6 THE REALITY OF AUTHENTIC LEARNING IN VIRTUAL WORLDS

Helen S. Farley

Authentic Learning

Virtual worlds can be used to replicate the sorts of pedagogical activities used in classrooms and lecture theatres in the real world. They also provide an environment in which to explore emerging pedagogies, or allow the investigation of issues that might be too arduous, dangerous, or expensive in real life. In addition, the social nature of virtual worlds represents a manifest progression from discussion boards, augmenting existing communication channels by including those social and cultural conventions operating in real life, and establishing new ones that are unique to the environment (Good, Howland, & Thackray, 2008). Given the obvious affordances of virtual worlds for learning, there has been a tendency for some educators to claim that virtual worlds will overcome many of the barriers encountered in the provision of authentic learning.

Authentic learning places the learner in the environment of the doer, assimilating the skills and beliefs about a particular discipline or profession (McClean, Saini-Eidukat, Schwert, Slator, & White, 2001). This approach typically focuses on real-life, multi-faceted problems with learners working toward their solution often by using role-playing, scenario-based activities, illustrative case studies, or through participating in virtual communities of practice. The learning environments are inherently multidisciplinary and generally not constructed in order to teach theoretical ideas. Instead, authentic learning utilizes activities in which learners grapple with tangible learning contexts rather than with abstracted knowledge (Pimentel, 1999). The learning environment resembles

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some “real life” disciplinary context or activity (Lombardi, 2007). These might include flying an airplane, nursing an ill patient, detecting financial fraud, or participating in a religious ritual. Duffy and Jonassen (1991) recommend that learners should use tools to perform activities that resemble those found in the contexts they will work in in the future. Of paramount importance is the creation of situations that let learners practise the proficiencies essential in the specialist environments where they aspire to work (Savery & Duffy, 1995). The goal is to prepare learners to do the kinds of complex tasks that occur in life. As a result of bringing learners into more authentic learning environments, educators hope that they will evolve from novices to experts (Roussou, 1997). It is argued that skills developed in virtual worlds contribute to expertise development, innovativeness, creativity, and other skills needed for the jobs of the future (Mishra & Foster, 2007).

Brown, Collins, and Duguid were among the first to suggest that knowledge is not independent but instead, is “situated, being in part a product of the activity, context, and culture in which it is developed and used” (1989, p. 32). They also exposed the separation between knowing and doing as a myth and proposed the value of a “cognitive apprenticeship” (Brown et al., 1989). Since that time, a number of authors have distilled lists of characteristics from that literature around authentic learning and those modes of learning associated with it, such as situated learning. A meta-analysis of some 45 papers led Audrey C. Rule (2006) to the conclusion that there were four broad themes in authentic learning:

1. Real-world problems that engage learners in the work of professionals.
2. Inquiry activities that practise thinking skills and metacognition.
3. Discourse among a community of learners.
4. Student empowerment through choice.

Though these themes are undoubtedly found in authentic learning contexts, it is useful to seek further clarification into what characterizes authentic learning.

After analyzing an extensive body of literature, Herrington, Reeves, and Oliver found 10 characteristics that they believed contained the essence of authentic learning. They wrote that:

1. Authentic activities have real-world relevance . . .
2. Authentic activities are ill-defined, requiring students to define the tasks and subtasks needed to complete the activity . . .

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3. Authentic activities comprise complex tasks to be investigated by students over a sustained period of time . . .
4. Authentic activities provide the opportunity for students to examine the task from different perspectives, using a variety of resources . . .
5. Authentic activities provide the opportunity to collaborate . . .
6. Authentic activities provide the opportunity to reflect . . .
7. Authentic activities can be integrated and applied across different subject areas and lead beyond domain-specific outcomes . . .
8. Authentic activities are seamlessly integrated with assessment . . .
9. Authentic activities create polished products valuable in their own right rather than as preparation for something else . . .
10. Authentic activities allow competing solutions and a diversity of outcomes (2007, pp. 86–87).

These characteristics have been widely cited in the literature exploring authentic learning and discussion around them will form the basis for this investigation.

Many educators claim that "authentic learning," or learning-by-doing, is the most desirable way to educate students, leading to a deeper, more complex, and contextual understanding of a particular discipline area. Even so, the reality is that it is often too difficult, expensive, or dangerous to provide these opportunities in the classroom or lecture theatre (Lombardi, 2007); hence educators have turned to virtual-world environments to create simulations of disciplinary or professional contexts.

Authentic Learning in Virtual Worlds

Technology can be central for helping to foster those proficiencies that enable learners to thrive in an environment where technology is ubiquitous and for facilitating authentic learning experiences. In addition, technology can enable the creation of digital communities of practice and provide experience for many of the tools in use by current practitioners (Rosenbaum, Klopfer, & Perry, 2007). With the advent of virtual worlds, educators heralded the arrival of a technology that could facilitate authentic learning in a relatively inexpensive and safe way. There are a plethora of virtual worlds available to educators; the most popular is Second Life, as it enables users to create content, has its own economy, and is inexpensive to access. For tertiary educators, these features of virtual world environments enable them to provide their students with authentic learning experiences that resemble real-world activities and scenarios. A

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budding architect can design a building on a grand scale, walk around inside it once it is complete and move walls and shift staircases to craft more useable spaces. A soon-to-be surgeon can practise unfamiliar procedures on a patient who will not sue him or her and cannot die if something goes wrong. And a student of history will more fully understand historical events when he or she takes on a role and wanders around a battleground or participates in a significant legal trial (Farley & Steel, 2009). Participation could also increase speed in reaction times, improve hand-eye coordination, and raise learners' self-esteem (Pearson & Baily, 2007, p. 1). For certain disciplines, the educational affordances of a virtual environment such as Second Life are obvious (Salmon, 2009, p. 529).

Virtual worlds can act as venues for authentic learning by providing simulations. These can model certain facets of systems that may be inherently complex and allow learners to manipulate different parameters to observe the consequences of their actions (Rosenbaum et al., 2007). Learners are within and part of a constructed environment. Each one is an active participant, not merely a viewer of a static scene. Instead, they are engaging with the simulated environment in a way that resembles real-life interactions, rather than in response to embedded prompts. Authentic tasks cannot be successfully completed by learners alone, but can be handled with the help of peers or educators who demonstrate effective strategies (Jones & Bronack, 2007, p. 96). In addition, environments such as those provided by virtual worlds are invaluable when guiding learners to perform tasks that are prohibitively expensive or too hazardous to perform in the real world (Adams, Klowden, & Hannaford, 2001; Dieterle & Clarke, 2007). Well-crafted simulations deployed in virtual worlds can deliver safe and economic opportunities to facilitate authentic learning in an optimal way (Mason, 2007; Cram, Hedberg, Gosper, & Dick, 2011).

Even though the potential seems great, authentic learning conditions can be very difficult—if not impossible—to recreate (Griffin, 1995). More recently, a number of authors, while acknowledging the claims made around the potential efficacy of Second Life as a location for education (and more specifically authentic learning), also point to the lack of empirical evidence to support those claims (Good, et al., 2008; Vrellis, Papachristos, Natsis, & Mikropoulos, 2010; Mahon, Bryant, Brown, & Miran, 2010). Even before the widespread adoption of virtual worlds, social scientist and commentator Sherry Turkle warned against claims about the efficacy of new technologies in this arena. She suggested that even though new technologies provide opportunities for learning, there is considerable risk that because the virtual is deliberately compelling, and since virtual technologies are usually primarily designed to provide entertainment,

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educators believe that they are achieving more than they actually are (Turkle, 1995). Though experiences in virtual worlds can be immersive and engaging, they still may not be authentically educative for the user (Jackson & Lalioti, 2000).

Some Factors Influencing the Success of Authentic Learning in Virtual Worlds

Virtual worlds are viewed as places where anything is possible; the most elaborate buildings can be constructed, and models of biological systems can be designed with impressive attention to detail. A simulation of a living cell can be crafted with intricate recreations of organelles, chemical messengers whirling around the cytoplasm, and receptors sitting on the cell membrane waiting for hormones that will switch it on, switch it off, or induce it to self-destruct (apoptosis). Biology students can push through the cell wall and watch these processes up close—maybe alter the parameters to check how that action changes the cell's responses. In another part of the virtual world, nursing students figure out how to treat a woman with a post-partum hemorrhage. Should she sit up or lie down? Is it too soon to call for a doctor, and how can her husband be calmed down (Honey, Connor, Veltman, Bodily, & Diener, 2012)?

Because such a large amount of detail can be incorporated into a virtual world build, it is tempting to believe that authenticity is embedded into the learning for which that build was designed. As I mentioned above, authentic learning is a multi-faceted process with many complex and interrelated characteristics. To truly ensure authentic learning is achieved in these environments—or any environment—it is necessary to fully consider all that authentic learning entails.

The Kinds of Knowledge Appropriate for Authentic Learning in Virtual Worlds

In discussing authentic learning in virtual worlds, we are talking about a wide range of professions, disciplines, and associated activities. A quick survey of the literature reveals examples of firefighting and evacuation training (Buono, Cortese, Lionetti, Minoia, & Simeone, 2008), commerce education (Schiller, 2009), community nursing (Schmidt & Stewart, 2010), and the acquisition of pre-clinical skills for dental students (Phillips & Berge, 2009) all happening in Second Life. Some disciplines such as psychological counselling are heavily reliant upon developing effective verbal communication skills. Yet others require the acquisition of practical, physical skills such as veterinary surgery or pipe laying for road construction. Given the diversity of skills that need to be acquired across all disciplines, it is not possible to say with any degree of

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confidence that virtual worlds provide suitable environments for authentic learning across all disciplines or for all activities.

Some discipline areas are well suited to using virtual worlds for authentic learning. For example, a virtual world may offer support for languages other than English. In many virtual worlds, there are communities where English is rarely used. Indeed, Second Life has its own areas predominantly populated by native speakers of a variety of languages—and many groups exist inworld which take advantage of this opportunity for authentic language learning (Cooke-Plagwitz, 2008). Many of these language-based sims offer contextually rich environments reflective of various cultures and countries. These virtual spaces hold many possibilities for authentic communication between language learners and native speakers of a target language (Dickey, 1999). In Second Life, residents of virtual Paris and virtual Morocco primarily speak French, and native Italian speakers wander through the streets of a virtual Milan, pausing outside the famous Teatro della Scala.

Language learners can communicate about things in (and even outside of) the virtual environment (Dickey, 1999). The communication is real, and the situations are real (Deutschmann & Panichi, 2009, p. 38). These environments can therefore facilitate greater levels of experiential learning combined with language practice that may not always be possible in more traditional e-learning environments. Deutschmann and Panichi give examples of appropriate tasks in these environments (2009, p. 38):

1. asking and giving directions
2. touring SL and finding specific places
3. visits to a cultural location (i.e., a library or art gallery)
4. attending a conference or live performance
5. interviewing residents of Second Life
6. finding factual information from Second Life sources
7. using avatar movements to express emotions
8. participating in physical activities (playing [simulated] sports, etc.)
9. doing things (shopping, playing chess)

In a virtual world, if a learner asks another avatar for directions to a particular place, the communication is real. There are spaces in those environments that can be navigated to. By way of contrast, in the classroom a learner merely role-plays being lost and then goes through the motions of navigating the directions once they are offered (Deutschmann & Panichi, 2009; Jauregi, Canto, de Graff, & Koenraad, 2011). There is no opportunity to learn through

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genuine misunderstanding as the learner is not required to follow those directions in any verifiable way. In the virtual world, users can interact using a diversity of norms of social interaction and experience real interpersonal communication while concurrently engaged in meaningful learning (Thorne, 2008). Communication exchanges inworld are often contextual and follow the patterns of real-world communication (Jauregi, et al., 2011). Howard Vickers, who runs the online language school Avatar English, has used this capacity for contextual communication with his students. He has adapted Bernie Dodge's (1997, 2004) original WebQuest model (http://www.webquest.org) to the 3D virtual environment with his SurReal Quest (Vickers, 2007). By exploiting the communicative features specific to Second Life, Vickers sends his students on information quests throughout the virtual world that require them to interact with native speakers of the target language in addition to pursuing traditional Internet research. Students are ultimately required to present their information in an audio or video podcast. In this way, learners are able to practise their newfound language proficiencies through a blend of Internet research and social interaction in the virtual environment (Cook-Plagwitz, 2007). One of the greatest benefits of using virtual worlds as venues for language learning is their ability to facilitate authentic communication (Deutschmann & Panichi, 2009).

Even though the potential for foreign language learning in virtual worlds is promising, educators must remain cognizant of the fact that many non-verbal cues will be missing from interactions in these environments. Though as the client-side software is developed it is becoming progressively easier to move through and communicate both verbally and non-verbally in a virtual world, many cues are missing, including facial expressions, subtle body movements, and those culture-specific hand gestures that often accompany speech. Potentially, the variables needed for effective language learning could be lost (Jackson & Lalioti, 2000). Some of these issues will ultimately be overcome with the incorporation of motion capture technologies such as the Microsoft Kinect. Avatar Kinect is a multiplayer online game accessible via the Xbox 360 with the Microsoft Kinect sensor. The motion capture capabilities of the sensor enable the facial expressions and gestures of the user to be captured. Currently, a limited number of environments are available via Avatar Kinect, but it is conceivable that the Kinect technology could be adapted for use in other virtual environments such as Second Life. This seems especially likely given that a version of the Kinect sensor with the capability of integrating with a desktop or laptop PC was released in February 2012.

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An early example of a build that embeds authentic learning would be the River City Multi-User Virtual Environment (MUVE), which was developed in 2000 to teach middle school students how to conduct a scientific investigation with topics relevant to biological and epidemiological inquiries. The students, posed as visitors to the fictional River City set in the nineteenth century. Working in small groups, they were tasked with discovering why the city was so afflicted by disease. They were required to construct an experiment to test a hypothesis they devised. They could interact with a variety of characters, such as a university professor who delivered pertinent lectures, and an investigative reporter who prompted them to reflect on their findings. As Agostinho (2006) reported, the use of characters to present significant data can be a useful strategy in virtual environments. The students learned how to use scientific instruments, and at the end of the process delivered their findings to their class in a simulated academic conference. The MUVE was connected to a database that collected information about the activities of individual students for formative assessment. During immersion in the MUVE, students became scientists: they learned the underlying principles of the subject, acquired the investigative skills and processes used by scientists, devised and carried out explorations to test their hypotheses, and understood why these investigations are so weighty (Dieterle & Clarke, 2007). In other words, students learned about science by being scientists. Rather than utilizing the usual didactic methods of knowledge transfer, the River City curriculum supported learners as they began talking within the community of scientists. In this way, newcomers became part of a community of practice through the configuration of the meaning of learning and by engaging their intent to learn (Dieterle & Clarke, 2007; Rosenbaum, et al., 2007). Immersion in a virtual environment can allow learners to acquire firsthand those skills, procedures, and facts that characterize their future professions. These include professional capabilities such as personal responsibility, the ability to work effectively in teams, professional ethics, client or patient care, and risk management (Barton, McKellar, & Maharg, 2007).

In contrast, some skills are very difficult to acquire in a virtual world. For example, it would be very difficult to learn physical or practical skills such as surgery without an appropriate user interface. In Second Life, there are many recreations of hospitals, including operating theatres (see Patel et al., 2012). The surgical instruments are laid out in them, apparently ready for use. What these environments generally lack, however, are natural user interfaces so that the actions of the user resemble those of his or her avatar. This degree of precision in movement would be necessary to enable the acquisition of surgical skills.

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It would also be very difficult to teach surgery without replicating the feel of a scalpel meeting flesh, which remains prohibitively expensive and technically difficult (Farley & Steel, 2009; Hayward, Astley, Cruz-Hernandez, Grant, & Robles-De-La-Torre, 2004; Luursema, Verwey, Kommers, & Annema, 2006). The term “haptic” refers to the sense of touch; these clues provide information about weight, surface features, relative size, density, flexibility, and shape of a structure which can be felt with the hand or other part of the body (Luursema, Verwey, Kommers, & Annema, 2008). Even though there are considerable difficulties in bringing this degree of realism to a virtual world, there are examples of it being done successfully in single-user virtual reality environments (see Schreuder, Oei, Maas, Borleffs, & Schijven, 2011). The teaching of Minimally Invasive Surgery (MIS) is particularly suitable for this style of instruction, and though these simulations are not taking place in virtual worlds, it is not difficult to foresee this happening in the near future. A number of projects are already exploring the potential of haptic feedback in these environments (Warburton, 2009). Thus virtual worlds can act as authentic environments for problem-solving but are not necessarily authentic for developing practical skills (McClean, Saini-Eidukat, Schwert, Slator, & White, 2001).

Authenticity of the Environment

Much ado is made about the physical beauty or the visual accuracy of many builds in virtual worlds. In any list of must-see destinations in Second Life, Vassar College’s Sistine Chapel ranks highly, with visitors marvelling at the level of accuracy in the virtual reproduction (for example, see Curtis, 2011). Michelangelo’s detailed paintings and Raphael’s tapestries can be viewed up close in a way that is not possible in the real-world Sistine Chapel. In fact, any visitor to the actual Sistine Chapel will relate how crowds of people jostle for position, or describe the feeling of awe that descends when entering that impressive space. Though the recreation of the Sistine Chapel in Second Life is as visually accurate as possible, several important cues that make the visit to Rome’s monument so compelling and memorable are missing in its Second Life counterpart.

In a similar way, the Virtual Hajj—maintained by Islam Online—impressively replicates all of the sites on that important pilgrimage route, yet fails to engender the heightened emotions that emerge when a large number of adherents bump against one another as they circle the Kaaba. When thinking of the Hajj, this mass of humanity is as characteristic as any other aspect (Radde-Antweiler, 2008). The Virtual Hajj takes just a couple of hours to complete,

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whereas the real Hajj takes several days, in addition to the months of planning beforehand. It is possible that undertaking such a virtual pilgrimage might overemphasize some aspects of this holy duty while underplaying others, giving an erroneous impression of what the Hajj actually entails. An authentic environment would ideally provide a social, emotional, and cultural context as well as replicating a physical environment, and these factors may be more significant than the backdrop. Authentic settings enable effective teaching and learning through collaboration (Lombardi, 2007). Recreations of real-life professional and disciplinary contexts are often missing those cues that would lend them authenticity and move them beyond a simple visual recreation.

Barton, McKellar, and Maharg (2007) concur, stating that any attempt to perfectly imitate reality in virtual worlds is sure to fall short. Their point is that reality is far too complex and unpredictable, and cannot be readily reconstructed. Authenticity does not arise from a simple mimesis. The authors illustrate their point using the example of a flute from the Baroque period. In the literature, there are many accounts of how instrument-makers crafted them. But no matter how closely these methods are followed, the modern copy, though resembling the original, will never be exactly the same (Barton, et al., 2007). However, if designers and educators identify and embed key cues in the virtual learning environment, authentic learning may still take place. It should be noted that these cues are not just visual, but may be social, emotional, or symbolic (Aldrich, 2009). Virtual world environments can provide a context in which knowledge is useful. Ideally, that context largely resembles the setting where learners will eventually be apply the knowledge. The context can be very specific or abstract, and beyond a physical recreation of a space (Aldrich, 2009). For example, in order to foster anti-bullying behaviour, it would be necessary to recreate a context that would engender high levels of stress and a feeling of being threatened in a person. These sorts of factors are conducive to the new content being absorbed. An emotional involvement in the content induces the brain to release the neurotransmitters necessary to encode memories and stimulate learning (Aldrich, 2009, p. 6).

In an attempt to recreate an authentic learning environment, Jackson and Lalioti (2000) imagine a build that would enable a young South African student to have a cultural experience in a virtual world environment. The student, of isiZulu cultural background, could experience what it is like to be a child, an adult male warrior in the army, and an adult woman in the *seraglio* (harem) established by Shaka Zulu during the early 19th century. The student could walk through recreations of the architecture and structures from that time

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period. But the cultural aspects would not legitimately come into play unless certain rules were added to the simulation, such as those taboos defining where different members of society could go and what objects they were able to interact with (Jackson & Lalioti, 2000). Experiencing culture is more complex than just walking through architecture and structures. A learner participating in such an environment is able to create one or more identities, allowing him or her to discover how a character is acknowledged or appreciated (Turkle, 1995; Butler & White, 2008). Here, being able to change the appearance of a learner's avatar to adapt to a specific role, and to recreate an environment which resembles the real world, will reinforce the apparent veracity of the simulation, and consequently enhance the student's willingness to suspend disbelief (Good et al., 2008).

The apparent physical reality of the learning environment is less important than the design of the task and learner engagement in the environment (Herrington et al., 2007). An authentic learning context is far more complex and unpredictable than a mere visual recreation of a physical space. Social, cultural, emotional, and symbolic factors also provide important information about the context in which skills are to be practised and where domain-specific knowledge is to be rehearsed. If these are missing, the virtual build may not be sufficiently similar to the real-life context in which the student will have to apply these skills for transfer to occur.

Availability of Information/Sufficient Complexity of the Environment

Authentic learning opportunities involve ill-defined problems and real-life contexts (Kluge & Riley, 2008). Life is not straightforward. The necessary clues to solve a problem are rarely laid out and signposted as such, yet in virtual world scenarios this is frequently the case. For example, an artificial intelligent (AI) agent or "bot" can only respond in limited ways to a nursing student taking a clinical history in a virtual world. If the student's questions fall outside those the bot recognizes, it will ask for the question to be repeated in another way (Amundsen, 2011). The range of responses from the bot is limited by the way it is programmed. In real life, a person questioned in the same way would most likely give some sort of response, however unhelpful it might be.

In this domain, the difference between those problems that are well-structured and those that are ill-structured becomes important. Usually in virtual worlds the former predominate, and these sorts of problems have absolutely correct and knowable solutions (Kitchener, 1983; Cram et al., 2011). Unfortunately, there is little indication that the ability to resolve well-structured problems

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leads to the emergence of expertise in the learner (Schraw, Dunkle, & Bendixen, 1995). Consequently, those problems that are most useful for authentic learning in virtual worlds are ill-defined ones that may require contradictory assumptions, evidence, and beliefs that lead to different solutions (Kitchener, 1983). In other words, to teach learners how to solve ill-defined problems they must be engaged in solving complex problems requiring both deductive and inductive reasoning (Reeves & Reeves, 2008).

A law student may ask a client for documentation irrelevant to resolving a legal dispute, yet this skill of careful selection is learned only through experience. In a virtual world simulation of a legal dispute, it becomes exceedingly difficult to anticipate what students will ask for, making it necessary to incorporate a lot of extraneous information into an authentic learning environment (Barton et al., 2007). This is the best way for students to learn how to effectively filter out what is not necessary. Learning environments in virtual worlds often do not incorporate this extra information, challenging the assumptions made about authentic learning within them. What also needs to be considered is the development of appropriate outcomes for student actions such that they can identify gaps in their knowledge (Rosenbaum et al., 2007). For example, an AI bot patient needs to respond in a physiologically believable way to the administration of the wrong dose of a drug by a student nurse.

In contrast, business simulations are well suited to virtual worlds; in many ways they mimic the real world because of their capacity for collaboration, they have an indigenous currency, and they contain a population external to a particular course or program sufficient to sustain a business. It becomes possible and even desirable to design business simulations that incorporate a collaborative learning environment incorporating fun, play, and authenticity in its processes that mirrors real-world economic conditions (Mak & Palia, 2005). Because Second Life has its own currency, currency exchange, and a large population, it is possible to run a business in this environment. The population (as of January 30, 2012) was 27,759,350. At any one time, around 60,000 residents are online. In one 24-hour period, the value of transactions was $1,402,509 USD (Shepherd, 2012). Inherently, the environment is sufficiently complex such that a business responds in an unpredictable way. The design of learning is not dependent on the forethought or imagination of the designer to the same extent as simulations in other disciplines. Business students are able to market and advertise their business to the Second Life community. They must think about the location of their enterprise and the range of products that they are selling or services they are offering. The large resident population can

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access their goods and services. Solving the issues to run a successful Second Life business are in themselves the sorts of ill-defined problems that characterize authentic learning.

The Learner Experience

If the learner experience is compromised through lag due to insufficient bandwidth, poor technical skills, steep learning curve, and so on, then the learner's cognitive load will dramatically increase (Pollock, Chandler, & Sweller, 2002). These problems can be designed around, but usually they are not. For authentic learning to occur, the complexity in a scenario must be due to the ambiguous context inherent in the activity rather than because of the user interface or unreliability of the technology. When learners have to contend with extraneous information—for example having to learn how to use an unfamiliar user interface or navigate through an unfamiliar environment—their attention is pulled away from the objective of the learning exercise. This phenomenon is known as extraneous cognitive load and impacts negatively on learning (Pollock et al., 2002).

In order to promote student engagement with a program, course, or activity in a virtual environment, it is necessary to generate immersion. Immersion has been defined as the "the subjective impression that one is participating in a comprehensive, realistic experience" (Dede, 2009, p. 66), and is seen as a necessary condition for "presence the psychological sense of actually being located in the virtual environment (Franceschi, Lee, & Hinds, 2008, p. 5). Engagement refers to the focus of a learner's attention on the task at hand, and given sufficient involvement and mental clarity can lead to the optimal learning state of "flow." This term was first coined by Mihaly Csikszentmihalyi (1990) and refers to a mental state that athletes equate with "being in the zone."

A virtual environment that promotes a more intense experience of sensory immersion will engender a greater feeling of presence (Witmer & Singer, 1998, p. 228). Various technologies facilitate sensory immersion, thereby locating the experience in three-dimensional space. These technologies may provide visual stimulation. More complex virtual environments also provide stereoscopic sound and haptic feedback, applying vibrations and forces to the participant (Dede, 2009, p. 66). The more sensory data provided by the environment, the greater the sense of presence (Franceschi et al., 2008, p. 6) and as more senses are engaged, presence is likewise increased (Steuer, 1992). If a simulation is authentically realistic, more emotions are stimulated in the learner in response to tasks and events within that environment. Students are more likely to

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experience tension, fear, or frustration, leading to a more authentic emotional environment. This has long being recognized as a factor facilitating authentic learning (Smith, 1987).

The novel user interfaces of the Nintendo Wii and Microsoft Kinect gaming systems are evidence of the innovation displayed by gaming developers catering to the lucrative console gaming market. These interfaces have radically altered the way that users interact with three-dimensional virtual environments. Existing user interfaces such as the QWERTY keyboard and mouse commonly do not facilitate speed, responsiveness, and dimensional motion, diminishing the user's experience (Champy, 2007). Haptic feedback further enhances immersion by facilitating the user's interaction with 3D objects (Butler & Neave, 2008). For university educators, being able to leverage these attributes for use in virtual worlds such as Second Life would enable them to provide learners with the opportunity for authentic learning experiences that more closely resemble real-life tasks and scenarios (Farley & Steel, 2009).

In addition to the more general factors in the learner's environment, there is the hardware user interface acting as an extension of the physical environment. For users of virtual worlds, these interfaces bridge the physical and the virtual. Most learners accessing a virtual world environment will do so with a keyboard and conventional mouse, better suited for navigating around a document than a virtual world. Consequently, learners accessing these environments encounter a range of physical challenges. Issues include:

- the functional isolation of users (Xin, Watts, & Sharlin, 2007);
- the fact that movement is not intuitive and in addition, there is limited freedom of movement (Fassbender & Richards, 2008);
- there are particular problems for children, the elderly or those with disabilities who are unable to coordinate keyboard strokes and precisely use a mouse (Cardoso, Melo, Giomes, Kehoe, & Morgado, 2007; Kim, Roh, & Kim, 2008); and
- the inability to leverage the common knowledge that users acquire from their ordinary physical interactions in their day-to-day living (Xin, et al., 2007).

These factors may create sufficient distraction in the physical environment to decrease the feeling of presence in the virtual world. User interfaces that facilitate more intuitive movement would help to overcome these sorts of issues, extending the affordances of these environments for more authentic education and training. Well-crafted simulations deployed in virtual world environments

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are able to deliver safe and cost-effective recreations of authentic contexts that can enable optimum learning, particularly when enriched with the capacity for tactile precision and haptic feedback (Farley & Steel, 2009). An obvious example from the real world is training aircraft pilots to fly. Flight simulator training, when used in tandem with training in a plane or helicopter, has been discovered to be more effective than training with just an aircraft (Hays, Jacobs, Prince, & Salas, 1992).

Future Directions and Conclusion

Though at first glance, virtual worlds such as Second Life appear to be the ideal environment in which to embed authentic learning, in reality this would be difficult to achieve under normal circumstances. Even when only considering a few of the characteristics that Herrrington and her colleagues (2007) identified as integral to the process, it becomes evident that in order to realize the enormous potential of virtual worlds for authentic learning, careful planning and design are necessary. It is also necessary to accept that the skills and knowledge associated with some disciplines, professions, and skills are simply not suited to virtual world learning.

Effective simulation to support authentic learning goes a long way beyond visually recreating an environment. Educators must work together with learning designers to ensure that authentic tasks align with the crucial components of the learning environment: goals and objectives, disciplinary content, technological affordances, and assessment (Herrington et al., 2007). Cognitive realism is more important in simulations. As far back as 1963, Bert Y. Kersh identified that realism was not important in classroom simulations (Kersh, cited in Smith, 1987). Though he was talking about simulations that involved film projection, the same principles hold true for virtual world environments. Much more essential are those factors that promote immersion and presence. There is fruitful research to be done in defining the minimum necessary conditions for promoting immersion, and hence, presence. Factors are likely to include interface design, the physical location of the learner, and the more obvious properties associated with the design of the environment and tasks learners will undertake.

Brown, Collins, and Duguid (1989) stated that knowledge and abstract ideas arise from the subtle complexity of the outside world. This knowledge cannot be distilled if the environment is not sufficiently complex, if markers and guideposts guide learners through activities with known outcomes. Authentic

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learning is partially defined by the inclusion of ill-defined problems for which there are no straightforward answers and certainly not just one correct answer. Those skills that are learned are relevant to the environment. This is consistent with what happens outside of virtual environments and leads to "situated cognition" (Van Eck, 2006). Because these conditions are difficult to design for in virtual worlds, it will be necessary for educators to collaborate to design fewer but more complex and authentic simulations that can be replicated at little cost and evolve iteratively. Educators should collaboratively research those characteristics of a discipline-specific context that are necessary for a learner to experience in order to gain the knowledge necessary for the successful practice of that discipline, and then incorporate those characteristics into any simulation.

Simulation is potentially one of the most potent tools available to e-learning designers. Well-crafted simulations can engage and challenge the learner in a very direct and individual way. To maximize success in these situations, the learner must work at a higher cognitive level than required by the mere recall associated with traditional didactic methods. Instead, the learner must be immersed in the situation and apply both novel knowledge and extant skills to meet the challenges set before him or her. Though not all simulations are instructional, instruction that exploits the techniques of simulation are more likely to capture the learner's attention for longer periods of time (Rude-Parkins, Miller, Ferguson, & Bauer, 2005), facilitating the emergence of presence and subsequently flow. In addition, by making the experience directly relevant, learners have an emotional stake in the content, making them more likely to learn (Aldrich, 2009, p. 6).

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