Development and Evaluation of Virtual World Instruction Based on a
Constructivist Learning Environment Design Framework

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ABSTRACT

By their very nature, physical classrooms limit the external resources that are readily available to teachers and students. However, many educators desire to expand the student's learning environment to include outside resources (Partnership for 21st Century Skills, 2009; NCSS, 2010; U.S. Dept. of Education, 2004). Much of this desire is due to the influence of constructivism; however, many teachers are without the knowledge and resources to implement a Constructivist Learning Environment (CLE) (Diem, 1999; Mason et al., 2000; Swan & Hofer, 2008). Therefore, how to create a suitable community-driven learning environment that allows classroom teachers to utilize resources outside their immediate location is a problem faced by many of today’s educators.

Past research has identified five key attributes any CLE must incorporate: embedded within realistic and authentic environments, allow for communication and collaboration among and between students, teachers and mentors, allow for multiple perspectives and views to be seen and shared, promote a student’s self-awareness and self-reflection, and allow the learner to be autonomous (Jonassen, 1994; Driscoll, 2005). When considering this list against technological affordances, the one technology that appears capable of fulfilling these requirements is virtual worlds (Kemp & Haycock, 2008). Designed as a developmental research study, this research validates the use of virtual worlds as a development tool when building a CLE within the K-12 environment.
Dedication

Quite simply, thank you Daisy, InsaneMustache, Readingfreak and Sid. This never would have been possible without you.
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Chapter One: Introduction

In America, brick and motor walls and a fixed location define the traditional K-12 classroom. By their very nature these physical classrooms limit the external resources that are readily available to teachers and students alike. In response, many educators desire to expand the student's learning environment; moving away from the solitary classroom to actively include outside resources such as, individuals, content experts and materials (Partnership for 21st Century Skills, 2009; National Council for the Social Studies [NCSS], 2010; U.S. Dept. of Education [DOE], 2004). The goal of this desire is to facilitate larger learning communities so that students and experts alike, regardless of location, are allowed to collaborate, discuss and construct artifacts while working together throughout the learning process. Much of this desire is due to the influence of constructivism in today’s educational process. However, many teachers are without the knowledge and resources to build these learning communities and access additional material outside of their immediate proximity (Diem, 1999; Mason et al., 2000; Swan & Hofer, 2008). Therefore, how to create a suitable community-driven learning environment that allows classroom teachers to utilize resources outside their immediate location is a problem faced by many of today’s educators.

However, when considering the desire to expand the learning environment a very practical question must be asked: in a time of global economic crisis, with education receiving less and less governmental funding and budgets in school systems across our country being reduced, how can teachers effectively and efficiently broaden their student's learning environment? The answer many professionals point to is instructional technology (NCSS, 1994; National Science Foundation [NSF], 2008; DOE, 2010). Technology is seen a bridge that can provide both access to outside resources and opportunities that are not accessible to location-
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based classrooms. By providing access to these outside resources, technology is serving to facilitate the building of a larger learning community in which different student populations can work alongside each other and experts while building their individual knowledge. The building of such learning communities, and this approach to instruction, correlates to the rise of interest in building a Constructivist Learning Environment (CLE).

Built on the foundational work of Bruner (1961) and Vygotsky (1994), amongst others, constructivism is the belief that individual knowledge is based on individual previous experience, but built in an active social context. In other words, learning only happens through engagement in active, social experiences that cause the student to “wrestle” with new information until it becomes meaningful. It is almost as if new information can only be learned by first understanding the value society places on it and the context the information falls within. That is not to say that a mob-mentality dictates what everyone “learns,” feels, or believes, but rather that understanding how society views and values new information allows the individual to make sense of the new information and fit it into their world-view.

Constructivist learning theory espouses that knowledge is constructed by an individual through experience and social interaction and is not something that can be transmitted to a learner (Jonassen, Peck, & Wilson, 1999). Therefore, when building a CLE the learning activity must be embedded within realistic and authentic environments, allow for communication and collaboration among and between students, teachers and mentors, allow for multiple perspectives and views to be seen and shared, promote a student’s self-awareness and self-reflection, and allow the learner to be autonomous (Jonassen, 1994; Driscoll, 2005).

When using these guidelines to build a CLE, instructional designers need to identify a technology that is capable of facilitating the growth of a CLE and also test its affordances as
being capable of expanding the learning space. Any identified technology would have to afford
the ability for multiple learners to come together at the same time, communicate and
collaboratively build knowledge while engaging in a learning activity. Furthermore, the
instructional technology must be persistent to allow for multiple visits without the loss of created
materials, and must be engaging enough for learners to want to participate. When considering
this list of technological affordances, the one technology that appears capable of fulfilling these
requirements are virtual worlds (Kemp & Haycock, 2008).

Virtual worlds are characterized as online situations that allow for: 1) multiple
participants to come together at one time, 2) actions to occur in real time, 3) content to be easily
created by both instructors and students, and 4) social networking to flourish (Warburton, 2009).
As such, virtual worlds “provide strong support for synchronous interactions and collaborations”
(Livingstone, Kemp, & Edgar, 2008, p. 140). However, there is an identified gap in the current
scientific understanding of the challenges educators face when designing and implementing
learning programs utilizing instructional technology (Hew & Cheung, 2010), such as virtual
worlds.

In light of all of the above, it is appropriate at this time to examine if virtual worlds are a
plausible technology on which to build a CLE conducive to extending the learning environment
outside of a traditional classroom. Doolittle and Hicks (2003) posit that constructivism is not
only an appropriate paradigm to apply to the use of technology in the classroom, but one that has
not yet been fully implemented. Guiding principles have been identified by past research,
however they have yet to be vetted in virtual world implementation.

Designed as a developmental research study, the goal of this research is to propose a
framework for practitioners to follow when designing a CLE based in a virtual world. Past
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research has identified five key attributes any CLE must incorporate, as well as the affordances the technology driving virtual worlds provides. However, as of yet, no research has been conducted to test if virtual worlds are a valid technology on which to build a CLE. If successful, this framework could be used in practical application by educators who desire to incorporate these types of experiences into their instructional programs.
Chapter Two: Literature Review

In this chapter, a literature review is provided on the key theoretical underpinnings and justifications for the use of virtual worlds as a basis for building constructivist learning environments. First, the foundations of Constructivist learning theory are examined and the guiding principles of constructivist learning environments identified. Next, the affordances of virtual worlds are discussed as a tool for building constructivist-learning environments and past research is surveyed. Third, the importance and structure of design and development research is reviewed. Lastly, models and their components are described.

Constructivist Learning Theory

To provide a greatly simplified explanation of constructivism, knowledge is an internal realization of external experiences. Accordingly, it is not the product of learning (knowledge concept) that is important so much as the process the individual learner goes through to construct that knowledge. According to constructivism, knowledge is mainly developed/determined through interaction with the social culture, prior experiences and the environment surrounding the learner; in other words, “knowledge is constructed by learners as they attempt to make sense of their experiences” (Driscoll, 2005, p. 387). It is only through these experiences that knowledge is actualized and comes to be “known.” If it was not for the social interaction, in the first place, then meaning is lost, as any potential new knowledge cannot be understood without the external social and cultural influences. To constructivists, “humans create meaning as opposed to acquiring it” (Ertmer & Newby, 1993, p. 62 emphasis in original).

It is the act of discovery in which individuals explore their world and, almost as a byproduct of that act, new understanding becomes known. New knowledge is not an external item that can be claimed by the learner, but rather the discovery process is needed to help
amplify the learner’s internal capabilities (Driscoll, 2005); in other words, the external discovery process is needed in order for the student to recognize what was already within them. It was through this process that learners realize that knowledge is embodied within their culture and in turn internalize that knowledge into rules of thinking about their world (Bruner, 1971). Through the process of discovery students grow in bits and spurts as cultural knowledge is seen, understood and adopted. This new knowledge is, in turn, “transmitted to the child…by agents of the culture: ways of responding, ways of looking and imaging, and most important, ways of translating what one has encountered” (Bruner, 1964, p. 13).

Similarly, Vygotsky believed that cognitive development was intricately interwoven with social interaction. Vygotsky (1978) believed that learning occurred, and was a product of, an individual’s internalization of the value placed upon societal tools and resources. In other words, Vygotsky felt that learning could only happen through social interaction; the learner would understood the new information by coming to terms with the context of the value society placed on it. That is not to say knowledge is static; the same constructs will definitely mean different things at different times as each individual grows, matures and encounters different experiences. As Driscoll (2005) explained, “individual development could not be understood without reference to the social and cultural context within which such development is embedded” (p. 247).

But how exactly does the knowledge embedded in society and culture become “learned” on an individual level? According to Vygotsky (1994) this happens through the process of mediation when social knowledge is transformed into internal psychological functions. Because much of Vygotsky’s work (1978) involved children and their early development his views centered on how children interacted with the societal, cultural and environmental stimuli they
received on a daily basis. Through his work with children Vygotsky (1978) noted that as children responded to these stimuli they changed their thinking in the act of responding. Mediation then became an important tool in human development because it was through the mediation process that new information was received in a societal context and internalized by the learner. This was because through mediation items agreed upon as valuable by the community were shown to be of value to the learner and therefore the new item was learned in response. Therefore, much of human development was only going to occur through a series of social interactions. Luria (1994), a colleague of Vygotsky, wrote:

> we consider that the development of the child's conduct can be reduced to a series of transformations, that these transformations are due to the growing influence of cultural environment, the constant appearance of new culture inventions and habits, and that each invention of a new 'artificial' habit involved a change of structure of the child's conduct. (p. 47)

Within this one statement much of what Vygotsky believed is reflected. Cognitive development occurs as a learner interacts with their community and as the community grows and changes, so will an individual. The two are intricately locked together, and one cannot happen without the other. The learner is an evolving member of the community, capable of new discoveries and insights, which in turn change the community, just as the community shares its collective knowledge causing individual changes in the learner. As Vygotsky (1994) himself said, "man is a social creature, that without social interaction he can never develop in himself any of the attributes and characteristics which have developed as a result of the methodical evolution of all humankind" (p. 352).

According to constructivists, learning is an active process. That is to say, students do not
just sit and passively receive information and recite it back in perfect order. Rather, each individual actively considers what she hears, sees and experiences and then construct an understanding of that material. In this sense, it is important that constructivist-based exercises utilize realistic and meaningful experiences. It is only if the activity is based in a realistic context that the material be best understood and applied in the correct fashion by the learner. The problems must also be integrated within the social environment of the learner. As Tam (2000) indicates, “the problems provide the context for the learners to apply their knowledge and take ownership of their learning” (p. 52).

**Constructivist learning environments.**

As support for constructivism grew, so did the desire to implement the theory into practice (Jonassen, 1994). As such, Constructivist Learning Environments (CLE) began to be built and tested (Lebow 1993; Jonassen, 1994). Within the field of Instructional Design, Duffy and Jonassen (1992) became two of the first to address the growing demand for identifying a guiding constructivist framework within the field. Subsequently summarized, Jonassen (1994) believed that knowledge construction could be facilitated in learning environments that:

- provide multiple representations of reality, thereby: avoiding over simplification of instruction by representing the nature complexity of the real world; focus on knowledge construction, not reproduction; present authentic tasks (contextualizing rather than abstracting instruction); provide real-world, case-based learning environments, rather than pre-determined instructional sequences; foster reflective practice; enable context- and content-dependent knowledge constructions; and supporting collaborative construction of knowledge through social negotiation, not competition among learners for recognition. (p. 35)
These guidelines are based on the constructivist belief that learning is not something that should be controlled but rather an activity to be facilitated or fostered. Therefore, Jonassen (1994) presented the guidelines in accordance with the constructivist belief that learning could not be encapsulated within a set of instructional steps but rather could only be achieved by designing a learning environment in which self-regulated learning could occur within a student.

Building on his earlier guidelines, Jonassen (1999) created a model for designing a CLE. The model consisted of a series of six concentric rings, including: social/contextual support, conversation and collaboration tools, cognitive (knowledge-construction) tools, information resources, related cases and the problem context, representation and manipulation spaces. This structured the activity to allow for the necessary resources and experiences for the learner to challenge their own assumptions, and thusly gain a deeper understanding of the world around them.

Lebow (1993) also created a set of guiding principles to apply constructivism to instructional design. At the time, constructivism was still fairly new and many in the field were at odds with its applicability to the traditional behaviorist approach to designing instructional event. The more traditional values of technology, including, replicability, reliability, communication and control (Heinich, 1984), contrasted “sharply with the seven primary constructivist values of collaboration, personal autonomy, generativity, reflectivity, active engagement, personal relevance and pluralism” (Lebow, 1993, p. 5). However, Lebow posited that constructivism and instructional design were not at odds with each other, but rather that when applied correctly constructivism was a lens in which to frame the learning process and could be used to design instruction. His answer was five guiding principles of constructivist learning.
First, Lebow (1993) articulated that in an effort to ensure that the learning process did more good than harm, there should be a “buffer between the learner and the potentially damaging effects of instructional practices” (p. 5). Meaning that rather than forcing a one size fits all approach to learning, students should maintain some degree of freedom and responsibility for their own individual learning process. Lebow actualized this in four sub-points, increase emphasis on the affective domain of learning, make instruction personally relevant to the learner, help learners develop skills, attitudes, and beliefs that support self-regulation of the learning process, [and] balance the tendency to control the learning situation with a desire to promote personal autonomy. (p. 5)

The second principle Lebow posited is that any learning activity should “provide a context for learning that supports both autonomy and relatedness” (Lebow, 1993, p. 8). The goal here is to build an environment in which each student can see the interrelatedness of the big picture and still identify their individual responsibility and accountability. This dynamics allows for multiple perspectives to be shared, but yet still allow for individual differences and respect amongst the group members.

Lebow’s (1993) third principle stated that the reasons for learning should be embedded into the learning activity itself. The goal here was to account for constructivist belief that knowledge was an individual activity that was shaped by the learner’s world-view and past experiences. Therefore, for learning to occur the student must be placed into authentic, realistic environment in which reflected real-world activities. This was critical since constructivist believe that learners are motived by personal goals, expectations and attitudes, which are different for each individual in each activity and therefore it was only by basing learning activities on real-world issues that an environment suitable for learning could be facilitated.
Fourth, Lebow (1993) cited that learning should be self-regulated “by promoting skills and attitudes that enable the learner to assume increasing responsibility for the developmental restructuring process” (p. 10). Learning is affected by individual goals, motivations, experiences and attitudes; therefore CLEs should place students in situations that would cause them to critically think about these very items. As Fosnot (1984) had stated almost a decade earlier, learners need their equilibrium disrupted in order to be motivated to better understand why a change is necessary. In other words, learners needed to be presented enough new information to cause them to realize a shift of some kind is in order.

Lastly, Lebow (1993) thought that instructional designers should “strengthen the learner’s tendency to engage in the intentional learning process, especially by encouraging the strategic explorations of errors” (p. 11). By pointing out the errors made in the self-regulated learning process, it was thought that learners become better able to recognize their own mistakes. This contributes to building of equilibrium disruption, mentioned previously, and once again become aware of why changes in their internal viewpoints are required. Taken all together, the five principles identified by Lebow (1993) provide a framework of how constructivist-based learning activities could be shaped.

The following year, Savery and Duffy (1996) expanded upon Lebow’s five principles and presented their own list of eight constructivist instructional principles. These principles included: (1) anchoring activities to “larger task or problem” (p. 137); (2) supporting the learner to develop “ownership for the overall problem or task” (p. 138); (3) designing “an authentic task” (p. 138); (4) setting the task and creating an environment that “reflects the complexity of the environment they should be able to function in at the end of learning” (p. 139); (5) allow the student to take “ownership of the process used to develop a solution” (p. 139); (6) creating an
“environment to support and challenge the learner’s thinking” (p. 139); (7) encourage student to test “ideas against alternative views and alternative contexts” (p. 140); and (8) “provide opportunity for and support reflection on both the content learned and the learning process” (p. 140).

When examined together, instructional designers are left with a guiding set of principles/feature to follow when building CLEs. The five elements common to each of the frameworks presented by Jonassen (1999), Lebow (1993) and Savery and Duffy (1996) include: being embedded in realistic and authentic environments, allowing for communication and collaboration, allowing for multiple perspectives and views, allowing for learner self-awareness and self-reflection, and allows for the learner to be autonomous. Furthermore, these have also been identified within additional research (Table 1).
Jonassen, Peck, and Wilson (1999) summarized it well by saying that for learning to occur within a CLE, students must be able to “explore, experiment, construct, converse and reflect on what they are doing so that they learn from their experiences” (p. 194). But how do instructional designers take these guiding principles and put them into practice when designing instruction? In today’s society, it seems the answer may depend on the technology on which is chosen to implement a solution.

Technology has already been accepted as a tool to help build a constructivist approach in the classroom and has demonstrated it is capable of encouraging both meaningful learning and interactive instruction (White, 1999; Oliver, 2000). Therefore looking forward, it seems when designing technology-mediated instruction, the instructional designer must identify a technology that supports the same features as a CLE. As Jonassen (1994) originally stated, when building a learning environment in which to apply instructional technology, “a supportive environment in

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<td>Allows for communication and collaboration</td>
<td>Jonassen, 1994; Fosnot, 1996; Salmon, 2000; Cates, 2001; Driscoll, 2005; Schunk, 2008; Chitanana, 2012</td>
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<td>Allows for multiple perspectives and views</td>
<td>Jonassen, 1991; Lebow, 1993; Salmon, 2000; Driscoll, 2005; Karagiorgi &amp; Symeou, 2005</td>
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<td>Allows for learner self-awareness and self-reflection</td>
<td>Merrill, 1992; Lebow, 1993; Jonassen, 1994; Fosnot, 1996; Salmon, 2000; Gold, 2001; Savery &amp; Duffy, 2001; Driscoll, 2005; Chitanana, 2012</td>
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<td>Allows for the learner to be autonomous</td>
<td>Lebow, 1993; Jonassen, 1994; Fosnot, 1996; Driscoll, 2005</td>
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which the learner can interpret at least a simulated reality in order to understand that reality” (p. 35) needs to be established. It is this type of learning environment that will “engage learners in knowledge construction through collaborative activities that embed learning in a meaningful context and through reflection on what has been learned through conversation with other learners” (Jonassen, Davidson, Collins, Campbell, & Haag, 1995, p. 13).

By looking at instructional technology in this light, instructional designers need to identify a tool that allows for multiple learners to synchronously come together, communicate and collaboratively construct while engaging in an activity. Furthermore, the technology must be persistent to allow for multiple visits without the loss of created materials, and must be engaging enough to keep participants engaged. In consideration of these factors, virtual worlds seem to have the required affordances and could be used as an appropriate tool when designing instruction.

**Virtual Worlds**

Virtual worlds are characterized as online situations that allow for: 1) multiple participants to come together at one time, 2) actions to occur in real time, 3) content to be easily created by both instructors and students, and 4) social networking to flourish (Warburton, 2009). Since their advent, virtual worlds have been the focus of much attention and interest by the education community. In one literature review, Hew and Cheung (2010) identified a total of 470 academic papers that had been written on or about the use of virtual worlds. However, of the 470 identified articles only 15 were empirical research studies based in K-12 or higher education settings. While the literature review indicated that virtual worlds were being used as communication spaces, for simulations and experiential activities it also demonstrated that up until 2010 most writings on the use of such spaces were mainly hypothetical or theoretical in
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nature. The lack of empirically based evidence supporting the use of virtual worlds as means of improving learning events has yet to be readily available. That is not to say that there are no studies examining the use of virtual worlds in educational activities, but rather not enough research has been conducted to draw knowledgeable conclusions (Dickey, 2005). Though, early indications do suggest that activities conducted within virtual world settings do support and can improve learning effectiveness (Bailey & Moar, 2001; Ondrejka, 2007, Savin-Baden, 2008).

Like other new technologies that had come before, virtual worlds were quickly seen as a technology that could enable drastic reform within technology-driven learning environments. As such, early adopters began exploring what could be achieved within its use in both formal and informal learning environments. However, before examining the research that has been conducted within virtual worlds one should first understand the types of learning paradigms that seem to best fit within a virtual world environments.

**Learning paradigms.**

In 2006, Hayes examined peer-to-peer learning in a study of situated learning in virtual worlds. In her ethnographic study of *Second Life*, she found that learning could occur in a number of ways. Residents can learn from more experienced residents through chance encounters, from free classes offered in *Second Life*, or from other web based tools such as list-servs or websites outside of *Second Life*. In each case, the knowledge is passed to the resident/learner from a non-traditional expert (i.e., not a formal teacher).

Building on this participatory nature of virtual worlds, Ondrejka (2007) argued that *Second Life* is uniquely suited as a viable learning environment. He posited that Vygotsky's theories on education, that learning needs context within society can be applied within virtual worlds. To Ondrejka, virtual worlds were “engaging playgrounds for experimentation” (2007, p.
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241) and simultaneously immersed participants into social networks. Ondrejka theorized that “people learn best when they spend time with people who have mastered the skills they wish to learn” (p. 242) and believed setting activities in virtual worlds, such as Second Life, allowed for that learning from others to occur. The ability to learn, become knowledgeable and pass that knowledge on is a key chain of attributes when arguing for the constructivist nature of Second Life.

Savin-Baden (2008) argues that learning in Immersive Virtual Worlds (IVW) cannot depend on linear cognitive learning theories, such as those used by some online video games. By their very nature, video games, though they may feel open and user directed through the use of hundreds of hours of game-play or multiple side adventures, do have one designed path that the game makers want all players to follow; IVWs, such as Second Life, do not. Within such worlds there is no end-goal or direction that has to be taken by a participant. Individuals are free to pursue any activity they wish once connected to the technological system driving the IVW. Therefore, Savin-Baden argues that IVWs are not linear in nature so the same learning theories applied to gaming cannot be applied to these environments. Instead she proposes that practitioners need to better understand how the student relates to the course structure, material, and the agency leading the instructional event. By doing so she feels that “smooth curricula spaces” (p. 158), which are more open, flexible and allow learners movement within the material, can be created. Because social multi-user virtual worlds, such as Active Worlds or Second Life, have no linear path, the design of open flexible learning environments is possible.

This same argument seems better constructed and communicated by Kemp and Haycock (2008) in their paper that detailed learning in Second Life. The framework of their paper was directed as a response to educators “seeking to establish learner-centered, participatory
environments in a constructivist pedagogical framework” (p. 89). Kemp and Haycock argue that it is the ease with which instructors and students can work together to create new learning experiences in a social collaborative environment that is important. They go so far as to propose that Second Life can work as a shell and provide a framework for the creation of non-violent “video game-like experiences” (p. 92). However, they state that unlike the linearity of video games, Second Life does not have a set linear path, supporting Savin-Baden in her assessment (Kemp & Haycock, 2008).

Also in 2008, Stoerger reviewed virtual worlds as an educational tool that enhances visual literacy skills. Stoerger postulated that virtual worlds, by being immersive and engaging, not only build learner/player knowledge of the content but also “positively affect the underlying understanding of the content” (2008, p. 52). This deeper understanding of the material was caused by the interaction between objects and the learner. Furthermore, Stoerger wrote that virtual worlds also allowed for the learner being “situated within a visually rich and engaging space” (p. 53). By engaging in activities set in this type of environment, learners used visual thinking strategies and gained better understanding of the situation on hand.

All of these studies support the argument that virtual worlds, such as Second Life, can be used as a delivery mechanism for education pursuits. As Kapp (2009) so succinctly stated, a “virtual world is simply the natural extension and convergence of several technologies currently used for online learning” (p. 3). By taking the best of each earlier set of technologies, virtual worlds allow for: multiple participants to come together at one time, actions to happen in real time; regardless of distance; content to be easily created by both instructors and students; and social networking to flourish, meaning students and instructors can interact, build relationships and share information (Bartle, 2004; Kapp, 2009; Sanchez, 2009; Warburton, 2009). This does
not mean that virtual worlds are any better than any other tool used for the delivery of instructional content. Rather, by combining the best of previously built tools virtual worlds can provide an authentic and compelling learning experience that otherwise would not be available to students.

**Affordances of virtual worlds.**

In his review of *Second Life*, Atkinson (2009) believed that effective instruction could be designed in virtual worlds by taking advantage of four basic principles within virtual worlds: Immersion, Interaction, Identity, and Integration. Immersion speaks to the extent learners can be focused in realistic environments that represent real or familiar places. This is seen in virtual worlds by the ability to recreate authentic spaces, such as hospitals, human organs, natural environments and other social spaces. Interaction is simply the ability to control or change immediate environment surrounding the participant. Within virtual worlds such ability is evidenced through the collaborative building of complex objects, such as buildings and cars, or by simply having a cup of coffee together. Identity is how users see themselves and portray that representation in the virtual world. Lastly, integration deals with how virtual worlds are combined with other platforms and technologies. Atkinson stated, “learners will become indistinguishable from teachers as learning communities become immersed and adapt to the integration of virtual worlds and real worlds” (p. 32).

As a technology, virtual worlds provide a “through the window” experience in which the participant views “the 3-D world through the window of the computer screen” (McLellan, 2004, p. 465). This experience is a progression built on what has come before, but does not replace it. Virtual worlds would not be possible if the home computer, Internet, and other technological advances had not of come before it. Likewise, other distance education technologies built the
foundation on which the use of virtual worlds is possible. This is not to say that these earlier
technologies, TV, video, audiotapes, disks and CDs, learning management systems, and
computers are inferior to virtual worlds in any way. Each of them has their own unique
affordances and can be successfully used in distance education activities when appropriate.
Likewise, a virtual world has its own set of affordances that make it an ideal delivery system in
the right situations.

First, virtual worlds build off previous media, which allowed multiple participants to
come together (McLellan, 2004). It can be said that television was the first media that allowed
multiple participants to gather with a shared visual environment. However, this environment was
limited in that all the participants shared a common view of the one or two scenes that were
available to them at the time. More recently this experience was enhanced as web conferencing
solutions, such as WebEx or GoToMeeting, gain in popularity and technological function. Such
programs again allowed multiple participants to come together; only now each participant has an
individualized view based on the cameras being used by other participants. Building on this,
virtual worlds allows multiple participants to gather and share a common experience but also
allows for each participant to have a truly individual view and experience as their view is not
limited by other participants (Bartle, 2004). Within virtual worlds participants can view the
worlds around them just as in real-life, which potentially leads to a more immersive and
meaningful experience.

Second, taking advantage of what had come before, virtual worlds allow for the shared
creation of tools, artifacts, and indeed even environments by programming experts and non-
experts alike (Warburton, 2009). Similar to the Internet’s advancements in allowing multiple
people to create and edit shared resources without knowing complex code or even in some cases
basic knowledge of HTML, many virtual worlds have incorporated simple tools that anyone can use to build very rich, complex learning environments. For instructional designers this means we can both design an intervention and easily see it implemented without worrying about needing a developer’s expertise.

Lastly, virtual worlds take advantage of recent improvements in social networking capabilities (Atkinson, 2009). Building from the proliferation of Web 2.0 tools, such as blogs and wikis, that for the first time allowed disparate participants to easily create content, virtual worlds also allow for participants to create content and resources without knowledge too much complex code or programming languages. This allows for communities to quickly, efficiently and effectively share a repertoire of resources among numerous members.

Virtual worlds allows for the recreation of and interaction within an environment. They also allow for multiple participants to be in a shared space at the same time, interacting and communicating just as if meeting someone in real life. Accordingly, “virtual worlds enable students to learn through seeing, knowing, and doing within visually rich and mentally engaging spaces” (Stoerger, 2008, p. 56). Therefore, most definitions of virtual worlds agree on five key affordances, including: synchronicity – actions occur in real-time, persistence – the world exist even if a participant leaves, shared experiences – multiple users come together at one time, interactivity – users can effect changes to the world, and representation – users have an avatar, or character, that represents them (Bartle, 2004; Book, 2004; Sanchez, 2009; Warburton, 2009; Atkinson, 2009).

**Virtual world research.**

While there have been virtual worlds created solely for educational use and research (Table 2), the cost to do so is beyond what the average teacher or researcher can pay. Therefore,
most researchers conducting work on and in virtual worlds leverage existing systems, such as Second Life or Active Worlds, when conducting research activities.

Table 2: Examples of Educational Focused Virtual World

<table>
<thead>
<tr>
<th>Virtual World</th>
<th>Developer</th>
<th>Goal</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moose Crossing</td>
<td>Georgia Tech</td>
<td>Teaches children 9-13 creative writing and programming skills</td>
<td><a href="http://www.cc.gatech.edu/elc/moose-crossing/">http://www.cc.gatech.edu/elc/moose-crossing/</a></td>
</tr>
<tr>
<td>Quest Atlantis</td>
<td>Indiana University</td>
<td>Teaches children 9-16 education strategies and social citizenship in formal and informal environments</td>
<td><a href="http://atlantis.crlt.indiana.edu/">http://atlantis.crlt.indiana.edu/</a></td>
</tr>
<tr>
<td>River City</td>
<td>Harvard University</td>
<td>Teaches middle school aged children scientific inquiry and 21st century skills</td>
<td><a href="http://muve.gse.harvard.edu/rivercityproject/">http://muve.gse.harvard.edu/rivercityproject/</a></td>
</tr>
<tr>
<td>Tapped IN</td>
<td>SRI International</td>
<td>Serves as an online community for educators</td>
<td><a href="http://tappedin.org/tappedin/">http://tappedin.org/tappedin/</a></td>
</tr>
<tr>
<td>Revolution</td>
<td>MIT</td>
<td>More game than virtual world it teaches revolutionary war era history set in Williamsburg, VA</td>
<td><a href="http://educationarcade.org/node/357">http://educationarcade.org/node/357</a></td>
</tr>
</tbody>
</table>

Bailey and Moar (2001) conducted one the earliest studies using virtual worlds within K-12 education. Using Active Worlds Bailey and Moar investigated how primary school children could and would use virtual world technology in the classroom to gauge the potential applications of virtual worlds in teaching and learning. Of particular interest to this discussion is the fact that study approach was driven by the “importance of children experiencing learning through making, together with the development of peer-to-peer communication and collaboration via the networks of the Internet” (p. 22). The Vertex Project was then conducted over the course of year and consisted of multiple workshops and lessons to teach both teachers and students how
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to use *Active Worlds*. Building on that towards the end of the partnering of multiple schools so students could work in collaboration with each other. Overall, the researchers found that “the students had a positive experience with technology and definitely valued the communicative, collaborative and creative possibilities embodied” (p. 27) within virtual worlds. By calling these affordances out, the researchers begin to define virtual worlds as a constructivist tool and also provide further evidence supporting the use of virtual worlds in constructivist-based technology driven learning activities.

Similarly, Dickey (2005) conducted two case studies in collaboration with projects run in *Active Worlds* in an effort to actualize how virtual worlds can be used for educational activities. The first case study focused on Business Computing course run by the University of Colorado; the second dealt with a 3-D object-modeling course run by *Active Worlds*’ volunteers. Dickey’s findings concluded that Active Worlds was a good setting for educational activities because it allowed for participant engagement and collaborative problem solving. Additionally, Dickey identified that “providing a setting for students to apply their skills in a collaborative multidimensional environment” (p. 445) supported course objectives. Furthermore, in the case study conducted on the 3-D modeling class, Dickey found support for situated learning. Situated learning is the belief that knowledge is based on the context and environment it fits within. Again, these studies provide support and justification for the use of virtual worlds in constructivist-based education.

Most early research examining educational activities in virtual worlds concentrated on qualitative data rather than quantitative; therefore most evaluations of such pursuits deal more with student perception, use and reflection of activities. For example, in examining the ways in which virtual worlds could be used to foster multicultural collaboration Ligorio and Van Keen
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(2006) examined how seven schools in two countries could use *Active Worlds* as a tools to improve the students' English and communication skills. One classroom in each school created a different building in “Euroland” to share different aspects of their respective culture. In analyzing the results, the researchers concluded that overall both students and teachers reacted positive to virtual world endeavors. In their words, “students were strongly involved and experienced a huge amount of pleasure while learning” (p. 122). Overall, the project was considered a success because it allowed for the students to create their own knowledge in the process of collaboration.

More recently, studies have introduced mixed methodologies. Ye, Fang, Liu, Chang, and Dinh (2008) examined the use of virtual worlds in secondary education through the use of an environmental simulation game built within *Second Life*. In creating the game Appalachian Tycoon within *Second Life* Ye et al. were able to take advantage of its simulation capabilities to provide students context for the decisions they made regarding the use of land situated next to a stream. In making decisions that caused changes to the virtual landscape, students could see firsthand how those management decisions impacted not only the land but also the related environmental impact of each land use choice. The goal of the game was to create a balance in order to generate the most amount of points by the end of the timed session and in order to achieve the highest points learners had to have an understanding of the underlying environmental impact of each land use choice. Therefore, learning was contextual and knowledge was immediately put to use. In pilot testing, high school students (n=15) responded that they felt virtual worlds were “very instructive” (93.3%) (p. 4) again showing that students are receptive to this type of technology-based instruction.

Jarmon, Traphagan, Mayrath, and Trivedi (2009) examined the use *Second Life* within an
interdisciplinary communication course. In an effort to teach ways to improve communication skills between researchers the main goal of the course was to teach communication adaptivity to better understand how communication with “multiple communities of practice, societies, scientific disciplines and the material artifacts of each” (p. 171). While mainly conducted face-to-face, part of the course requirements was completion of a semester-long project within Second Life. Data was collected from student journals, surveys, group discussions and the final projects the students turned in. The final results of the project concluded that Second Life was well suited for experiential learning “particularly as students were able to learn by doing and applying learned concepts to the real world” (p. 178). This is better seen in the comments of one of participants, “actually having to doing something with it [Second Life] certainly increased my understanding of how you could apply it in other world contexts” (p. 174). However, it should be noted that no data was collected to be able to compare class grades with previous non-Second Life sessions.

In another study reporting similar results, Second Life was used in the teaching of management information systems graduate level students (Wagner & Ip, 2009). While teaching a course on virtual organizations and global teamwork, the researchers used Second Life as a working location for teams of students to build and run an online business over the course of four weeks. The researchers’ goal was to evaluate Second Life as a way to promote action learning and data was collected from 40 (out of possible 113) student surveys when the activity was complete. Results indicated at least a “casual relationship” (p. 254) between Second Life and action learning. And again, similar to the results found by Jarmon, Traphagan, Mayrath, and Trivedi (2009) students perceived their learning to have been improved.

Research conducted by Hudson and Degast-Kennedy (2009) did find improvement in
course grades with a corresponding virtual world activity. In an effort to create a realistic experience while participants who were preparing to become border agents in Canada, Hudson and Degast-Kennedy built a simulated environment within *Second Life*. The simulation was authentically based on an actual border crossing close to the researchers and came complete with elements that were fully customizable yet replaceable as needed to provide variety. Participants within the class ran through the simulation as border agents, travelers and impartial observers in order to learn not only from their own experiences but also those of others within the class. Students' views and attitudes of the exercise were surveyed both before and after the 12-hour exercise. The results indicated that the student’s initial skepticism was replaced with excitement and appreciation of a valuable learning tool (Hudson & Degast-Kennedy, 2009).

Similarly, Lee (2009) examined the use of *Second Life* as a means to teach Operations Management (OM). Within the course students where tasked with finding and learning about a business running in *Second Life*, including the interviewing of the business owner. From this effort, Lee was hoping students would feel more connected with the course content and also have experience that was more closely related to the real world. The virtual world activities themselves were focused on helping students “translate that knowledge [of virtual worlds] into OM principles and techniques” (p. 8). Data, in the form of surveys and researcher observation, was collected over two seven week periods. At the end of that time Lee concluded that the exercise “improved the quality of student learning” (p. 12).

In a study on language literacy, Merchant (2010) examines the use of virtual worlds as a tool developed specifically for 10 English primary schools. The research is actually one of the few long-term projects developed using an off the shelf virtual world, in this case *Active Worlds*. From 2006 to 2008 the created world, Barnsborough, was available to teachers and students as
an exercise to drive inquiry skills and provoke written literacy skills via a corresponding student guide. The environment itself had the feel of a polluted, abandoned town in which students, in the guise of avatars, would interact with items and clues to discover what had happened to the town’s population. During the two years the project was run and data was collected there was evidence that virtual worlds did have a “significant impact on pupil motivation and performance” (p. 138). However, it is more interesting to note that the researcher points out that two years after the project ended, despite being available to a broader audience the space was “underused” (p. 138). This is significant in the fact that though available to teachers to use, there are other barriers keeping them from freely and successfully utilizing this technology.

From these studies early indications that virtual world environments do provide support for success in educational activities were identified. However, more research is needed to be able to generate any long-term conclusions on success measures or design principles.

**Design and Developmental Research**

Developmental research is the “systematic study of designing, developing and evaluating instructional programs, processes and products that must meet the criteria of internal consistency and effectiveness” (Seels & Richey, 1994, p. 124). As such, it is not the act of creating instructional materials, but rather examining the ways and means in which such materials are created and the underlying processes and procedures that are followed when creating such material. The hope is to “improve the process of instructional design, development and evaluation” (Richey, Klein, & Nelson, 2004, p. 1099).

Developmental research, as defined by Seels and Richey, is similar to design experiments (Brown, 1992), design research (Design-Based Research Collective, 2003), development research (van den Akker, 1999), or formative research (Reigeluth & Frick, 1999). While each
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has a different approach, “the underlying goals and approaches are similar” (Wang & Hannafin, 2005, p. 6). The ultimate desire of each methodology is to improve the educational process through critical examination and reflection.

Within the field of instructional design and development, developmental research is a method for critically understanding the theoretical process that underlies instructional development. The difference between the two being that “instructional development typically builds on previous research, [while] development research attempts to produce the models and principles that guide the design, development and evaluation processes” (Rickey, Klein, & Nelson, 2004, p. 1102 italics in original). Therefore, it is important to note that while many times when conducting a developmental study an instructional event is produced, it is not the product that is the unit of analysis but rather the process, procedures, models, and techniques that the team utilized during the creation process.

Because of this differential, according to Richey and Klein (2007) there are six main components of the design and developmental research. These include: “(a) learners and how they learn, (b) the context in which learning and performance occur, (c) the nature of content and how it is sequence, (d) the instructional strategies and activities employed, (e) the media and delivery systems used, and lastly, (f) the designers themselves and the processes they used” (p. 3). Each one of these six components is equally important and worthy of study. However, when translated into action, design and developmental research studies typically fall into one of two categories: product and tool research or model development research.

Product and tools developmental research studies.

Product and tool developmental research, previously referred to as Type 1 (Richey, Klein & Nelson, 2004), centers on the tools and products created during for the instructional event.
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Within this type of study the “design and development process is used in a particular situation is described, analyzed and the final product is evaluated” (Richey & Klein, 2007, p. 9). Product development studies typically examine a product or program, provide examples of processes and procedures available to fellow practitioners and generally involve the entire Instructional Design (ID) process, though the study itself might focus on only one or more stages of the process (Richey & Klein, 2007). On the other hand, tool developmental research examines the tools and resources that instructional designers use during the ID process in hopes of increasing their efficiency and effectiveness. However, in both cases the results are mainly content or product specific and the results are not usually generalizable to outside environments.

In light of the topic of this research, virtual worlds and CLEs, only one research study has been identified in the literature base. In combining elements of problem-based learning, CLE design, and experiential learning, Downey (2011) proposed the i-MMOLE framework. While he calls it a framework, Downey presents i-MMOLE as a tool for instructional designers to use when building lessons in virtual worlds. I-MMOLE provides guidance to instructional designers by walking through five key steps when design such lessons, establishing the context, investigating underlying concepts, provides experiences and constructing knowledge, assessing knowledge and follow-up activities. Downey created this tool through what he calls “an iterative, design-based research process” (p. 34) consisting of his own gameplay, research, framework development, testing and refinement. The end result was i-MMOLE and the 300+ lessons that have been developed by Downy and his former students at the University of South Florida. The framework seems promising, but it needs to be noted that it has not been validated by any other source or reviewed by experts for following the tenets of constructivism, problem-based or experiential learning.
Model developmental research studies.

Design and development model research, formally called Type 2 (Richey, Klein, & Nelson, 2004), focuses on the “development, design and use of design and development models” (Richey & Klein, 2007, p. 10). Within this type of study the focus changes from the resulting product or tool, to the model and processed used by the instructional designer(s). These types of studies seek to validate existing or new development models or “identity and describe the conditions that facilitate successful design and development” (Richey & Klein, 2007, p. 11). As such, the results are generalizable and able to be applied in a number of areas or conditions.

Research methodology in design and development research.

Like other fields of study, design and development research methodology can take many different forms. However, because most design and development research is based upon real-world issues and problems, the methodology typically employed must be multi-dimensional or mixed method as well. And while many of the studies rely on qualitative rather than quantitative techniques (Richey & Klein, 2007), researchers do employee both to take advantage of the best features of each approach depending on the research question on hand. However, the majority of product and tool research typically employs a case study approach (Richey, Klein, & Nelson, 2004; Richey & Klein, 2007). Yin (2009) defines case study methodology as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context” (p. 13, emphasis in original). Within developmental research, researchers are trying to both explore and describe a problem at the same time. However, because there is an assessment aspect in this line of inquiry as well, product and tool research also uses evaluation techniques to measure the success of the product. van den Akker (1999) feels this is because a “formative evaluation provides the information that feeds the cyclic learning process of developers during subsequent
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loops of the design and development trajectory” (p. 10). As such, evaluation protocols might take multiple forms to ensure fair and impartial data collection.

Unlike tool and product research, model development research usually employs multiple methods of examination. While case study research can be found in the literature, it is not the norm but instead experiential and quasi-experimental techniques are more frequently employed, along with other qualitative research methods (Richey, Klein & Nelson, 2004). The change in technique is due to the corresponding change in research focus, moving from the specific context that usually defines product and tool research to the more generalized findings of model development research.

**Developmental research questions.**

Like other fields of study, developmental researcher questions can come from many sources. It is up to the individual researcher to define a topic and then evaluate enough material to identify a plausible research question(s). However, since much of developmental research is applied in nature, three areas of possible material have been identified by Richey and Klein (2007), this includes: “actual workplace settings and projects, technology (especially the newer and more innovative examples), …[and] theoretical questions prompted by current research and development literature” (p. 16).

Workplace issues seem fairly straightforward and indeed, it is not hard to image why this area is ripe with possible areas of study. Everyday workplace problems and programs provide rich fodder of material for examination in tool and product developmental studies. Many practitioners are faced with the same problems or are using the same tools and, as such, researchers have the opportunity to study both for areas of improvement and efficiency. The ability to study both improvement and efficiency is justified in that any identifiable areas of
improvement are immediately put into practice and used as an exemplary. It should be noted that while many times developmental research focuses on issues of key concern within the practitioner community (Richey & Klein, 2007), almost any practitioner concern could serve as a workplace issue worthy of research.

Emerging technology provides another area of plausible research questions. As Milrad, Spector, and Davidsen (2000) so succinctly stated, “instructional technology changes what teachers and learners do and can do” (p. 13). Instructional designers must be constantly aware of the affordances of the ever-changing technology landscape and understand how and when different tools could be used. Being aware of the current tools and technologies within the field is not a new concept, and in looking back throughout the history of the profession there is a discernable pattern of examination of each emerging technology over time. However, what the profession has also learned over time, is not to focus on media comparison or learner characteristics, but rather “studies of how the product or program was designed, what conditions facilitated its development, or of what unique processes were used” (Richey & Klein, 2007, p. 21). In these instances, appropriate research questions ask, “How is it use?” “What obstacles or barriers might be faced?” “What is required to best position the technology for success?”
Lastly, current research also provides material for research question identification (Richey & Klein, 2007). As such, current research provides the means by which models, both old and new, are identified, reviewed, analyzed and tested. These models are the stimulus for research, as validation studies continue to refine the model or individual processes the model contains. Or, as technology emerges and society changes existing research can point out the deficiencies in current models and provide the impetus for new models and theories to be developed. Again, however, it should be noted that many times theory revision or new model identification is due to the changing nature, focus and needs of the professional community of practice.

**Models**

A model can be one of many things, including: (a) a fashion or design, (b) a miniature representation of a larger physical item, (c) a person who poses for artists or (d) a physical representation of a system, theory or methodology (Dictionary.com, 2013.). Models can also be verbal, physical, visual, graphical, three-dimensional, computational or electronic. Therefore, it is important to clearly understand models within an educational context.

Gustafson and Branch (2002) define models as a “simple representation of more complex forms processes and functions of physical phenomena or ideas” (p. 1). This is due to the fact that in their opinion “reality is too complex to portray” (p. 1). Models arose out of the need to simplify and explain the complex inner workings of an otherwise inexplicable phenomenon. However, models “can never be a complete representation, because you must abstract in order to translate reality into theoretical terms” (Seels & Glasgow, 1998, p. 166). Therefore when developing a model the creator can only attempt to capture all the variables/concepts involved, show their interdependence and capture an overview of the process based on the best information.
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available at the time. Ultimately, it is the goal of model creator to “describe, prescribe, predict, or explain elements of the referent system” (Andrews & Goodson, 1980, p. 3).

Model development.

But how exactly are ID models developed? Historically, there has been little documentation on model development research within our field (Gustafson & Branch, 2002; Tracey & Richey, 2007). That is not to say that no models were developed, but rather little research has been done to assess their corresponding validity or application (Gustafson & Branch, 2002). Historically speaking, it wasn’t until the 1990’s that model development research became mainstream. In the act of describing the Dick and Carey Model, Dick (1997) was one of the first to perhaps fully document a model “as a process of applying a diverse body of research and thinking of the times to the task of creating instructional products” (Tracy & Richey, 2007, p. 370).

Instructional design models represent the researcher’s understanding of the procedures used in an instructional development process. As such, they “visually communicate their associated processes to stakeholders by illustrating the procedures that make it possible to produce instruction” (Gustafson & Branch, 2002, p. 2). In other words, instructional design models detail the process and provide a framework for working through a development process when used correctly in a given situation.

By defining the process models also serve multiple functions. Not many would argue that models serve to help an individual visualize a complex process or provide tools for managing an instructional design project; however, models also allow researchers to test theory and also function to provide criteria that can be used to assess a “good design” (Seels & Glasgow, 1998). Moreover, Lippit (1973) argues that in addition to these for primary functions,
models can also be used to help predict outcomes, be a source of recreation, “professional
doodling” as Lippit refers to it (p. 34), and provide a mechanism of communication between the
model builder and model user. In total then, instructional design models are a visual
representation of a complex process to serve to provide a framework, or tool set, for an
instructional designer to use while conducting a development project.

Components of a model.

Keeping in mind that models are a visual representation of a process, they can be
represented in many ways. However, most models made up of the same components. These
include the physical design aspect, conceptual components and any corresponding tools. First,
and foremost, models used standardized geometric shapes to represent the complexity of the
phenomena. According to Lippit (1973), “model building refers to the process of putting
together symbols according to certain rules to form a structure which corresponds to a real-world
system under study” (p. 30).

When contextualized in visual medium, models often consist of squares, rectangles,
circles, triangle or diamonds, and lines to represent the various components of all involved
concepts, processes, and parties. Squares, or rectangles, represent a major functional process or
function. Circles typically represent commonality amongst multiple items. A diamond typically
represents a decision point in the process. And lastly, lines, both solid and dotted, represent the
path to follow when applying the model in practice. Along these same lines, the model itself can
be displayed in multiple forms, with some debate whether a linear or cylindrical representation is
best (Seels & Glasgow, 2004).

However, geometric representation aside, what content does a model contain? As
discussed above, a model is a representation of a more complex process. Therefore when
speaking about models, a model must contain the fundamental processes, or steps, that should be carried out in order to fulfill the goal the model supposedly directs itself to. Within instructional design Andrews and Goodson (1980) were perhaps some of the first to examine multiple instructional design models for commonalities. Their examination consisted of reviewing 40 pre-existing instructional design models across 18 dimensions including, needs assessment, defining learning characteristic, sequencing of goals, formation of instructional strategy to match requirements, pre-testing developed content and long-term of the program/project. Ultimately, they cautioned that many of the developed models really represented a series of steps, rather than “rather than the complex and rigorous analytical and cybernetic process required for effective application of the general systems approach to instructional design” (p. 13).

Six years later, Richey (1986) examined the Andrews and Goodson’s research and was able to reduce their list of common elements to six core elements that all instructional design must contain. These core elements are: determining learner needs, determining learning goals and objectives, building assessments guidelines, choosing the instructional delivery procedure(s), testing the development material/program, and installing and maintaining the learning activity. According to Richey (1986) a successful instructional design model should contain these six criteria in order to provide a practitioner with enough direction to use the model to a successful outcome.

These days, more often than not, when referring the core components of the instructional design process, practitioners refer to the ADDIE process. First proposed in 1975, ADDIE represents the five core processes that practitioners engage in while developing a new learning activity: analyze, design, develop, implement and evaluate (Branson et al., 1975). While originally proposed as a new model for instructional design work, over time ADDIE has become
more of a universally accepted heuristic acronym for the five core conventions of our work, though some would refer it as the most simplistic instructional design model (Seels & Glasgow, 1998). In either case, most instructional design researchers would agree that any newly proposed instructional design model should contain some representation and description of these five stages.

Lastly, good models must contain any tools or resources that need to be implemented when following the process it represents. Practitioners should have ready access to any model specific tools when walking through the instructional design process. These tools can be templates to complete as specific points in the process, or rubrics to be used to evaluate the finish product. Depending on the model, not every one will contain such tools. However, if the model developer used them in the formation of the articulated model, or directly refers to such a resource, then it should be included as a required resource when the model becomes publically available.

**Literature Review Summary**

In light of the examined research, it is appropriate at this time to conduct an exploratory research project examining the use of virtual worlds in building a Constructivist Learning Environment. Educators are actively working to identify and implement methods that allow access to resources that fall outside their location-based classroom. Many times, this access is provided by technology driven solutions. This stems from the basis that currently educators are looking at instructional technology as a catalyst of reform, as seen in both recent government policies and the NCSS position statements and curriculum guidelines. Building on these polices, the NCSS (1994) calls for instructional technology to help in the expanding of the classroom to provide more resources to individual students by building a learning community that expands the
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classroom walls. While the government policies are aimed at improving STEM fields, they provide the foundation of using instructional technology to improve student learning in general. In addition, the guidelines also call for educational activities to be authentic, meaningful and relevant to the learner.

Much of this desire to expand the classroom and incorporate outside resources corresponds well with constructivist learning theory and the belief that individual knowledge is based on past experience and social interactions. Therefore, when considering the implementation of instructional technology to expand the learning environment instructional designers must identify a solution that also supports the identified criteria for a Constructivist Learning Environment (CLE). Based on an examination of the current literature, the key affordances provided by virtual worlds (synchronicity, persistence, shared experiences, interactivity and representation) are a well-suited framework in which that CLE could be built (Lebow, 1993; Jonassen, 1994; Fosnot, 1996; Driscoll, 2005) (Table 3). However, little to no instructional development research has been conducted in combinations of these two variables (Downy, 2007; Hirumi, et al., 2010).

Table 3: CLE Guiding Features and Corresponding Virtual World Affordances

<table>
<thead>
<tr>
<th>CLE Guiding Principle</th>
<th>Corresponding Affordances of Virtual Worlds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson is embedded within realistic and/or authentic environment</td>
<td>Synchronicity, Persistence, Shared experiences, Interactivity, Representation</td>
</tr>
<tr>
<td>Lesson allows for communication and collaboration</td>
<td>Persistence, Shared experiences, Interactivity</td>
</tr>
<tr>
<td>Lesson allows for multiple perspectives and views</td>
<td>Persistence, Shared experiences, Interactivity, Representation</td>
</tr>
<tr>
<td>Lesson allows for learner self-awareness and self-reflection</td>
<td>Persistence, Shared experiences, Representation</td>
</tr>
<tr>
<td>Lesson allows for the learner to be autonomous</td>
<td>Persistence, Interactivity, Representation</td>
</tr>
</tbody>
</table>
While other educational technologies may have some of the same affordances, no other method currently combines all of these into one cohesive tool. Virtual worlds allow instructional designers the opportunity to create fully authentic educational programs in immersive, engaging environments in which multiple participants are active, collaborative co-creators (Kemp & Haycock, 2008). As examined within the constructivist literature, authentic environments, context and community cannot be separated from knowledge (Jonassen, 1999). While it is true that learning can occur in forms of instructional technology that individually contain one or more of the affordances of virtual worlds, these other mediums (e.g., text-based chats, discussion lists and forums, wikis, and video conferencing) lack a persistent 3-D world, which potentially limits the effectiveness of these programs. Looking at a static web-page, responding to an email, or posting a discussion forum item is not the same as engaging in a live discussion in which ideas and thoughts are constantly bounced around and vetted by other community members. Virtual worlds allow for these activities in ways not fully vetted in other systems.

As seen earlier, only one developmental research study has been conducted examining the use of virtual worlds and CLEs (Downey, 2011). More research is needed to validate or supplement these early findings and add to our literature base. As was also discussed, one of the reasons for a developmental study is to propose or validate new or existing models for instructional development (Richey & Klein, 2007). Therefore, using a development framework for this project is an appropriate methodology to follow.

In conclusion, conducting an exploratory study to identify a framework through which virtual worlds could facilitate a CLE provides an opportunity to enhance learning programs by combining authentic, contextual learning environments with fully immersive environments that allow students to engage, share and interact in ways not possible in other delivery mechanisms.
Chapter Three: Research Methodology

This study focused on the design, development and evaluation of a constructivist-learning framework when applied to activities conducted via virtual world technology. As discussed in the previous chapter, product and tool development, e.g. virtual world as tools used by instructional designers, is one aspect of design and development research (Richey & Klein, 2007). Therefore, this chapter outlines the study design, procedures, sampling, and site selection the study will follow by applying a design and development methodology.

Research Questions

The study seeks to answer the following two questions:

1. Do the five guiding constructivist learning environment principles, as identified in past research, align with the affordances of virtual world technology?

2. What are the implications of using virtual world technology when designing and developing constructivist-learning environments in K-12 education?

Study Significance

The purpose of this study is to conduct a developmental research project examining the use of virtual worlds in designing a constructivist-learning environment (CLE) in K-12 education. The development and evaluation of a prototype module that reflects CLE principles will provide a needed opportunity to critically examine virtual world and CLE model development and will also help to evaluate the implications of using virtual world technology in teaching and learning. At the same time, it also contributes to the greater Instructional Design and Technology knowledge base by providing a CLE design framework for use by IDT practitioners. Furthermore, very little past virtual world research has focused on K-12 education. While a few studies have been conducted within the primary school setting, in general educators
and researchers alike are left with a gap in scholarly understanding of how virtual worlds are implemented and used in this setting.

**Study Design**

This research was envisioned as an exploratory product and tool developmental research study in which a virtual world prototype was built and evaluated upon the CLE features identified in the literature review. Product and tool developmental research studies focus on “situations in which the product development process used in a particular situation is described and analyzed and the final product is evaluated” (Richey & Klein, 2007, p. 9). As such, it is appropriate to use this approach when focusing on a single product, in this case a designed virtual world prototype, and detailing its development and evaluation. Like other developmental research projects, this research used formative evaluation techniques to assess the prototype lesson against the guiding features identified in past research. The study was conducted in three phases, including: analysis, development, and evaluation.

**Site Selection**

Data was collected from an elementary located near a large state university in the northwestern United States. The school has a student population of over 600 students in grades kindergarten through sixth. Within the school, there were approximately 75 students in the sixth grade class that was broken into three distinct classrooms. Each classroom had one assigned teacher and several parent volunteers.

**Participants**

Participants were selected through convenience sampling (Fraenkel & Wallen, 2006). A convenience sample was used from the site in which the researcher had ready access. From the selected study three sixth grade teachers were given open-ended semi-structured interviews
DEVELOPMENT AND EVALUATION OF VIRTUAL (Appendix A) to solicit their views on the integration of technology within the classroom. The goal of the interview was to “understand the lived experience of other people and the meaning they make of that experience” (Seidman, 2006, p. 9). Therefore, the interview provided the best means in understanding the use of educational technology, e.g., virtual worlds, in K-12 education. The interviews also provided the means by which to identify participants’ current views towards and use of technology, as well as possible barriers to implementation and content ideas for the prototype.

After the prototype lesson was developed, each teacher evaluated its components in order to provide formative feedback. Also participating was an expert in constructivist learning theory, who evaluated the prototype for adherence to constructivist theory. This expert evaluation was used to validate the framework identified in the guiding CLE features. Therefore, the total number of participants in this study was limited to four.

Study Procedure

The study was conducted in three phases. The first phase, analysis, included the interviewing of the three teachers at the selected site. The second phase, development, focused on developing a prototype lesson based upon CLE guiding features. The third phase, evaluation, allowed the expert review and teachers to review the created prototype.

Phase one: analysis.

The project began by interviewing three teachers using a semi-structured interview protocol (Appendix A). The goal of the interview was to understand the views currently held by the teachers with regards to technology integration in the classroom. In addition, the interview also sought to understand where there might be opportunities for using virtual world technology in an actual lesson. It should be noted that prior to the interviews, approval to conduct the
research was sought and granted from both the Institutional Review Board (Appendix F) and the local public school administration.

**Phase two: development.**

Based on the results of the interviews in Phase One and the CLE features identified in past research, a prototype utilizing virtual world technology was developed. The prototype aligned the five principles of CLEs to the corresponding affordances of virtual worlds (Table 4). Besides the lesson material, the prototype also included: an introduction, objective(s), resource materials, lesson and assessment plans.

**Table 4: Actualizing the Guiding CLE Features in Prototype**

<table>
<thead>
<tr>
<th>CLE Guiding Principle</th>
<th>Corresponding Affordances of Virtual Worlds</th>
<th>Actualization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson is embedded within realistic and/or authentic environment</td>
<td>Synchronicity, Persistence, Shared experiences, Interactivity, Representation</td>
<td>Prototype designed within virtual world</td>
</tr>
<tr>
<td>Lesson allows for communication and collaboration</td>
<td>Persistence, Shared experiences, Interactivity, Representation</td>
<td>Virtual world technology has text-based and voice capability</td>
</tr>
<tr>
<td>Lesson allows for multiple perspectives and views</td>
<td>Persistence, Shared experiences, Interactivity, Representation</td>
<td>Virtual world technology allows for presentation of multiple perspectives</td>
</tr>
<tr>
<td>Lesson allows for learner self-awareness and self-reflection</td>
<td>Persistence, Shared experiences, Representation</td>
<td>Prototype allows for both self and group reflection to take place</td>
</tr>
<tr>
<td>Lesson allows for the learner to be autonomous</td>
<td>Persistence, Interactivity, Representation</td>
<td>Prototype must allow both individual and group activities</td>
</tr>
</tbody>
</table>

**Phase three: evaluation.**

According to developmental research design product and tool studies involve situations “in which the design and development process used in a particular situation is described, analyzed and a final product is evaluated” (Richey & Klein, 2007, p. 9). Therefore an evaluation
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was conducted. The evaluation was formative in nature in that it only served to provide
information used in order to identify future possible improvements (Richey & Klein, 2007; Russ-
Eft & Preskill, 2009).

Two levels of evaluation were conducted in this study. First, one expert in constructivist
learning theory, Dr. Peter Doolittle, evaluated the prototype to determine how well it followed
the identified features of constructivist learning environments. Secondly, the three teachers
evaluated the lesson on its feasibility of implementation, ease of use, and relevance.

The researcher developed two rubrics (Appendix B and C) and distributed them to the
reviewers. The Lesson Prototype evaluation (Appendix B), used by teachers, focused on the
prototype design and completeness. While the instrument did question the alignment of the
constructivist learning principles to the prototype, its primary purpose was to identify the use and
effectiveness of virtual world activities in the K-12 classroom. The Expert Reviewer rubric
(Appendix C) focused solely on the alignment of the pre-identified guiding CLE features and
how well they were, or were not, contained within the prototype.

Data Analysis

Over the course of the study data was collected from personal interviews, observations
and expert evaluation (Table 5). During Phase one, Analysis, each of the recorded interviews
was transcribed and the transcripts were then reviewed and coded. Coding is the act of
organizing the data into major themes (Creswell, 2009) and is an important first step before
making meaning of the collected information (Rossman & Rallis, 1998). As the interviews were
coded general themes emerged and guided the development process during the second phase of
the conducted research. Specially, the results of the interview helped the researcher identify both
prototype content focus and the implementation challenges to be overcome in the use of virtual
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world technology in K-12 education.

Table 5: Data Source and Plan for Analysis

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Data Sources to be used</th>
<th>How the data will be analyzed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do the five guiding constructivist learning environment principles, as identified in past research, align with the affordances of virtual world technology?</td>
<td>Evaluation and interview data collected from expert reviewer and teachers</td>
<td>Whole text analysis, coding, and category development</td>
</tr>
<tr>
<td>What are the implications of using virtual world technology when designing and developing constructivist-learning environments in K-12 education?</td>
<td>Evaluation and interview data collected from expert reviewer and teachers</td>
<td>Whole text analysis, coding, and category development</td>
</tr>
</tbody>
</table>

After the design and development of the prototype the researcher presented the prototype to the teachers for evaluation (Appendix B) in Phase three. The results of the evaluations provided formative data to use in improving the prototype materials (Richey & Klein, 2007) and also addressed the first research question. Likewise, in phase three, the prototype was shared Dr. Peter Doolittle, an expert in Constructivist Learning Theory. Dr. Doolittle evaluated (Appendix C) the prototype to its adherence to Constructivist theory and the five guiding principles identified earlier. In both cases the evaluation data was collected via a written evaluation completed after reviewing the developed prototype and its supporting materials. The results of both sets of evaluations were reviewed and used to identify needed revisions within the prototype.
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Summary

The literature review, presented in Chapter 2, identified five guiding features to include in a constructivist-learning environment. This study focuses on the application of those features when applied within virtual world technologies. The identified features were operationalized into a prototype, after conducting interviews with teaching professionals. The interview results identified implementation challenges and content topics for the prototype. The data collected was used to design a prototype, including supplemental resource materials. Lastly, three teachers and one expert to constructivist learning theory evaluated both the appropriateness of the prototype in the K-12 classroom and operationalization of the guiding CLE features in virtual world technology. The actualization of this methodology is discussed in Chapter 4.
Chapter Four: Results

This chapter outlines the results of the research. It begins with a narrative of the data collection process and describes the design and development process that was involved. It then reports on the evaluation of the developed prototype. By doing so it serves to further detail the nature of the design and development research underlying this study.

Phase One: Design

As detailed in the prior chapter, Phase One of the study consisted of interviewing three sixth grade teachers at an elementary school located in the Northwestern United States. The interviews were conducted in late April 2013. These participants were selected because of the researcher’s ready access to them. An open-ended semi-structured interview was conducted with each participant. Each interview was audio-recorded and subsequently transcribed. The transcript of each interview was contextually coded and the results were used to define and guide the prototype development described later in this chapter.

Participant interviews.

The interview protocol (Appendix A) was broken into two sections, the first dealing with instructional technology and the second concerning participant instructional strategies. The first section of the interview was used to gain an understanding of the currently held participant views, knowledge and use of instructional technology. Overall, all the participants were familiar with the term instructional technology and used it to describe the Internet, computers, projectors, documents cameras, and smart boards in some of their classrooms. However, it needs to be noted that not all classrooms had equal access to these resources. Participant one was perceived as the most “techie” of the participants because of a grant received in the past used to purchase more equipment for her classroom, including a smart board, which neither of the other
participants had in their classrooms.

All three participants were conducting similar activities with the students in their class with the instructional technology available to them. These activities included, visiting educational websites for supplemental information, writing papers, developing presentations and media creation exercises. For example, Participant Three stated he had the students use the Internet a lot to access material, stating “Everyday Math Online… Worldbook Online, Quoteland.com, and they all have an Easybib account.”

There were two common themes that emerged when participants were asked about challenges they faced in the use of instructional technology: technological glitches and student ability. First, all three participants felt that using technology was a challenge because they could not be sure everything would always work, based on internet speed, necessary updates and software compatibility. Participant One reflected,

the bulbs burn out and they don’t work sometimes when you expect them to. The Internet goes out and you can’t connect sometimes when you’ve got 30 kids sitting at the computers in the lab. The server is slow, you know, websites are gone, or inappropriate, you know, commercial pop-up kind of stuff.

The other main concern was the ability of the students. Overall it was felt that today’s students were less technologically proficient than in years past. This is the reflected in the statement made by two of the participants:

“[A] major problem is students’ lack of ability. I would say that my students know less now than students ten years ago – keyboard skills, how to use a menu bar…They lack those skills more than the kids I’ve had in the past, so I’m concerned about that.”

(Participant Two)
“I guess typing skills is a challenge that we see.” (Participant Three)

When asked about concerns or challenges they might face if asked to implement a new technology in the classroom the responses varied. Participant One was mainly concerned that the students might not have the technical ability to participate with the lesson material. Participant Two was equally concerned with students’ ability, but also would want to ensure the technology fit within goals of the curriculum topic. Participant Three had no concerns, other than a desire to have some basic training provided.

Participants were also asked if they had any administrative concerns regarding being supported or having training provided for new technology implementations. While the responses differed somewhat, overall the participants felt comfortable working things out on their own. Participants One and Three had taken occasional workshops offered by their school system, but tended to be comfortable enough with technology to develop proficiency and problem-solve on their own. Participant Two said she generally did not attend trainings, but was a frequent caller to the system-wide help desk stating,

I would rather try to teach myself. They've dumped a lot on us, on the computer, in the last 5-10 years, with new grading program, new email program, with minimum amount of training. I don't know what I'd do without my computer now - I'm one of the first ones to call the help desk in the morning if there's a problem. They know me there, when I call them.

The last question in the first half of the interview asked specifically if the participant had any prior knowledge or awareness of virtual worlds. All three participants had heard of virtual worlds and had a basic understanding of what they were. Participant One was the most familiar with virtual worlds and had participated herself in meeting conducted in Second Life. Because of
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this previous experience Participant One stated, “I can see how 12-year olds could go out of hand. And I think for me being, like, responsible for what happens there, trying to monitor all of that would be a challenge. That’s definitely one thing I don’t know how to monitor.”

The second half of the interview focused on the instructional strategies the participants use in the classroom. Each of these five questions corresponded to the features of CLEs identified in the literature review. Specifically, the participants were specifically asked if their lessons: (1) were embedded in realistic or authentic environments, (2) allow for communication and collaboration between students, (3) allow for multiple perspectives or viewpoints, (4) promote learner self-awareness and self-reflection, and lastly (5) allow the learners to be autonomous.

When questioned if their existing lessons were placed in realistic or authentic environments, all the participants responded positively. All three participants couched their answer around the fact that they try to help the student see the bigger picture and how the topic fits into the world around them. For example, Participant One stated, “I would say we are trying for a larger context….I try to think of the big picture, of what I want them to obtain.” Similarly, Participant Two said, “I think we’re always making connections between what we’re doing right now and how that fits into a bigger picture.”

When asked about communication and collaboration, all the participants said it was a main focus when preparing lessons. This is perhaps best seen in a statement made by Participant Three:

Well, I mean, we do a lot of group work at our seats with this technology. And that's like, I mean, really, probably, one thing - or three things they could take with them this year (this is like, my goal for a lot of these kids) is them being able to find a partner, and work
with a partner, and them to be able to ask questions. So feel confident enough in themselves and where they are to be able to ask a question. And when I put them in groups, you know, those kids that don't work together, I'm like, this is your chance! You think it's hard to work with a partner now? Wait till next year when you don't recognize anyone in your class.

This communication also played a role in helping them ensure that students were introduced to multiple perspectives during lessons as well. When asked this question, Participant One stated:

I think that's the purpose of a lot of communication is, you know, seeking to understand, you know. And we talk about communication as more than talking, you know. Communication, you know, you're sending a message but you're also listening to someone else's messages. And then you're adjusting your own thinking in the process. You know, so rarely, but sometimes we'll go through the whole process of having some sort of communication activity and then talking about how did that change your own thinking, you know, how many of you think differently now, what did you think first, what do you think now, why do you think you changed your mind?

Similarly, Participant Two stated,

Oh yes, we constantly are connecting up in here. That's why we're in groups. They edit each other papers; usually when we are in the rough draft phase, we usually save time for everyone to get together and share what they're writing, share with a partner. I have kids who go into the coat closet, they're on the floor, you know they're sharing their writing just to kinda get other people's perspectives, um, and there's some kids who will gravitate toward certain students because they know they're going to be honest with them and tell
them what they need to work on. That's always cool. And then there's other kids who, "I don't want the honest", so sometimes I have to force unions. Um, but, yeah, I would say even when they're working on their D.O.L. I want them to do it together, you know, work in your group, you know if you find an error tell your groupmates so that you can work together. I think it's - learning in isolation is boring! Yeah, I mean they're social beings, so I try to use that as much as possible.

When asked about self-awareness and reflection, all three participants said they use techniques to promote this in their lessons. For example, Participant Two stated,

I ask them to grade their papers first. They have a rubric that they go through and they have to be self-aware and self-honest with how well they think they've done on work.

And we do reflection at the end of each quarter. We do the self-reflection, the, you know, self-evaluations on how they did in each subject area for their portfolio.

Throughout the second half of the interview it was very clear the participants all wanted their students to be self-directed and autonomous. Participant Three was so focused on encouraging this in his classroom that the question was actually skipped during the interview because he stated, “We want them to become independent learners and manage themselves.”

Lastly, all the participants were asked what subjects they had left to cover or if they felt strongly about a lesson that could benefit from the five instructional features identified earlier. All participants agreed that the main topics to be covered dealt with space, conflict and environmental studies. The students had just recently completed a field trip to a local science center examining astronomy and space travel and had another field trip to local outdoor park to finish a series on environmental issues. Collectively the participants thought the students were most interested in the conflict theme. Unfortunately, none of the participants were able to
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identify a lesson or topic in which they felt strongly could benefit from the five guiding principles.

**Interview summary.**

Using the interviews as an aid to guide Phase Two of the study, three important themes emerged. First, the participants were comfortable with technology and integrating it into their classrooms. Introducing a new technology, such as virtual worlds, would not be seen as too outside the norm for these teachers. This is important to note because from this finding the developed prototype likely would not be seen with fear or apprehension greater than any other new tool or technology.

Second, when introducing a new technology, none of the participants felt training had to be provided in order for it to be successful. Classroom training might be attended for larger system-wide implementations, but for items they would use in the classroom themselves, they all felt comfortable learning on their own. This is an important finding suggesting that the proposed prototype will need to have some basic instructor resources or suggestions, on how to get started with using the software, but no formalized professional development instructions.

Lastly, with the identification of major themes being covered, the participants provided direction on lesson focus that could be developed and immediately put to use in the classroom. Again, these themes were: conflict, space exploration and environmental studies. Overall, the interviews conducted in Phase One provided insights on teacher views regarding technology integration in the classroom and understanding where there might be opportunities for using virtual world technology in a classroom lesson.
Phase Two: Development

Moving into Phase Two, it was first determined that Second Life would be the virtual world development platform for the prototype. This choice was made because of the researcher’s past experience and familiarity with that virtual world. It should also be noted that Second Life does currently meet all the affordances of virtual worlds previously identified in the literature review: synchronicity, persistence, shared experiences, interactivity, and representation.

The next decision dealt with whether to build content within Second Life for the research or to utilize existing in-world representations. As determined in the interviews, teachers spend considerable time looking for pre-existing materials or items that can be easily tweaked, rather than building materials from scratch. Therefore, creating something unique for this study would fall outside the norm of teacher behavior. The researcher concluded that it was best to look for content in Second Life that could be designed into a lesson plan that reflected CLE practices and features.

Sims are simply 256 x 256 virtual meter regions within Second Life definable as a single server process (Linden Labs, 2012). A parcel is a smaller part of a sim that has been sectioned off for individual use. A basic search was conducted both inside Second Life and using a general Google search in a web browser. These searches identified a number of possibilities and the researcher spent many hours exploring each identified sim and/or parcel for age appropriateness, accuracy of content, security, and level of inter-activeness. After this review four sims/parcels were identified as possibilities for the prototype (Table 6).
Table 6: Possible Second Life Existing Content

<table>
<thead>
<tr>
<th>Sim/Parcel Name</th>
<th>Content Focus</th>
<th>Second Life Location (srl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Front 1917</td>
<td>Poetry in World War I (communication, conflict)</td>
<td><a href="http://maps.secondlife.com/secondlife/Frideswide/219/198/647">http://maps.secondlife.com/secondlife/Frideswide/219/198/647</a></td>
</tr>
<tr>
<td>International Spaceflight Museum</td>
<td>Astronomy and space travel (space, astronomy)</td>
<td><a href="http://maps.secondlife.com/secondlife/Spaceport%20Alpha/84/215/24">http://maps.secondlife.com/secondlife/Spaceport%20Alpha/84/215/24</a></td>
</tr>
<tr>
<td>Etopia Island</td>
<td>Sustainable living (environment studies)</td>
<td><a href="http://maps.secondlife.com/secondlife/Etopia%20Island/192/56/23">http://maps.secondlife.com/secondlife/Etopia%20Island/192/56/23</a></td>
</tr>
</tbody>
</table>

Once these areas were identified the researcher met with Participant One, who was appointed the main contact by the other two participants. During this time, the researcher and Participant One walked through each possibility and discussed the prospective environment and discussed the possible prototypes that could be built within. From this discussion, informal feedback was collected on teacher interest and student appropriateness and two of the possible sims were removed from further consideration (Etopia Island and Western Front 1917). Etopia Island was removed because Participant One felt it lacked enough focus and that students would be distracted in moving around such a large area. Western Front was removed due to technical glitches within the simulation (e.g., many of the audio files did not seem to work during multiple visits to the site). This left the researcher to consider the two remaining possibilities, the U.S. Holocaust Memorial Museum and International Spaceflight Museum.

The meeting with Participant One also served as an important functional test of the Second Life software within the school facility. Once the researcher was connected to the school’s secure wireless network, the Second Life software was downloaded and installed on the researcher’s MacBook Air personal computer. Once installed the researcher logged into the Second Life client software and was successfully able to access the Second Life Grid. Also during
the demonstration, all main communication features were tested including text chat, voice chat, audio and video streaming. All tests were successful. This alleviated any fears that Second Life may not be a suitable technology to implement based on technical requirements.

After meeting with Participant One, the researcher then examined both the International Spaceflight Museum and the U.S. Holocaust Memorial Museum in further detail. The researcher revisited each environment while also reviewing the previously identified interests of the teachers. Ultimately, the researcher decided to build the prototype within the U.S. Holocaust Memorial Museum (Figure 1) and have students learn about Kristallnacht, the Night of Broken Glass. Using this environment, the researcher would craft the prototype to reflect the five guiding CLE features within it.

*Figure 1: Entrance to Kristallnacht in Second Life*

**Instructor resources.**

With the content topic chosen, attention was turned to creating prototype resources to introduce both the topic and Second Life to instructors. The first decision point focused on
whether or not to create a classroom-based workshop to introduce virtual world technology, and *Second Life*, to instructors. The decision was based on two findings from the participant interviews in Phase One. First, teachers spend a lot of time on their own looking for new ideas, tools and technology to incorporate into the classroom; therefore, the researcher felt it was unlikely that creating a workshop would be of benefit because a workshop generally involves multiple participants and not individual instructors. Second, from the data collected, one of the general findings indicated that these instructors felt confident in figuring things out on their own. Therefore, the decision was made to not develop a workshop-type instructor-led training as a resource for the prototype but rather focus on identifying materials readily maintained and available for general use.

Linden Labs, like all software vendors, releases periodic software updates, enhancements and bug fixes for the *Second Life* software. For example, during this study, conducted in April and May 2012, Linden Labs released two software updates. Therefore, the researcher felt it was important to not just create materials that could be used this one time and quickly become outdated, but rather identify existing materials that where maintained and updated by Linden Labs or other long-standing members of the *Second Life* community. By doing so, it ensured that a long-term solution for instructor training was identified and instructors would not be left to find current materials in the future. With this in mind, the researcher identified three resources and outlined their use in the Instructor Resources document (Appendix D).

First and foremost, instructors were directed to download the *Second Life* software and online *Second Life* Quick Start guide. This online tutorial walks new users through the basics of Second Life, covering everything from creating an avatar to navigation to communication and environmental interaction. By referencing this guide, instructors new to *Second Life* should have
more than enough information to feel comfortable in using the software. Additionally, this guide is regularly updated by Linden Labs and therefore always provides the most up to date information on how to get started in Second Life.

Second, when new Second Life avatars, or residents as they are called in-world, are created, they appear at Welcome Island (Image 2). In the created resources, instructors are informed to read all the signs, follow the path and learn the basic navigation and controls in order to move and interact with both the environment and each other. Ensuring that this basic in-world training is not skipped helps familiarize new residents to Second Life and provides an introductory orientation to both the software and virtual world environment.

Lastly, the created resources direct instructors to another more immersive and instructional orientation at Virtual Ability Island. Virtual Ability Island has been Second Life for the last six years with the mission of helping people with disabilities use virtual world technology (Virtual Ability, Inc., 2012). As one piece of their in-world services, Virtual Ability has built and maintained an elaborate orientation (Figure 3) that builds upon the basics provided
by Second Life Welcome Island. Having new instructors move through this orientation helps to reinforce the basic concepts taught at Welcome Island but also builds new more advanced skills.

*Figure 3: Virtual Ability Orientation*

In summary, the Instructor Resource contained one online, web-based guide and two in-world orientations. Two of the resources are maintained by Linden Labs, thus ensuring that the materials are current and updated as new software versions are introduced. The third resource is provided by a long-standing member of the Second Life community and helps new residents build deeper skills in-world. Taken collectively, the researcher felt these materials would provide instructors with the necessary materials in order to learn to use Second Life on their own for the prototype.

**Prototype.**

With the content topic and instructor resources decided upon the researcher turned his focus to the prototype development. The first step was to review all the pre-existing content found within the Second Life site, Kristallnacht. In the early weeks of May 2013 the researcher
reviewed, examined, read, and interacted with every piece of the Kristallnacht recreation within *Second Life* (Appendix F). As this discovery process was underway an idea for the prototype began to develop.

The study’s participants were all familiar with the use of the Internet to find supplemental material online. During their interviews they had all indicated they had used the Internet as a way for their students to visit places otherwise not available to them; in other words, as a tool to take virtual field trips. The prototype could serve a similar function and provide a means for students to not only read and learn about conflict during Kristallnacht, but also as way to see and hear firsthand the chaos it caused. Therefore, the decision was made to frame the prototype as a virtual field trip in which small groups of students would have to first search for information and then discuss their experiences.

The prototype (Appendix E) is set in the U.S. Holocaust Memorial Museum within *Second Life*. It is envisioned that it could be used in a variety of curriculum units including, conflict studies, World War II history, Jewish or Holocaust history, or German studies. The purpose of the prototype was to study the idea of conflict in the context of the night of Kristallnacht. Therefore, the learning objectives focused on learning about the historical events surrounding Kristallnacht, with the secondary objective of students gaining technical proficiency with digital media and virtual worlds.

The prototype was designed as a one-hour lesson. However, if instructors and/or students are unfamiliar with *Second Life*, it was suggested two to three hours be spent becoming familiar with the software. This recommendation was outlined in the Instructor Resources (Appendix D). The prototype was designed as two distinct activities.

The prototype begins with the instructor bringing a small group of students (four to six
was suggested) to the U.S. Holocaust Memorial Museum. Once the instructor had ensured everyone had arrived, he/she would pass out the Kristallnacht Lesson Note Card and explain to the students that they had 20 to 30 minutes to answer the questions it contains. The students would then walk into the museum and find the answers to the questions in the note card. The instructor would be free to move around the museum and monitor student’s progress or help if any problems arose.

Once the students had finished answering the questions, or after 30 minutes had transpired, the instructor would collect the completed note cards and the second half of the lesson would begin. During the remaining time the instructor would guide the students through a discussion that encourages reflection upon what they experienced. It also allows for students to share multiple perspectives and consider conflict from many vantage points. This discussion could be focused on any curriculum theme the instructor framed the lesson upon, though the prototype did provide a few thought-provoking examples, such as: “How would you have felt if you were a Jew on the night of Kristallnacht? What about if you were Aryan?”; “Why do you think Jewish people were treated so badly?”; “How would you feel if you woke up tomorrow and were told you could no longer come to school, or play with certain friends, because of what you believed?”; and, “what do you think happened to Jewish people after Kristallnacht? Do things get better or worse?”

After allowing for approximately a 20-minute discussion, the prototype is complete, except for the instructor assessment. Answers to the Kristallnacht Lesson Note Card are provided in the prototype for instructors who wish to assess the historical knowledge the students might have gained. Instructors looking to assess participation, critical thinking, communication or other areas aligned with CLEs features, may grade off the contributions of each student during the
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group discussion or from interactions they witnessed at any point during the lesson.

Development Summary

Based on the guiding CLE criteria, virtual world affordances and the interviews conducted in Phase One, a prototype lesson was created in order to research the ability of virtual worlds to facilitate a CLE. This prototype was designed by implementing the five guiding criteria for CLEs within the affordances that virtual world technology provides. Table 7 outlines how each CLE criteria was actualized within the prototype.
Table 7: Prototype Material to Meet Criteria

<table>
<thead>
<tr>
<th>CLE Guiding Principle</th>
<th>Corresponding Affordances of Virtual Worlds</th>
<th>Developed Prototype Actualization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson is embedded within realistic and/or authentic environment</td>
<td>Synchronicity, Persistence, Shared experiences, Interactivity, Representation (Bartle, 2004; Book, 2004; Sanchez, 2009; Warburton, 2009)</td>
<td>Prototyped utilized the virtual world Second Life (persistence) and was built around US Holocaust Memorial Museum. This build is a realistic representation of a German town after Kristallnacht. Within the parcel, students can visits, homes, school, businesses, an embassy and Synagogue to experience events of that night (interactivity). Meaning the developed prototype occurred within a realistic environment, in which multiple students could interact and collaborate in real time (synchronicity) to share an experience in which different views, both theirs’ and historical, were presented in an authentic manner.</td>
</tr>
<tr>
<td>Lesson allows for communication and collaboration</td>
<td>Synchronicity, Interactivity, Representation</td>
<td>Second Life has both text-based and voice chat features (interactivity). It also allows for notecards and other resources to be shared between and among multiple residents (representation). In the developed prototype both sharing of notecards and voice chat are utilized in the lesson (representation, synchronicity).</td>
</tr>
<tr>
<td>Lesson allows for multiple perspectives and views</td>
<td>Persistence, Shared experiences, Interactivity, Representation</td>
<td>The Kristallnacht representation (persistence) included digitized versions of actual historic documents, photos, images, and audio accounts of survivor stories. The second half of the prototype was small group discussion after all students had completed the scavenger hunt. This was designed as a time that would allow students to share their perspectives (shared, experience, interactivity) with each other, as well as reflect on the personal experiences</td>
</tr>
<tr>
<td>Lesson allows for learner self-awareness and self-reflection</td>
<td>Shared experiences, Representation</td>
<td>This first part of the prototype was designed as a scavenger hunt for information (representation, shared experience). During this time it is expected that as students gained information on the events of Kristallnacht they would be self-reflective and self-aware of what they might have done or how they would have acted that night. The second half of the prototype was a small group discussion, completed after all students had finished the scavenger hunt. This was designed as a time of guided reflection and awareness.</td>
</tr>
<tr>
<td>Lesson allows for the learner to be autonomous</td>
<td>Persistence, Interactivity</td>
<td>The Kristallnacht representation (persistence) does have an entry and exit access point, however there is no designated path that must be followed once inside. The prototype took advantage of this and the questions that must be answered in the notecard can be found in any order. No matter the path or pace a student follows, all materials and interaction provide the same information (interactivity).</td>
</tr>
</tbody>
</table>
Phase Three: Evaluation

The third phase of the research involved the evaluation of the prototype by both the participating teachers and an expert in constructivist learning theory. The evaluation process was formative in nature, in that it provided information to help improve future versions.

Teacher evaluation.

When the researcher considered the prototype complete, a delivery meeting was scheduled with the participating teachers. During the course of this meeting the researcher explained the evaluation process, handed each participant a paper evaluation form (Appendix D) and presented the prototype. The written materials were presented first. The researcher walked the participants through the materials and explained the purpose of each section. The researcher also demonstrated how the participants could use the materials in their own classrooms and how to lead their students through the lesson. The participants had the opportunity ask questions, but no questions were raised.

After the written materials were presented the researcher demonstrated the Kristallnacht parcel in Second Life. Upon first attempting to log in, the research immediately received an error about not being able to access the voice feature of Second Life (Figure 14). This was not the case during the previous test with Participant One. No other errors were noted in functionality during the rest of the prototype demonstration. However, from this one event it was inferred that Second Life could be unreliable and problematic technology to use if similar results are not received each time upon its use.
Continuing on with the presentation in *Second Life*, the researcher showed the participants how to give, receive and write on the Kristallnacht Lesson Note Card. Once this was complete, the researcher entered the Memorial Museum and demonstrated prototype.

During this part of the demonstration, the participants began asking questions dealing with keeping students on task, the number of students they could work with, and other classroom management items. It was the researcher’s impression at the time that participants were not concerned with using virtual world technology due to any technology-driven issue. But rather, participants were more concerned with classroom management practices and how they might have to adapt and change their teaching practices.

In total, the prototype presentation took approximately 30 minutes. At that point, the participants were asked to complete their evaluations. All three participants immediately asked if they could complete their evaluation overnight since it was the last day of school. Therefore, the researcher collected all three completed evaluations the next day.

**Teacher evaluation results.**

The written evaluation contained nine questions. Question One asked, “do you feel the lesson is complete and provides enough detail in order to effectively implement it within the classroom?” All three participants felt the prototype was complete. Participant One stated, “The lesson looks complete and is well detailed.” Participant Two added, “The lesson is complete as
written.” However, this question also provoked the same response from all three teachers that spilled over into Question Two, “Is there anything that needs to be added? If so, what,” Question Three, “Is there anything missing? If so, what,” and Question Four, “Is there anything that needs to be changed? If so, what?”

While all the participants felt the prototype was complete they also indicated that each would need to gain a comfort level with the technology before implementing it into the class. As Participant Three responded to Question Two, “A teacher comfort level needs to be found so all students could/would participate and be monitored.” Participants One and Two echoed similar thoughts. In response to Question Three, Participant One stated, “A teacher’s guide would be extremely helpful” and wrote “* Teacher support & training” on the side of the page. It is unknown if overnight any of the participants took the time to walk through the lesson themselves, Participant Three is the only one to state he did not actually attempt to visit the prototype, but if not, that could possibly explain their uneasiness. However, what these statements do express is a need that they felt was not met in the prototype and also contradicts their original interview statements about feeling comfortable figuring things out on their own. Clearly, in the case of virtual worlds that may not be the case and more in-depth, possibly instructor-led, training sessions may be required in order to implement such technology into K-12 classrooms.

Question Five, “If you were to implement this lesson, what challenges would you face,” asked about challenges that participants might face if implementing the prototype. In response to this, the participants stated that classroom management would be a factor, as well as reliably functioning technology. Participant One wrote, “The organization/structuring of using 2nd Life with 30 students –how to rotate students through the sim and supervise activity while most of the
class is doing something else. Bandwidth & reliable tech is always an issue.” Participant Two echoed a similar sentiment, “for an old dog like me…I see many challenges; new program, new language, tech issues, focusing students on actual purpose of lesson.” Lastly, Participant Three felt that “student supervision would be huge.” Collectively, these statements indirectly support the use of virtual worlds, as a technology tool, but demonstrate that in doing so teachers perceive there may be a paradigm shift in the way they teach and administer the classroom.

Question Six, “What could be done to address the challenges you identified above,” asked about ways to address the challenges identified in Question 5. The participants felt that more resources were needed to support their own personal comfort levels with virtual world technology. Participant Two asked for “a class taught for teachers prior to implementation would help.” Once again this contradicts an earlier interview statement on the ability to learn the new system independently. Both Participants One and Three identified the desire to see additional resource materials in which they could learn how others had effectively implemented similar lessons into other classrooms. Participant One suggested, “a teacher’s manual with supplementary lessons that students could complete independently while other are in the sim would be helpful.” Participant Three wanted an “online implementation lessons where we could watch teachers in action teach lessons while students explore.” Here again, virtual worlds as a technology seem to be accepted as a tool, but one that is perceived as requiring advanced support, training and a change to classroom management practices.

Question Seven asked, “On a scale of one to four (one being the best) how effective do you feel this lesson would be when implemented in the classroom?” Participants One and Three both selected one and stated it would have to be done “correctly.” Participant One explained her definition of correctly, in Question Eight, “Please explain your reasoning for the rating above,”
by saying, “under poor supervision or lack of structure for the rest of the class – there could be major problems.” However, Participant Two answered “four” in response to this question stating, “If I was able to master program and effectively focus students on task this would be an exciting lessons.” From this statement it can be inferred that it isn’t the technology, or virtual worlds, that are a problem but rather a perceived paradigm shift in the approach to teaching that is more of hindrance.

The last question, Question Nine, asked participants to evaluate how well each guiding CLE feature was met in the prototype on a likert scale of one to four, with one being the highest (Table 8).

<table>
<thead>
<tr>
<th>CLE Principle</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson is embedded within realistic and/or authentic environment</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lesson allows for communication and collaboration</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lesson allows for multiple perspectives and views</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lesson allows for learner self-awareness and self-reflection</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lesson allows for the learner to be autonomous</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

The responses to the first four feature of CLE were all rated positively, scoring either a one or two, and seen by participants to be present within the prototype. However, the last feature, learner autonomy, proved to be slightly more varied and only two of three participants answered the question. Participant Two did not know what the question was asking and left it blank. However, Participant One, who scored the question a four, indicated in the notes that she felt here was too much risk to allow autonomy in a school related activity, contradicting her initial interview responses. This could mean one of two things, either Participant One felt learner autonomy was present, but that it should not be in a school activity or that it was not present and
explained why she felt it should not be in the first case. Overall, however, Question Nine did indicate that the participants all felt the guiding principles of CLE’s were present in the lesson to some degree.

**Expert Evaluation**

Upon completion, the prototype was sent to Dr. Peter Doolittle, an expert on constructivist learning theory, for evaluation of how well the prototype aligned with constructivist theory and the five identified features of CLEs. Dr. Doolittle examined the activity and completed his evaluation in August 2013.

The first question asked of Dr. Doolittle how well did the prototype align to the guiding CLE features based on a Likert scale of one to four with one being the highest (Table 9). Overall, Dr. Doolittle scored the prototype on the positive side, from 2 to 2.5. However, in coding the written comments in the matrix, and in further questions, an interesting distinction began to form.

<table>
<thead>
<tr>
<th><strong>Features of CLEs</strong></th>
<th><strong>Rating</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning embedded in realistic and authentic environments</td>
<td>2</td>
</tr>
<tr>
<td>Allows for communication and collaboration</td>
<td>2</td>
</tr>
<tr>
<td>Allows for multiple perspectives and views</td>
<td>2.5</td>
</tr>
<tr>
<td>Promotes learner self- awareness and self- reflection</td>
<td>2.5</td>
</tr>
<tr>
<td>Allows for the learner to be autonomous</td>
<td>2</td>
</tr>
</tbody>
</table>

In evaluating each of the five features, Dr. Doolittle distinguished between the virtual world environment and the prototype content and design. For example, when evaluating the authentic and realistic nature of the prototype he states, “‘Realistic and authentic’ should pertain
to more than the environment, it should pertain to how one interacts within the environment.”
This difference was also seen when asked about allowing for multiple perspectives. Dr. Doolittle stated, “it’s important to distinguish SL’s ability to foster multiple perspectives and the lesson.”
In the end, Dr. Doolittle noted that, “environments are neither constructivist nor non-constructivist; it all depends on how the environments are used. An interesting environment has been built, but how can it be leveraged to foster more student individual and social construction.”

For Question Two, “Do the materials implement what you consider to be a constructivist-learning environment? Why or why not,” Dr. Doolittle did not feel that a CLE was achieved. As designed, the prototype happens in two parts: the first part being the finding of information while being immersed in the activity and the second, reflecting on the experience as a group. As a single individual, it was impossible for Dr. Doolittle to experience group discussion and reflection. This perspective is seen in Dr. Doolittle’s statement that, “in answering the questions, I wasn’t asked to construct knowledge in any meaningful way; that is, I was just answering mostly fact-based questions, I wasn’t asked to summarize, extrapolate, challenge ideas, interrogate conclusions, synthesize facts, or solve a problem.” However, this description mirrors the designed purpose of the first half of the prototype, knowledge gathering. This activity was designed to allow individual to find the information they needed within the parcel. It was only after this first activity is completed that the students move into the more reflective and discussion oriented group activity.

When questioned on how the prototype deviated from the constructivist learning theory, Question Three, Dr. Doolittle pointed to the issue raised in the prior question, the fact that he was not asked to reflect on or summarize the information or exchange and challenge the ideas of others. At this point it should be noted that the group discussion in the second half of the
DEVELOPMENT AND EVALUATION OF VIRTUAL prototype was to address this exact issue; which, as also identified above, Dr. Doolittle did not experience in its entirety.

Question Four of the expert evaluation, asked how the issues raised above could be addressed in order to improve the overall prototype design. In response, Dr. Doolittle suggested four items: changing the outcomes of the prototype to take better advantage of the Second Life environment; changing the first part of the activity so instead of answering questions, student use another form of inquiry within the environment; constructing a more narrative discovery process to deepen knowledge construction; and, adding more interaction among students in part one of the prototype.

First, Dr. Doolittle indicated that the lesson objectives were too “low-level” and should be modified. He suggests a more complex objective such as, “how did Kristallnacht serve as a model for Nazi Germany’s conduct of the entire WWII campaign? or what does the behavior of German soldier and Jewish civilians say about human agency?” It was his opinion, that by doing so the objectives would more align to the justification of using a virtual world platform on which to build a CLE.

Second, Dr. Doolittle states that the students need a bigger reason to answers the questions in the notecard to create “meaningful knowledge.” Therefore, he suggests that an “interaction strategy be developed that would provide guidance on how to inquire within the town be developed.” By doing so he suggests students would be better able to understand and process the information they were collecting.

Third, Dr. Doolittle suggested changing the prototype “to foster a narrative” by utilizing the artifacts as “sign-posts for the journey.” In doing so the goal is to strengthen knowledge construction for the individual learner. Underlying these statements was Dr. Doolittle’s belief that
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the environment held additional information and items of importance than simple what was asked about on the lesson note card. He felt that more items within the environment should be utilized in some way to deepen the knowledge acquisition and construction of students.

Lastly, Dr. Doolittle suggests that Part One of the lesson be modified to include more interaction. One viable option he stated was to include more discussion in Part One. However, he did not provide any further explanation so it is unclear in what way he felt this would improve the prototype.

Dr. Doolittle’s suggestions provide clear guidance for necessary changes. However, the provided suggestions focus on the changing of the prototype lesson materials and not the prototype development platform. This point is seen in one of Dr. Doolittle’s final statements, “to align more with constructivism, the activity needs to be changed, not the environment.” However, that distinction aside, just as seen in the teacher evaluations there is supporting evidence of virtual world technology as being an appropriate tool for use when designing and building a CLE. This is specifically seen in Dr. Doolittle’s statement, “given the five constructivist principles, it would appear that the process + environment could foster more communication/collaboration (part 1), provide and foster more perspectives (part 1), foster more explicit self-awareness/self-reflection (part 1), and foster greater autonomy.” However, it is important for instructional designers to note that the environment alone cannot make a CLE and much thought must be put into the design of the corresponding activity in which the students engage.

Future Refinements

After conducting the study, the researcher identified two changes that would improve future versions of the prototype based on both the researcher’s prior experience and knowledge
working within virtual worlds and the results of the study. First, it is important to recognize that it is the role of an instructional designer to match the learning objectives with the right tool to effectively achieve the desired outcome. With any technology, the instructional designer must ensure that the tool’s affordances both support and strengthen the designed learning activity. In the case of this research, the designed prototype was supported by virtual world technology, however the prototype was not strengthened by taking full advantage of the immersive nature of virtual worlds affordances. In future versions, this should be rectified by changing the nature of the prototype to be more immersive and narrative in nature so the students are fully drawn into both the environment and the learning activity. Therefore, rather than the existing two-part activity, the prototype should become a single small-group activity. Additionally, the activity should change from a “hide-and-seek” discovery activity to a more role-playing activity.

Within the redesigned activity the students act as a group of “forensic scientists” who are called-in to research a disserted town. Their instructions before going into the town are simply to use any information available to them to reconstruct events that occurred within the township and the significance that activity played within the larger global context. While examining the town the students work collaboratively to draft a report of their findings. This draft then must be delivered to their supervisor (teacher). After drafting the report the entire group then “debriefs.” The debrief acts as time of guided reflection and discussion. It also acts as a time when the teacher can correct any misinterpretations or guide the group to consider alternative, or missing, information before finalizing the final report on the circumstances that occurred.

The activity is still embedded within a realistic environment but by modifying the activity to a more narrative, discovery nature the lesson becomes more authentic to the students. Communication and collaboration is also increased by the change as well. Students must work
together throughout the discovery exercise and while drafting the findings report. The opportunity for multiple perspectives to be considered is also increased by the change. Now students must listen to each other while forming their thoughts and opinions before collectively drafting the report. This act also indirectly increases self-awareness and reflection, as each student must consider what they hear and read and said before believing it to be true enough to report in the finding documents. By adjusting the activity in this manner, the features of a CLE are more directly aligned within the prototype. A change of this nature would also address the concerns and suggestions seen in Dr. Doolittle’s evaluation.

The second change that should be made is to the support and training resources made available to teachers wishing to implement virtual world technology into their classrooms. While the teachers indicated they were comfortable figuring out new software tools on their own, as stated in their Phase One interviews, the researcher’s past experience in working with virtual worlds led him to believe otherwise. It was his initial thought that a workshop type training would best prepare teachers to successfully implement Second Life. However, to be true to the teachers’ expressed beliefs, the prototype did not contain such an exercise and instead included written self-paced materials.

As seen in the teacher evaluation data in Phase Three, the researcher was correct in his belief that more training would be required for teachers. In response, the materials included with the prototype must change to reflect this need. Therefore, rather than including a list of resources that a teacher can use to become familiar with Second Life the getting started materials are replaced by a three-hour getting started workshop. This time-frame is based on the researcher’s previous work teaching instructors how to effectively use virtual world technology. Teachers should take the workshop before working with students in Second Life. The focus of the
workshop is not only learning how to use the software but also includes time for discussion on teaching techniques, such as class management, appropriate behavior, and other issues the teachers may have concerns about. This workshop should provide the opportunity to become both functionally familiar and confident with the software. By incorporating this first change into the prototype future participant teachers are better informed and situated for success in using virtual worlds.

Again, these two changes, in activity design and support materials, are based on both the researcher’s experience and the evaluative findings of this study. By making these two identified changes, the researcher believes that the prototype more directly aligns to the identified CLE features. Additionally, teachers are also better prepared to successfully implement such programs in their classrooms, and by successfully implementing such programs the initial need of expanding the location-based learning environment is achieved.
Chapter 5: Discussion and Observations

The purpose of this study was to examine the design and development of a CLE when built upon virtual world technology. The desire to do this stems from the need of educators to extend the learning environment and include resources outside the physical classroom (U.S. Dept. of Education, 2010). This desire is partially based on the tenant of Constructivist learning theory and been operationalized into constructivist-learning environments (Lebow, 1993; Jonassen, 1994; Salmon, 2000). Technology provides a means to extend the classroom and include outside resources, however further research into technology-based CLEs is still needed (Doolittle & Hicks, 2003). Having been around barely 10 years, virtual world technology builds on recent technological advances and enables multiple means of identification, communication, and collaboration in one tool. It has quickly been used for a number of applications and purposes across both business and education, however there is little research on its appropriateness in supporting a CLE in physical K-12 classrooms.

Summary of the Study

In order to address the classroom extension problem identified above, a comprehensive literature review was conducted. The literature review ultimately identified five features that all CLEs must include: authentic environments (Savery & Duffy, 1996), communication/collaboration (Sweller & Clark, 2006), multiple perspectives (Jonassen, 1994), self-awareness/reflection (Lebow, 1993), and learner autonomy (Tam, 2000). In designing a CLE an instructional designer must ensure that the technology used can facilitate the inclusion of each of these criteria (Jonassen, 1994). Considering the rapid pace of which technology changes there is needs to identify a tool that affords the opportunity to facilitate a CLE.

In considering new technological tools, the literature review identified the affordances of
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virtual worlds as a medium that aligns well to supporting the guiding CLE features. Past research has identified the five key affordances of virtual worlds as: synchronicity, persistence, shared experiences, interactivity, and representation (Bartle, 2004; Book, 2004; Sanchez, 2009; Warburton, 2009; Atkinson, 2009). However, little empirical research has been collected on the use of virtual worlds in education (Hew & Cheung, 2010).

Only Downey (2011) has created a tool, i-MMOLE, for instructional designers to use when building lessons in virtual worlds. I-MMOLE provides guiding framework by establishing five steps to follow when design such lesson within virtual worlds. These five steps are: establishing the context, investigating underlying concepts, provides experiences and constructing knowledge, assessing knowledge and follow-up activities. Downey stated this framework was built based upon his own gameplay, research, framework development, testing and refinement, however this framework has yet to be validated by additional research. Nor has i-MMOLE been reviewed by experts to determine if it aligns to the tenets of constructivism or for its ability to support a CLE.

Therefore, a developmental research study was conducted that examined the design and development of a CLE based upon virtual world technology. The literature review provided the guiding framework, which was then operationalized within a prototype virtual world activity. During the study, participants were interviewed to survey their attitudes and behaviors towards the use of new technology in the classroom. This information was used to help design the necessary support materials for the prototype’s use in the classroom. Both the teachers and one expert in constructivist learning theory then evaluated the prototype. The data collected evaluated the effectiveness and design of the prototype and also served to identify needed revisions.
Study Implications

The results and data collected in this study have both theoretical and practical applications. Theoretically speaking, this study identifies guiding features of technology-enhanced CLEs and validates the application of those features within virtual world technology. The five identified features of CLEs, authentic environments, communication/collaboration, multiple perspectives, self-awareness/reflection, and learner autonomy, can all be facilitated by the five affordances of virtual worlds, synchronicity, persistence, shared experiences, interactivity, and representation. This study also contributes to the Instructional Design knowledge based by furthering our knowledge about both design and development research methods and the use of virtual worlds in education. In practical terms, the study identified potential barriers that must be addressed when designing virtual world activities for K-12 classrooms. These barriers include teachers, feeling the need to change their classroom management techniques, finding the technology challenging, and desiring more structured training and support resources.

Theoretical Implications

This study identified guiding features of technology-enhanced CLEs and validated the application of those features within virtual world technology. The five identified features of CLEs, authentic environments, communication/collaboration, multiple perspectives, self-awareness/reflection, and learner autonomy (Lebow, 1993; Jonassen, 1994; Fosnot, 1996; Honebein, 1996; Salmon, 2000; Cates, 2001; Driscoll, 2005; Kirschner, Sweller, & Clark, 2006; Chitanana, 2012), can be facilitated within the five affordances of virtual worlds, synchronicity, persistence, shared experiences, interactivity, and representation (Bartle, 2004; Book, 2004; Atkinson, 2009; Sanchez, 2009; Warburton, 2009). Both the teachers and the constructivist
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expert felt that to a degree the guiding CLE features were present within the prototype. Moving forward, instructional designers have supporting evidence that virtual world technology is capable of supporting CLE development and, in turn, help in the expansion of the learning environment.

Richey and Klein (2004) posit that the design and development knowledge base has six facets: “(a) learners and how they learn, (b) the context in which learning and performance occurs, (c) the nature of content and how it is sequenced, (d) the instructional strategies and activities employed, (e) the media and delivery systems used, and lastly (f) the designers themselves and the processes they use” (p. 3). Designed as tool based development research study, this study directly contributes to the instructional design knowledge base in two ways. First, this study examined the virtual world Second Life (a tool/delivery system) and found it supports the design and development of constructivist learning environments. Richey and Klein (2004) also state that too few “tools employed in practice have been empirically tested and validated” (p. 3). This study directly addresses the gap identified by Richey and Klein and validates the use of virtual worlds as tool on which to build CLEs.

Additionally, the design and development process used by the researcher is outlined in the study. While this study was tool-based and the practical implications, addressed in the next section, are more context-specific they provide clear guidance to designers facing similar development projects. These findings provide clear guidance and outline what barriers must be overcome in the K-12 classroom to use virtual worlds in an “efficient and effective manner” (p. 132). From this it is clear that both this study and its findings contribute directly back into the field of Instructional Design by informing our design and development research methodology.

Finally, this study contributes back to the field by further examining the use of virtual
DEVELOPMENT AND EVALUATION OF VIRTUAL

worlds as a technology for learning. While previous researchers have examined the usefulness and effectiveness of virtual worlds in education, both Dickey (2005) and Dass, Dabbagh & Clark (2011) point out that this technology is still young and in need of more research before any conclusions can be drawn. Additionally, past articles cited virtual worlds learning environments as being founded on the tenets of constructivism (Wagner & Ip, 2009; Dass, Dabbagh & Clark, 2011) but no research focused on validating those actual claims. This article provides direct support for the latter statement and further contributes to the scholarly knowledge base surrounding the use of virtual worlds. While virtual world technology may still be young, the results of this study begin to lay the foundations for future scholarly work on which to base claims like the ones above.

Practical Implications

There is also a “lessoned learned” aspect to the results of this study that informs the more practical implications taken from the results. First, teachers identified a belief that they needed a different classroom management technique when working in virtual environments. This was an unanticipated response and neither the prototype nor designed materials addressed the issue. Many teachers might say they interact differently, and do adopt a different methodology, when working with an “online” class as opposed to the traditional physical classroom. Is there a different approach to classroom management between the physical and virtual environment as well? Calongne (2008) and Kelton (2009) bother reported pedagogical issues when detailing their experience in Second Life, but neither identified this exact point. Further research is necessary to more closely examine this issue and identify possible solutions.

Second, similar to other studies this study identified that technology itself can be a concern when implemented within the K-12 classroom environment (Lee, 2009). While this
study did not find that network bandwidth was a limiting factor, as seen in other research (Warburton, 2009), the frequency of software updates left teachers feeling ill at ease of being able to successfully use the software on their own without another physical support presence, teacher aid or instructional technologist, in the classroom. As seen in Sherman and Hick (2000), without such supports in place the likelihood of a teacher implementing technology-dependent activities, such as virtual worlds, is a barrier to be overcome. Again, more research is needed to identify and evaluate possible solutions.

Lastly, similar to Stoddard (2009), this research identified the fact that teachers identified the need for more structured support and training resources as another barrier to implementing the use of virtual worlds in the classroom. This is similar to the results of other studies conducted within Second Life, which have found that the learning curve is steep (Dickey, 2011) for new residents to learn how to “live” within the environment. When questioned in the initial interviews the teachers all reported being comfortable in figuring things out on their own. The prototype was developed to contain support materials as self-directed resources so that teachers could take a prepared lesson and implemented it in their classroom without extra training or support. (Dickey, 2011) However, this was not found to be the case. It appears that virtual world technology is either more intimidating or complicated than the participating teachers felt comfortable working with on their own. In the future, instructional designers should closely examine both the amount and types of support resources made available to participants during the needs analysis stage.

Taken collectively, these three lesson learned provide both guidance for future designers and also identify areas of needed continued research. As a young technology, there is still much to learn on how to best implement and use virtual worlds to enhance educational environments.
While this study found evidence that CLE’s can be facilitated by virtual worlds as a tool, identifying the best, most efficient method of effortlessly implementing them in a classroom environment remains to be determined.

**Conclusion**

Virtual world technology, while relatively new, has been expanding in both accessibility and usage. More virtual world communities are coming online each month, enabling students to access both people and resources from around the globe. Yet its application in the K-12 classroom has yet to be both fully. This study began that process by examining the use of virtual worlds in alignment with CLEs to answer two research questions:

1. Do the five guiding constructivist learning environment principles, as identified in past research, align with the affordances of virtual world technology?
2. What are the implications of using virtual world technology when designing and developing constructivist-learning environments in K-12 education?

In answering the first research question, this research found that the guiding CLE principles, as shown in Table 1 on page 13, do align well with the affordances of virtual world technology. Evidence for this was seen in both the teacher and expert evaluations and provides support for the continued use of virtual world technology as a tool for Instructional Designers to use when designing a CLE.

Equally important were the items identified by the research as barriers to overcome when implementing virtual world technology in the K-12 classroom. This research identified three main areas of concern for teachers: technical issues, training/support and classroom management techniques. With regards to technical concerns this research found that like other software or hardware technical tools, virtual world technology is problematic. While this research did not
examine the implementation of the developed prototype, or experience bandwidth or hardware concerns, it did find that because of the frequent software updates to *Second Life* consistent performance was not seen. This was experienced firsthand when the voice feature worked in the initial demonstrations but not in the prototype presentation for final evaluation. It might be possible to minimize such problems by not performing software updates between lessons, but that would be an item to be examined more closely in future research.

The next barrier identified was that of teacher training and support. In general, the participants self-identified as being competent and proficient in figuring out new tools and software on their own. With that in mind, the researcher developed minimal support materials for the prototype. These materials (Appendix E) were designed to lead the participants through a series of exercises so they could become comfortable and proficient with the software and prototype lesson on their own. However, as identified in the evaluation results, the participants raised the concern that virtual world technology was more complex than they originally thought and desired more training and support if they were to implement such a lesson on their own. Here again, future researchers should consider the exact nature of training and resource support materials made available to K-12 teachers in similar situations.

Additionally, the research found that the participants also thought that classroom management techniques were an area of concern. From the evaluation data it was clear that overall the participants felt virtual worlds were a viable technology that could be implemented in the classroom. The issue however was that in doing so their own classroom management skills would have to change as would the way they teach their students. While this might seem like the “you can’t teach an old dog a new trick” adage, the participants in this research were eager and receptive to use virtual world technology but were unsure of how they may have to change the
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management style they use to keep track of 20+ students in a virtual world environment. Future research should focus on how this concern can be minimalized or examine ways in which virtual world lessons could take place in semi-closed environments.

Lastly, as pointed out in the expert evaluation, it is important that instructional designers and practitioners are clear that a tool alone does not inherently make a CLE. While the prototype used virtual world technology that by itself did not make for a successful CLE. To implement a CLE one must carefully consider both the designed activities and the tool used in order to successfully create such an environment. However, overall, this study did conclude that virtual world technology afforded the ability to sustain a CLE if properly designed.
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References


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Appendix A: Interview Protocol

Welcome:

Hello, my name is Dave Dannenberg and I am doing a study that will enable me develop a constructivist learning environment using virtual worlds technology. As the first step in my research I would like to find out how you are currently using instructional media within your social studies curriculum.

Before moving on, be sure to:

— Remind participant that answers are anonymous and confidential and will only be used in data analysis.
— Obtain signature on informed consent form.
— Ask for permission to audiotape the interview.
— Define instructional media and virtual worlds

Questions:

1. Are you looking forward to the end of the year?
2. Do you have any big summer plans?

Instructional media

3. What types of instructional media do you use within your classroom?
4. What challenges have you faced when using instructional media in the past?
5. When using instructional media what kind of activities do you have the students do?
6. Do you find that some kinds of activities work better than others? Which ones?
7. What concerns do you have when you think about using new technologies you hear about?
8. If I were to create a lesson using a new instructional media for use what do you think would be some of the challenges for implementing it would be?
9. Have you ever heard of virtual worlds? If so, please describe your experience with them?

Instructional Strategy

10. Do you ever try to have your lessons embedded in realistic or authentic environments? Which ones?
11. When creating your lessons do you allow for communication and collaboration between students? How? In what lessons?
12. When creating your lessons do you allow for multiple perspectives or viewpoints? In what ways?
13. When creating your lessons do you think about promoting learner self-awareness and self-reflection? In what ways?
14. When creating your lessons do you allow you learners to be autonomous?
Lesson Material
15. What subjects are left to teach this year?
16. Based on past experience, do you find that your students have problems with any one lesson or content area in particular? If so, what?

Closing:

— Be sure to thank participant for their time.
— Go over my contact information
Appendix B: Participant Evaluation

Lesson Prototype Evaluation

Please evaluate the developed virtual world based framework by answering the questions below. Please provide as much feedback as you can.

1. Do you feel the lesson is complete and provides enough detail in order for you to effectively implement it within your classroom? Why or why not?
2. Is there anything that needs to be added? If so, what?
3. Is there anything missing? If so, what?
4. Is there anything that needs to be changed? If so, what?
5. If you were to implement this lesson, what challenges would you face?
6. What could be done to address the challenges you identified above?
7. On a scale of one to four (one being the best) how effective do you feel this lesson would be when implemented in the classroom?

1  2  3  4

8. Please explain your reasoning for the rating above.
9. On a scale of one to four (one being the best), please indicate how well you feel the provided lesson aligns to each of the listed features.

<table>
<thead>
<tr>
<th>Features</th>
<th>Rating</th>
<th>Explanation</th>
</tr>
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<tbody>
<tr>
<td>Realistic and authentic environment</td>
<td>1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>Allows for communication and collaboration</td>
<td>1 2 3</td>
<td></td>
</tr>
<tr>
<td>Allows for multiple perspectives and views</td>
<td>1 2 3</td>
<td></td>
</tr>
<tr>
<td>Promotes learner self-awareness and self-reflection</td>
<td>1 2 3</td>
<td></td>
</tr>
<tr>
<td>Allows for learner autonomy</td>
<td>1 2 3</td>
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</tbody>
</table>
Appendix C: Constructivist Expert Evaluation

Please evaluate the developed virtual world based framework by answering the questions below. Please provide as much feedback as you can. If you have any questions, please do not hesitate to contact me at 540-449-9315 at any point in time.

1. On a scale of one to four (one being the best), please indicate how well you feel the provided framework aligns to each of the listed features of constructivist learning environments.

<table>
<thead>
<tr>
<th>Features of CLEs</th>
<th>Rating</th>
<th>Please Explain</th>
</tr>
</thead>
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<tr>
<td>Learning embedded in realistic and authentic environments</td>
<td>1 2 3 4</td>
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</tr>
<tr>
<td>Allows for communication and collaboration</td>
<td>1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>Allows for multiple perspectives and views</td>
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</tr>
<tr>
<td>Promotes learner self-awareness and self-reflection</td>
<td>1 2 3 4</td>
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<tr>
<td>Allows for the learner to be autonomous</td>
<td>1 2 3 4</td>
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2. Do the materials implement what you consider to be a constructivist-learning environment? Why or why not?

3. In what ways do you think the lesson deviates from constructivist learning theory?

4. From a constructivist point of view, how do you think the problems identified above should be addressed in order to improve the lesson?

5. Overall, how does this lesson align, or not align, with constructivism?

6. Are there any recommendations you would make to improve this lesson with regards to better alignment with constructivism?

7. Is there anything else you think we should know with regards to the lesson and its alignment with constructivism?
Appendix D: Instructor Resources Document

Required software:

Getting started information:
The Second Life Quick Start guide is accessible online. This document will walk you through the basics of creating a Second Life avatar and using the software for the first time.


The first time you use Second Life you will appear at Welcome Island. Follow the signs and prompt to become familiar with Second Life. It is also suggested you follow Second Life Quick Start webpage.

When finish with Welcome Island, teleport to Virtual Ability Island to experience another, more in-depth, orientation experience. You may move to Virtual Ability Island by clicking this link:


Once you have completed the Virtual Ability Orientation, you are ready to move on with the lesson. If students are unfamiliar with Second Life, it is suggested they follow the same learning sequence.
Appendix E: Prototype

Kristallnacht: The Night of Broken Glass

Possible Topics:

- Conflict, World War II, Holocaust, Jewish history

Required Resources:

- Internet access, high band width recommended
- Computers, MAC or PC
- Second Life software

Lesson Overview:

Using the virtual world technology of Second Life, students will immerse themselves in a recreation of Kristallnacht, the “Night of Broken Glass.” During the exercise, small groups of students will search for clues to answers questions regarding the events that took place on Nov 9-10, 1938. Questions will be given to teams/individuals via a Second Life notecard, on which information can be written and saved.

Lesson Objectives:

By the end of this lesson, students will:

- Know what Kristallnacht was and when it occurred.
- Know the timeline of events that led up to Kristallnacht
- Understand how Jews were treated during and after Kristallnacht
- Be able to navigate and control an avatar in an online virtual world

Time required:

One hour for actual lesson.

If Second Life has never been used before please allow three to four hours, broken down as follows

- One to two hours to create teacher avatar and learn to use Second Life software
- One hour to work with students to create their avatars and learn to use the Second Life software
- One hour of student exploration and discussion during the lesson

Assuming no prior knowledge of Second Life, instructors are directed to the attached
instructor resources document. This document provides a very brief overview of Second Life and basic instructions on where to find additional information to get started. Please keep in mind that if you are unfamiliar with virtual world technology, such as Second Life, it is suggested you plan to spend one hour entering the environment and becoming familiar with the software and experience.

**Considerations:**

The Second Life software requires not only high bandwidth Internet but also fairly advanced computer hardware. It is highly recommended that you view the Second Life System Requirements webpage, currently found at https://secondlife.com/my/support/system-requirements/?lang=en-US.

Additionally, you may also want to check with your local Instructional Technologist or Support Department to see if they are aware of any conflicts or issues from past experience.

**Lesson:**

This lesson is best conducted in two parts. Part one should last 20-30 minutes, and part two should last about 20 minutes.

**Part I:**

You may teleport to US Holocaust Memorial using the link below: http://maps.secondlife.com/secondlife/US%20Holocaust%20Museum1/23/36/27

Once at the Holocaust Memorial, introduce the topic and give each student avatar the Kristallnacht Lesson note card. Explain to the students that they should write the answer to each question on the notecard as they find the necessary information. When they answer all the questions, they can then exit the memorial and meet outside the building. If should take each student 20-30 minutes to answer all the questions. As each student exits the memorial, have him or her turn in the answered notecard.

You can pass a notecard to another person/avatar by left-clicking on the card, dragging it to the person that you want to receive it and letting go of the mouse.

**Part 2:**

Once all the students have completed, hold a small group discussion in Second Life focusing on your particular lesson objectives. If necessary, use the following prompts as a guide, if necessary:

- What caused Kristallnacht?
• How would you have felt if you were a Jew on the night of Kristallnacht? What about if you were “Aryan”?
• Why do you think Jewish people were treated so badly?
• How would you feel if you woke up tomorrow and were told you could no longer come to school, or play with certain friends, because of what you believed?
• Do you think anything could have been done to stop Kristallnacht?
• What do you think happened to Jewish people after Kristallnacht? Do things get better or worse?
• Do you think it was fair that Jewish people had to pay for the damages? Do you think they could pay for it all? What happens if they didn’t?
Kristallnacht Lesson Note Card

1. When and where did Kristallnacht occur?
   a. Nov 9-10, 1938 throughout Germany *

2. Describe the conflict that led up to Kristallnacht?
   a. The pretext for the violent pogroms of Kristallnacht was the November 7
      assassination of a German diplomat in Paris, Ernst vom Rath, by Herschel
      Grynszpan, a Jewish teenager whose parents, along with 17,000 other Polish
      Jews, had been recently expelled from the Reich. Initially denied entry into
      their native Poland, Grynszpan's parents and the other expelled Polish Jews
      found themselves stranded in a refugee camp near the town of Zbaszyn in the
      border region between Poland and Germany.

3. How did Kristallnacht get its name?
   a. The Night of Broken Glass from all the glass in the street the next morning.

4. Name one way the Jewish prisoners could arrange to leave a concentration camp
   they were taken to after Kristallnacht?
   a. Release came only after the prisoners arranged to emigrate and agreed to
      transfer their property to pure blood Germans.

5. Who had to repay for the damages done during Kristallnacht?
   a. Nazis forced the Jews to pay the costs of the pogroms. Insurance monies to
      cover damages were confiscated, Jewish store and home owners had to
      repair their buildings at their own cost, and an 'atonement' fee of 1 billion
      Reichsmarks (about $400 million) was imposed on the Jewish community

6. What was the intention of the Nuremberg Laws?
   a. Served as the basis for the exclusion of Jews from German society and for all
      subsequent anti-Jewish legislation enacted during the Third Reich. Also
      forbid sexual intercourse between people with Jewish ancestry.

7. Who initiated the violence of Kristallnacht?
   a. With Hitler's approval, radical activists in the Nazi party initiated the
      violence of Kristallnacht. Meanwhile, the SS and Security Police used it as an
      opportunity for German police to stage mass arrests of Jews.

8. How were Jewish shops, businesses, churches, and homes treated during
   Kristallnacht?
   a. They were broken in to, destroyed, set fire to or otherwise vandalized. Many
   items were stolen, including family heirlooms, historical documents, money,
   jewelry, and artwork.

* Answers in red should not appear on the note card your distribute.
Instructor Resources

**Required software:**


**Getting started information:**

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The first time you use Second Life you will appear at Welcome Island. Follow the signs and prompt to become familiar with Second Life. It is also suggested you follow Second Life Quick Start webpage.

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Once you have completed the Virtual Ability Orientation, you are ready to move on with the lesson. If students are unfamiliar with Second Life, it is suggested they follow the same learning sequence.
APPENDIX F: Prototype Images

Figure 5: US Holocaust Memorial Entry Room

Figure 6: Entry Display with Notecard Visible
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**Figure 7**: Re-created Town After Kristallnacht

![Image of a re-created town after Kristallnacht](image1)

**Figure 8**: Before (Left) and After (Right) Jewish Storefront

![Image of a Jewish storefront before and after](image2)
Figure 9: School Room with Notecard Visible

Figure 10: Unharmed Aryan Storefront
Figure 11: Vandalized Jewish Home

Figure 12: Embassy with Documentation on Display
Figure 13: Destroyed Synagogue with Notecard

Figure 14: Memorial Reflection Room After Exiting
APPENDIX G: IRB Approval

MEMORANDUM

DATE: March 15, 2013
TO: Barbara B Lockee, David Randall Dannenberg
FROM: Virginia Tech Institutional Review Board (FWA00000572, expires May 31, 2014)
PROTOCOL TITLE: Development of a Design Framework to Create a Virtual World-Based Constructivist Learning Environment
IRB NUMBER: 13-251

Effective March 15, 2013, the Virginia Tech Institution Review Board (IRB) Administrator, Carmen T Green, approved the New Application request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 3 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

http://www.irb.vt.edu/pages/responsibilities.htm

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As: Expedited, under 45 CFR 46.110 category(ies) 6,7
Protocol Approval Date: March 15, 2013
Protocol Expiration Date: March 14, 2014
Continuing Review Due Date*: February 28, 2014

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Intern IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.
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* Date this proposal number was compared, assessed as not requiring comparison, or comparison information was revised.

If this IRB protocol is to cover any other grant proposals, please contact the IRB office (irbadmin@vt.edu) immediately.