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RESEARCH ARTICLE

The pragmatics of virtual worlds for K-12 educators: investigating the affordances and constraints of *Active Worlds* and *Second Life* with K-12 in-service teachers

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Abstract The purpose of this study is to address the pragmatics of integrating virtual worlds for teaching and learning for K-12 education. Specifically this qualitative investigation focuses on a reflective dialogue gathered from a group of K-12 (primary and secondary school) educators about their experiences using both *Active Worlds Educational Universe* and *Second Life*. Reflections consist of both their experiences as (a) a learner within both applications, (b) developing instructional content in both applications, and (c) perceptions of value of each application for teaching and learning. The goal of this research is to investigate how K-12 teachers' perceptions of virtual worlds may impact the integration of new tools for teaching and learning.

Keywords Virtual worlds · *Active Worlds* · *Second Life* · K-12

Abbreviations

AWEDU	Active Worlds Educational Universe
AW	*Active Worlds*
SL	*Second Life*
K-12	Kindergarder through 12 Grade (primary and secondary school)

During the past decade the development of new media has presented both innovative opportunities and intriguing challenges for educators and instructional designers. Among the newer offerings are three-dimensional multi-user virtual environments. Three-dimensional multi-user virtual environments are online virtual reality environments in which

This paper is dedicated to the memory of Professor John C. Belland a beloved mentor and visionary whose great intellect and generosity of spirit continues to inspire.

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users move and interact in simulated three dimensional spaces. Although during the past decade, dozens of virtual world applications have emerged and faded, both *Active Worlds* and *Second Life* have emerged as two of the more popular and persistent virtual world applications.

The purpose of this study is to address the pragmatics of integrating virtual worlds for teaching and learning for K-12 (primary and secondary school) education. Specifically this investigation focuses on a reflective dialogue gathered from a group of K-12 educators about their experiences using both *Active Worlds* and *Second Life*. Reflections consist of both their experiences as (a) a learner within both applications, (b) developing instructional content in both applications, and (c) perceptions of value of each application for teaching and learning. The goal of this research is to investigate how K-12 teachers' perceptions of virtual worlds may impact the integration of new tools for teaching and learning.

Theoretical framework

Within the field of instructional design, a major focus of the field is on the cultivation and development of interactive learning environments (Winn 2002). The epistemological shift towards constructivism and the impact of technology has had great influence on the design of learning environments. The contemporary notion of learning environments recognizes that meaningful, active learning takes place in complex, multi-modal environments in which the learner plays an active role in constructing knowledge (Hannafin et al. 1994; Hannafin et al. 1999; Jonassen 1999; Land and Hannafin 1996). The theoretical assumption is that learners construct understandings by interacting with information, tools and materials as well as by collaborating with other learners and reflecting. Yet, these environments must also help scaffold the learning process.

Within the constructivist continuum, the act of reflection has long been looked upon as a valuable tool for learning. Dewey defined reflection as the "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the future conclusion to which it tends" (1910, p. 6). Dewey loosely outlined the stages of reflection as uncertainty, observation, suggestion, reasoning, and corroboration/verification which help move learners towards understanding (1933). From the works of Dewey to the present day, researchers as diverse as Kolb (1984), Eisner (1997), and Brown et al. (1989) have valued the importance of reflection to the learning process.

Although much research has been devoted to the design of learning environments (Hannafin et al. 1994; Hannafin et al. 1999; Jonassen 1999; Winn 2002) the emergence of new tools and technology is continually challenging the field of instructional design to find models and methods for developing engaging interactive learning environments. Virtual Worlds such as *Second Life* and *Active Worlds* offer new and exciting opportunities for creating interactive constructivist learning environments.

Literature review

This review draws upon both qualitative and quantitative research as well as cognitive and constructivist-based perspectives of learning. While there are obvious connections between virtual worlds and constructivist learning environments (e.g., building, communicating, and access to resources), there is informative research about the educational use of virtual worlds from a cognitive perspective. These two perspectives are not viewed as being

mutually exclusive, but rather as mutually informative focusing on different aspects of learning (Sfard 1998).

Although virtual worlds are still relatively new, there has been a modest amount of research conducted as well as a variety of educational initiatives incorporating 3D virtual environments as a supplement to traditional classroom activities (Bailey and Moar 2001; Barab et al. 2000, 2001; Bers 1999; Bers and Cassell 1999; Corbit and DeVarco 2000; Dickey 2003, 2005). Unfortunately, out of that body of research, relatively little work has been done with K-12 students (Bailey and Moar 2001, 2003; Barab et al. 2001; Bers 1999; Bers et al. 2001; Corbit and DeVarco 2000). Among the earliest of the desktop 3D virtual worlds applications used for educational initiatives was the Web-based Virtual Reality Mark-up Language (VRML), *Active Worlds*, and Microsoft's Virtual Worlds platform (Dickey 2007). Barab et al. (2001) used VRML with high school students to effectively foster understandings based on "learning by doing". Bailey and Moar (2001, 2003) used *Active Worlds* to support the VERTEX project, designed to explore the use of virtual worlds within a constructivist paradigm. They found that the use of 3D virtual worlds helped to foster collaboration, communication, and storytelling with 9–11 year old students. Similarly Bers (1999) and Bers et al. (2001) found through their 3D virtual world, *Zora*, that the setting supported children's' exploration of identity, community and personal representation. *Active Worlds* has served as the underlying platform for both Barab's game-based learning environment, *Quest Atlantis*, as well as Dede's, *River City*. While both of these initiatives are described as games or game-based learning environments, *Active Worlds* provided an accessible tool for authoring these youth-based learning environments which fostered critical thinking, inquiry-based learning, immersive engagement, and situated learning (Barab et al. 2005, 2007; Ketelhut et al. 2008).

While there were a variety of educational initiatives (K-12 and beyond) supported by *Active Worlds* and other now dormant desktop 3D virtual world applications, more recently, *Second Life* has emerged as one of the most prominent and accessible virtual world application. Despite the notoriety of *Second Life* in popular media, research is just beginning to emerge (Baker et al. 2009; De Lucia et al. 2009; deWinter and Vie 2008; Franklin et al. 2008; Gillian 2009; Good et al. 2008; Jarmon et al. 2008; Molly 2008; Yee et al. 2007). Of that body of work, very little is devoted to K-12 initiatives. Likely this is due to age limits. Linden Lab's Second Life's Main Grid is limited to those 18 years of age or older. For those ages, 13–17, Linden Lab provides the Teen Grid, however, adults must apply to be granted permission to participate in the Teen Grid and even with permission access is limited. Nevertheless, of the limited research of K-12 initiatives in SL, Franklin et al. (2008) found that the use of SL as an authoring platform for student-created educational games was motivational for the students. Gillian (2009) used SL with students of similar ages to explore how students make meaning and construct knowledge in multimodal environments. Although the research about K-12 initiatives in SL is very limited, educational initiatives using Active Worlds indicates that virtual world can support unique learning opportunities (Barab et al. 2007; Ketelhut et al. 2008; Merchant 2009; Warren et al. 2008). While these initiatives offer compelling evidence about the utility of using virtual worlds for teaching and learning, relatively little research has been conducted addressing how the affordances and constraints of each virtual world application might impact K-12 teachers and students. Most 3D virtual world applications provide core features such as the illusion of 3D space, avatars that serve as visual representations of users, and an interactive chat environment. However, each application has various strengths and weaknesses in design and it is important that educators and instructional designers have

knowledge of how these features are manifested in order to make informed choices when selecting a virtual world application to serve as an interactive learning environment.

Methods and process

The methodological framework for this qualitative investigation is a case study. The reason for choosing qualitative methodology is not to provide judgment about the suitability of either *Active Worlds* or *Second Life* for K-12 education, but to examine some of the factors that impact the pragmatics of K-12 teachers' adoption of new technology. Within this case study framework grounded theory methodology (Glaser 1992; Strauss and Corbin 1998) was employed. Grounded theory methodology is a method of data collection and analysis in which theory emerges from data gathered rather than being identified a priori. The process of data gathering and analysis is an iterative process.

Setting and content

The setting for this investigation was both the classroom and virtual world interactions in a three credit-hour graduate course entitled, *Virtual Worlds for Educators*, offered during the summer semesters of 2007 and 2008 at a mid-sized state university in the US. Eight K-12 teachers participated in this study. Four of the teachers worked with early childhood learners, two with middle childhood, and two with adolescent learners. Subject areas included language arts, foreign language, math, science, and social studies.

The focus of the *Virtual Worlds for Educators* course is to introduce educators and instructional designers to research, pedagogy and practice of using virtual worlds for education. The course was 2 weeks in duration and met 5 days a week for 4 h a day. The class met in a traditional classroom/lab environment with much of the interactions taking place in both the Active Worlds Educational Universe (AWEDU)[1] and the main grid of Second Life (SL).[2] The teachers were able to interact with one another in the virtual environments as well as in classroom. All participants were aware of the identities of the other participants and the instructor, in both virtual settings as well as the classroom.

Part of the introduction to each application included instructions on creating/selecting avatars, movement, communication, building and other relevant actions. The teachers used both chat tools to communicate in-world with one another as well as speaking aloud. When they encountered users who were not students in the course, they used the chat tools of each application to communicate. The instructor was an active participant in the in-world activities in both applications. The instructor identified herself to the teachers in both virtual worlds and used a stock avatar from AWEDU as her visual representation. She also purposely chose to use a basic avatar with little embellishment in SL.

During the course, the teachers were introduced to exemplary educational environments in both AWEDU and in SL. All of the class guided exploration in both environments was situated in educational environments. Through the duration of the course the teachers were exposed to journal articles about the educational use of virtual worlds (including both AW and SL) as well as non-referred resources, training materials and Websites.

[1] AWEDU is an educational universe supported by Active Worlds. All of the worlds within this universe are devoted to educational initiatives including K-12, higher education, and beyond.

[2] Second Life does not currently offer an educational "grid", but does offer a "Teen Grid" for teenagers age 13–17. Adults may apply for permission to participate in the Teen Grid.

Data collection

Data collection included prolonged and persistent observations of classroom activities in class and "in-world", email messages and conversations, student work, and informal interviews. Additionally, prolonged engagement in the field, peer debriefing, members' check, negative case samples, and an audit trail were part of the qualitative methodology (Glaser and Strauss 1967; Lincoln and Guba 1985). To support prolonged engagement the researcher was involved in observation throughout the duration of the course. Peer debriefing consisted of both formal reviews of data with one colleague in the field of technology for the duration of the study. Member checks were conducted informally during the process of data collection. Negative case analysis was conducted by reexamining the data to identify samples which displayed variation or contradicted the overall interpretations. Additionally, an audit trail was collected based on Lincoln and Guba's (1985) six categories of information including: raw data, data reduction and analysis products, data reconstruction and synthesis products, process notes, and instrument development information (p. 319). Within this study, these sources included field notes, observation notes, student work, and email interactions. This triangulation of multiple-data collection and methods was designed to support trustworthiness (Erickson 1986), however, it should be noted that the interpretation of these data were still subjective (Peshkin 1988; Fine 1994). According to Patton (2002) the researcher is an instrument of measurement. In this research, the researcher/instructor attempted to remain neutral and to foster an environment for open critical discussion, however, the very fact that such a course was offered imposes a level of subjectivity or more precisely a bias toward valuing virtual worlds. Similarly, it could easily be argued that the teachers likely also were somewhat biased in their interests of virtual worlds for learning due to the fact that they enrolled in the course.

In an attempt to foster reflective dialogue and practice, each class meeting was loosely structured around Brockbank and McGill's (2007) fourth application for reflective dialogue. Each class meeting began with an introduction of the day's activities and an initial discussion among the teachers about what they knew of the topic/activities and their perceptions. This stage was followed by the class activities. The teacher participants were encouraged to talk aloud during the activities and engage in dialogue with each other and the professor. Each class meeting ended with a debriefing reflective discussion. Part of the course homework included daily journal entries reflecting on their experiences.

Data analysis

Miles and Huberman's (1994) pattern classification strategies for identifying themes and patterns were used in the iterative process of data analysis. During the "open coding" process, potential themes were initially identified based on data collected during in-game experiences. During that time, emergent themes were identified (Strauss and Corbin 1998).

Class overview

There are notable differences between both applications, but where possible, attempts were made to provide parallel levels of instruction and scaffolding. The decision to use *AWEDU* first was based on the age of the application and was meant to illustrate some of the historical trajectory of virtual world.

Upon entering AWEDU, the teachers initially landed in the main AWEDU world. During participatory demonstrations, they guided in movement, chatting, changing avatars,

and traveling from world-to-world and were exposed to the online help and tutorials. The teachers were also exposed to several exemplary educational environments both K-12 and higher education environments.

After all of the teachers quickly mastered the basics, they were then guided through the process of building. They were taught how to select and rotate objects and where to locate objects. The participatory demonstrations focused on building a simple house; however, most of the teachers selected different objects than those selected by the instructor. The purpose of building was to demonstrate the building process of selecting pre-fabricated objects (i.e., wall, floor, window, etc.) and manipulation features (i.e., move, rotation, change texture, etc.). After the guided participatory demonstration, the teachers were allotted time to build structures/environments of their choice. All chose to build environments, some created complex furnished houses, while other chose to create outdoor environments. Seven of the environments built by the teachers were somewhat related to their teaching (e.g., a house to teach Spanish vocabulary, a setting for an interactive play, a historical home for social studies).

Each class session included guided exploration and/or guided instruction (e.g. how to move, build, and communicate). Interspersed between guided sessions, time was allotted for the teachers to explore and create. During all of the classes, teachers were encouraged to talk about their experiences both in world and in class. Discussion and reflection was a large part of the learning experience.

Unlike AWEDU, SL has an integrated environment called *Orientation Island*, designed specifically to teach users how to use SL. Topics covered in *Orientation Island* include appearance, movement, communication, etc. Upon entering SL, all of the teachers were encouraged to participate in the activities provided by SL on Orientation Island. All of the teachers participated, although some choose to explore different aspects in different order. All began with movement, but afterward several choose to explore changing their avatars' appearance while some explored other aspects. Because the instructor had an established avatar, she chose to create a demo avatar to participate with the teachers. As with AWEDU, the teachers were provided with participatory demonstrations in movement, chatting, changing avatars, and traveling from location to location, although this was also covered in *Orientation Island*. Additionally, the teachers were provided with participatory demonstrations in how to use the search features along with the online help and tutorials. After completing activities in *Orientation Island*, the teachers were also exposed to several exemplary educational environments including the International Society for Technology in Education (ISTE), several universities, a physics and science environment, a renaissance village, along with other environments created by students and faculty at the university.

After the teachers mastered the basics, they were then guided through the process of building. Rather than building a house with pre-fabricated pieces as in AWEDU, they were guided through the process of creating a snowman. Unlike AWEDU, within SL, users can create unique objects. The choice to guide the teachers through the process of creating a snowman was meant to expose them to the different aspects of 3D object modeling in SL (translation, rotation, scale, texture, color, etc.) and expose them to the relative ease of creating unique objects in SL. As with the AWEDU exercise, most of the teachers selected slightly different objects, textures, colors, etc. than the instructor. After the guided participatory demonstration, the teachers were allotted time to build structures/environments of their choice.

The class format using SL was similar to that of using AWEDU. Each class session included guided exploration and/or guided instruction (e.g., how to move, build, and communicate). Interspersed between guided sessions, time was allotted for the teachers to

explore and create. During all of the classes, teachers were encouraged to talk about their experiences both in world and in class. Discussion and reflection was a large part of the learning experience. The overarching goal of the course was for the teachers to design a lesson unit integrating a virtual world for teaching and learning.

Findings

Active Worlds Educational Universe

Participatory observations were conducted with students in a computer lab setting and within the virtual world settings. Participants in both iterations of the course explored AWEDU during their first week of class and SL during the second week. None of the participants had experience with either application prior to the course.

Teachers as learners: observations

During the initial exploration in AWEDU, the teachers were very actively engaged in their adventures. Their conversation was lively and much of their dialogue consisted of expressions of exuberance of the experience, requests for information, and speculation about the use for teaching.

Exuberance
Look I'm flying, can you see me? Can you guys see me?
Look at this. Did you guys see this? Come over here XX

Requests for Information
Can I run? Oh I'm running. Wait, how did I do that? What did I do?
I'm on the carpet and flying? Can you see me? I want to get off– how do I get off?
I can't get off! Am I gonna be stuck on this thing?

Speculation
This is cool! I bet some of my students would really love this especially since most of them were raised with games.
This would be a great way to introduce a topic, like students could go to another country or visit different periods in history.
Is this the moon? Wow, my kids would really like this. We could visit the moon when we study space!

Teachers as learners: teacher reflections

Throughout the course, the teachers were asked to keep a reflective journal about their daily experiences in virtual worlds. The journal entries echoed much of the exuberance and speculation displayed in class.

> …when I was walking around the "home world" if you will I felt a very similar feeling that I did when I played video games that were similar to AW such as Myst or Riven or even Doom. I felt the same sort of push that those games gave me—the push to move around, explore, find the hidden passage, discover the secret world, etc. I imagine that students might feel the same thing even if the world they were

> exploring was educationally motivated, for example a medieval village. Constructed to allow the students an educational experience, AW might certainly be a good way to really immerse students in the topic of study.
> I have several ideas spinning through my head for how I will use this with my students. I can really see a benefit for those students that are hard to engage in any other kind of schoolwork. I have many questions as to application and logistics with this type of lesson but I think they will be answered as we "play" and learn through hands-on experiences.

Although most of the journal entries echoed sentiments expressed during class, several teachers also expressed issues of concern including physical discomfort they had experienced during class along with concerns about how much of an investment of time would be required for some of the ideas they had generated during class.

> The feeling of movement was more than I expected. I have never gotten carsick and I happen to love IMAX movies and roller coasters. But the immersion of the computer and the way you could swing your line of vision was very cool and, at times, a little nauseating. I did find that chewing gum and having a drink helped with the equilibrium issues from the virtual sites.
> On the down side, I did go home early because I felt unpleasant after going through all the turns and tunnels.
> …what a labor of love creating a medieval village for example would be… The time commitment to building something specific in AW is probably quite huge.

Creating educational content: observations

After the initial exploration and exposure to a few educational initiatives in AWEDU, the teachers were introduced to building within an AWEDU world. Within AWEDU, users have two options for creating content by using either Active World (AW) objects or creating unique objects and placing them on a server. For the first option, AW provides a library of thousands of objects for users to combine to create environments. Objects include walls, roofs, doors, walkways, lights, etc. Users also have the option of customizing objects by adding different textures.

Creating unique or custom objects requires the ability to write RWX scripts or to use object modeling software such as Blender or Maya and convert objects into RWX files. This process requires specific art and technology skills.

Within the 30 min of instruction, all of the teachers had built structures by combining objects from the AW library and were in the process of adding furnishings to their structures. Five of the teachers began working on structures they could envision using for a learning activity with their students, while the other three chose to create "homes." They were very pleased with the ease in which they were able to build and talked about how easily their students would be able to build structures and environments within AWEDU.

Though initially, the teachers seemed pleased with the ease in which they were able to build structures, after several hours, several teachers asked to learn about interactive options to expand their scope. After exploring many of the options for creating sensors and triggers, activating Webpages, and including sound, they were pleased that the interactivity did not require knowledge of programming. However, toward the end of the activity, six teachers expressed frustration of not having the option to easily create unique objects.

Creating educational content: teacher reflections

Much of the teacher reflections also echoed the in-class dialogue about creating their own educational content. Although initially the teachers quickly became acclimated to building, after a several hours, they began to find limitations and expressed those in their reflections.

> I enjoyed visiting all of the worlds and found building easy, but it would be better if there were other objects. I wanted to make my school, but there aren't any of the stuff we have in my school.
> I wanted to make a person that could talk with my students, but that seems like it is a lot more involved. I like the fact that some things are really easy, but I think active worlds needs to include more things for teachers.

Perceptions of value for teaching and learning: observations

Throughout the week several themes emerged that were of concern to all of the teachers. These concerns included visual representation, security, cost, and time investment.

As the teachers explored various educational worlds, they became more aware of the limitations of their visual representation. AWEDU does not allow for unique or individualized avatars, instead, AW provides a library of avatars from which world owners may select. Users visiting a world are limited to choosing from the selection of avatars provided by the world owner. In turn, multiple users may use the same avatar within an environment. World owners may opt to create unique avatars for their world; however, this requires the ability to use an external modeler such as *Lightwave*, *Blender*, or *Maya*, conversion into RWX file format, knowledge and basic animation cycles, and the availability of an external server to store the avatars.

Several teachers noted how they would have difficulty identifying students because all of their students could potentially use the same avatar in an environment. Several also expressed concerns about some of the female avatars provided in the AW library of avatars stating that the avatars were clothed in ways that were demeaning of gender and/or not age appropriate for their learners. Two teachers also noted that the limited avatar selection might impact the overall impression they might want to create in a world, for example having avatars in modern clothing would be incongruent with a historical setting.

Security was a major topic among the teachers as they discussed the need to control access to and of their students. They noted the importance of finding methods to ensure that their students were not able to leave or that someone outside of their class would be able to access their students without the teacher's permission. AW offers several options for educators including the purchase of an entire universe or the purchase of a single world within AWEDU. The teachers were exposed to both options, but expressed concerns that although they could control access to worlds within AWEDU, they also needed to insure that their students could not leave a world within that universe and go to another. They also expressed concerns about the provision that allowed users (potential students) to whisper to one another and to possibly whisper to someone not associated with their class.

Cost was another major concern for all of the teachers. Most stated they did not have funds to purchase a world or a universe. Several teachers also expressed concerns that they did not have access to the expertise they felt was required for some of the technical aspects such as storing and accessing files and setting up a world. Most felt comfortable in the fact that they could use AWEDU for free and that other initiatives such as *River City* and *Quest Atlantis* had provisions for no-cost use.

Perceptions of value for teaching and learning: teacher reflections

Most of the journal reflections reiterated class discussions about visual representation, security, technical requirements, and cost.

> I don't think I want my students to be able to dress like a hooker.
> Some person was trying to talk to me today and wasn't in our class. I can see how it would be good for students to talk with others in active worlds such as for languages and maybe an expert in a field, but I would have to know who they were talking to first.
> I assume that one's computer needs to be pretty up-to-date and fast in order to process all the information AW allows. I don't know that the computers my school has would be anywhere near able to do this task.

Second Life

Teachers as learners: observations

During the initial discussion of SL all of the participant teachers indicated they had heard of SL. Several stated that the introduction and use of SL was one of the reasons they had enrolled in the course. All of the teachers cited episodes of popular television shows which had featured SL. Several, who had seen an episode of *Law and Order* which focused on SL, expressed concerns about cybersex and SL. All of the teachers had preconceived ideas that they would be able to recreate themselves in Second Life (SL) and that adult content was part of SL.

Because all of the participants were over the age of 18, all activity took place on the Main Grid; however, the teachers were presented with information about the use of the Teen Grid and were reminded that for most of them, their students would use the Teen Grid. They would also have the option to apply for access to the Teen Grid as an educator. Two teachers who taught high school students noted that in several of their classes, they typically had students ages 16–18 and questioned whether the 18 year old students would have access to the Teen Grid or if their class would be split between the Main Grid and the Teen Grid.

Upon activating Second Life, all of the teachers participated in the SL Orientation Island activities which are part of Second Life's introductory training. During the orientation, they learned movement, communication, appearance, and search options. Much of the dialogue was very similar to that expressed during their initial experience with Active Worlds with expressions of exuberance of the experience, requests for information, and speculation about the use for teaching.

> *Exuberance*
> Wow, I can do a lot more stuff. I can sit and dance and move around a lot more!
> This is so real, kinda creepier real, but in a good way.
>
> *Requests for Information*
> How do I land without falling in my face? (Laughing) Well, not my face, but my avatar face?
> Are you smoking? Can my avatar smoke? Oh, that might not be good with students.
>
> *Speculation*
> This seems more like a game. I bet my students would like it.

It seems like there is more to do physically here. Like maybe it could be used for even teaching sign language.
This could be really good. With the right clothes we could do plays and stuff, couldn't we?

Teachers as learners: teacher reflections

Like most of the journal reflections about AWEDU, many of the journal entries echoed the dialogue in class; however, unlike the reflections of AWEDU, several teachers expressed negative comments. Several of the negative comments expressed feeling overwhelmed by the experience. Subsequent interviews with participants revealed they many had felt overwhelmed when they initially visited SL. Two the teachers continued to feel overwhelmed by the scale of SL.

I was impressed with what I saw so far. I was pleased. I was interested. It amazed me that there were so many features to explore–buttons, right clicks, left clicks, page up, page down…Additionally there were so many things one could do to one's avatar.
It was interesting to cross paths with people who weren't part of our class, but you realize how being naive can quickly work to your disadvantage.

Creating educational content: observations

After participating in Orientation Island and exploration with a few educational initiatives in Second Life, the teachers were introduced to building within a SL setting. First the teachers were taken to a sandbox and guided through unpacking an existing object. Next, because SL has provisions for creating unique content, the teachers were guided in building a simple snowman. The guided instruction included a hands-on introduction to geometric primitives and scaling, rotating, and moving objects as well as combining and adding textures to an object.

Most of the dialogue focused on requests for assistance. All of the participants completed the snowman, but only one teacher continued to build additional objects. Although the teachers were allotted time to continue to build or explore finding objects, most abandoned any building activities and instead focused on developing the appearance of their avatar.

Creating educational content: teacher reflections

The teacher journal reflections of building within SL were both positive and negative. Much of the teacher reflections expressed enthusiasm for being able to create individual and unique content and the educational/constructivist advantages for their students. However, there were also major concerns about the amount of time required to build objects and the knowledge required for using Linden Scripts for adding interactivity.

I like the fact I can build things, but it takes so much time. I know you said we could find a lot of stuff, but it would be nice if it was in one place like active worlds was. Maybe I don't know where to look, but it takes me a long time to find free stuff.
I like that I can create anything, but it would take a lot of time to become really good at it.

Similar to the in-class actions, many of the teachers quickly abandoned building to continue working on their avatar. This was expressed in some of their reflections.

> Even now I want to log back on and tweak my facial hair, heighten my cheek bones, put some clothes on. I didn't know that there was so much to do, learn, toy around with. I can see how all of these features really pull users in so that as you said, they spend hours and hours in Second Life.
> I really enjoy playing around with my avatar. That's my favorite part of SL, but I'm not sure how educational it would be.

Perceptions of value for teaching and learning: observations

Throughout the week the same themes, visual representation, security, cost, and time investment, emerged that were of concern to all of the teachers, however, with some notable differences based on the affordances and constraints of SL.

Because SL affords users the ability to create unique avatars, all of the teachers spent a great deal of time working on the appearance of their avatar. Several admitted to downloading SL at home mainly to work on their avatar. While they enjoyed this option, many expressed concern about how this affordance could become a great distraction for learners. Three of the teachers noted that all of the avatars they encountered were young, pretty, and shapely. Discussion ensued about concerns of gender roles, physical appearance, race, ethnicity, and also anorexia. Many of the teachers expressed concern that most of the avatars were "too perfect".

What was interesting to note is that although the teachers had great concern, the appearance of their visual representation was a great lure. At the end of the SL building activity, only one student had built an object in SL. Most had spent the time working on their avatar.

As with AWEDU, security was a major topic among the teachers. All expressed concern about the prevalence of adult content on SL. Although the majority of teachers had students who were within the age range for the Teen Grid, all of the teachers expressed concern about access to the Teen Grid. Additionally, the two teachers who worked with adolescent populations expressed concern that their students might have to split between both grids.

Interestingly, all of the teachers expressed concern about how parents would react to the possibility of their children using SL. One teacher stated that the television shows that included SL would likely have a negative influence many parents. Another stated that all a parent had to do was "Google Second Life" to find many references to objectionable content and likely it would result in a call to the principal. They expressed concern that students, in an attempt to learn more about SL, would encounter SL Websites with questionable content at home or on other non-school computers.

Several teachers also expressed concern over the scope and scale of SL stating feelings of it being somewhat overwhelming along with a fear that they would lack control over events and actions within a SL environment. What was most notable is that in both iterations of the course, several teachers referenced the case of Julie Amero. Julie Amero was a substitute teacher in Connecticut who was accused of displaying pornographic images to her students (Carvin 2008). Although Amero had not sought out the images, as several security experts who became interested in her case contend, a malicious *adware* was the cause for streaming pornographic images on a classroom computer. All of the teachers felt great empathy for Amero and stated concerns that they thought Amero had panicked when the images started

appearing. One teacher stated that if something similar happened to him, he hoped he would think to unplug the computer, but he feared he would probably just keep clicking and trying to close the images like Amero. Most notable about these discussions were the teachers' statements about their fears of not being able to control technology. All of the teachers expressed feelings of great empathy toward the plight of Amero and concerns that something similar might happen to them. Because all of the teachers had encountered mature content in their explorations of SL, the reputation along with their perceptions of a lack of control over SL was a major concern and likely impediment to use.

Cost was another major concern for all of the teachers. Similar to discussions of AWEDU, were the lack of funds to purchase a SL island. Although lower cost options of renting land were presented, several teachers expressed concerns about cost. Several teachers also expressed concerns about the time they would need to invest to create content although there was great appreciation for the abundance of free educational content.

Perceptions of value for teaching and learning: teacher reflections

Most of the reflections reiterated class discussions about visual representation, security, technical requirements, and cost.

> …as far as using SL for this or other educational purposes, from what I can see so far my students would really have to be watched closely so that they would stay on task. My school is draconian in terms of what they censor—no YouTube for instance. I doubt that they would endorse SL.
>
> I wouldn't allow students to freely explore Second Life because of some of the mature content. I would want to keep them in some of the safer places.

Comparison of affordances and constraints of AWEDU and SL

Within both AWEDU and SL, the teachers displayed great exuberance and enthusiasm in exploring and building in these environments. In both applications, teachers speculated about how to best use them for teaching and learning, however, in both the class activities and reflections, the teachers revealed some key aspects of the affordances and constraints of each virtual world and the potential impact those might have for teaching and learning (see Table 1).

In terms of building, both AWEDU and SL had provisions for building. The prefabricated objects and pieces, along with the convenient object repository allowed the teachers to begin constructing environments almost immediately; however, they were hampered by the limited amount of objects and the lack of easy provisions for building unique objects. In contrast, SL had an integrated modeler, and provisions for sharing objects, but had a slightly higher learning curve and lacked a central repository of objects. While there were ample provisions for found, borrowed, and bought objects, the teachers noted the amount of time required for building, both in terms of building an environment for their students and in student built projects.

Both applications has avatars that served as visual representations of learners, however, like with building, in AWEDU teachers were limited to choosing between pre-existing avatars. Additionally, the selection of avatars was dependent upon the world owner's selection, so as they visited different worlds, they had to use different avatars. This was viewed as both a positive and negative. In contrast, in SL, the teachers were free to construct their own unique avatar, along with dress and adorn it as they choose. However,

Table 1 Comparison of Affordances and Constraints of AWEDU and Second Life

	AWEDU	SL
Building		
Low learning curve	×	×
Library of prefabricated objects	×	×
Central repository of objects	×	
User created objects	×	×
Integrated modeling and texturing tools		×
Easy interactivity	×	×
Avatars		
Library of prefabricated avatars	×	
Low potential distraction from avatars	×	
Unique avatars customized by each user		×
Control over basic movements	×	×
Custom control over movement and kinesthetic options		×
Control over age and dress appropriate avatars	×	
Security		
Control who enters a owner controlled space	×	×
Spaces devoted to educational initiatives		
Space with age limit controls	×	×
Cost		
Free educational locations	×	×
Free additional initiatives (River City and Quest Atlantis)	×	
Time		
Relatively low time investment for small projects using prefabricated or found objects	×	×
Low learning curve	×	×
Medium learning curve for more advanced features		×
High learning curve for more advanced features	×	
Reputation		
Potential controversial reputation		×

it did not escape their notice that they spent the majority of their time in SL altering and adorning their avatar rather than building or exploring content. Although initially they were more enthused about SL provisions for unique avatars, by the end of the class they acknowledged that both AWEDU and SL had strengths and weaknesses with avatars. AWEDU allowed more focus on content, while SL allowed more personal expression and playing around with identity.

Three prevailing concerns expressed by all of the teachers were security, cost and time. Because of the reputation of SL, there were concerns about how it would be perceived by parents and administrators. All of the teachers had encountered objectionable content during their exploration of SL. Although they were well informed about the Teen Grid, they were concerned that parents might not know about the Teen Grid and instead visit SL main grid and encounter some objectionable content. Because AWEDU is not limited by age, but rather by content, they were able to visit educational sites as well as see the

differing levels of security. Despite their perceptions, it should be noted that the teachers only visited AWEDU. Had they visited the main Active Worlds Universe, they likely would have encountered much of the same objectionable content. Both applications have provisions for securing the safety of young users, but in different ways and levels. In AWEDU world owners can designate who may visit a world or universe. In SL the Teen Grid is for all users under the age of 18 and maintains some provisions for those beyond 18. Additionally, land and island owners (on both the Teen Grid and the Main Grid) may designate who may visit their space.

Both AWEDU and SL are free to use, however, each also has a subscription system and both charge a fee for buying/renting space. In AWEDU the cost is initially $695 to purchase a small world for 1 year, followed by $395 per year to maintain that world. For roughly the same amount of space, SL users may purchase an island (Teen or Main Grid) for roughly $1000 for a year. However, SL, unlike AWEDU, has an economic system and owners may lease portions of islands to other users to help defray costs.

While all of the teachers enjoyed exploring both AWEDU and SL and expressed the value in both for teaching and learning, one of the major concerns of all the teachers was the investment in time, both time invested in learning, building and in the time invested in teaching. While they appreciated all of the building tools available with SL and ease of building with AWEDU, most stated that they would be more most likely to use a virtual world that was already developed for specific content that was aligned to content they were teaching. Most stated that while they appreciated the provisions, they often felt pressed for time to teach their existing content and needed content that would supplement their current content requirements.

In summary, the teachers appreciated both applications and felt each had somewhat different strengths and weaknesses. AWEDU allowed them to focus on content, while SL allowed for more personal expression. Both had the potential to support learning and engage both teacher and students.

Discussion

The scope of this qualitative case study is by no means comprehensive, but rather intended to examine some of the pragmatics of integrating virtual worlds for teaching and learning in K-12 education. Specifically this investigation focused on a reflective dialogue gathered from two groups of K-12 educators about their experiences using both AWEDU and SL. The goal of this research is to investigate how K-12 teachers' perceptions of virtual worlds may impact the integration of new tools for teaching and learning. The findings of this study are intended to illuminate the experiences of K-12 educators using two popular virtual worlds and to provide insight into their perceptions about the use of these worlds for K-12 education. It is important to note some of the limitations of this study. The participants only used the educational universe of Active Worlds. Because of the age of the participants, they were limited to SL's Main Grid and not the Teen Grid. The Teen Grid serves 13–17 year old users, so the relevance of SL is limited for many of the participants in this study. Currently there are not provisions for users under the age of 13. This is a notable limitation for using SL with younger learners.

It should also be noted that the professor for this course and subsequent research is an avid user of several virtual worlds (including those in this study), yet all attempts were made to provide an environment for open discussion and critical views. Nevertheless, it is possible that the teachers filtered some of their reflections. Furthermore, it should be noted

that the intention of the course was not to frame a comparison between the two applications, but rather to present two possibilities for teachers. The danger of providing two of anything is that when binary constructs are presented; inevitably one side of the binary is privileged over the other. Privileging once construct over another is not necessarily an intended state, but often occurs as a result of defining one relation to its opposite (Knights 1997). No comparison was intended as part of the course, but rather comparisons between the applications emerged as a result of data analysis.

The findings of this investigation reveal advantages and limitations of both AWEDU and SL as educational tools; however, the applicability of these findings is limited based on teachers' experiences as learners and not as practitioners using a virtual world for teaching and relatively short exposure to both virtual worlds.

The findings reveal that both AWEDU and SL provided an engaging environment for learning. All of the teachers demonstrated great enthusiasm in their forays into virtual worlds. Many of their in-class and journal reflections included observations of the constructivist nature of virtual worlds. This is similar to the findings of Bers and Cassell (1999) in their use of virtual worlds as a constructivist environment for learning.

Most of the teachers expressed great enthusiasm for AWEDU and while many of those same sentiments were expressed with SL, several teachers also mentioned some negative aspects of SL. Prior to the course, none of the teachers were familiar with AWEDU, nor had they any preconceived ideas of it, yet all of the teachers had heard of SL and had some preconceived notions about mature content. Their preconceptions of SL may have impacted how they viewed the virtual environment. It is also important to note that in both iterations of the course began with AWEDU, which in turn became a means for comparison with SL. It is interesting to note, however, that six of the teachers had enrolled in the course based on their interest in Second Life.

All of the teachers participated in building in both AWEDU and SL, but with marked differences. In AWEDU, all of the teachers built fairly complex structures which included interior furnishings. Five of the teachers were creating content they envisioned using with their students. AWEDU afforded easy construction of structure by supplying a library of objects. This allowed for ease and speed, however, the constraints soon became apparent when several teachers wanted to include content that was not available in the AW library. Many felt limited by the constraints of not having an accessible option for creating unique content.

In SL, the teachers learned to create unique content, yet despite expressions of frustration with the constraints of AWEDU, most of the teachers did not pursue building although they were allotted time and assistance. Only one student took advantage of the affordances in SL for building unique content. Instead, the majority focused on altering and enhancing the appearance of their avatars. Within AWEDU, the teachers spent relatively little time selecting avatars, with the majority of their time spent building, whereas in SL, they spent relatively little time building and the majority of their time on their avatar. SL had more affordances for both building and visual representation, but in terms of engagement, visual representation trumped building among this group of teachers. Ironically, many of these teachers expressed concerns about the visual representation of most avatars (young, attractive, physically fit, etc.) and expressed concerns that the affordance of unique visual representation could be a major distraction for their learners (as perhaps it had been for the teachers).

For both AWEDU and SL, themes of visual representation, security, and cost were the criterion most teachers used when discussing their perceptions of each virtual world's value as a medium for teaching and learning. Initially many stated concerns about the

selection of avatars provided by AWEDU because of the limits and some of the female avatars represented mature or superficial values. However in SL, despite the affordances of unique visual representation, many of the teachers presented similar arguments about avatars in SL. What is interesting to note is that in SL all of the avatars represent how users wish to present themselves—which in and of itself provides commentary about perpetuating values of representation.

Security for learners was also a major concern among all of the teachers with the majority of teachers perceiving greater control and safety within AWEDU. However, it is important to note that all of the teachers had some knowledge of SL prior to the course and some notion about mature content and SL, whereas none of the students had prior knowledge of AWEDU. It is equally important to note that Active Worlds provides two different universes: the main Active Worlds universe and Active Worlds Educational Universe. The main Active Worlds universe is a social virtual world environment. Depending upon interests, users in that environment may encounter some of the same adult and mature content encountered in SL. AWEDU is a universe devoted to educational initiatives. Users are not exposed to the same types of mature content they may encounter in the main universe. Likely had the teachers had experiences in the main universe, their perceptions likely would have been altered. Similarly, because of limitations of age, the teachers were not able to access the Teen Grid and if they had, their perceptions of security may have also been altered. Despite their experiences, it is also important to note that many felt that due to television depictions and Web presence that SL was more problematic in terms of security of their students, but also for their individual job security. Discussions of Julie Amero's case revealed profound fears many educators felt toward not only emerging technology, but also of an innocent loss of control over existing tools they commonly used.

For most educators, cost is always an issue both in terms of monetary output, but also in terms of the personal investment of time and energy. Most of the teachers were enthused about the option of creating unique content for their students, but most were wary of the time investment. Although in many regards AWEDU had more constraints, for the majority of teachers, it allowed for easier construction. On one hand, the Lego-like aspects of the AWEDU objects allowed the teachers to quickly construct structures and environments, however, the lack of affordances for building unique objects limited their options. On the other hand, the affordances of SL for building unique content was, for many, overwhelming and they wanted ease and availability of finding free objects similar to AWEDU.

In summary, both virtual worlds offered both similar and different affordances and constraints. While options for building and visual representation were considered an asset, they also posed a hindrance. In final discussions, most of the teachers concluded that both AWEDU and SL provided great opportunities for teaching and learning, but that both had areas of great concern. The main limitation is that these virtual worlds were created as social environments and not as educational environments. Most of the teachers noted the importance of having tools developed to meet the needs of teachers rather than pushing teachers to adapt to existing tools.

Conclusion

It is important to acknowledge that the dynamics of a learning environment are more than the result of mere tools or technology, but instead are predicated on the interplay between content, the instructor, and the learners. However, the affordances of a virtual world may

influence opportunities for interaction, so it is important to understand how different virtual worlds function. Virtual worlds are an emerging technology tool that affords a variety of learning opportunities for extending, rethinking, and envisioning new learning environments. However, like all technology, virtual worlds are not value-neutral and each has differing affordances and constraints. Understanding how each works will help insure that virtual worlds develop into more than mere novelties, but become meaningful and engaging interactive learning environments. The benefit of this study is that it will help educators and developers understand more about the pragmatics of integrating new tools for teaching and learning.

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