way: "They gravitate toward group activity and social networking; they identify with their parents' values and feel close to their parents; they spend more time doing homework and housework and less time watching TV, they believe "it's cool to be smart", they are fascinated by new technologies; they are racially and ethnically diverse…" (Oblinger, 2005:2).

Academic colleagues from different countries have begun to consider whether students around the world have similar experiences to those in North America. Oliver and Goerke' (2007) for example, researched undergraduate students in Australia to find out whether their students confirm these assertions. "Ownership of laptops, mobile phones and music devices appears to be growing rapidly among this group, along with their use of tools such as instant messaging, blogs and podcasts" (Oliver and Goerke, 2007). Another example of this is the work done by Creanor et al. (2006) and published as the LEX (Learner Experience of E-learning) Report. A total of twenty two interviews and six focus groups were conducted to evaluate students' experiences with e-learning in the UK. Findings of the report include the fact that learners involved in the research tended to be highly skilled networkers and often used technology to pull support when needed.

The significant changes that today's students bring with them when they start their post-secondary education creates an urgent call to understanding the different ways they learn and therefore, to change the ways institutions educate them. But it is time not only to radically change the way teaching takes place, but also, to redesign curriculum, graduation processes, evaluation methods, infrastructure needs, and so on

Web 2.0 technologies are here to test educational institutions making such a transformation (Anderson, 2007). Moving content from a static to a dynamic perspective, changing the lecture-centered relation of classroom teaching to a more student-centered one, breaking the old image of the instructor as the only knowledge holder, promoting collaborative approaches to teaching, etc. are some of the challenges they have started to face.

In the following sections of this paper some of these possibilities are analyzed, and a case study from a tertiary education institution in Canada, working on the redesign of its curricula and implementing innovative ways for teaching and learning is presented.

IV. A NEW LEARNING PARADIGM: *From a geographically limited to a virtual context*

During the last years, virtual worlds have become an important part of teaching and training, transforming the way people work and learn. As the technology allows more and more content to be virtual, so improves the possibility of better learner engagement. VR has also started to transform the way students have access to content, entertainment, and knowledge, making content portable and therefore, transforming the physical limits of the classroom.

With the arrival of the digital natives or Net-Geners at higher education institutions, the use of mobile technologies to access learning content has started to be seen as a way for them to acquire content and engage in knowledge exchange. The introduction of mobile technologies into the learning experience is expected to foster active learning by engaging students in the process and facilitating their interaction with learning and content. Used effectively, individual technologies have the potential to change the learning dynamics and foster new pedagogical approaches, enabling the instructor to promote collaborative, independent learning (Callaghan et al., 2006).

A recent study in North America by Salaway et al. (2008) showed how students' use of information technologies is growing day by day. Statistics from the report indicated that while in 2003 the percentage of students that owned cell phones was only 33%, two years later this number increased to 66.1%, an ownership that combines the use and possession of other gadgets such as iPods, tablet PCs, etc. This phenomenon has caused some higher education institutions to start using mobile technologies to deliver content.

In parallel to the technology transformation, educators at nearly every level of instruction are examining the tools required to produce the 21st Century skills that today's students need to be

successful in their workplace. Furthermore, innovative instructors are working on ways to end with the current disassociation of many of today's courses and academic programs (in curricula across colleges, universities and polytechnics), with the students in the Net Generation expectations, technological capabilities and technology engagement, so that technology could be integrated to course delivery/discovery and knowledge sharing. As Wesch (2007), an anthropologist of the University of Kansas, mentioned in his digital ethnography work, today's students have to be prepared, if this is possible, for those jobs that they are going to get when they graduate, when these jobs do not really even exist in the present.

However, it should be considered that the effective use and continued growth of new technologies inside and outside the classroom environment is dependent on two crucial factors:

1. Students' possibilities for learning engagement; and
2. Instructors' technological skills and attitude towards change.

This is why reflecting on the challenges that students bring when they start their post-secondary learning, implies that the analysis of how colleges, polytechnics and universities are evolving, transforming the way they teach, requires a constant evaluation of pedagogical models (student-centered alternatives), and the implementation of new educational goals and innovative strategies to deliver content and promote students' engagement. In fact, mobile technologies have proved to be an attractive option for many instructors to distribute their course lectures to students.

V. VIRTUAL LEARNING ENVIRONMENS AND THE CHANGING ROLE OF INSTUCTORS

Virtual environments support the new pedagogical model where the instructor has become a facilitator of knowledge and is no longer the "knowledge holder". Burkle & Meredith (2008) examine the change from the instructor as a 'knowledge source' to a facilitator providing a conversational framework for the evolution of learning. In order to enable the evaluation of the effectiveness of learning, she identifies the key elements of the process: discussion (between the instructor and the student); interaction (between the student and some aspect of the world defined by the instructor); adaptation (of the world by instructor and action by the student) and reflection (on the student's performance by instructor and student). Furthermore, the researchers believe that this framework can be applied to the evaluation of technologies in learning. In fact, the use of technologies for teaching and learning should have as one of its main goals, to provide student centered situations, where instructors facilitate access to content in a sharing environment.

While in the 'Acquisition Model' the role of the instructor is to deliver, convey, and clarify knowledge and concepts, in the 'Participation Model' he/she is a facilitator, a mentor, an expert participant, and guardian of practice/discourse. Furthermore, with the Acquisition model, the focus of learning activities is on acquiring pre-specified knowledge and on developing understanding of predetermined concepts. With the Participation Model, the focus of learning activities is on becoming a member of a community of practice, learning from the community but also contributing to it. With the Acquisition Model what is to be learned is generally predetermined. In the Participation Model, the interactions that the learner contributes to may serve to change the knowledge base of the community even as he or she participates. As analyzed in the following section, as students used Second Life environment to review the lab procedures, they became active participants of the class content: learning from it, and also contributing to it.

Sloman characterises the acquisition model as a 'transmission framework' where the instructor passes on a fixed body of information and the student interacts with pre-packaged content. In this model, he argues, "the skill of the teacher lies in the selection of the content and teaching style to produce a specific outcome from the students" (2001:113). He describes the 'Participation Model' as a collaboration (transformation) framework that emphasises individual thinking and the construction of meaning.

The collaboration (transformation) framework necessarily emphasises individual thinking and construction of meaning. Teaching with this approach is more tentative, flexible, and experimental – hence it is student-centred. In this context a community of learners will improve learning through their interaction. A pedagogical theory means little if instructors do not apply it, and technological resources have no value if not used. In fact, the number of instructors who choose to be innovators in technology and pedagogy is limited.

Both models are related to pedagogic theory where "Behaviourist" models are compared with "Constructivist principles". The "Acquisition Model" could be associated with Behaviourist theory, while the "Participation Model" is related to a Constructivist approach. This assumption is based on the fact that in the transmission model a teacher (lecturer or instructor) can pass on a fixed body of information and the "student or learner interacts with a pre-packed content" (Sloman, 2001: 114), while the transformation framework implies individual thinking and constructing of meaning.

Holley & Haynes (2003) suggest that "such changes are most visible in the ongoing erosion of individual or small group teaching, and in the attempts to change the nature of contact time away from delivery of information towards more active participation" (p.4). The development and implementation of widely accessible communication and information technologies has been a key driving force in the move towards the adoption of Social Constructivism as a guiding principle in HEIs (Burkle & Meredith, 2008). In other words, this change has resulted in a change in the role of the instructor from the "sage of the stage" where transmissive, didactic learning took place to the "guide on the side" where more student-centered learning takes place (Pasnik, 2007).

The next section of this paper explores how the SL platform makes possible for instructors to interact with learners in a behaviourist model approach. An ongoing research and interviews with instructors involved in the project are presented.

VI. SECOND LIFE AT SAIT POLYTECHNIC: A SNAPSHOT OF A VIRTUAL ENVIRONMENT

SAIT Polytechnic is a higher education institution in Alberta with approximately 49,000 learners distributed in full time programs, apprenticeship programs, continuing education and corporate training (Bates, 2007).

SAIT first introduced technologies for learning in 1997 when it started delivering courses through the so called "laptop program". By 2009, most of the seven academic schools have a number of courses in the laptop program, or are using some other learning technology, such as videoiPod, YouTube videos, or SL virtual spaces to deliver courses and lab procedures. There are more than 90 fully-wired classrooms, and the number of computer ports on campus has risen from 2,000 in 1997 to more than 15,000 in 2008.

In June 2008, a group of innovative instructors of the Robotics and Multimedia Programs at SAIT decided to explore the possibilities of using SL for their students. A team consisting of the Academic Directors of the School of Information and Communication Technology and the School of Manufacturing and Automation, the Robotics and Physics instructors, the Academic Chair for the Multimedia Program, and the CISCO Chair of e-learning was put together to design a working plan and research needed to be done in order to build a proper learning environment in SL. The main objectives of the plan were as follows:

- To enhance the virtual learning environment;
- To accommodate a variety of learning styles that will allow students to preview and review virtual demonstrations upon desire and demand;
- To enhance the use of SL in the educational process;
- To allow the instructors to test a virtual environment (virtual sandbox) for teaching 'hands on' skills;
- To allow learners to be more independent in controlling the pace and timing of their learning; and
- To reinforce the student-centred nature of learning.

It was with these goals in mind that the group decided to purchase two islands in SL, to start building learning environments. Two groups of students in two different programs were targeted: the Robotics students in the School of Manufacturing and Automation, and the Multimedia students in the School of Information Technologies. In the summer of 2008, the first island was purchased and the sandbox experience started after that. Only 6 months later, another island was acquired, with the purpose of having a larger place that will accommodate a bigger number of instructors, students and programs to be developed there.

The original enthusiasm of the two instructors - the founders of the islands, together with the desire of bringing more programs to using SL as a virtual platform, soon extended to other instructors in other

Programs at SAIT. Furthermore, some students in those programs had already been working with their instructors in the programming and design of virtual environments at SLAIT. However, the big challenge that SAIT is facing now, is the need to bring students to use the built virtual environments as part of their course curricula, so that teaching can be tested here. In September 2009, the instructor in the School of MA is planning to have at least 20 students learning in SLAIT (where he will continue to teach his robotics course), while the instructor in the School of ICTs is working on having at least a couple of instructors in the New Media Program teaching using SLAIT as a learning platform. Furthermore, and since it is hands-on learning what these environments want to test, instructors need to accommodate students' expectations and learning needs, across programs where using tools, building environments and testing materials is part of learning.

VII. LEARNING IN VIRTUAL WORLDS: INSTRUCTORS' PERSPECTIVE

Face-to-face interviews of instructors involved in *SAIT in Second Life* (SLAIT) initiative have been taking place continuously, as part of the research being undertaken for this project. Furthermore, interviews have been conducted by the media both internally and externally to SAIT. In this section, instructors' opinions on SLAIT are analyzed and further SLAIT challenges are underlined.

When interviewed for this case study, the instructor in the School of Information and Communication Technology stated that SL has brought a number of benefits to teaching and that *"virtual simulation is going to be huge in the next 50 years"*. In SL, it is possible to simulate some parts of real life, in quick and efficient ways, particularly the interaction between people and representations of physical objects such as structures, furniture, equipment, vehicles, etc. In his own words, *"Finding the balance between time consumed (in making objects and scripting) and results obtained is one of the challenges that we are currently facing"*.

For the instructor working in the Manufacturing and Automation Program, using SL represents a number of *"amazing possibilities"*, in his own words, that range from the use of group discussions with learners around the world, to the possibility of exploring equipment and facilities simulations (See Figure 1 below).

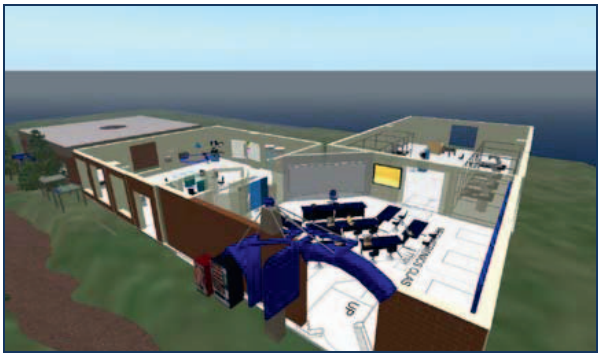

Figure 1. SLAIT Robotics Factory visualization in Second Life

When interviewed about students' learning needs that will be fulfilled by the SLAIT virtual environment, the instructor answered that at SLAIT his students will be able to look at facilitates, equipment and locations from many angles, and explore traffic flow, safety hazards, best equipment positions, etc. *"Students can play with a variety set designs, pieces, materials and colors very quickly to come up with the look they want. They can also work in much larger spaces than we can provide them, with equipment far more expensive than we could afford (robocam studio, camera crane, etc.). We can even make movies in SL (called machinima)"*.

In the instructors' opinion, and for those students in a distance learning environment, interacting with SL before coming to SAIT's real life campus is of great benefit since they could learn in labs with virtual equipment, reducing the time and equipment required to learn a procedure (Refer to Figure 2). This fact, underlined by the interviewed instructors, will reduce teaching costs and will allow those students already in the workforce to combine distance education on a part-time schedule, maintaining their employment during training. Furthermore, as one instructor put it, *"Learners in distance programs will have a sense of belongingness, of presence"*.

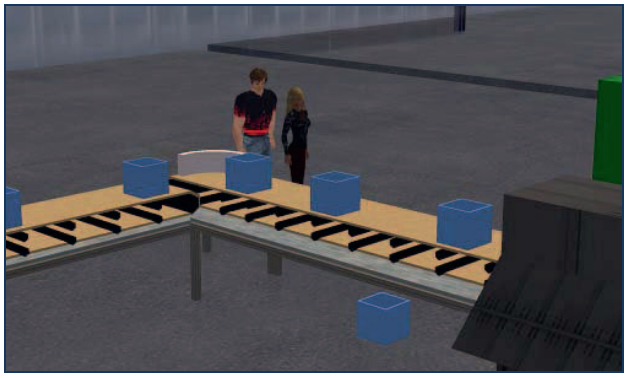

Figure 2. Instructors in the Robotics Program analyzing how things move in a virtual manufacturing band at SLAIT (SAIT Second Life campus)

At the time of writing, only a limited number of students at SAIT are part of the working team of the founder instructors of both islands, currently developing a number of objects or animations. By next term, the project of including a larger number of students (not only to design objects but to learn at SL) is already being discussed and strategies are currently being put in place for this to happen.

VIII. TRAINING FACULTY FOR SECOND LIFE

One of the most important issues raised by the instructors involved in the SLAIT project was the fact that SL design and programming is time consuming and requires training for faculty users. This finding is similar to what other authors in the area of educational technologies have found when describing the need to properly train faculty when they are using technologies in teaching (Bates, 2007 Hughes, 2005). When used as a learning technology, or as a virtual place where learning takes place, SL requires, as any other learning technology, some training to use it in its full potential. When SAIT is ready to move from an experimental phase to a more mainstream level, it will be necessary to have training support from units such as Faculty services within SAIT, or faculty already involved in the use of SL will need to train other potential users.

IX. Exploration tasks in Virtual environments

Major uptake of technologies and environments such as SL require serious consideration of reducing meta-learning overhead, both at the level of resource creation and during learning process. Economies of scale may weigh in favour of the efforts and time spent on providing rich multimedia resources; however, it is important to identify how the actual benefits of such virtual environments could reaped to provide the kind of experience to learners that is not typically possible in existing educational settings (Kinshuk et al, 2006). More so, appropriate pedagogies need to be developed to support exploration tasks within such environment and assessment mechanisms need to be developed to ensure that learning is actually taking place and that the students are learning what they are supposed to be.

X. CONCLUSIONS & FURTHER RESEARCH

As we witness the impact of VR in SL in the teaching and learning experience, we also have to consider the fact that, at present time, this is only the 'tip of the iceberg'. Future developments in virtual environments will make possible what today is not even thinkable. Further research on SL possibilities for hands-on learning will need to take into account the active participation of students, as they build and develop their own learning scenarios in SL, and will need to approach teaching and learning as a dynamic process, where both learners and instructors interact in the same 'virtual world', in the construction of knowledge. This is a preliminary research on potential benefits and challenges of Second Life in Teaching and Learning at SAIT and sets forth the foundation of future studies to explore these venues at larger scale. We hope this initial exploration is beneficial for professionals involved in teaching and learning in the academia in general.

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