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An Investigation of Special Education Teachers' Perceptions of the Effectiveness of a Systematic 7-Step Virtual Worlds Teacher Training Workshop for Increasing Social Skills

Natalie Christina Nussli
University of San Francisco, nnussli@gmail.com

The University of San Francisco

AN INVESTIGATION OF SPECIAL EDUCATION TEACHERS' PERCEPTIONS OF THE EFFECTIVENESS OF A SYSTEMATIC 7-STEP VIRTUAL WORLDS TEACHER TRAINING WORKSHOP FOR INCREASING SOCIAL SKILLS

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ABSTRACT

This study describes how a systematic 7-Step Virtual Worlds Teacher Training Workshop promoting inquiry, experiential learning, and sociocultural theory guided the enculturation of 18 special education teachers into three-dimensional virtual worlds. The main purpose was to enable these teachers to make informed decisions about the usability of virtual worlds for students with social skills challenges, such as students with autism. Mixed-methods data analysis and triangulation were based on the analysis of seven instruments. Six of the seven steps of the intervention received high ratings indicating its viability for teachers' professional development opportunities.

An 11-item attitude scale with reliability coefficients of .79 (pre-survey) and .72 (post-survey) measured the participants' perceptions of the affordances and challenges of virtual worlds and their enthusiasm to use virtual worlds. The results suggest that the teachers' attitude toward using Second Life in education has become more positive as a result of the intervention with a statistically significant increase ($p = .00$) and a large effect size ($r = .51$). On a separate 10-point rating scale consisting of one item, the teachers rated their perception of the overall usability of Second Life for social skills practice. Although the mean usability was higher after the intervention, no statistically significant difference was detected ($p = .14$). Overall, a majority of the participants (76%) tended to be supportive of the idea of using virtual worlds in special education despite a variety of concerns.

Three themes emerged, namely, *Virtual World Pedagogy*, *Virtual World Benefits*, and *Virtual World Challenges.* Overall, they encompassed 18 codes. The need for pedagogical and technical facilitation and the teachers' desire for a well-structured,

confined, and safe virtual region with built-in scaffolding became evident. A tendency toward maximal teacher control over the students' avatars and their movements was diametrically opposed to the teachers' eagerness to promote free exploration. Social skills practice and repeated practice opportunities in a stress-reduced environment emerged as the key benefits of virtual worlds for students with social skills challenges. The study resulted in 14 practical recommendations, a revised 4-Step Virtual Worlds Teacher Training model, and suggestions for future research for special education purposes.

SIGNATURE PAGE

This dissertation, written under direction of the candidate's dissertation committee and approved by the members of the committee, has been presented to and accepted by the Faculty of the School of Education in partial fulfillment of the requirements for the degree of Doctor of Education. The content and research methodologies presented in this work represent the work of the candidate alone.

Natalie Christina Nussli — September 15, 2014
Candidate

Dissertation Committee

Dr. Mathew Mitchell — September 15, 2014
Chairperson

Dr. Kevin Oh — September 15, 2014

Dr. Peter Williamson — September 15, 2014

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CHAPTER 1

INTRODUCTION

Statement of the Problem

Virtual worlds allow students to go on a fieldtrip, to explore the inside of a cell as part of a biology course, or replicate classic experiments without the cost of running a real laboratory. Virtual worlds allow students to practice Spanish with native speakers in a dance club in Barcelona without traveling. Virtual worlds allow students of psychology to experience hallucinations without actually suffering from them. Virtual worlds allow groups to work in a secret cave behind a waterfall, rather than in a bland classroom, without the need of a nature trip. These options may sound unreal but they are, indeed, realistic. Taking students to virtual worlds, which are also called three-dimensional (3D) immersive virtual worlds, has become increasingly popular in education (Chapman & Stone, 2010).

Virtual worlds hold great promise for supporting students with social skills challenges, such as students with autism, by offering them a safe virtual platform for the practice of social encounters (Stichter, Laffey, Galyen, & Herzog, 2014). In particular, virtual worlds have potential as a common platform where students can get together to practice peer interaction, collaboration, take advantage of the benefits of experiential learning, all under the guidance of a virtual teacher (Stichter et al., 2014). Research reporting on specific teacher training for the use of virtual worlds in special education, however, is difficult to locate, which indicates that there is a need to provide special education teachers with training opportunities in virtual worlds so they can help their students take advantage of the potential benefits of virtual worlds for social skills practice.

Social skills intervention programs in virtual environments, such as iSocial, hold great promise for supporting schools and students to gain social competence, which points to an increasing need to provide qualified teachers to deliver this training (Stichter et al.).

Recent research suggests that teachers may have difficulties in developing comfort with this technology (e.g., Blankenship & Kim, 2012; Inman, 2010). There is, however, a lack of research that addresses the preparation of teachers to effectively use these virtual environments in teaching (Guasch, Alvarez, & Espasa, 2010; Guzzetti & Stokrocki, 2013; O'Connor & Sakshaug, 2008-2009; Pérez-García, 2009; Storey & Wolf, 2010). For the period of 2001 through 2012, Nussli and Oh (2014) identified 21 articles reporting on virtual worlds teacher training. Systematic attempts to provide teacher training in this area, however, have been rare (Guzzetti & Stokrocki, 2013). In 2010, Storey and Wolf reported being unable to find a College of Education that was using Second Life, still the most frequently used virtual world among educators (Dalgarno, Gregory, Carlson, Lee, & Tynan, 2013), as a pedagogical tool to deliver course content in teacher preparation. They emphasized that even though future teachers were strongly encouraged to engage their students by using new tools and adopting new strategies, there was little evidence of teacher education colleges practicing what they advocate.

In the past four years, however, there has been some progress. The University of the West of England, Bristol, UK, for instance, launched a Master's degree in Education in Virtual Worlds in August of 2012. The University of Washington offers a Certificate in Virtual Worlds for educators who wish to learn how to build and evaluate virtual worlds to optimize educational applications. There are also an increasing number of platforms for sharing information about virtual worlds best practices (e.g., Ctrl Alt

Teach!) and books (e.g., Nelson & Erlandson, 2012; Savin-Baden, 2010; Wankel & Hinrichs, 2011). Interested educators can join the International Society for Technology in Education (ISTE) Special Interest Group for Virtual Environments (SigVe) and attend conferences about virtual worlds best practices in education (VWBPE). Most of the discussion about best practices, however, is taking place in discussion forums (Savin-Baden, 2010), such as Second Life Educators List (SLED), rather than through empirical research.

Online teachers have to play a variety of roles, such as teacher, counselor, mentor, facilitator, instructional designer, site coordinator, and administrator (Ferdig, Cavanaugh, diPietro, Black, & Dawson, 2009). In addition, a paradigm shift is required in terms of teachers' perceptions of instructional time and space, in-world management techniques, and ways of engaging students through virtual communication (Davis et al., 2007). Even those educators who are already using virtual worlds often do not seem to take full advantage of the unique affordances: Virtual lectures and slide presentations tend to replicate traditional teaching scenarios, thereby foregoing the opportunity to design learning experiences that embody different pedagogical perspectives and to combine these innovatively (Good, Howland, & Thackray, 2008; Ollé & Kristof, 2014; Storey & Wolf, 2010).

This intervention contributes to research by providing empirical data about special education teachers' experiences of a virtual world, both from the perspective of the teacher and the learner, with a focus on social skills practice. The intervention was based on three theories: If educators are immersed in virtual worlds to get first-hand experience (experiential learning theory), if they have repeated opportunities for self-reflection on

the usability of Second Life for special education framed by an inquiry approach (inquiry-based learning), and if they can receive maximal and continued support from their peers and their instructor in practicing virtual navigation and communication (sociocultural theory), then they will quickly and effectively be able to use Second Life to their satisfaction (Pérez-García, 2009). While the potential for this technology in a classroom setting is immense, its practical implementation requires that teachers receive appropriate training that builds both their confidence in their virtual teaching skills and their commitment toward 3D technology. The fact that virtual worlds are changing at a fast pace, however, raises the question whether virtual worlds are only suitable for individuals with a tolerance for ambiguity. Stamina, modeling, scaffolding, and continuous mentoring are key prerequisites (Alvarez, Guasch, & Espasa, 2009; Compton, Davis, & Correia, 2010; DiPietro, 2010; Silva, Correia, Pardo-Ballester, 2010) for a successful and positive virtual worlds experience.

Therefore, the overarching goal of this intervention was to help address the research gap about virtual worlds teacher training, especially in special education, by measuring special education teachers' perceptions of the effectiveness of virtual worlds teacher training. Specifically, the problem was addressed by attempting to raise 18 special educators' awareness of the affordances and challenges of virtual worlds in a systematic 7-Step Virtual Worlds Teacher Training Workshop. The intervention's objective was to enable these teachers to make informed decisions about the usability of virtual worlds for special education, especially for students with social skills challenges.

Background and Need

I will start with an overview of virtual worlds and then discuss the skills needed for 3D virtual teachers as well as existing guidelines for educators using virtual worlds. Gaining insight into all of these components will help to (1) design effective, systematic virtual worlds teacher training intervention, (2) measure special education teachers' perception of the intervention's effectiveness, and (3) gauge special education teachers' perceptions of the usability of virtual worlds as a platform to practice social encounters for students with social skills challenges, which are the three overall goals of the intervention.

Virtual Worlds and Second Life

Schroeder's (2008) definition of virtual reality is "a computer-generated display that allows or compels the user (or users) to have a sense of being present in an environment other than the one they are actually in, and to interact with that environment" (p. 1). A virtual learning environment is specifically used for educational purposes (Cobb & Stanton Fraser, 2005). Second Life is an online virtual world developed by Linden Lab, where people aged 16 and over can meet other residents, socialize, join groups (such as support or discussion groups), create and trade virtual objects and buildings (Second Life Wikipedia), or simply explore the world individually.

Many educational institutions worldwide have recognized its considerable potential for education. Educational platforms can be found in the areas of astronomy, medicine, music, literature, biology, history, mathematics, forensic science, ecology, and tourism, to name a few. A virtual world provides three important features: an interactive 3D environment, avatars for visual representations of the users, and a chat tool for

communication (Dickey, 2011). Second Life offers both text and voice chat. Interactivity refers to actions that users can take and may affect other users' states or actions (Kim, 2013). Users roam around freely, mostly without predetermined goals, socialize with others, and create or manipulate virtual objects (Jestice, 2010). As opposed to video games, virtual worlds do not usually offer a mission to accomplish and offer less sophisticated graphics.

For many students and teachers, virtual worlds are fun and combine some of the best teaching tools from distance education, face-to-face, and virtual reality into a viable educational medium with virtually unlimited capabilities (Smith & Berge, 2009). Virtual environments may also offer many opportunities for people with disabilities in terms of social experiences (Stendal, Balandin, & Molka-Danielsen, 2011). Attending virtual concerts and experiencing other cultures and countries through virtual traveling are some of the benefits of the elimination of physical barriers. Other benefits, which may increase the quality of life, include the elimination of barriers to social participation, such as sharing a sense of a community (Stendal et al.).

Virtual reality helps students gain a greater understanding of abstract concepts; students can improve their understanding by manipulating and scaling virtual objects or environments; and they can visit places that distance, time, or safety concerns would normally prohibit (Jackson & Fagan, 2000). This means that learners can immerse in situations that would be impossible or impractical in real life (e.g., *Nanotechnology Island* offers an exploration of the minute details of the most miniature, microscopic technology that humans have developed), take advantage of 3D data visualizations (such as the Pythagorean theorem), see hidden unseen phenomena (forces directed on an

object), and have easy access to museum artifacts, such as the *Splo Museum* with more than 100 hands-on scientific exhibits (Rothfarb & Doherty, 2007).

In recent years, educational researchers and teacher educators have shown great interest in the use of virtual worlds in instructional design and assessment (Chapman & Stone, 2010; Jarmon et al., 2009; Johannesen, 2013; Mayrath, Traphagan, Heikes, & Trivedi, 2011; Schiller, 2009), the use of virtual worlds in inquiry-based learning (Barab, Sadler, Heiselt, Hickey, & Zuiker, 2010; Good et al., 2008; Lin & Tallman, 2006; Nelson & Ketelhut, 2007), the use of virtual worlds in inquiry-based learning in special education (Harlow & Nilsen, 2011; Kleemans, Segers, Droop, & Wentink, 2011), and the use of virtual worlds for language development (Aydin, 2013; Balcikanli, 2012; Blasing, 2010; Grant & Clerehan, 2011; Hislope, 2009; Ishizuka & Akama, 2012; Knutzen & Kennedy, 2012; Mroz, 2012; Wang, Calandra, Hibbard, & Lefaiver, 2012; Wang, Song, Stone, & Yan, 2012; Wehner, Gump, & Downey, 2013, Zheng, Young, Wagner, & Brewer, 2009).

Despite the popularity of virtual worlds, however, research about their effectiveness in terms of learning remains far behind actual usage (Jestice, 2010). While many possible benefits of virtual realities in learning have been investigated (e.g., Dalgarno & Lee, 2010; Warburton, 2009), systematic research testing the effectiveness is still in its infancy (Jestice, 2010). A few examples of empirical research provide compelling evidence of effective learning, for example about project-based experiential learning (Jarmon et al., 2009), biology experiments in virtual laboratories on Genome Island (Clark, 2009), and interview practice at virtual international borders by students of Justice Studies (Hudson and Degast-Kennedy, 2009).

Virtual Environments for Special Education Purposes

One of the purposes of the intervention was to enculturate special education teachers into virtual worlds and have them reflect on the potential of virtual worlds for special education students, with a focus on social skills practice. Virtual environments have been shown to offer potential affordances to develop social and communicative skills and provide educational intervention for individuals with social skills challenges, such as autism or Asperger. As early as 1999, Trepagnier suggested that virtual reality may support learning in people with cognitive and perceptual impairments (including autism) because the technology can mediate planning, problem-solving, behavior management, and communication for people with limited expressive language. Similarly, virtual reality can be a useful learning resource, not only because it offers independent practice in a safe test and training environment, but also because the gaming aspects enhance user motivation (Rizzo & Kim, 2005). Parsons and Mitchell (2002) emphasize that interaction can take many forms to replace face-to-face communications, which many individuals with autism may find threatening.

Mitchell, Parsons, and Leonard (2006), for instance, demonstrated how virtual environments could be used to teach social understanding and empathy to adolescents with autism. Training in a virtual café led to significant improvements in the participants' judgments and explanations about where to sit. Virtual worlds can help to develop the ability to identify emotions of avatars (Moore, Cheng, McGrath, & Powell, 2005) and result in significant increases on social cognitive measures and emotion recognition, as well as in real-life social and occupational functioning (Kandalaft, Didehbani, Krawczyk, Allen, & Chapman, 2013).

The key advantages of a virtual environment for people with social skills challenges include: (a) anonymous interactions and high levels of interactivity without requiring the complex language and social behavior that are typically necessary for face-to-face conversations (Fusar-Poli, Cortesi, Borgwardt, & Politi, 2008); (b) a relatively safe space where social mistakes are less catastrophic than in a face-to-face environment (Strickland, 1997); (c) a virtual space where a sense of collaboration, community, and cohesion can be developed, and where rules can be learned and tasks repeated as many times as needed (Fusar-Poli et al., 2008). Individuals with social skills challenges will experience less stress in all of the above situations if they can have these interactions in a virtual space that reduces the stress and sense of risk that can occur during face-to-face interaction with another person (Bernardini, Porayska-Pomsta, & Smith, 2014; Smith, Swanson, Holverstott, & Duncan, 2007). Virtual environments are considered a suitable platform for the simulation of social events, potentially allowing insight into others' minds.

Individuals who find the real world challenging can gradually learn to cope with their real life challenges in a virtual world (Burstin & Brown, 2010). While they are in an inviting and motivating virtual environment, they tend to forget their limitations or disability (Burstin & Brown). Virtual environments can also be used in situations that are too risky. Coles, Strickland, Padgett, & Bellmoff (2007) concluded that virtual worlds constitute a highly effective method for teaching safety skills to high-risk children with learning difficulties. Neel (2006) suggested that virtual reality could be used to teach social skills to students with emotional behavioral disorders who tend to demonstrate low engagement in class. In a virtual environment, the students' rewards for inappropriate

responses/behavior could be reduced while rewarding appropriate choices. The difference to a real-world environment would be that a virtual environment provides a risk-free place to learn and practice appropriate responses to stressful situations (Neel).

Another option of using virtual reality might be to block unwanted impulses in children with severe attention deficit-hyperactivity disorder (Neel, 2006). Rose, Brooks, and Rizzo (2005) reported about the potential of virtual reality in the rehabilitation of disabilities resulting from brain injury, including executive dysfunction, memory impairments, spatial ability challenges, and attention deficits. In DeAngelis (2009), patients entered a protected area in Second Life where their avatars practiced communicating and negotiating in realistic settings under the guidance of a therapist. The therapist only entered the scene when the client needed help. After practicing social skills in a safe space with therapeutic aims, for example on *Brigadoon,* a private Second Life destination designed for individuals with autism, individuals can venture out to public virtual spaces and interact with anyone (Gorini, Gaggioli, Vigna, & Riva, 2008).

In sum, the potential benefits of virtual worlds for students with autism are that the users can role play (Parsons & Mitchell, 2002), learn social rules and social skills (Cobb et al., 2002, Rutten et al., 2003), have control over their learning experience (Cheng, Moore, & McGrath, 2002), can practise and learn by their mistakes (Cobb et al.), and can learn at their own pace (Parsons, Mitchell, & Leonard, 2004) in a virtual environment that is increasingly realistic to represent the real world (Parsons & Mitchell, 2002). Overall, a review of these studies suggests that virtual environments do have potential in special education for the practice of social encounters (Newbutt & Donegan, 2010), "particularly in the realms of life and social skills, which may be difficult to

practice in the real world (Parsons & Cobb, 2011, p. 357), although the development of a robust technology that can make a real difference in real-world classrooms is still a challenge (Parsons & Cobb). Potential risks for students on the autism spectrum include the development of an obsession with computers, less willingness to interact in the real world (Parsons & Mitchell, 2002), and the rote learning of appropriate behavior without learning the social implications (Neale, Kerr, Cobb, & Leonard, 2002; Rutten et al., 2003). Despite an array of research conducted in the field of virtual environments and special education, I was unable to identify previous studies reporting about virtual worlds training for special education teachers. But because several studies paint a very encouraging picture of the potential of virtual worlds in assessing and educating individuals with autism, especially for social skills training, special education teachers may need appropriate training in the use of virtual worlds as assistive technology to help their students practice their social skills. By experiencing virtual activities in the intervention, the participating special education teachers will be able to model virtual world immersion to their students, which, in turn, will help their students to learn how to participate in virtual activities.

Pilot-Studies

Previous research about guidelines for 3D teachers, such as the management of virtual communication, group work, the alignment between course objectives and virtual activities, the pacing and scaffolding of activities, technical support and troubleshooting, and how to prompt interaction (e.g., Baker, Wentz, & Woods, 2009; Edirisingha, Nie, Pluciennik, & Young, 2009; Inman, Wright, and Hartman, 2010; Wheeler & Salmon, 2008) informed the design of a pilot study (Nussli, Oh, & McCandless, 2014). The pilot-

study provided empirical data about the perceptions of nineteen general education pre-service teachers (with teaching experience) of the usability of virtual worlds for education. The findings suggested that there is a need to provide future teachers with thorough virtual worlds experiences in teacher education programs in order to enable these teachers to familiarize with the potential of virtual worlds and to make informed decisions about its applicability to their students. Instead of simply demonstrating a teaching tool, a fully immersive experience is recommended to recognize the capability of virtual worlds. The findings led to the development of a Teacher Prep Virtual Worlds 6-Step Model with the following components: (a) a systematic, scaffolded introduction to a virtual world, (b) engaging in collaborative virtual explorations, framed by a pedagogical rationale and self-reflection, (c) identifying the unique affordances of virtual worlds, (d) having students design learning activities framed by a pedagogical rationale, (e) providing the assistance of a more experienced in-world facilitator, and (f) demonstrating how to locate subject matter directories in-world.

The second pilot-study (Oh & Nussli, 2014) offered recommendations and a virtual worlds teacher training model for special education teachers (without prior knowledge of virtual worlds). Twelve special education teachers collaboratively explored the usability of Second Life for special education to develop the ability to make informed decisions about the affordances and challenges of virtual world teaching and to help identify effective components for virtual worlds teacher training. Several key benefits of virtual worlds for special education students emerged from the qualitative analyses, namely, social skills practice, collaborative learning toward a joint goal with a competitive element, and increased motivation to participate, especially for topics that

would otherwise be perceived as less interesting. Almost all participants reported seeing the educational potential of virtual worlds if used strategically. Similarly, they agreed that virtual worlds could be motivating where other pedagogical techniques or other technologies might fail. In particular, they highlighted the potential for students with learning challenges and social skills practice.

A critical component of virtual worlds teacher training is that all educational virtual activities be framed by sound pedagogical rationales. School administrators might become increasingly accepting of the incorporation of virtual worlds into teaching if they are confronted with compelling evidence of purposeful and pedagogically sensible virtual teaching (Nussli et al., 2014). Increasing popularity of virtual teaching, in turn, may boost the demand for virtual worlds teacher training.

Unique Features of the Intervention

The intervention conducted in the present study was unique in five ways: namely, (a) the systematic design of the 7-Step Virtual Worlds Teacher Training Workshop, (b) the quantitative measurement of the participants' change in attitude before and after the intervention, (c) the explicit link between each step of the intervention and systematic inquiry, (d) the investigation of the effectiveness of the intervention components, and (e) the unique focus on special education teachers' identification of the special affordances of virtual worlds for special needs students. Another feature that was rare, but not unique, was the use of Skype for voice communication, rather than the built-in Second Life voice function. Typically, Second Life voice communication is replaced by text chat to lower technical barriers (Annetta, Murray, Gull Laird, Bohr, & Park, 2008; Edirisingha et al., 2009; Kirriemuir, 2010; O'Connor, 2009-2010). To take advantage of the benefits of

voice communication without risking technical issues, Skype was used in one of the seven intervention steps (details in Chapter 3). Next, I will describe the five unique features.

Systematicity. I identified only two studies that took a systematic approach to virtual worlds teacher training, namely, a virtual ethnography study by Guzzetti and Stokrocki (2013) and a case study by Campbell (2009). Their research goals, findings, and a critical evaluation are described in Chapter 2. Chapter 3 offers a comparison between Guzzetti and Stokrocki (2013), Campbell (2009), and the intervention.

Quantified change in attitude. I was unable to locate any other study that quantified the change in attitude before and after the training, except for the two pilot-studies that I co-authored (Nussli et al., 2014; Oh & Nussli, 2014).

Inquiry. "Inquiry should take the form of student-centered interactions with realistic materials and processes related to inquiry" (Nelson & Ketelhut, 2007, p. 267). While an inquiry approach in virtual worlds teacher training research is not unique, it seems to be rare. I only found three other studies about virtual worlds teacher training (Campbell, 2009; O'Connor, 2009-2010; Omale, Hung, Luetkehans, & Cooke-Plagwitz, 2009) that used an inquiry approach. None of the three studies, however, have made the systematic connections between the individual steps and the inquiry approach explicit.

Validating effectiveness of intervention. In the same vein, I was unable to find any previous studies that specifically investigated the effectiveness of virtual worlds teacher training and its individual components. In addition, no other study has used the same components, although Guzzetti and Stokrocki (2013) and Campbell (2009) have used several components and instruments that were quite similar to those used in this

intervention. The design of the instruments used for the intervention has been inspired by all 18 studies reviewed in Chapter 2.

Special affordances for special education. Finally, another unique feature of the intervention is the teacher sample. Except for the second pilot-study (Nussli & Oh, 2014), I found no other study that introduced special education teachers to virtual worlds, although there are numerous studies investigating the usability of virtual worlds for special education learners. Measuring the perceptions of special education teachers of the special affordances of virtual worlds and recording their ideas for learning activities resulted in rich and unique data that are likely to advance the effective use and design of virtual learning activities for special needs students. Although the 18 studies reviewed in Chapter 2 offer very valuable findings, 17 of them were conducted with general education teachers who may not have had the same insight into the special affordances of virtual worlds that special education teachers may have. Chapter 2 will provide more details about how these unique features emerged from the review of the existing research.

Purpose of the Study

The primary purpose was to determine special education teachers' perception of the effectiveness of a five-hour long, systematic 7-Step Virtual Worlds Teacher Preparation Workshop in terms of enabling them to make informed decisions about the usability of Second Life for students with social skills challenges. For the purposes of the intervention, "effective" virtual worlds teacher training is defined as the participants' ability to make informed decisions about using virtual worlds in both K-12 and higher education, with a special focus on special education. Figure 1 displays an overview of the steps.

Virtual Worlds Teacher Training Intervention	Step 1: Preliminary Survey
	Step 2: Unique Affordances & Resources
	Step 3: Virtual Exploration
	Step 4: Lesson Plan Presentation
	Step 5: Written Reflection
	Step 6: Lesson Plan Analysis
	Step 7: Post-Survey

Figure 1. Overview of the intervention.

A secondary purpose was to determine whether there was a teacher change of attitude resulting from engagement in a systematic intervention. A third purpose was to determine the special education teachers' perceptions of the usability of virtual worlds for special education (especially for students with social skills challenges), the benefits and challenges of virtual worlds as well as their usability for collaborative learning.

Eighteen special education teachers collaboratively explored one prominent example of virtual worlds, namely Second Life, during five hours over a period of two weeks. The intervention guided participants in a variety of critical and purposeful virtual explorations, framed by an inquiry-based approach. Mixed methods were used for data analysis. A survey measured whether or not there was a change of attitude toward the usability of virtual worlds in education as a result of the intervention and if it was statistically significant. Qualitative analyses were based on seven instruments. The data

informed the design of effective virtual worlds teacher training, the usability of virtual worlds for special education students, and best practices in virtual teaching.

Research Questions

The intervention was guided by the following primary research questions:

1. What are special education teachers' perceptions of the effectiveness of the systematic 7-Step Virtual Worlds Teacher Training Workshop in terms of enabling them to make informed decisions about the usability of virtual worlds for special education?
2. To what extent is there a teacher change of attitude toward the usability of virtual worlds for special education resulting from engagement in the systematic 7-Step Virtual Worlds Teacher Training Workshop?
3. What are special educators' perceptions of the usability of virtual worlds for special education, especially to practice social encounters for individuals with social skills challenges?

Two sub-questions are embedded within the third research question:

4. What are special educators' perceptions of the benefits and challenges of virtual worlds for special education?
5. What are special educators' perceptions of the potential of virtual worlds for collaborative learning?

Theoretical Framework

The intervention was built upon three constructivist theories: experiential learning theory, inquiry-based learning, and sociocultural theory. Constructivist accounts of learning highlight people's contribution to the construction of knowledge (Bredo, 1997).

Three systematic components were incorporated into the design of the intervention: experience, analyze & reflect, and collaborate. It will be explained how each of the three theories was represented in the intervention, how they overlapped, and what their unique contributions were.

Experiential Learning Model (ELM)

The intervention revolved around active virtual experimentation and reflective observations, both of which are representative of experiential learning theory. The experiential learning model (de Freitas & Neumann, 2007) extends Kolb's experiential learning model (1984) to adapt the use of 3D applications. Experiential learning theory, grounded in the fundamental theoretical work of Dewey, Lewin, and Piaget (Jarmon et al., 2009; Kolb, Boyatzis, & Mainemelis, 2002), puts experience at the center of learning, which allows students to become involved into learning actively and take responsibility for their learning. Kolb's experiential learning model builds understanding through the four steps: concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb et al., 2002). The experiential learning model allows teachers to rethink how they teach in 3D spaces "where learning sequences and experiences are choreographed to support peer interactions" (de Freitas & Neumann, 2007, p. 1). Rather than emphasizing curriculum development, the experiential learning model revolves around sequencing learning experiences, collaboration, peer feedback, and reflection. Experiential learning has systematically been built into two steps of the intervention. Specifically, the participants explored virtual worlds themselves (rather than watching a presentation of someone else's virtual explorations), created virtual learning

activities, and tried out, evaluated, and modified virtual lesson plans designed by other educators. Details are described in Chapter 3.

Following Kolb's (1984) experiential learning cycle concept, users of virtual worlds can act on the objects in the 3D environment, which allows them to learn by doing, to observe the outcomes of their actions, to test their hypotheses about the world and to reflect further on their own understanding (Hew & Cheung, 2010). Dalgarno and Lee (2010) identified experiential learning as one of five unique affordances of virtual worlds for learning. For example, experiential learning tasks facilitate learning that would be impractical or impossible in the real world (Dalgarno & Lee, 2010), such as exploring the inside of a volcano or being immersed in a tsunami. Similarly, Warburton (2009) included experiential learning among several types of teaching approaches in virtual worlds, and Hew and Cheung (2010) found that virtual worlds may be used as experiential spaces, communication spaces, and simulations. Virtual worlds have been widely recognized as suitable spaces for experiential learning (Cobb, 2007; Dalgarno & Lee, 2010; de Freitas & Neumann, 2007; de Freitas & Oliver, 2006; Hew & Cheung, 2010; Inman et al., 2010; Jarmon et al., 2009; Mantovani, 2001; Warburton, 2009).

First-hand experience, analysis, and reflection are common features of experiential learning and inquiry-based learning. The unique feature of experiential learning, according to the experiential learning model by de Freitas and Neumann (2007), is the sequencing of the individual steps, which is also a critical feature of inquiry-based learning. An added value of inquiry-based learning is that it offers a way to systematically advance first-hand experience and reflection in tandem.

Inquiry-Based Learning

The special educators' enculturation into virtual worlds is set in the context of inquiry-based learning. In the National Science Education Standards (NSES), the National Research Council (1996) defined inquiry as:

> a multifaceted activity that involves making observations; posing questions; examining books and other sources of information to see what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answers, explanations, and predictions; and communicating the results. Inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations. (p. 23)

Figure 2 displays the inquiry cycle that I adapted from Lin and Tallman (2006) for the purposes of this intervention.

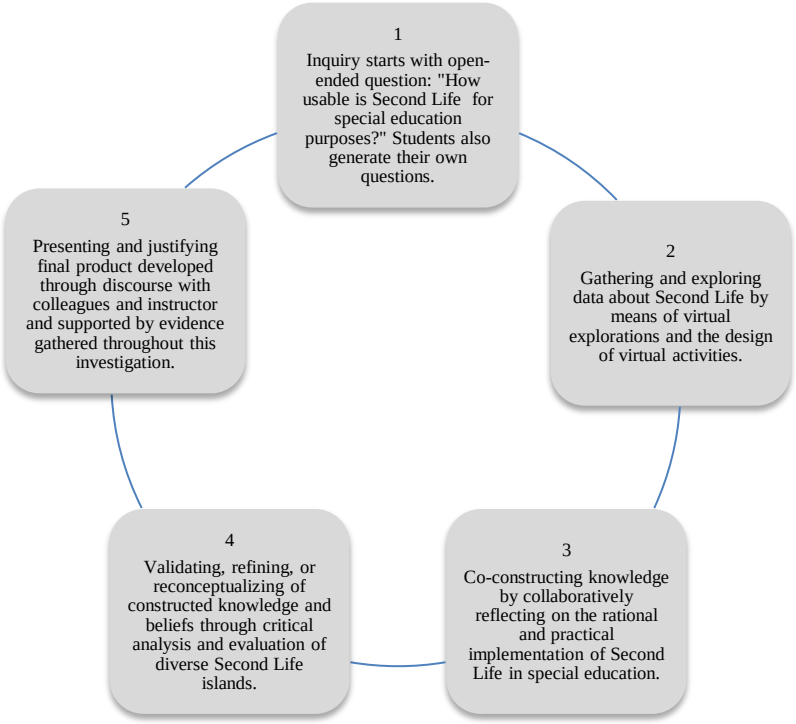

Figure 2. The inquiry cycle informing the intervention (adapted from Lin & Tallmann, 2006).

All steps of the virtual worlds teacher training have been designed from an inquiry perspective. (I will discuss in Chapter 3 how I have aligned each of the seven intervention steps with the inquiry approach.) The key steps included: familiarizing with Second Life, reading and discussing research about the unique affordances of virtual learning environments, experiencing Second Life first-hand by collaboratively exploring a variety of Second Life regions and creating tasks supported by a rationale, reflecting on and discussing the potential of these regions for special education, analyzing and evaluating existing Second Life lesson plans, and making an informed decision based on first-hand experience.

The inquiry-based approach is frequently associated with collaborative learning (e.g., Edge, 2002; National Research Council, 2000). Collaboration is also an integral part of sociocultural theory (Vygotsky, 1978) and the experiential learning model (de Freitas & Neumann, 2007). The added value of sociocultural theory, however, is the focus on the dialogic processes that have systematically been built into five steps of the intervention.

Sociocultural Theory

Social learning theories build on both cognitive and humanist learning theories and are based on the premise that learning is a social activity that happens in relationship with others (Bradbery, 2007; Prawat, 1996). They have been constructed mainly on the foundation of Vygotsky's (1978) sociocultural theory according to which all cognitive learning occurs at the social level before it becomes learning at the individual level. Throughout his work, Vygotsky (1978) emphasized the importance of social influence and experience on human development.

In the intervention, a Vygotskian perspective helped to frame the special educators' experience as a catalyst for professional growth. The sociocultural framework emphasizes cooperation, interaction, discourse, and participation processes (Lipponen & Kumpulainen, 2011), for example, when students engage socially in discussions and collaborative activities and when task achievement is contingent on collaboration, that is, collaborative learning involves tasks that can only be accomplished if the participants work together. Practical examples of collaborative activities in virtual worlds can be found in Stichter et al. (2014) who asked their participants to plan a vacation together (where to go, what to pack, negotiating means of transportation), build a restaurant (negotiating types of menus, building, and managing a budget), and help the king in a medieval castle find missing items. Another example of collaborative learning has been described in Morgan (2013) who used the U.S. Holocaust Museum in Second Life to facilitate a more intimate encounter with a historical event and as a venue for a student-led history discussion group, combined with historical inquiry, research, and creativity. To facilitate social presence and foster socialization, virtual learning activities for 3D spaces could be designed in a way that helps students establish an online identity, understand how the online environment can be used for learning, and develop trust and mutual respect to work together at common tasks online (Edirisingha et al., 2009). In addition, if the tasks are socially meaningful, they have the potential to spur cognitive development (Tasker, Johnson, & Davis, 2010).

The dynamics of virtual world help to bring people with a shared interest together to form large communities. "They arrive at an informal synergy, using each other's virtual skills to achieve the benefit of all the parties involved. These specialized

communities within virtual worlds are thus customized to be especially engaging to their members" (p. 84, Franceschi, Lee, Zanakis, & Hinds, 2009). Group engagement emerges when the participants participate in the whole process, that is, they do not stop engaging after they have completed their own specific task and they actively support each other from the beginning to the end of the process (Franceschi et al.).

The internalization of knowledge from interaction is termed appropriation (Wertsch, 1998), and the appropriation of cultural tools, such as language, facilitates the engagement in meaningful tasks (Driver, Asoko, Leach, Mortimer, & Scott, 1994). Cooperative development is an inquiry-based approach to professional development designed by Edge (2002), which helps to create mediational space for the participating teachers in which they can articulate their concerns amidst a learning community. In a dialogic process, speakers are required to articulate their ideas clearly, thereby sharpening their own understanding. Identifying a gap between educators' technology background and the digital culture of the 21st century may push educators beyond their comfort zones and force them to externalize these conflicts through active engagement.

A group of mostly U.S. interpreters of Vygotsky focus on dyadic interaction, an approach in which "a more knowledgeable other structures the learning experience in a way that allows the novice to overcome whatever limitations in skill might impede his or her attainment of a desired goal" (Prawat, 1996, p. 217). In this intervention, the instructor assumed the role of the more capable peer and supervisor and guided the participants through a reflective process about the usability of virtual worlds for special education. I, in my role as the in-world assistant, assumed a similar role to help the participants overcome the steep learning curve that is typical of virtual worlds.

The supervision and assistance offered to the participants during the intervention are borrowed from Lave and Wenger's (1991) framework of legitimate peripheral participation. Supervision and assistance as well as mutual support among the participants were necessary to help the participants, who were relative newcomers to virtual worlds, to move from their actual participation to full participation in a community of practice, in this case a community of virtual educators. "Only with enough legitimacy can all their inevitable stumbling and violations become opportunities for learning rather than cause for dismissal, neglect, or exclusion" (Wenger, 1998, p. 101).

Rogoff (2003) suggested that people's participation in cultural activities generates a dynamic process, which, in turn, has the potential to transform individuals' understanding. Documenting thoughts, such as journal writing in the intervention, is an essential process of active transformation. Rogoff called this process participatory appropriation. The participants of the intervention will have ample opportunities for individual and collaborative reflection, which may ultimately lead to a reconceptualization of their attitude toward the use of virtual worlds in education, thereby resulting in the internalization of knowledge (Vygotsky, 1978, p. 90).

Three-dimensional virtual environments have been widely recognized as effective mediators of collaborative learning activities (de Lucia, Francese, Passero, & Tortora, 2009; Ho, Nelson, & Müeller-Wittig, 2011; Konstantinidis, Thrasyvoulos, Theodouli, & Pomportsis, 2010; Schmeil, Eppler, & de Freitas, 2012; Warburton & Pérez-García, 2009; Yang, Yeh, & Wong, 2009). Based on the findings of the two pilot-studies (Nussli et al., 2014; Oh & Nussli, 2014), my theory of action is that the participants in the intervention developed a feeling of community on which they can rely for mutual support

during their virtual explorations. Participants in the pilot-studies mentioned repeatedly how much they had appreciated the collaborative setting and that they would have been overwhelmed by the learning curve required to navigate and communicate in Second Life if they had had to work individually. Most participants of the pilot-studies agreed that they had achieved a better result by working collaboratively than would have been possible through individual performance and that the discussions and negotiations with their peers had helped them to reconceptualize their beliefs. These findings are in support of Johnson, Johnson, and Holubec (1998), who reported that collaboration is associated with greater efforts to achieve and more positive relationships among students, including a sense of community, social support, and cohesion. The support built into Second Life in the form of communication tools facilitates social interaction, collaboration, and shared immersion (Jarmon et al., 2009). Second Life and Skype are the technical tools that helped to mediate learning in the intervention.

While the three systematic components of the intervention - experience, analyze & reflect, and collaborate - heavily draw from the experiential learning model (de Freitas & Neumann, 2007), each of the three theories offers added value to the design and rationale of the intervention.

Significance of Study

The study of special educators' enculturation into virtual worlds by means of a systematic virtual worlds teacher training is significant for several reasons. I have discussed five unique features of the intervention in the Background and Need section, namely, (a) the systematic design of the intervention, (b) the quantitative measurement of the participants' change in attitude before and after the intervention, (c) the explicit link

between each step of the intervention and systematic inquiry, (d) the investigation of the effectiveness of the intervention components, and (e) the unique focus on special education teachers' identification of the special affordances of virtual worlds for special needs students. I anticipate the following additional benefits.

Most importantly, the intervention could be used in teacher education programs nation-wide with minor adjustments. The enculturation into virtual worlds assisted teachers in developing an understanding of the pragmatics of 3D technology integration into their teaching. Based on the results of the pilot studies, I hypothesized that a fully immersive experience with extensive practice opportunities was bound to provide a valuable overall experience. The intervention was important because the participating special education teachers validated the effective components of virtual worlds teacher training, which, in turn, provide empirical guidelines for other teacher educators who wish to incorporate a similar training.

The intervention was also important because it was an attempt to bridge the divide between digital immigrants (Prensky, 2001) who have not grown up with technology and digital natives (Prensky) who have grown up with technology. The intervention was intended to ease the participating teachers' transition into the use of 3D technologies. The convergence of the traditional education and the digital learner is a conflict of cultures (Prensky, 2006). Academic professionals can be expected to have a good command of digital media literacy so that they can support students in developing digital media literacy skills (NMC Horizon, 2012). Due to a limited amount of training, however, teachers often feel that they lack technical support, the skills, or a pedagogical rationale for using technology in their teaching (NMC Horizon). The combination of modeling,

scaffolding, and mentoring (Alvarez et al., 2009; Silva et al.; 2010) in the virtual worlds teacher training was a successful attempt to ease the participating teachers' transition into 3D virtual teaching.

The intervention helped teachers to overcome the steep learning curve in virtual worlds. Only few users with little or no experience in emerging technologies manage to overcome the technological threshold, while those educators who feel comfortable using technology in their teaching will easily learn the skills required for functioning in a virtual world (Warburton, 2009). Campbell (2009), for instance, reported that only 25% of pre-service teachers (N=24) participating in a focus group interview were planning to use Second Life in their future teaching although they acknowledged the educational potential of virtual worlds. Transitioning newcomers is one of the main challenges in virtual research (Dickey, 2011; DiPietro, 2010; O'Connor, 2009-2010; Storey & Wolf, 2010). Participants might be overwhelmed by a difficult interface and frustrated by hardware problems (Storey & Wolf, 2010) or they might reject virtual worlds because they see them as a venue for play rather than as a platform for learning (Cheal, 2009; Childs, Schnieders, & Williams, 2012). The intervention addressed these issues by providing appropriate preliminary virtual training and a systematic, scaffolded enculturation into virtual worlds.

The intervention filled a gap by preparing educators in the use of virtual worlds so that they can implement these tools in their teaching methodology (Collins, 2012). When looking at current teacher education, virtual worlds are still used sparingly. But once 3D teaching becomes more popular, teacher educators will want to model effective uses of virtual worlds to pre-service teachers. The participants in the intervention had the

opportunity to analyze learning experiences through the lens of a learner, thereby assisting them in developing meaningful guidelines for their future teaching.

Finally, the intervention was important because research into teachers' perceptions of the value of virtual worlds and how these perceptions impact their virtual teaching practice advances our understanding of the educational potential of virtual worlds, especially for students with social skills challenges. As 3D teaching is becoming increasingly popular, it is critical to continue to build on best practices of virtual worlds teacher training. Teachers' buy-in to the use of virtual worlds, however, may be intricately linked with effective teacher training. As a result, one of the key steps is to secure teachers' acknowledgment of the validity of virtual worlds for education. The intervention was important because it immerses teachers in purposeful virtual experiences, which has enabled them to make informed decisions about educational uses of virtual worlds.

Definition of Terms

Affordances. In the field of virtual worlds research, affordances describe unique benefits, such as in Dalgarno and Lee (2010) who abstracted five unique affordances of virtual worlds for education, namely, spatial representation, enhanced motivation, collaboration, experiential learning, and transfer. For a more in-depth discussion of affordances, please see Dalgarno and Lee (2010).

Avatar. A personizable three-dimensional representation of the self (Smart, Cascio, & Paffendof, 2007).

Collaborative learning. Students work in groups, mutually searching for understanding, solutions, or meaning, or creating a product. Collaborative learning represents a

shift from teacher-centered to learner-centered learning environments (Smith & MacGregor, 1992).

Digital immigrants. Individuals who have not grown up with technology before the advent of the digital age. The term was coined by Prensky (2001).

Digital natives. Individuals (students) who have grown up with technology during the digital age. The term was coined by Prensky (2001).

Griefers. Rogue users' avatars harassing others by using violence or inappropriate language.

Immersion. The degree of presence sensation perceived by the user, that is, users feel present in and physically connected with the 3D environment, rather than in their actual physical environment (Huang, Backman, & Backman, 2010).

Navigation. Moving around freely in a virtual world by using specific tools (e.g., arrows and shortcuts on keyboard, mouse wheel).

Second Life. A popular, interactive, real-time 3D environment that uses avatars for visual representations of the users and both a text and voice chat tool for communication (Dickey, 2005). Among all multi-user interactive environments, Second Life is the most popular social virtual world platform among educators (Salt, Atkins, & Blackall, 2008).

Social presence. "A feeling of group participation and belonging associated with multiple users of a virtual environment. Also referred to as 'group presence' or 'copresence'" (p. 80, Franceschi, Lee, Zanakis, & Hinds, 2009).

Traditional educators. This is a widely used term in the literature about virtual schooling. Jamison (2008), for example, offered the following definition: "Individuals

unfamiliar with the presence and personal use of ubiquitous connectivity and game-based technology in their daily experience" (p. 7).

Three-dimensional (3D). Having or appearing to have extension in depth. Enhances feeling of spatial immersion.

21st-century digital skills. A set of skills necessary for students to succeed in the digital age. Thirty-three digital skills have been identified for 21st-century teachers (Educational Technology and Mobile Learning, 2013). These encompass using and creating digital audio, video, blogs; social bookmarking to share sources; use infographics; compile e-portfolios; be knowledgeable about online security; creating and delivering asynchronous presentations and lessons; creating online surveys; using collaborative online tools; finding and evaluating authentic web content; using mobile devices; using digital note taking tools; annotating documents; using online graphic organizers, to name a few examples.

Usability. The degree to which using Second Life would enhance learning (adapted from Fetscherin & Lattemann, 2008).

Virtual world. "A computer-generated display that allows or compels the user (or users) to have a sense of being present in an environment other than the one they are actually in, and to interact with that environment" (Schroeder, 1996, p. 25). These online environments provide an illusion of 3D space. An avatar is used as a visual representation of the user.

CHAPTER 2

OVERVIEW OF THE LITERATURE

While the Background and Need section provided an introduction to the dispersion, benefits, and challenges of virtual schooling, as well as the difficult transformation from the traditional to the virtual teacher, the literature review will focus on identifying the key components of effective virtual worlds teacher training for learning and instruction purposes. I will establish the need for teacher training in emerging 3D technologies and reinforce the intricate link between teachers' buy-in to the use of virtual worlds and effective teacher training. This chapter concludes with the discussion of the findings of this review from the perspective of special education.

Background

Using Virtual Worlds in Teaching

Researchers recognize the need for teacher training in the pedagogically sound use of virtual worlds to accommodate digital learners' needs in the 21st century (e.g., Blankenship & Kim, 2012; Dalgarno & Lee, 2010; Molka-Danielsen, Deutschmann, & Panichi, 2009; Storey & Wolf, 2010), but research on pre-service teacher training and attitudes toward technology, especially in regard to using virtual worlds in education, is limited (Kennedy-Clark, 2011). Learning to use virtual environments as professional teaching tools is uniquely challenging (Haugen, Ask, & Bjoerke, 2008) because virtual teaching requires unique skills, as well as all of the skills necessary in a face-to-face classroom (Ferdig et al., 2009). Teaching and learning in an avatar-based virtual world might need a different set of skills than being able to use social networking sites, instant messaging, and chat programs (Blankenship & Kim, 2012).

One of the recommendations of the Horizon Report (NMC, 2010) has been to reconceptualize teacher education to prepare teachers for the skills needed by a 21st-century educator. Several obstacles to the development of these skills have been identified. For example, the lack of research from which to inform general or content-based practices in virtual school settings is a concern because many of the documents base recommendations and set standards on existing practice, which may lack empirical support (Ferdig et al., 2009). In the same vein, Oliver and Herrington (2003) have called for a re-engineering of the concept of learning design as opposed to a simple repacking of course content into a virtual format. New possibilities for teaching and learning entail a revision of curriculum design; simply using new technologies will not catalyze change (McWilliam, 2005).

There is also a risk that educators develop learning spaces and activities that fail to engage learners because they do not reflect on what it means to be engaged in a virtual space and ignore which factors prevent engagement (Mount, Chambers, Weaver, & Priestnall, 2009). All these concerns deserve being addressed when designing effective virtual worlds teacher training because teaching in these spaces appears to require yet another set of skills in addition to the skills required for teaching in 2D environments, such as course management systems or text-based discussion forums. I will address the following steps recommended for the design of effective virtual worlds teacher training: (a) establish need for virtual worlds teacher training, (b) identify empirical guidelines for teaching in virtual worlds, (c) extrapolate unique teaching skills from empirical research, and (d) convince teachers of unique affordances of virtual worlds for education.

Using Virtual Worlds Across Disciplines

A limited number of studies (e.g., Cheong, 2010; Christensen, Tyler-Wood, Knezek, & Gison, 2011; Gregory, Campbell, Knox, Dalgarno, Reiners, & Masters, 2011; Gregory & Masters, 2012; Muir, Allen, Rayner, & Cleland, 2013) have investigated the use of virtual world to prepare pre-service teachers for classroom practice. In other disciplines, however, virtual worlds have played a much more important role in staff training and development. The effectiveness of 3D environments as a tool to train and assess the competencies of professional staff has been demonstrated empirically in many fields, such as in the field of learning fire investigation (e.g., Davies & Dalgarno, 2008), disaster training (e.g., Farra, Miller, Timm, & Schafer, 2013), or learning to assess a quality system in the pharmaceutical industry on *Usalpharma Island* in Second Life (Maderuelo, Martin-Suarez, Perez-Blanco, Zazo, Cruz-Benito, & Dominguez-Gil, 2014). In the field of education, however, a ten-year critical review of empirical research on the educational applications of virtual reality by Mikropoulos and Natsis (2011) suggests that no definitive conclusions can be made regarding the retention of the knowledge gained in virtual worlds.

Most importantly, virtual environments have been used for simulations in healthcare and the military. The medical research suggests that virtual worlds may be valuable to teach technical skills, decision-making, and teamwork (Foronda, Godsall, & Trybulski, 2013). Foronda et al. provide an up-to-date systematic review of the use of virtual worlds in both the medical field (training of nurses, physicians, and emergency personnel) and the military field (emergency response to chemical, biologic, radiologic-nuclear, and explosive incidents). Although virtual clinical simulations (VCS) have been

used in nursing for a long period of time, a review has shown that only three articles out of 86 articles formally examined the use of VCS in nursing (Foronda et al.), leading to the conclusion that more research is needed to determine the effectiveness of VCS in nursing. Consorti, Mancuso, Nocioni & Piccolo (2012) arrived at similar conclusions in their meta-analysis on studies in which virtual patients were used either as an alternative method or additive to the usual curriculum versus interventions based on more traditional methods. The findings revealed that although there was evidence that virtual patients are effective, further research is needed to determine their most beneficial curricular integration and their cost/benefit ratio relative to other active learning methods. Farra and Miller (2013) conducted an integrative review to examine the demonstrated effectiveness of virtual reality training in disaster training of healthcare workers. Similar to the findings of the other reviews mentioned above, however, their results indicated a lack of studies in this area. They suggested that rigorous and larger studies with measurement of long-term retention were needed.

Two reviews resulted in more positive perspectives. Rizzo et al. (2011) provides an overview of how virtual worlds have been and should be used for military behavioral healthcare, documenting the clinical targets where virtual reality could add value to clinical assessment and intervention to prevent, identify, and treat combat-related PTSD in military service members. A systematic review by Sweigart, Burden, Carlton, and Fillwalk (2014) investigating the efficacy of virtual patients in medical education also provides promising results. Experience with 800 students substantiated that virtual worlds provide an effective, nonthreatening environment for developing interview skills across courses.

In conclusion, using virtual worlds for teacher education to practice classroom behavior has been limited, whereas virtual worlds research in the fields of healthcare and military abound. Due to the narrow focus of this study on teacher training, I have excluded studies from my literature search that were conducted in other disciplines, although I would recommend that educational researchers familiarize themselves with virtual worlds research done in other fields to benefit from their experiences. One commonality across the disciplines mentioned above is that there still seems to be a lack of quantitative studies demonstrating the effectiveness of learning and knowledge retention as well as a lack of longitudinal studies, which hinders systematic comparisons (e.g., meta-analysis).

Selection of Reviewed Literature

In order to gain further knowledge about effective virtual worlds teacher training and to delineate the extent to learning and instruction purposes, I used the following criteria for the article selection process:

1. Studies had to be specifically concerned with guidelines for teacher education in the use of virtual worlds.
2. Articles were peer-reviewed, data-based studies published between 2002 to 2013.
3. Studies had to include either quantitative, qualitative, or mixed method designs (no reviews or conference proceedings).

Article Selection

This literature review has explored the use of virtual worlds in teacher education within the past 12 years (2002-2013). The selection of key words for this search was based on an examination of articles written about this topic. After I determined the key

words and time frame, I applied the following descriptors (in italics) in four different types of search engines, namely, Education Full text, PsychINFO, Proquest, and ERIC: *Immersive virtual worlds, teacher education, educational technology,* and *Second Life.* This procedure, as well as the tracking down of references cited by relevant sources (backward reference search), yielded 35 articles. Next, I excluded the following studies: (a) empirical articles about pedagogical activities in virtual worlds with a focus other than virtual worlds teacher training, (b) empirical articles about virtual worlds teacher training with a sample other than teachers, and (c) theoretical articles. For example, in the excluded articles, the main focus may have been on the identification of course content and topics having educational applications in virtual worlds, on students' perceptions of the usability of virtual worlds, the use of connectivism when teaching in virtual worlds, the social and emotional aspects of learning in virtual worlds, on using virtual worlds to practice student behavior management, or on teachers' awareness of new media literacy.

If a study failed to specifically address teacher training, that is, the enculturation of teachers into virtual worlds to enable them to make informed decisions about their usability for education, it was excluded. This selection process excluded 17 studies resulting in a final selection of 18 studies that closely fit the literature review criteria, including two pilot-studies that I co-authored. Table 1 provides an overview of the purpose, the sample, the method, and the major findings of each of the 18 studies that focused on virtual worlds teacher training. This overview is important because it separates the 18 studies from the other supporting literature used to describe the affordances and challenges of virtual worlds.

Table 1

Overview of Studies With a Focus on Virtual Worlds Teacher Training

#	Authors	Purpose(s)	Sample	Major Findings
1 *	Annetta, Murray, Gull Laird, Bohr, & Park (2008)	To find a viable source for synchronous course delivery in a virtual world and to teach in-service teachers to design and create role-playing video games to supplement science instruction.	13 in-service teachers	Students would benefit from an increased sense of engagement, safe adventure, and challenge that virtual worlds offer. Feelings of connection among students may increase outside class, and the virtual environment might be more interesting and enjoyable than traditional classrooms.
2 *	Blankenship & Kim (2012)	To demonstrate how pre-service teachers (re)shape their pedagogic identities while immersed in professional development using Second Life and Skype.	12 pre-service teachers	Virtual environments enable pedagogic transformations among pre-service teachers if the teaching audience, developmental goals, and the venue of instruction are considered appropriately. The participants had to experience technical growth beyond their pedagogic transition.
3 ***	Bowers, Ragas, & Neely (2009)	To assess the value of Second Life among post-secondary instructors with experience in using Second Life as an educational tool.	162 in-service teachers	Respondents were divided into innovators (10.5%, more than two years of Second Life experience, lowest satisfaction score), early adopters (69.8%, six months to two years, highest satisfaction score), and early majority (19.8%, less than six months) based on their Second Life experience. Instructors who conducted classes fully in Second Life were significantly more satisfied than those who used it as only a small supplement to a real-world class.
4 *	Campbell (2009)	To investigate pre-service teachers' pedagogical approaches to using Second Life for specific cohorts and curricula with a focus on problem-based learning and to assess the potential of Second Life for education.	36 pre-service teachers	The majority reported that the problem-based learning task in Second Life made them feel more comfortable exploring new technologies and that they would not have been able to experience these as well on their own. Using Second Life assisted them in thinking innovatively and opening their minds to new experiences. They could all see the potential of Second Life, especially for high school classes.
5 *	Dickey (2011)	To investigate how K-12 teachers' perceptions of virtual worlds may impact the integration of new tools for teaching and learning.	8 in-service teachers	The teachers believed that their students would like the environment because of the game aspect, because they can visit different periods in history or other countries, and that students who are hard to engage in schoolwork would benefit. Distractions and security issues (adult content) were a concern. Most stated they would be more likely to use an environment that was already developed for specific content rather than creating it themselves.

Continued

* Qualitative, ** Mixed methods, *** Quantitative

Table 1 (Continued)

#	Authors	Purpose(s)	Sample	Major Findings
6 *	Edirisingha, Nie, Pluciennik, & Young (2009)	To identify affordances of virtual worlds for learning to develop pedagogical models and develop learning activities that facilitate social presence and socialization among distance learners for collaborative learning in Second Life.	4 pre-service teachers	The in-world socialization of this cohort of distance learners in Second Life extended to real-life network building. The creation of immediacy and social presence led to positive learning experiences. The ability to get their avatars to do things and to interact with the environment supported socialization. The learning scenarios worked well because of their purposeful learning design. A technologist provided support during the session.
7 *	Gamage, Tretiakov, & Crump (2011)	To explore teachers' beliefs and perceptions about learning affordances of multi-user virtual environments (MUVEs) and to measure differences in perceptions between educators without experience of teaching in MUVEs and early adopters of MUVE-based teaching.	33 in-service teachers	Educators without experience had an overall positive perception of MUVE adoption, similar to those with experience. Findings indicated that co-presence in Second Life increases motivation, shy students are more likely to interact, communication is more honest, and that Second Life is a valuable tool for creating environments that are not possible in real life. Meaningful interaction, however, may be difficult with large numbers of students, and there is more room for misinterpretation than in face-to-face interaction.
8 *	Guzzetti & Stokrocki (2013)	To measure teachers' perceptions of the usability of virtual worlds for teaching and to investigate their potential for developing teachers' resources, confidence, and digital skills by means of an 8-step workshop.	25 pre- and in-service teachers	Virtual worlds may support both K-12 and undergraduate curricula, but the lack of necessary technology to implement virtual worlds is an obstacle. The time needed for lesson planning or site building, student safety, a lack of funds to cover the costs of land, and age appropriateness were common concerns too. Several teachers planned to use Second Life to stimulate their students' critical thinking and to gain new insights into a concept or skill.
9 *	Kirriemuir (2010)	To provide an overview of how virtual worlds are being used for teaching and learning in UK universities and colleges.	42 in-service univer-sity teachers	Eighty percent of UK universities reported virtual world use in 2009. Second Life was by far the preferred choice. Main problems were a lack of time and funding, and technical issues within the institution. The IT departments not seeing any value in virtual worlds is another barrier, which points to a lack of awareness of emerging, technology-based teaching and learning practices.
10 **	Neely, Bowers, & Ragas (2010)	To investigate the extent to which the perspectives of post-secondary instructors with experience using Second Life as a teaching tool reflect the constructivist attributes of a rich environment for active learning (REAL).	162 in-service teachers	Second Life offers a great potential in realizing the attributes of a rich environment for active learning (REAL), namely, student responsibility and initiative, authentic learning context, authentic assessment, co-operative support, and generative learning activities. Technological barriers, institutional opposition, and limited familiarity, however, prevent some instructors from fully implementing Second Life into their curricula.

Continued

* Qualitative, ** Mixed methods, *** Quantitative

Table 1 (Continued)

#	Authors	Purpose(s)	Sample	Major Findings
11 **	Nussli, Oh, and McCandless (2014)	To enculturate general education pre-service teachers into the use of Second Life and enable them to make informed decisions about the usability of Second Life for education by means of a systematic 7-step workshop.	19 pre-service teachers	The difference between the participants' two attitude scores generated by the pre- and post-survey was found to be statistically significant with a large effect size. Results suggested that this 7-Step Virtual Worlds Teacher Training Workshop had a positive impact on the participants' attitude toward integration of Second Life into teaching. Five themes emerged with regard to the unique affordances of the Abyss Observatory's deep-sea area. The "Teacher-Prep Virtual World Six-Step Model" for effective pre-service teacher preparation for teaching in Second Life was developed.
12 *	O'Connor (2009-2010)	To identify the most effective activities in Second Life as well as social and collaborative gains.	34 pre-service teachers	The cumulative insights from groups likely generated more creativity than would have been possible in most online courses. Second Life provided the opportunity to interact at a distance in more personal ways and reduce social isolation. The physical presence as an avatar may support these relationships.
13 *	O'Connor & Sakshaug (2008-2009)	To describe preparatory activities when considering using Second Life within an online course environment for K-12 science and math teachers wishing to use Second Life in their teaching.	in-service teachers (N=?)	There are many possibilities to develop instructional components, such as exploratory studies to simulate real world studies. Examples include polling avatars, investigating social groupings as well as visiting science and professional sites. Social networking, collaboration, and community building can be facilitated through meetings, presentations, and discussions.
14 **	Omale, Hung, Luetkehans, & Cooke-Plagwitz (2009)	To examine the impact of 3D MUVE attributes on collaboration and interaction for an online problem-based learning activity by focusing on how the 3D MUVE attributes sustain collaboration and interaction.	8 pre-service teachers	First, virtual worlds were fun and engaging, but it was easy to get off task. Participants occupied a great deal of time in social interaction to build social presence but were unable to fully transfer this rich group synchronization to the cognitive goals of learning. Virtual worlds attributes helped negotiation, clarification, and brainstorming among participants, but had relatively less influence on the organization and convergence of problem solutions.
15 **	Oh and Nussli (2014)	To enculturate special education teachers into the use of Second Life and enable them to make informed decisions about its usability for education in a systematic 11-Step Workshop.	12 in-service teachers	Social skills practice, collaborative learning toward a joint goal with a competitive element, and increased motivation to participate emerged as key benefits. Guidelines for virtual worlds teacher training and the elements of an ideal educational Second Life sim were identified. No statistically significant change of attitude toward the usability of virtual worlds was found.

Continued

* Qualitative, ** Mixed methods, *** Quantitative

Table 1 (Continued)

#	Authors	Purpose(s)	Sample	Major Findings
16 **	Pérez-García (2009)	To develop teachers' virtual competencies and skills that help to increase learners' motivation and participation.	162 in-service teachers	Second Life offers a limited set of tools for managing advanced collaboration between teams, compared with most groupware applications. In-world cooperation and synchronous learning interactions can be improved by scaffolding them with external tools that provide a persistent space.
17 *	Silva, Correia, & Pardo-Ballester (2010)	Two faculty members engaged in a semester-long collaborative effort (mentoring) to understand how they can use Second Life in teacher education and language learning.	2 in-service teachers, 1 mentor	The roles of mentor and mentee were interchangeable because the mentor was also learning as a result of the mentoring relationship. Imitation and modeling were found to be more effective than when the mentor just told the mentees what to do. Mentees found it reassuring to have a Second Life 'buddy' for personal interaction, collaboration, and to feel a sense of belonging.
18 *	Storey & Wolf (2010)	To identify how learning in Second Life impacts learning opportunities from the perspective of instructors, students, and technologists providing expertise, support, and guidance.	13 pre-service teachers	All respondents agreed that they had been encouraged to take responsibility for their own learning, that the delivery methods of this course helped with their learning, and that they had acquired skills that would be useful in their profession. Their statements reflected six common stages of development: novice, frustration, perseverance, comfort, risk-taking, and competence.

* Qualitative, ** Mixed methods, *** Quantitative

Guidelines

Existing Guidelines for Educators

In addition to knowing what a virtual world is, educators would benefit from learning why, how, and when to use it; which virtual world to use for which target population (age, gender, education level, interest, achievement levels, personal characteristics); how to create tasks for which purpose; how to align tasks with objectives and curriculum (Delwiche, 2006); and how objectives may be met or enhanced using virtual worlds (Mayrath et al., 2011). Schools would also benefit from allowing teachers and learners time for up-skilling and providing continued support in the planning and incorporation of virtual activities (Dalgarno & Lee, 2010; Eaton, Guerra, Corliss, & Jarmon, 2011; Ketelhut & Schifter, 2011). Existing guidelines include the need for a pedagogical rationale, synchronicity, scaffolding, prior virtual experience, stimulating places, functional design, and technical support. Each guideline will be briefly outlined. Table 2 shows a summary of the guidelines and the extrapolated teaching skills.

Table 2

Existing Guidelines and Extrapolated 3D Teaching Skills

Guideline	Extrapolated 3D Teaching Skills
Pedagogical Rationale	• The ability to recognize that the affordances of virtual worlds are only valid for education if supported by a solid pedagogical rationale, including the ability to reflect on questions such as why rather than how a virtual space should be used with students (Alvarez et al., 2009; Ham & Davey, 2005; de Freitas & Neumann, 2007; Silva et al., 2010). • The ability to establish a clear connection between course objectives and well-aligned activities in virtual worlds (Alvarez et al., 2009; Baker et al., 2009; Bower et al., 2009; Brown, Davis, & Kulm, 2011; Correia & Ballester, 2010; Ham & Davey, 2005; Davidson Smith, 2009; de Freitas & Neumann, 2007; Delwiche, 2006; Dickey, 2011; Ellis & Anderson, 2011; Good et al., 2008; Inman et al., 2010; Mantovani, 2001; Mayrath et al., 2011; O'Connor, 2009-2010; Silva et al., 2010).
Synchroni-city	• The ability to encourage and manage virtual communication, to keep the virtual group together, and to have a system to know who is speaking is key to taking advantage of the social and communicative affordances of synchronicity (Annetta et al., 2008; Annetta & Shymansky, 2005; Bowers et al., 2009; Edirisingha et al., 2009; Ham & Davey, 2005; O'Connor, 2009-2010; Pérez-García, 2009).
Scaffolding	• The ability to provide continuous scaffolding because more authentic, challenging, and open-ended problems in ill-structured environments can be problematic for students (Hills & Hannafin, 2001). • The ability to implement scaffolding guidelines, such as by discussing procedures, goals, and clear expectations before a virtual session (Ellis & Anderson, 2011, Delwiche, 2006; Good et al., 2008; Mayrath, Sanchez, Traphagan, Heikes, & Trivedi, 2007; McVey, 2008; Nussli et al., 2014; Oh & Nussli, 2014; Pérez-García, 2009; Rappa, Yip, & Baey, 2009; Sanchez, 2007) and continuous support by a more experienced mentor (Silva et al., 2010).
Prior Experience	• The ability to evaluate students' prior experience and technical skills because these factors impact students' attitude toward the use of virtual worlds in education and will determine the needed amount of scaffolding (Campbell, 2009; Cheal, 2009; Compton et al., 2010; Jarmon et al., 2009; Mayrath, 2011). • Using virtual fieldtrips and observations are preferable to reliance on self-reports (Jarmon et al., 2009).
Stimulating Spaces	• The ability to identify and use creative and visually stimulating virtual spaces (Dalgarno, 2002; de Winter, Winterbottom, & Wilson, 2010; Good et al., 2008; Guzzetti & Stokrocki, 2013; Masters & Gregory, 2010; Neely et al., 2010; Oh & Nussli, 2014; Omale et al., 2009; Warburton, 2009) that support experiential learning (Gamage et al., 2011) rather than sending students to virtual spaces that attempt to replicate the brick and mortar classroom (Gough & Dearnle, 2009). • The ability to give students the responsibility for their own learning by taking advantage of the creative environment, free of real-world constraints (Good et al., 2008).
Functional Design	• The ability to recognize the varying functionality of virtual spaces and to reflect on which transient space best accommodates which task (Gough & Dearnle, 2009; Molka-Danielsen et al., 2009).
Technical Support	• The ability to overcome the steep learning curve by having a positive or neutral attitude toward the potential of virtual worlds for learning and instruction (Jamison, 2008). • The ability to troubleshoot technical issues and the willingness to closely collaborate with a technical facilitator (Boland, 2009; Bowers et al., 2009; Brown et al., 2011; Eaton et al., 2011; Edirisingha et al., 2009; Ellis & Anderson, 2011; Ferdig et al., 2009; Guzzetti & Stokrocki, 2013; Ketelhut & Schifter, 2011; Kirriemuir, 2010; Mayrath et al., 2011; Minocha, Tran, & Reeves, 2010; Neely et al., 2010; Nussli et al., 2014; O'Connor & Sakshaug, 2008-2009; Oh & Nussli, 2014; Omale et al., 2009; Pérez-García, 2009; Storey & Wolf, 2010; Warburton, 2009) and the willingness for technical growth beyond the pedagogic transition into a virtual teacher (Blankenship & Kim, 2012).

Pedagogical rationale for teaching in a virtual world. "There is no natural purpose [in virtual worlds] unless one creates one" (Warburton, 2009, p. 416). Even if an educator masters all the skills required to facilitate the tasks outlined above, there is still no guarantee for effective teaching: The affordances of virtual worlds are only valid for learning and instruction if supported by a solid pedagogical rationale (Dickey, 2011; Good et al., 2008; Ham & Davey, 2005; Mantovani, 2001; Molka-Danielsen et al., 2009; Oh & Nussli, 2014; Omale et al., 2009; Silva et al., 2010). Each virtual world has unique affordances and drawbacks.

Three-dimensional virtual worlds, such as Second Life and Active Worlds, have been perceived as valid educational platforms, for example by K-12 teachers (Dickey, 2011; Guzzetti & Stokrocki, 2013), by both educators and students in distance learning (Thompson, 2012), for the advancement of critical thinking and problem solving (Childress & Braswell, 2006; Guzzetti & Stokrocki, 2013), and in project-based experiential learning (Jarmon et al., 2009). Both Second Life and Active Worlds have their unique affordances and drawbacks (Dickey, 2011), which is why their suitability varies depending on the purpose and student population.

Hence, developing the ability and the willingness to address the following questions will help educators to clarify the suitability of using a virtual world before allowing students to wander around in virtual spaces: why to use virtual space with students, rather than how (Ham & Davey, 2005); how technology can improve pedagogy, if at all (Alvarez et al., 2009; Correia & Ballester, 2010; de Freitas & Neumann, 2007); and which virtual world aligns best with a specific set of objectives and why (Dickey, 2011). Omale et al. (2009), for instance, recommended a careful evaluation of how 3D

spaces contribute to or inhibit inquiry learning before incorporating them into teaching. O'Connor (2008) evaluated whether the use of a virtual world truly supported her course objectives, while Jarmon et al. (2009) examined how learning changed because of the use of a virtual world. Second Life, for instance, allows educators to be innovative in the design and combination of learning experiences borrowed from different pedagogies (Good et al., 2008). Learning how traditional pedagogical practices can be extended in novel ways needs careful reflection (Wankel & Hinrichs, 2011). Finally, Inman et al. (2010) suggested that the connection between course goals, requirements, and virtual activities be thoroughly explained to students. O'Connor (2008), for instance, phoned each student prior to her course providing an overview of Second Life, explaining how it was going to be used and encouraging creative experimentation.

Students will lack motivation to use technology unless reasons are presented why a technology is incorporated and how it is relevant to a task, especially when a high learning curve is anticipated (Eaton et al., 2011). Establishing a clear connection between course objectives and learning activities in virtual worlds is critical (Baker et al., 2009; Brown et al., 2008; Davidson Smith, 2009; Delwiche, 2006; Ellis & Anderson, 2011; Inman et al., 2010; Mantovani, 2001; Mayrath et al., 2011; O'Connor, 2008; O'Connor, 2009-2010; Silva et al., 2010).

Synchronicity. Synchronicity is one of the key elements to the success in online distance learning (Annetta & Shymansky, 2005; Ham & Davey, 2005; O'Connor, 2009-2010; Pérez-García, 2009). Due to its voice communication features, Active Worlds, for instance, was identified as a viable source for synchronous, online course delivery (Annetta et al., 2008). Edirisingha et al. (2009), who investigated the pedagogical

potential of Second Life in an archaeology class, suggested that studies of synchronicity demonstrate the benefits of social presence and socialization for online learning. They described how a small cohort of distance learners established social presence in Second Life and how their positive learning experiences in Second Life, such as collaborative virtual explorations, extended into a real-life network among these learners (Edirisingha et al., 2009). Social presence helps learners to feel a sense of community; social presence in online education, for example, is critical for a positive experience (Gunawardena, 1995). Social presence has been defined as the ability to identify with a community and establish trust and relationships for purposeful communications by bringing in their individual personalities (Garrison, 2009). Three-dimensional virtual worlds are perceived as more sociable than 2D environments, such as text-based discussion forums in course management systems. Students namely enjoy discussions in Second Life because they can see their own avatar and others' avatars (Mayrath et al., 2007), whereas a linear, asynchronous 2D discussion board neither offers immediacy, a sense of presence, nor a sense of community.

The need for synchronicity informs the following teaching skills that are unique to 3D environments: The ability to encourage and manage virtual communication and to keep the virtual group together (McVey, 2008), for example, by making sure that no one teleports to another island. Having a system to know who is speaking is another prerequisite to taking advantage of the social and communicative affordances of synchronicity. Student avatars can be asked to raise a hand or stand up during group discussions to indicate their wish to speak. Konstantinidis et al. (2010), for example, used a tool indicating the current speaker by displaying a halo over the speaker's head.

Synchronicity also requires instructors to be aware of the way they communicate with their students (McVey, 2008). In his study with ten K-12 teachers, McVey identified the following characteristics of expert communicators that may inspire confidence while leading a class in a virtual setting: posting only short lines of text; avoiding complex thoughts in a single message; instead, breaking long messages into several short ones for those who choose to communicate in text form rather than through voice.

Scaffolding. The openness of virtual worlds with their potential lack of structure can be challenging for both students and teachers. Careful scaffolding (Delwiche, 2006; Mayrath et al., 2007; McVey, 2008; Nussli et al., 2014; Oh & Nussli, 2014; Pérez-García, 2009; Rappa et al., 2009; Sanchez, 2007; Silva et al., 2010) and well-structured class management and organization in virtual worlds are vital. Penfold (2008), for instance, reported that students were less engaged, even bored, when faced with unpredictable, open-ended, or less structured activities. If the teacher was not online to encourage or remind the students, there was a strong "out-of-sight-out-of-mind sense" (Ham & Davey, 2005). Good and colleagues (2008) offered scaffolding by applying a studio-based approach where students regularly discussed their progress with their peers in an open-ended way and where they received support from facilitators.

Scaffolding and support can be offered by the instructor or by providing specific tools or tasks and resources. At a more complex level, an intelligent agent can provide support as well (Dalgarno, 2002). The effectiveness of these agents, also called pedagogical agents, has been widely reported (Haake & Gulz, 2008; Mayer, Mautone, & Prothero, 2002; Moreno, 2005; Moreno & Mayer, 2000; Moreno & Mayer, 2004; Moreno, Mayer, Spires, & Lester, 2001; Wang, Johnson, Mayer, Rizzo, Shaw, & Collins, 2008).

Students in open-ended web resources must possess significant discipline, knowledge, and metacognitive, higher-order thinking skills (Lin & Tallman, 2006) because they are faced with more authentic, challenging, and open-ended problems in ill-structured environments (Hills & Hannafin, 2001). Scaffolding can help to overcome these problems. Ellis and Anderson (2011) provided four useful scaffolding guidelines that would be beneficial for teacher training: (a) preplanning classroom management procedures by discussing procedures while setting clear expectations to increase everyone's comfort level during the virtual experience, (b) discussion of goals at the beginning of the virtual session, (c) use of agendas and advance organizers, and (d) advance distribution of assignments with indication of time allotments.

Prior experience. Learning how to measure students' prior experience in virtual worlds and technical ability is another important skill because these factors may result in a more positive attitude toward the implementation of virtual worlds in a classroom (Jarmon et al., 2009). To assess students' experiences and abilities, it may be wise not to rely on self-report measures exclusively but to observe students' approach to a virtual task in order to see whether their understanding is superior to those students without virtual experience or less pronounced technical abilities. Students' experience and abilities will impact the type of activity, task design, student training, time allotted for the task, the need for scaffolding, and assessment (Mayrath et al., 2011).

Stimulating spaces. The visual appeal of virtual worlds has been widely reported (e.g., Dalgarno, 2002; Masters & Gregory, 2010; Nussli et al., 2014; Oh & Nussli, 2014; Omale et al., 2009; Warburton, 2009), especially in supporting experiential learning (Gamage et al., 2011) and when providing "authentic context that make concepts more

transferable to the real world" (Neely et al., 2010, p. 107). In their observational study on 95 virtual campuses in Second Life, Gough and Dearnley (2009) frequently noticed the inclusion of replica designs from real campuses, which sometimes had a claustrophobic effect. As one of their 12 design principles for virtual campuses, they suggested that teaching areas do not need to be replicas of real spaces in order to be functional. Because educators are not bound by physical constraints, they can adopt novel ways to convey content. Stimulating, visually appealing, content-rich, and innovatively designed Second Life islands can invigorate students by creating a divergence from front-taught lessons (de Winter et al., 2010; Guzzetti & Stokrocki, 2013; Oh & Nussli, 2014). Examples include a Scandinavian town (*Kamimo Island,* Molka-Danielsen et al., 2009), a marine biology island (*Abyss Observatory*, Nishimura, Lim, & Koyamada, 2012), a museum island (*Sunny Breeze*), the *StarTrek Science Museum*, the *Sploland Science Museum* (Rothfarb & Doherty, 2009), and *Maya Island* (University of Washington).

Group discussions, for example, can be much more stimulating in Second Life than in a bland classroom, for example, in a tastefully furnished submarine on *Lost Island* (University of Florida), around a fire in a hidden cave behind a waterfall *(Kamimo Island),* or immersed in optical illusions and surreal art *(Island of Enchantment)* or paintings by Gustav Klimt and French impressionists *(Museum Art Nouveau).* In addition to imagination, creativity, and stimulation of ideas (Omale et al., 2009), Second Life was also perceived as promoting student ownership, that is, freedom from real-world constraints, a sense of responsibility for their own learning, student independence, empowerment (Good et al., 2008), and enrichment (Guzzetti & Stokrocki, 2013). These findings suggest that spending time in virtual worlds could be worthwhile for teachers in

order to identify stimulating places for students, rather than sending students to virtual places that attempt to replicate the brick and mortar classroom. If training in the use of virtual worlds is integrated in teacher education programs, teacher educators may wish to consider preselecting a number of islands that meet these criteria.

Functional design. Finally, teachers may wish to use different spaces for different parts of the learning process, such as initiation, development, and reflection, as well as for different types of student interaction, such as an informal first meeting, focused group work, formal presentations, or private chats (Molka-Danielsen et al., 2009). Varying functionality allows users to select the most appropriate for the situation (Gough & Dearnley, 2009). *Kamimo Island* in Second Life demonstrates how spaces can be designed with intended functionality in mind so that they can be adapted easily for varied purposes that were not initially envisaged. Educators are advised to reflect carefully on which transient space best accommodates which task: Group meeting spaces exemplify how space can be used simultaneously for work or for private conversations, out of others' hearing range, because parts of the group space can be moved to different heights in the sky (Molka-Danielsen et al., 2009).

Technical support. Given the widely reported technical frailties of Second Life, ensuring technical support by closely collaborating with a technical facilitator, a technology coordinator or moderator is highly recommended (Blankenship & Kim, 2012; Brown et al., 2011; Eaton et al., 2011; Edirisingha et al., 2009; Ellis & Anderson, 2011; Ferdig et al., 2009; Guzzetti & Stokrocki, 2013; Ketelhut & Schifter, 2011; Kirriemuir, 2010; Mayrath et al., 2011; Minocha et al., 2010; Neely et al., 2010; Nussli et al., 2014; O'Connor & Sakshaug, 2008-2009; Oh & Nussli, 2014; Omale et al., 2009; Pérez-García,

2009; Storey & Wolf, 2010; Warburton, 2009; Warburton & Pérez-García, 2009), which is why pilot studies are strongly recommended to identify and remedy problems ahead of time (Minocha et al., 2010). For educators with a negative attitude toward the use of virtual worlds in education, the learning curve tends to be overwhelming, while for those educators with a positive or neutral attitude, the frustration experienced due to technical issues can actually boost their motivation to overcome this hurdle (Jamison, 2008). Therefore, it is important to ensure that educators with an initially negative attitude are presented with compelling evidence of the benefits for virtual learning prior to their first virtual experience. The pre-service teachers in Blankenship and Kim (2012) realized that their existing computer skills (social networking, grade-documenting programs, using Internet resources, etc.) did not match the skills needed to interact in an avatar-based virtual world, such as Second Life. Therefore, their transition into virtual teachers also required technical growth beyond a pedagogic transition.

The learning curve for educators leads to the assumption that the transition from a traditional teacher into a virtual teacher is even more challenging (Compton et al., 2010). It is highly recommended that teachers first try out the virtual student-assigned tasks themselves and develop the ability to troubleshoot because their students may not have the necessary skills to complete activities in a virtual world (Mayrath et al., 2011). An instructor's willingness to invest time in learning the affordances of a virtual world, spending orientation time in-world, and documenting their learning and experiences (O'Connor, 2008) is key to developing the skill to troubleshoot. Guzzetti and Stokrocki (2013) even pointed out the emotional costs of investing in new technologies. Alternative

plans should be available because technical glitches are unpredictable, even with high-end computers, high-performing graphic cards, and the fastest broadband connection.

Teachers' Perceptions of the Usability of Virtual Worlds

Despite a discussion of virtual schooling, the unique affordances of virtual worlds, the need for virtual worlds teacher training, and the elements that should be addressed in effective teacher training, one key element has not been addressed yet: Teacher's *willingness* to receive training in the use of virtual worlds. Several campuses in a study by Eaton et al. (2011) reported low faculty interest in learning a new technology. Many teachers are resistant to using such technologies due to a lack of time to learn new skills, a lack of self-efficacy, insufficient technological support within the school, and, not least, due to their concerns over the pedagogical value of the technology (Becta, 2004). Especially teachers from the print generation may reject the use of new technology (Prensky, 2006).

User acceptance of virtual worlds is expected to be a continued challenge (Fetscherin & Lattemann, 2007). Teachers who are not convinced of the validity of virtual worlds for education will hardly buy into the use of virtual worlds teacher training. Therefore, an important preliminary step prior to offering training is to provide compelling evidence of the unique affordances of virtual worlds. Teacher education programs would benefit from a balanced presentation of both unique affordances and challenges in 3D educational virtual worlds compared with 2D environments and face-to-face learning. In the same vein, school administrators would benefit from being educated about the advantages and challenges of virtual worlds (Guzzetti & Stokrocki, 2013). Warburton (2009) summarized the affordances as follows: rich interactions, visualization

and contextualization, exposure to authentic content and culture, identity play, simulation (when reproduction too costly), community presence (i.e., a sense of belonging), and content production. Other affordances include: promotion of creativity, autonomous learning, motivation, interest, enjoyment, and active learning (Bailey & Moar, 2011; Gamage et al., 2011; Good et al., 2008; Neely et al., 2010; O'Connor, 2009-2010; Prensky, 2001; Warburton, 2009). It is beyond the scope of this review to provide details of all affordances as claimed by the research. The following discussion will be limited to social affordances, a greater sense of realism, abstract concepts, experiential learning, impossible or impractical tasks, cost savings, and a few additional benefits.

Social affordances. If supported by external collaborative and management tools, virtual worlds offer various social affordances, such as the potential to enhance community building, collaboration, social interaction, and the possibility to observe and replicate modeled behavior (Childress & Braswell, 2006; Gamage et al., 2011; Green-Hamann et al.; 2011; Guzzetti & Stokrocki, 2013; Fusar-Poli et al., 2008; Mantovani, 2001; Mayrath et al., 2011; Newbutt & Donegan, 2010; O'Connor, 2009-2010; Oh & Nussli, 2014; Omale et al., 2009; Pérez-García, 2009; Warburton, 2009). The sense of presence can lead to a greater closeness within the group and richer communication. The sense of social presence helps users of a virtual environment to project themselves online and feel a sense of community. Immediacy, an important factor identified by Gunawardena and Zittle (1997) is inherent in synchronous discussions because all discussants are present simultaneously and exchange their thoughts in real time, which allows for immediate feedback.

Most importantly, the distributed 3D environment can allow learners to undertake tasks together, rather than just communicating (Dalgarno, 2002). As one study participant in O'Connor (2009-2010) noted, "Exploring the virtual environment together helped to develop a feeling of camaraderie" (p. 228). In a study by Bailey and Moar (2011), primary school children were far more motivated when they knew they would meet with other people, especially with students from other schools. Conversely, a lack of socialization opportunities can have negative impacts: Students in distance learning programs were more likely to drop out if they found it difficult to socialize with other students (Willging & Johnson, 2009). However, the support of a virtual world does not always yield social affordances: Riedl (2004) reported that some graduate students in the United States had difficulty trying to interact with avatars they did not know.

In order to stay connected to faculty and colleagues during field placements in other provinces, thereby building and maintaining a sense of community, Second Life was used to teach various elements of the curriculum in Loyalist College's Child and Youth Worker program online (Thompson, 2012), which suggests that the real strength of virtual worlds may lie in their use for distance education and hybrid delivery programs (Dalgarno, 2002; Salmon, 2009; Thompson, 2012). The above findings support the speculation that virtual worlds may one day become the preferred platform for cooperative learning activities (Childress & Braswell, 2006). However, while learners are motivated and engaged with the use of multi-user virtual environments, this does not necessarily result in greater learning beyond the classroom. The challenge for educators is in the transfer of skills to real life situations (McKerlich & Anderson, 2007). Teachers

need to create ample space and activities for socialization but, at the same time, need to avoid socialization taking a predominant role over learning.

Greater sense of realism. There are a number of circumstances in which the use of simulations may be preferable to the exploration of real environments. These can provide a greater sense of realism than other types of simulations based on 2D animations or photographic material because the learner can move freely through the environment and view it from any position and model the full physical behavior of objects (Dalgarno, 2002). Ideas learned within an environment providing a level of visual realism are easier to remember (Dalgarno, 2002). In a study by Barab, Kay, Barnett, & Keating (2000), for instance, students enacted basic astronomy concepts, such as the tilt of the earth and the period of orbit into dynamic 3D models. Three-dimensional modeling was also exemplified by Lu's (2010) students who created large-scale 3D works of arts in the *Art Café* in Second Life.

Abstract concepts. In some knowledge domains the concepts are abstract and not easily accessible to the senses (Dalgarno, 2002). On *Genome Island* in Second Life, for instance, visitors can explore a genetic cell from the inside. At an even more abstract level, one can immerse in a simulation of auditory and visual hallucinations of patients with schizophrenia (*Virtual Hallucinations*, Second Life). After a self-guided tour, 76% of 579 respondents to a survey reported that the environment had improved their understanding of auditory hallucinations and 69% reported that it had improved their understanding of visual hallucinations (Yellowlees & Cook, 2006). Teachers may wish to consider this option because virtual teaching of abstract concepts may lead to superior understanding, as compared with textbook teaching of these concepts.

Experiential spaces. The six characteristics of Second Life that facilitate experiential learning through concrete experiences and active experimentation include: the capacity to host virtual social interactions and collaborations; to test hypotheses by applying them to an actual project and doing something active without some of the risks and cost of the real world; the possibilities for meaningfulness of one's virtual actions to the real world; to allow for various skills to be practiced and demonstrated virtually; the stimulation of imagination, exploration, and creativity; and an increased sense of personal presence and tangible experience in the virtual world (Jarmon et al., 2009). Smith and Berge (2009) reported about an immersive Van Gogh museum[1] where students could step into and become part of the artist's masterpieces.

Following Kolb's (1984) experiential learning cycle concept, users of virtual worlds can interact with the objects in the 3D environment, which allows them to learn by doing, to observe the outcomes of their actions, to test their hypotheses about the world, and to reflect further on their own understanding (Hew & Cheung, 2010). Undergraduate biology classes replicated classic experiments in virtual labs on *Genome Island*, exemplifying active hands- and minds-on activities (Clark, 2009): Students can inject mice, for example, and observe the impact.

Virtual experiential spaces have also proved valuable in the practicing of social skills. In the case of social phobia, for example, the patient may be taken to a virtual world populated by other avatars with similar problems and asked to initiate a conversation and obtain feedback. On *Autism Island* and in the *Bridgadoon* group in Second Life, patients with Asperger's Syndrome can practice social interactions (Gorini

[1] Second Life island no longer accessible, video available at http://www.youtube.com/watch?v=Al3xnszLOVs

et al., 2008). Teachers have an infinite number of options for experiential purposes. The benefits of using virtual space are immense, but so is the amount of work needed to set up virtual experiences.

Impossible or impractical tasks. Virtual worlds enable learning in contexts that are impossible or difficult to experience in real life (Dalgarno, 2002). It allows the physically challenged to participate in an experiment or learning environment when they cannot do so otherwise (Mantovani, 2001), such as virtual driving (Cobb, 2007). These platforms provide a safe place for people with intellectual challenges to practice skills needed for survival in the real world. Other examples include the exploration of the inside of an organ to see how it is affected by disease or, if water treatment is taught, a real treatment can be shown instead of diagrams (Gamage et al., 2011). If oil drilling is taught, students' avatars can explore a virtual oil rig. Second Life, for instance, offers numerous opportunities on freely accessible islands to implement impossible or impractical tasks. VirtuaLU Education at Lehigh University (2012) offers extensive lists of recommended islands for the social sciences, sciences, humanities, and art.

Cost savings. Virtual laboratories provide compelling affordances, such as replacing experiments that use hazardous materials or occur too quickly or too slowly to be done in a regular laboratory period and reducing cost (Clark, 2009; Dalgarno, 2002). It should be cautioned, however, that learners who only do virtual experiments may well develop an understanding sufficient to pass written exams, but they will miss important learning outcomes that can only be achieved in a real lab (Dalgarno, 2002). Virtual worlds teacher training could, for example, offer a tour of existing, publicly accessible, virtual laboratories and specify effective practical activities. It seems important, however,

to be aware of the high cost and the advanced technical skills required to develop an own virtual laboratory.

Other benefits. Virtual experiences cannot replace their real-world counterparts, but they can be used to prepare students for the transfer of virtual skills to real-life skills (Dalgarno, 2002; Mantovani, 2001), such as in the virtual training of safe street-crossing skills for 7th and 8th graders (Schwebel & McClure, 2010). Another application of virtual worlds could be useful to avoid stereotypes and prejudices: Students may be less likely to succumb to social prejudices and role assumptions based on physical appearance (Gamage et al., 2011) because avatars may be customized in an indefinite number of ways. Role projection is perceived as another benefit: Customized avatars were used in a study by Walker (2009) to represent clients with specific disorders, for example a very thin person with an eating disorder or an avatar with visible self-harm injuries on arms, hands, and wrists. Licensed clinical counselors and graduate level counseling students played the roles and perceived the 3D environment not only as an effective method to develop their interviewing and diagnosis counseling skills, but also as realistic, interactive, engaging, and supportive of collaboration and communication.

Similar to studies conducted by Campbell (2009), Dickey (2011), and Guzzetti and Stokrocki (2013), the special education teachers in a pilot-study (Oh & Nussli, 2014) became familiar with educational resources in Second Life and planned activities that would offer learning affordances from which students could not otherwise benefit. The participants critically explored ten educational Second Life islands. Several key benefits of virtual worlds for special education students emerged from the qualitative analyses, namely, social skills practice for students with social skills challenges (e.g., DeAngelis,

2009; Fusar-Poli et al., 2008; Mitchell et al., 2006; Moore et al., 2005; Newbutt & Donegan, 2010), such as students with autism; training in risk- and stress-free virtual environments for special needs students (Burstin & Brown, 2010; Coles et al., 2007; DeAngelis, 2009; Kandalaft et al., 2013; Neel, 2006; Rizzo, 2005; Smith et al., 2007); collaborative learning toward a joint goal with a competitive element; and increased motivation to participate in the learning activities.

In summary, the research suggests that virtual worlds offer enough unique affordances to make them an important educational platform in the 21st century. There are wide applications, including self-paced tutorials, displays, immersive exhibits, immersive archeology, treasure hunts and quests, language and cultural immersion, creative writing (Guzzetti & Stokrocki, 2013), problem-based learning environments, inquiry-based learning situations, and distance learning settings (Mayrath et al., 2011) that lend themselves to modeling (Silva et al., 2010) in teacher training programs. Second Life has also been used for teacher training. Muir (2013), for instance, reported on eight pre-service teachers in their teaching practicum who role-played teachers and students in Second Life displaying a diverse range of behaviors, which afforded them the opportunity to practice classroom behavior management without impacting on "real" students (Muir, 2013; Savin-Baden, 2008). The virtual classroom was perceived as a relatively authentic classroom experience. The opportunity to view and reflect on the footage was considered one of the main benefits of using Second Life (Muir, 2013). A discussion of the unique affordances of virtual worlds, however, would be incomplete without a balanced presentation of the challenges. An awareness of challenges will assist teachers in making an informed decision about their commitment to virtual worlds.

Challenges

Even though virtual worlds are attractive spaces for education because of their open-endedness, combined with the ability to create content and to shape the environment in an almost infinite number of ways, they do present considerable design issues and other challenges to educators (Warburton, 2009). Limitations, which will be specified below, include: technical issues, distraction from learning, perception as a game, appeal depending on target group, a lack of models for design and assessment, teachers' negative control beliefs, time, lack of structure and support, variables influencing satisfaction, and levels of engagement.

Technical issues have been reported in almost all studies using virtual worlds. Technical frailties not only lead to frustration in both teachers and students (Cheal, 2009) but also threaten the viability of using virtual worlds for large-scale educational projects (Annetta et al., 2008; Dickey, 2011; Kirriemuir, 2010; Neely et al., 2010; Silva et al., 2010; Storey & Wolf, 2010; Warburton, 2009). Technological developments, however, are expected to extend the educational possibilities of virtual worlds, for example through the use of virtual reality goggles, body motion sensors (Ruddle & Lessels, 2009), 3D mice for intuitive navigation, interactive smartboards using Nintendo Wii controllers, or by hosting Second Life on 3G mobile devices (Dreher et al., 2009).

Another challenge is that the environment's interactivity and visual appeal can distract students from learning (Dickey, 2011; Moreno & Mayer, 2007; Storey & Wolf, 2010). Students failing to concentrate on an assignment because they were preoccupied with exploring the 3D space were reported in Dalgarno (2002) as well as in Lim, Nonis, and Hedberg (2006). Similarly problematic is the risk that students might perceive virtual

worlds as a game rather than an educational platform, which is intricately linked to the common misconception that a course in Second Life, for instance, engages students by the same motivating factors as games, namely, challenge, curiosity, control, and identity presentation (Cheal, 2009). While the use of game concepts can motivate and assist students through a program of study, students may be disappointed because Second Life is not as dynamic as other games they may have played (Wimpenny, Savin-Baden, Mawer, Steils, & Tombs, 2012).

Design and assessment can be additional challenges: Despite the need for instructionally effective activities and appropriate assessment, there are few models to emulate (Mayrath et al., 2011). While virtual worlds offer extensive possibilities for education, careful planning of instructional activities combined with formative evaluation is recommended (Mayrath et al.). The varying levels of appeal to some target populations (such as age, gender, gaming experience, and computer ability) also deserve consideration. Negative control beliefs refer to teachers' being afraid of not being in control of students who are off task due to the chat function and the complexity of the environment. Participating teachers in Kennedy-Clark (2011), for instance, were concerned that they could not monitor student progress while students completed the activities.

Despite an appreciation for free educational content, the time needed to create content, design lesson plans, or building virtual sites are another concern (Dickey, 2011; Guzzetti & Stokrocki, 2013). Most teachers participating in a study by Dickey (2011) stated that they would be more likely to use a virtual world that was already developed for specific content and aligned to the content they were teaching. This is a particularly

important finding, considering that most virtual worlds were conceptualized as social networks rather than educational platforms. Even if educators use existing islands rather than building them, they will still have to design assignments requiring ample time and thought.

Lack of structure and support is yet another issue. Mantovani (2001), for example, raised concerns about the open-ended exploratory nature of virtual environments. It would be naïve to assume that the learning process takes place naturally through exploration, especially when encumbered by a lack of structure. The teacher can provide guidance and improve the structure by supplementing the use of virtual activities by other types of information, such as audio and text annotations (Mantovani, 2001; Silva et al., 2010). Furthermore, specific tasks should be carefully defined and supported by student-teacher interaction. Teachers must develop specific expertise and sufficient practical experience of virtual learning in order to support learning processes (Mantovani, 2001), ideally by becoming a virtual student him- or herself.

Satisfaction with a virtual world is another issue that can impact learning in these environments. The course format, for instance, can play a role. Instructors who conducted classes fully in Second Life were significantly more satisfied than those who used it as only a small portion of a real-world class (Bowers et al., 2009). Adopter category, however, did not impact satisfaction. Bowers et al. investigated how post-secondary instructors differed in their levels of satisfaction with Second Life as an educational tool depending on their different adopter category. The extent of the respondents' Second Life experience determined their categorization into three adopter types: innovators (10.5%, more than two years of Second Life experience, lowest Second Life satisfaction score),

early adopters (69.8%, six months to two years of Second Life teaching experience, highest Second Life satisfaction score), and early majority (19.8%, less than six months of teaching experience in Second Life, moderate satisfaction level). The mean satisfaction score was 4.76 based on a 7-point Likert scale.

Finally, levels of engagement in virtual worlds designed for K-12 students have been found to be uneven. Most visitors to Whyville, a popular 2D virtual world for users aged 8 to 16, who experienced the Whypox (virtual epidemic) curriculum in informal settings failed to participate actively (Foley & Kobaissi, 2006). Similarly, Lim et al. (2006) reported low levels of engagement in Quest Atlantis, a 3D multiuser virtual world for users aged 9 to 15. It could be that some students simply tuned out in the face of the complexity and open-ended nature of virtual worlds, distracted by the very immersiveness and interactivity.

Opposite results emerged in two other studies. WolfDen in Active Worlds (Annetta et al., 2008) and the classroom-based WhyPox curriculum in Whyville (Galas, 2006) prompted very high levels of engagement. As a result of these contradictory findings, teachers may wish to pay close attention to which elements in virtual worlds enhance or hamper successful engagement.

The analysis of Oh and Nussli (2014) revealed an almost balanced ratio between perceived affordances and challenges for both general and special education settings (Table 3).

Table 3

Perception of Affordances and Challenges of Second Life

Benefits	Challenges
Platform for social skills practice	Amount of teacher and student preparation
Experiential learning (e.g., science experiments, cultural immersion)	Accessibility issues (e.g., internet connection, crashes, graphic card)
Exploring the impossible/impractical	Poor eye-hand coordination impairing navigation
Increased motivation	Safety issues (exposure to strangers)
Learning at own pace/increased student autonomy	Lack of required computer literacy
Spatial representation	Deceptive similarity to video games
Making abstract concepts more real	Visually overwhelming, distracting from learning
Multi-sensory input	
Anonymity, encouraging shy students to participate more	

Note: Oh and Nussli (2014)

An awareness of this extensive list of challenges may help educators to decide if the use of virtual worlds is preferable to another mode of transmission and under which circumstances (student population, purpose, curriculum alignment, low or high stakes testing, etc.). Effective virtual worlds teacher training includes a well-balanced discussion of affordances and challenges of virtual worlds.

Limitations of Reviewed Literature

Whereas anecdotal evidence abounds concerning what educators are doing in Second Life (Livingstone & Kemp, 2006), methodologically rigorous studies in this field are rare (Hew & Cheung, 2010). Limitations typically include the lack of control groups, a lack of member checking in qualitative studies, a lack of inter- or intraobserver agreement reliability, the use of self-report measures, and the novelty effect of virtual worlds (Hew & Cheung). Social desirability responding, for example, has long been viewed as a potential source of error in self-report measures, such as in surveys (Hancock & Flowers, 2001). Furthermore, most studies in this area fail to use a control group, which is why the instructional strategy used rather than the virtual world may account for positive learning gains. The novelty effect, in which new technology initially leads to

excitement and more enjoyment, has been demonstrated in Annetta et al.'s (2008) research, which indicated that their participants' enthusiasm about multi-user virtual environments was extremely high after the first week but leveled off after the course.

Thus, this section discusses the strengths and weaknesses of the 18 empirical studies and their research processes. Table 4 displays an overview of the strengths and weaknesses of the 12 qualitative studies.

Table 4

Strengths and Weaknesses of 12 Qualitative Studies

Authors	Strengths	Weaknesses
Annetta, Murray, Gull Laird Bohr, & Park (2008)	Two surveys were conducted: the first after a week into the course and the second two months after the study. The participants were 13 graduate students, all pre- or in-service K-12 teachers, and all of them, but one, were science teachers. The observer's field notes and email communications (the observer chose an avatar that resembled a spy and flew around to gain perspective on student interaction) and the participants' end products were analyzed. This is one of the few studies in this field that shares some of the data collection materials in the appendix, namely, the pre- and post-survey. Having access to these surveys not only provides a clearer idea of the study, but it is also helpful in the design of one's own research material.	The fact that only seven out of 13 participants completed the post-survey suggests that the researchers should have followed up with the participants who chose not to complete it. Their reasons might have been enlightening. Another weakness is that no alternative for voice chat, which was perceived as being too inconvenient because of technical issues, was provided. For instance, Skype could have been running simultaneously with Second Life. Numerous studies reported not using voice-chat in Second Life due to technical issues, restricting themselves to text chat. Voice reveals attitudes, emotions, and personal characteristics, whereas text chat does not. These assets should not be given up lightly.
Blanken-ship & Kim (2012)	This exploratory case study used within-case analysis and word-level analysis to unpack collaborative learning episodes. To help mitigate biases, the author reported debriefing with her co-instructors at different points during data collection to uncover preconceptions. Data collection procedures were clearly described (with the exception of the instruments themselves).	The small sample (N=12) suggested that the findings might not be generalizable to the larger population of language teachers. The data collection instruments were not described in detail. Although this is the only study that uses a control group (using Skype for language practice), no quantitative analyses (other than tallies) were conducted to compare their interactions with the experimental group (using Second Life). In her PhD thesis, on which this article was based, the first author acknowledged that because this type of pre-service teacher training has not been thoroughly examined in the literature, the tendency to interpret what the data actually revealed could have impacted internal credibility. The author also shared her concerns in terms of the novelty effect due to the use of an avatar in a 3D environment.

Continued

Table 4 (continued)

Authors	Strengths	Weaknesses
Campbell (2009)	Triangulation of data was achieved by building in a pre- and post-questionnaire, an online journal, learning activity reports, focus group interview transcripts, and audio recordings of participant presentations. The major take-away from this study is that each step of the teacher training was carefully explained so that other educators can replicate most of it.	Not all participants submitted the post-questionnaire (N=25 out of 36) and only some participated in the focus group interviews (N=24). While the author provided a few data samples, it is unclear whether the findings have been sufficiently corroborated because the decision trail and the rules of analysis were not reported. The process of transforming data into themes/codes was not described. The academic readings (two or three) about Second Life were not specified, which would have been helpful for teacher educators planning similar training for pre-service teachers. Qualitative data were coded in NVivo exclusively. It is unclear whether the author actually read the data himself and established preliminary codes. The author mentioned that he used the inquiry approach for the theoretical framework but failed to provide any details and make connections with the study design. Although the researcher answered each research question, it is unclear whether any specific themes emerged from the data.
Dickey (2011)	This case study is a good example of data triangulation. This case study used grounded theory methodology (Glaser, 1992; Strauss & Corbin, 1998) for data analysis. The data emerged from the reflections of eight K-12 teachers participating in the "Virtual Worlds for Educators" course, from observations of classroom activities in class and in-world, email messages and conversations, student work, and informal interviews. Peer debriefing, member check, negative case samples, and audit trail were used to strengthen the credibility of the data analysis. The teacher training course lasted 22 weeks, five days a week for four hours a day, which implies prolonged and persistent observations.	The author failed to specify which places were visited. It was simply stated, "The teachers were introduced to exemplary educational environments in both Active Worlds and in Second Life" (p. 4). Except for *Orientation Island* and the island, which is under development for the *International Society for Technology in Education* (ISTE), none were specified. "Several universities, a physics and science environment, a renaissance village" (p. 6) is a vague summary of destinations that is not helpful for educators and researchers who would like to explore and evaluate these islands for possible incorporation into their teaching. Another concern is how valuable building activities, such as the building of a snowman using pre-fabricated pieces in Active Worlds, are in order to evaluate the learning affordances of virtual worlds. This study incorporated several building activities. Even though building structures/environments can make sense in certain disciplines, such as architecture, it can generally be assumed that educators will not have or want to spend the time to build their own environment.

Continued

Table 4 (continued)

Authors	Strengths	Weaknesses
Edirisingha, Nie, Pluciennik, & Young (2009)	The data collection involved observations of training sessions, both in-world and face-to-face; participation in in-world learning activities; interviewing students and tutors within two weeks after the learning sessions; chat logs; and interviewing the keeper of *Media Zoo*, which is the Second Life region used for the course. The learning scenarios were purposely and carefully crafted and explained in detail to allow for replication by other educators. Themes were clearly identified and corroborated. Each finding was connected with one of the stages of Salmon's 5-stage model of online learning. The study provides valuable guidelines for educators who would like to use Second Life in their own teaching.	The sample was rather small (N=4). Voice chat was not used in order to lower the technical barrier for participants. But it seems that especially these distance learners would have benefited from voice to advance a sense of community and make communication more personal. This could have been arranged by running Skype in parallel to Second Life.
Gamage, Tretiakov, & Crump (2011)	One of the many strengths of this study is data triangulation to improve credibility of data analysis. Semi-structured in-depth interviews were conducted with 22 educators (11 with and 11 without virtual worlds experience) in Second Life. Data analysis was conducted by using the constant comparative method. Member checking and investigator triangulation improved the credibility of the data analysis. Although the authors only provided a glimpse of the participating educators' opinions, these opinions are likely to be encountered when implementing virtual worlds-based learning and will be of interest to education managers and teachers considering virtual worlds adoption. This article was also very valuable because it provided one of the richest reference lists for the purposes of the intervention. A six-dimension affordance model supporting experiential, collaborative, and constructivist learning was used to frame the study.	The only apparent weakness in this rich study is that the conclusions could have been developed in greater detail.

Continued

Table 4 (continued)

Authors	Strengths	Weaknesses
Guzzetti & Stokrocki (2013)	Each step of the 8-step virtual worlds teacher training workshop was introduced in sufficient detail so as to allow for replication. Emerging themes were clearly identified and elaborated on. Findings were adequately corroborated. Three theoretical perspectives (new literacy studies, social constructivism, and cybergogy) framed the study. The authors clearly explained how theory impacted the influence of their workshop. The sample (N=25) was sufficiently high to provide rich qualitative data. The methodology of teacher research was used, with elements of virtual ethnography when observing participants' virtual explorations and interactions. Field notes and chat logs were archived. Participants' participation was shadowed and traced. A unique feature was that the participants were interviewed by email one year after this course to find out if and how they used Second Life in their own teaching. Observations, interviews, and documents were analyzed iteratively through thematic analysis and matrix analysis.	Although the authors wrote that frequencies of response types were tallied within and across categories by calculating descriptive statistics, these statistics were not shared in the article. This study would have lent itself to the quantitative measurement of the participants' change in attitude toward the usability of virtual worlds for education, as a measure before and after the workshop.
Kirriemuir (2010)	This snapshot study (the most recent in a series of "virtual world watch" studies by the same author, from mid-2007 through March 2010) examined how technical issues in Second Life have been encountered and overcome by academics in UK higher education who have used Second Life for research or student teaching. Data were collected for each snapshot report by one qualitative, questionnaire-based survey every six months. Qualitative methodology was appropriate. The questionnaire allowed for open and often frank responses of many academics. The author clearly identified emerging themes and used these to formulate recommendations.	It is unclear how many surveys were completed. In terms of data collection, the author reported that some academics never respond to any surveys or requests for information, while other academics are using virtual worlds "under the radar" to avoid that knowledge of their activities negatively impact their work. Academics who have been defeated in their efforts to use virtual worlds are very difficult to identify. Technical services of nine universities were contacted and asked for their experiences of Second Life deployment but only one responded. Getting what could be very valuable information from these academics has been very challenging.

Continued

Table 4 (continued)

Authors	Strengths	Weaknesses
O'Connor (2009-2010)	The study is abundant with practical tips for teachers who would like to experience Second Life themselves. It provides compelling data about social affordances of virtual worlds. The methodology provides useful ideas how to design research for data triangulation. Two data sources were analyzed: first, students' comments and products and second, the instructor's feedback. The data were coded into general categories. These data were enriched by personal debriefings that students shared with the instructor and by time logs indicating how much time the participants had spent in Second Life. The study provides a rich evaluative account of virtual worlds.	A major drawback, however, was that none of the participants' ideas for possible K-12 applications in immersive environments were shared. Also, it would have been useful to have a more detailed description of the three courses, although it may have been difficult to include full descriptions because each of the courses had different purposes and the students in each course were at different points in their teaching careers.
O'Connor & Sakshaug (2008-2009)	The study was framed by inquiry by having participants pose and investigate their own research questions about Second Life. Data triangulation was achieved by having the participants keep a learning log, including reflections on the class meetings in Second Life, have them post selected sites or interactions found within Second Life, and delineate a possible Second Life project for K-12 students.	Unfortunately, just as in another article by the same author (O'Connor, 2009-2010), a major drawback was that none of the participants' ideas for possible K-12 applications in immersive environments were shared, which reduces the benefits of reading the article. The number of participants was not indicated.
Silva, Correia, & Pardo-Ballester (2010)	A variety of data collection instruments in this naturalistic inquiry study led to data triangulation, namely, the mentor's and the two mentees' reflective blog entries, observation notes from collaborative Second Life explorations, the mentees' interview data, and the Second Life chat logs. Furthermore, the first author carried out a comprehensive member check, which culminated with the inclusion of the mentees in the write-up of the study.	However, two problems arose in the data collection process, which may have cost valuable data and distorted some of the data: First, the interviews in Second Life could not be recorded due to technical problems with the Second Life video recording device. Second, reflections were written four months after the end of the project, rather than throughout the semester, and were therefore limited to what the mentees remembered after project completion.
Storey & Wolf (2010)	The major take-away of this study is an instructor's checklist with 12 clear guidelines for teaching in virtual worlds. This checklist is invaluable for any educators wishing to implement Second Life in teaching. Data were collected from four instruments: a pre- and post-course survey measuring students' perceptions, experience, knowledge and skill with games, technology, and virtual worlds; daily student blogs to reflect on experiences; and student artifacts to provide evidence that the goal (virtual school planning) has been achieved. The study was framed by constructivist philosophy.	Despite the rather small sample (N=13), quantitative analysis could have been conducted because the pre- and post-survey about participants' perceptions asked the same multiple-choice questions with four response choices, which would have allowed measuring the change in attitude before and after the workshop.

Table 5 provides an overview of the strengths and weaknesses of the five mixed-methods studies and one quantitative study.

Table 5

Strengths and Weaknesses of Five Mixed-Methods Studies and One Quantitative Study

Authors	Strengths	Weaknesses
Bowers, Ragas, & Neely (2009)	Similar to Neely et al. (2010), this exploratory case study provides extremely rich data. Data measurement involved more inspiration than the authors' 2010 study, which was limited to a survey with four open-ended questions. The authors provided valuable information about various aspects of online learning. This is the first comprehensive, exclusively quantitative review of 162 post-secondary instructors using Second Life to teach either prior to or concurrent with the time the questionnaire was administered. The survey consisted of open and closed questions. An ANOVA was conducted to compare mean satisfaction levels across adopter categories, followed by Bonferroni's post-hoc tests to measure statistical differences.	However, both studies (Bowers et al., 2009; Neely et al., 2010) failed to use a greater variety of data collection methods leading to data triangulation and thereby increasing credibility. No reliability was reported for the closed survey questions.
Neely, Bowers, & Ragas (2010)	The main strengths of this study were the rather high number of participants (N=162) in 15 countries teaching 25 academic disciplines, in comparison with other survey studies, and the fact that only teachers with experience in Second Life were eligible to complete the survey. These data provide a realistic overview of how Second Life is used in education. Two researchers independently coded the responses and then agreed on themes. All responses were collaboratively recoded.	The fact that an online survey with four open-ended questions was the only data collection measure limits the usability of this study. For future studies, the authors recommended using other tools of qualitative and quantitative measure, such as focus groups, in-depth interviews, and longer, more specific questionnaires.

Continued

Table 5 (continued)

Authors	Strengths	Weaknesses
Nussli, Oh, & McCandless (2014)	In this exploratory, each step is described in such detail that other educators can easily replicate the training. All readings, sources, and Second Life destinations have been disclosed. Both the instructor and an in-world facilitator offered continuous in-world support to the participants. Data triangulation was achieved through analysis of the various instruments used for data collection, including a preliminary survey, lesson plans, reflective journals, and a post-survey. Credibility was strengthened through investigator triangulation. The study followed a mixed-methods research design, utilizing constant comparative method of data analysis (Glaser & Strauss, 1967) as well as descriptive and inferential statistics. This is one of two studies where the authors quantified the participating teachers' attitude before and after a training workshop. Survey reliability reported a high level of internal consistency. Finally, the workshop was theoretically framed; connections to inquiry learning were specified.	The submission of the assignments and surveys required students to identify themselves. The fact that students were graded on their participation may have influenced the honesty of their comments. It would have been useful to include questions examining the participants' specific technological background, which would have afforded a distinction between digital immigrants and digital natives and a correlation between the participants' technology use and their attitude toward virtual worlds. The sample was rather small (N=19), although it seems adequate compared with similar studies. Survey reliability has been established for the initial 48-item survey when, in fact, only 12 items of the original survey have been used. Reliability analyses should have been repeated.
Oh & Nussli (2014)	The study followed a mixed-methods research design, utilizing constant comparative method of data analysis (Glaser & Strauss, 1967) as well as descriptive and inferential statistics. Data triangulation was achieved through analysis of the various instruments. For the analysis of the qualitative data, investigator triangulation was used. Quantitative data were described in detail so that readers could make their own judgments. This is one of two studies where the authors quantified the participating teachers' attitude before and after a training workshop. As opposed to similar studies, this is one of the few studies that revealed the Second Life locations that were used for exploration, which can save other teachers' and teacher educators' time in identifying valuable educational places. The workshop was described in detail.	The preliminary survey did not include questions examining the participants' specific technological background and use of technology both in their teaching and at home. Collecting these data would have allowed the authors to correlate the participants' technology use and expertise with their preconceptions of virtual worlds. Although the sample of twelve participants was small (N=12), it seems adequate compared with similar studies. Survey reliability has been established for the initial 48-item survey when, in fact, only 12 items of the original survey have been used. Reliability analyses should have been repeated.

Continued

Table 5 (continued)

Authors	Strengths	Weaknesses
Omale, Hung, Luetkehans, & Cooke-Plagwitz (2009)	Teacher presence was one of the strengths of this exploratory case study. Through the use of facilitation techniques, the teacher provided prompts, which were essential to keep participants on task. The research procedure was clearly explained. Themes were clearly identified and corroborated. Data were collected as follows: The instructor and the researcher observed and facilitated online meetings; discussion transcripts that were used as a catalyst for group interviews; and group interviews. A content analysis was conducted, for which coding reliability using NVivo's coding comparison function was reported as satisfactory. Frequency of occurrence was calculated (descriptive data). Data were coded into themes using elements of the community of inquiry approach.	One possible limitation may have been a limited experience in Active Worlds. It is unclear whether the participants were confined to the virtual meeting rooms all the time or if they experienced Active Worlds in any other way. The sample (N=8) was rather small.

No differences are apparent in the comparison of studies with pre-service teachers compared with in-service teachers. Except for Campbell (2009), all studies seem to be quite robust in terms of methodology and have more strengths than weaknesses. The studies that were most pertinent to this review (highest frequency of citations) include Gamage et al. (2011), Dickey (2011), Guzzetti and Stokrocki (2013), Nussli et al. (2014), O'Connor (2009-2010), Oh and Nussli (2014), Storey and Wolf (2010), and Omale et al. (2009), which equally worked with pre- and in-service teachers.

Overall, however, the concerns voiced by Hew and Cheung (2010) seem to be justified: the lack of control groups, a lack of member checking, a lack of interobserver or intraobserver agreement reliability, the use of self-report measures, and the novelty effect of virtual worlds. All of these issues have been observed in all of the 18 studies. Addressing these methodological shortcomings in future research will help to increase credibility, which, in turn, is likely to increase teachers' commitment to the use of virtual worlds.

Discussion

I have explored several aspects of practical and scholarly significance and I have established the need for virtual worlds teacher training through a review of findings about virtual worlds. I have described the unique skills required for a 3D virtual teacher and I have provided an overview of affordances and challenges of virtual worlds for education. Some teachers may be tempted to use technology because it seems progressive and innovative (Neely et al., 2010). A teacher's first responsibility, however, is to examine a curriculum and then decide on the most effective, rather than the most appealing, method to use technology to improve his or her pedagogy (Nelson & Ketelhut, 2007). Teachers cannot be expected to address all these uncertainties in the isolation of their classrooms. Instead, they need support and continuous mentoring by more experienced 3D virtual teachers (Silva et al., 2010).

From the reviewed data, the following steps and order in the design of effective teacher training may be inferred: The first step involves convincing teachers of the need of virtual schooling by presenting evidence of the unique affordances of virtual worlds for education. The second step involves the design of effective virtual worlds teacher training based on the following pillars: (a) more experienced virtual teachers help traditional teachers to transform into virtual teachers through careful scaffolding and mentoring (Compton et al., 2010), (b) acquire the unique skills required to become a virtual teacher, and (c) teacher educators model effective teaching in virtual worlds.

A key, albeit challenging, objective of effective teacher training is to identify how educators may combine pedagogies innovatively to take full advantage of the potential of virtual worlds for education. Teacher education programs are advised to address teachers'

concerns about the incorporation of emerging technologies in classrooms. The best teacher training, however, will be ineffective unless teachers' apprehension of having to use virtual worlds can be alleviated. Prensky (2001) predicted that game technology will replace classrooms, lectures, tests, and note-taking with fun, interactive learning environments, which may also explain teachers' anxiety about losing their jobs: the fear of being replaced by computers. By guiding concerned teachers through the exploration of pedagogically sound places in virtual worlds, the need for an adjustment of roles, that is, a transformation from traditional teachers to virtual teachers, may become evident. As Lu (2010) recommended, "The best way to learn about cutting-edge technology is not to read and hear about it but actually to use and experience it" (p. 24).

Future Research

There is a need for empirical studies that establish the validity of the basic assumptions about virtual worlds, that adequately link these unique characteristics with the potential learning benefits (Dalgarno & Lee, 2010; Good et al., 2008; Hew & Cheung, 2010; Inman et al., 2010; Jarmon et al., 2009; Kennedy-Clark, 2011; Warburton, 2009) and that demonstrate how virtual worlds provide advantages over other pedagogical techniques, including those offered by non-3D counterparts (Wimpenny et al., 2012). Obviously, if teachers are not convinced of the superiority of virtual worlds in certain fields for certain student populations, virtual worlds teacher training is bound to fail, however well-designed the teacher training may be.

To this end, future research could address the following elements: providing full evaluative accounts of 3D virtual projects; developing and understanding variables and processes pertaining to the use of virtual worlds; and providing more substantial support

for the claim that the online delivery of higher education is desirable, not just possible (Ham & Davey, 2005). Ideas for future research include: What do educators want their students to learn in a virtual class and which skills, in particular, can be enhanced through virtual worlds? How can students be engaged in a virtual world? How are virtual worlds implemented in curricula appropriately? What are elements of effective virtual design? How can educators' concerns, such as lack of time to create virtual assignments, be addressed adequately? Once these questions are answered satisfactorily, teacher-training programs may be designed more effectively because they will be based on substantiated data.

Summary

The overarching goal of this review was to identify the key components of effective virtual worlds teacher training for learning and instruction purposes. I have established the need for virtual worlds teacher training, which was followed by the identification of the required teaching skills. Existing empirical guidelines informed the unique teaching skills. I have identified the components of effective virtual worlds teacher training as: (1) convincing teachers of the need of virtual schooling by presenting evidence of the unique affordances of virtual worlds for education, and (2) designing effective virtual worlds teacher training based on the following pillars: (a) how to help traditional teachers transform into virtual teachers through careful scaffolding by more experienced virtual teachers, (b) how to acquire the unique skills required to become a successful 3D virtual teacher, and (c) successful modeling of online technology by teacher educators. The implications of this review are relevant for teacher educators, pre- and in-service teachers, schools, and instructional designers in both general and special

education. Because the teacher training in this study was conducted with special education teachers, this chapter will conclude in the discussion of the findings of the literature review from the perspective of special education, which also includes an overview of ongoing research efforts in this area.

Special Section on Special Education Teacher Training

Virtual environments have a powerful intuitive appeal for educators, especially for children with special needs (Parsons & Cobb, 2010) because the teachers can "imagine the value of learning environments in which content can be controlled and responses/understanding explored in ways that may not be possible in the real world" (p. 356). As outlined in Chapter 1, virtual reality is especially well suited to support the learning of students on the autism spectrum, particularly in terms of life and social skills (Parsons & Cobb, 2010). Another beneficial feature of virtual reality is that it can be used collaboratively (Parsons & Cobb). Virtual reality can be used for remote peer interaction where students are working together on a collaborative task while they are physically separated. This way of collaboration may be more appealing for social interaction between children with autism who may feel more comfortable communicating through a computer than working together in physical proximity with others (Parsons & Cobb).

The guidelines identified in this literature review, namely, the need for a pedagogical rationale, synchronicity, scaffolding, prior virtual experience, stimulating places, functional design, and technical support apply to both general and special education teachers and students. Based on the findings of one of the pilot-studies (Oh & Nussli, 2014), however, it seems that the participating special education teachers were particularly concerned about their students' technical abilities, which means that

preparation prior to a virtual fieldtrip becomes absolutely critical. Therefore, the designers of virtual worlds teacher training for special education teachers may wish to pay special attention to the technical affinities of special education students. If, for example, students have eye-hand coordination challenges, alternatives must be investigated. Some applications use non-persistent sound and fading messages to deliver information, which may result in cognitive overload for users who are unaccustomed to multitasking at this level (Smith, 2010).

Another potential challenge could be the stimulating places. The visual appeal and the interactivity could easily become overwhelming to some students. Simple destinations with streamlined information and labels might be more appropriate for some students. Finally, when working with special education students, scaffolding may also have to be more intense than with typically developing students. In the intervention, each of the seven steps offered reflection prompts to allow the participants to recommend modifications (of either a lesson plan or the features of a specific Second Life destination) to better accommodate their students' needs and abilities.

Current Research about Virtual Environments and Special Education

In 2010, Parsons and Cobb emphasized that more research is needed in order to understand how to use the features of virtual reality to best support learning. Since the publication of their literature investigating the research between 2000 and 2010, two large EU-funded projects, ECHOES and COSPATIAL, have investigated collaborative technologies designed to promote the learning of social competence by children with autism. Preliminary results suggest that ECHOES may have helped some children with autism to interact better with other people and with virtual characters while they were in

the environment (Rajendran, Prayska-Pomsta, Smith, & Lemon, 2013). Under the umbrella of COSPATIAL, Bauminger-Zvieli, Eden, Zancanaro, Weiss, and Gal (2013) suggested that children with autism demonstrated more appropriate understanding of collaboration and social conversation after the intervention, with some improvement in theory of mind. Improvement in actual social engagement, however, was more scattered.

In sum, although recent studies indicate the potential in the use of virtual reality for autism, its potential remains under-researched (Parsons & Cobb, 2010; Wallace, Parsons, Westbury, White, White, & Bailey, 2010). It seems all the more important that special education teachers keep abreast with current developments in this area so that they can enculturate their students into virtual worlds and help them learn by taking advantage of the special affordances of virtual worlds for social skills practice. The biggest challenge, however, could be the translation of virtual environments into workable, useful tools that offer realistic applications for everyday classrooms (Parsons & Cobb, 2010). In the intervention, several steps offered opportunities for the discussion of and reflection on such practical issues.

CHAPTER 3

METHODOLOGY

Restatement of Purpose

The primary purpose was to determine special education teachers' perception of the effectiveness of a five-hour long, systematic 7-Step Virtual Worlds Teacher Preparation intervention in terms of enabling them to make informed decisions about the usability of Second Life for students with social skills challenges. For the purposes of the intervention, "effective" virtual worlds teacher training is defined as the participants' ability to make informed decisions about using virtual worlds in both K-12 and higher education, with a special focus on special education. A secondary purpose was to determine whether there was a teacher change of attitude resulting from engagement in a systematic intervention. A third purpose was to determine the special education teachers' perceptions of the usability of virtual worlds for special education (especially for students with social skills challenges), the benefits and challenges of virtual worlds as well as their usability for collaborative learning.

Eighteen special education teachers collaboratively explored one prominent example of virtual worlds (Second Life) during five hours over a period of two weeks. The intervention guided participants in a variety of critical and purposeful virtual explorations, framed by an inquiry-based approach. Mixed methods were used for data analysis. A survey measured whether or not there was a change of attitude toward the usability of virtual worlds in education as a result of the intervention and if it was statistically significant. Qualitative analyses were based on seven instruments. These data informed the development of effective virtual worlds teacher training, the usability of

virtual worlds for special education, and best practices for virtual teaching. Figure 3 displays the purpose of each step.

Virtual Worlds Teacher Training Intervention	Step 1-Preliminary Survey. Measure preliminary attitude toward usability of virtual worlds for education.
	Step 2-Unique Affordances & Resources. Scaffolded introduction to virtual worlds and research findings, providing a context for the workshop.
	Step 3-Virtual Exploration. Engage in first-hand exploration of Second Life.
	Step 4-Lesson Plan Presentation. Communicate and justify the lesson plans developed in Step 3.
	Step 5-Written Reflection. Propel deep reflection about the usability of Second Life for social skills practice for students with social skills challenges.
	Step 6-Lesson Plan Analysis. Try out, examine, critique, and modify Second Life lesson plans developed by other educators.
	Step 7-Post-Survey. Demonstrate ability to make informed decisions about Second Life and measure post-attitude.

Figure 3. Purpose of each step of the intervention.

Research Questions

This investigation revolved around special education teachers' perceptions of the effectiveness of the intervention and of the usability of virtual worlds for special education, with a focus on social skills practice. The primary research questions were:

1. What are special education teachers' perceptions of the effectiveness of the systematic 7-Step Virtual Worlds Teacher Training Workshop in terms of enabling them to make informed decisions about the usability of virtual worlds for special education?
2. To what extent is there a teacher change of attitude resulting from engagement in

the systematic 7-Step Virtual Worlds Teacher Training Workshop?

3. What are special educators' perceptions of the usability of virtual worlds for special education, especially to practice social encounters for individuals with social skills challenges?

Two sub-questions were embedded within the third research question:

4. What are special educators' perceptions of the benefits and challenges of virtual worlds for special education?
5. What are special educators' perceptions of the potential of virtual worlds for collaborative learning?

Research Design

In this exploratory case study, a mixed-methods approach enabled me to explore the data from different perspectives: I used the qualitative data to gain insight into the perceptions and reflections of special education teachers, while the quantitative data informed the story and substantiated the qualitative data. As suggested by Johnson and Onwuegbuzie (2004), mixed methods design relies on taking the best elements of all available opportunities. Blending quantitative and qualitative methodologies allows a rich and comprehensive description complemented by measurable data (Johnson & Onwuegbuzie). Mixed methods provided a rich description of special educators' perceptions of the usability of virtual worlds for special education, which has informed the key components of effective virtual worlds teacher training. The collection of multiple data streams from the preliminary and post-survey, the written reflections, the lesson plan analysis prompts, and the researcher journal were used as triangulation tools.

Because the research on virtual worlds teacher training lacks quantitative data, the intervention took a mixed-methods approach despite the relatively small sample (N=18). A sample of 18, however, is comparable to the sample sizes in similar studies (Annetta et al., 2008; Blankenship & Kim, 2012; Campbell, 2009; Dickey, 2011; Edirisingha et al., 2009; Gamage et al., 2011; Good et al., 2008; Guzzetti & Stokrocki, 2013; Nussli et al., 2014; O'Connor, 2009-2010; O'Connor & Sakshaug, 2008-2009; Oh & Nussli, 2014; Omale et al., 2009; Silva et al., 2010; Storey & Wolf, 2010), which range between two and 41, with only five studies (i.e., approximately one third) having more than 13 participants.

Sample

The intervention was an integral part of a graduate-level technology course for special education teachers at the University of San Francisco (USF). The course instructor agreed to grant access to his class in spring 2014. I helped the instructor to facilitate the intervention. The convenience sample consisted of 18 (16 female and 2 male) special education teachers who were specializing in working with students with mild and moderate disabilities. All participants already had two and a half hours of Second Life experience, which they had acquired in a previous course in collaboration with the English as a Second Language Department. Although they perceived their experiences as negative due to a lack of focused interaction, they acknowledged the potential of Second Life for language learning. The class met once a week for four hours during an entire semester. One of the course projects was the purposeful and critical exploration of virtual worlds.

Timeline

Overall, the intervention lasted around five hours, both class time (about 4 hours) and homework (70 minutes) combined. The intervention took place within two weeks, specifically over three class periods and one virtual meeting from home. Steps 1 (15 minutes) and 2 (45 minutes) were combined into the first class meeting. Step 3 (70 minutes), which was conducted from home, took place at the end of the same week. Three days later, Steps 4 (50 minutes) and 5 (30 minutes) were incorporated into the second class meeting. One week later in the third class meeting, the intervention was concluded in Steps 6 (60 minutes) and 7 (30 minutes). Each step is described in detail under Data Collection Procedures in Chapter 3.

Instruments

In the following section, I will describe the seven data collection instruments. I designed the intervention and the instruments in close collaboration with the instructor. Based on the participants' feedback, we refined the intervention and the instruments after the first pilot-study and again after the second pilot study. A summary of each instrument's purpose, the item format, the data analysis, and the alignment with the research questions is displayed in tables. The appendices display an informed consent form (Appendix A) as well as all instruments (Appendix B through I). I will describe the purpose of each of the seven steps and how each instrument was used under Data Collection Procedures in greater detail. Details about data analysis, reliability, validity, and pilot testing are available in the respective subsections.

First Instrument: Preliminary Survey (Step 1)

The preliminary 23-item survey (Appendix B), specifically items 3 to 13, was developed with the objective of capturing participants' attitudes toward virtual worlds for educational purposes. It was administered in the first class period in the first step of the intervention. Participants were given 30 minutes to complete the online survey. More details will follow under Data Collection Procedures.

For the purposes of the intervention, "attitude" is defined as the participants' opinions in terms of the unique affordances of virtual worlds for special education, their personal anxiety level, their perceptions of the usability of virtual worlds, and their potential for collaborative learning. Attitude also encompasses the participants' willingness to implement Second Life in their teaching and their need for support in this process. Some of the 11 survey items were geared toward motivation, that is, whether the participants believed that students are more motivated for learning when using virtual worlds. Table 6 provides an overview.

Table 6

Alignment of Preliminary Survey Items with Research Questions

Item #	Summary and Purpose	Item Format	Data analysis	Research Question
1	Participants indicate their name to allow data comparison across instruments.	NA	NA	NA
2	Student-generated questions are key to inquiry-based learning. This item is designed to start the inquiry cycle that frames the intervention.	Open-ended	Qualitative	#1
3-13	Measuring participants' attitude toward the use of Second Life in education	5-point Likert-type	Inferential statistics Cumulative attitude score, non-parametric Wilcoxon signed rank test to determine statistically significant difference.	#2
14	Measuring participants' perception of the usability of Second Life in education, with a focus on social skills practice	10-point rating scale	Inferential statistics Cumulative attitude score, Wilcoxon signed rank test.	#2
15	Perceptions of benefits and challenges of Second Life for individuals with social skills challenges.	Open-ended	Qualitative	#3
16 17	Information about teaching experience (in years) and subject matter expertise to describe the sample in greater detail	Multiple choice (one answer) and open-ended	NA	NA
18 19	Demographic information to describe the sample in greater detail	Multiple choice (one answer)	NA	NA
20-23	Technology background to describe the sample in greater detail	Multiple choice (one answer)	NA	NA
24	Description of previous experience with virtual worlds.	Open-ended	Qualitative	all
25	Comment section	Open-ended	Qualitative	all

Survey development. In the construction of items 3 to 13, I ensured that all items serve a specific research purpose. Items did not address more than one topic. I did not use any abbreviations. Only words are used that are accessible to both native and non-native speakers of English with and without technical expertise or knowledge of Second Life. I avoided any technical jargon referring to virtual worlds. Items were phrased in a way that

respondents are able to answer the questions. Phrasing that elicits a socially desirable answer as well as long items were avoided. Both positively and negatively worded phrases were used to avoid acquiescence bias.

Measurement Format. The format of the 25-item preliminary survey included 5-point Likert-type scales, multiple choice and open-ended questions, and a 10-point rating scale. The following items were negatively keyed: 3, 5, 6, and 12.

Second Instrument: Written Reflection Prompts (Step 5)

I designed the written reflection prompts (Appendix C) around the research questions and provided an opportunity to reflect on practical ways of using virtual worlds for individuals with social skills challenges, guidelines for teaching in virtual worlds, the key components of virtual world teacher training, benefits and challenges, the participants' overall perception of the usability of Second Life for special education, and the features of an ideal Second Life space for special education. Immediately after Step 3-Virtual Exploration, the participants received a copy of the six reflection prompts so that they would have three days for reflection. Three days later, in class, the participants were given 30 minutes to write their reflection and submit it to the instructor on Canvas. At this point, the participants had already been immersed in the intervention for three and a half hours. Table 7 provides an overview. I will provide more details under Data Collection Procedures.

Table 7

Alignment of Reflection Prompts with Research Questions

Item #	Summary and Purpose	Item Format	Data analysis	Research Question
1	Practical ways of using Second Life for students with social skills challenges	Open-ended	Qualitative	#3
2	Best practices for virtual teachers	Open-ended	Qualitative	#1
3	Effective virtual worlds teacher training for special education teachers	Open-ended	Qualitative	#1
4	Benefits and challenges of virtual worlds	Open-ended	Qualitative	#4
5	Using virtual worlds in special education: why and how	Open-ended	Qualitative	#3
6	Features of an ideal Second Life destination for special education purposes	Open-ended	Qualitative	#1

Third Instrument: Lesson Plan Analysis Prompts (Step 6)

The lesson plan analysis (Appendix D) provided an opportunity for participants to see how other educators have designed their lessons around Second Life[2]. The prompts steered the participants' attention toward the unique affordances and challenges of virtual worlds and the needs of students with social skills challenges. The participants were also asked to reflect on how learning happens in Second Life, based on the specific lesson plan activities they had chosen for analysis. This instrument was administered in Step 6-Lesson Plan Analysis in the fifth and final hour of the intervention. Table 8 provides an overview. More details are provided under Data Collection Procedures.

[2] These lesson plans are available online at: http://tinyurl.com/lrqhoyu

Table 8

Alignment of Lesson Plan Analysis Prompts with Research Questions

Item #	Summary and Purpose	Item Format	Data analysis	Research Question
1	Contribution of a specific Second Life destination to learning	Open-ended	Qualitative	#3
2	Modifications of Second Life activity to accommodate special education learners	Open-ended	Qualitative	#3
3	Unique affordances of Second Life compared with other, non-3D learning environments	Open-ended	Qualitative	#4
4	Anticipated challenges when carrying out the lesson plan activities	Open-ended	Qualitative	#4

Fourth Instrument: Post-Survey (Step 7)

The post-survey consisted of 37 items (Appendix E). Similar to the preliminary survey, the format was a combination of 5-point Likert-type questions, multiple choice and open-ended questions, and a 10-point rating scale. The post-survey was administered immediately after Step 6-Lesson Plan Analysis in the final step of the intervention after four and a half hours of immersion into virtual worlds training. The content revolved around the participants' perceptions of the components of effective virtual worlds teacher training, the usability of Second Life for special education, and collaborative learning in Second Life. The following items were negatively keyed: 13, 15, 16, and 22. Table 9 provides an overview. More details about the administration are provided under Data Collection Procedures.

Table 9

Alignment of Post-Survey with Research Questions

Item #	Summary and Purpose	Item Format	Data Analysis	Research Question
1	Enter name	NA	NA	NA
2	Student-generated questions are a key element of inquiry-based learning. The preliminary survey starts with this question. The post-survey completes the inquiry cycle and should therefore provide the chance to share any pending questions.	Open-ended	Qualitative	#1
3-10	Questions about the perceived effectiveness of each of the intervention's inquiry steps	5-point Likert-type	Descriptive statistics	#1
11	Effectiveness of intervention to enable teachers to make informed decisions about the usability of Second Life for students with social skills challenges	Multiple choice	Descriptive statistics	#1
12	Selecting components of effective virtual worlds teacher training	Multiple choice (several choices)	Descriptive statistics	#1
13	Brainstorming on additional components of virtual worlds teacher training (optional)	Open-ended	Qualitative	#1
14-24	Measuring participants' attitude toward use of Second Life in education (same 11-item attitude scale as in preliminary survey)	5-point Likert-type	Inferential statistics, Cumulative attitude score, Wilcoxon signed rank test	#2
25	Measuring participants' perceptions of the usability of Second Life in education (same rating item as in preliminary survey) for students with social skills challenges	10-point-rating scale	Wilcoxon signed rank test	#2
26	Brainstorming on activities for students with social skills challenges to practice social encounters	Open-ended	Qualitative	#3
27	Perception of benefits and challenges for students with social skills challenges	Open-ended	Qualitative	#4
28-35	Collaborative learning	5-point Likert-type	Descriptive and reliability analysis	#5
36	Usefulness of inquiry approach to frame the intervention	5-point Likert-type	Descriptive	#1
37	Comments (optional)	Open-ended	Qualitative	all

Fifth Instrument: Researcher Journal

I kept a journal throughout the intervention to take field notes. The researcher journal served three purposes: First, to provide me with a way of understanding and assessing her role as a virtual facilitator. Involvement with and reactivity to the participants, activities, and the field setting were documented. Understanding the potential biases, attitudes, and reactions were an important part of understanding how these characteristics may have affected the collection and interpretation of data. Second, the journal acted as a forum for generating ideas and hypotheses. Third, the highlights from these notes inform best practices in virtual worlds teaching and may be helpful for other educators who are planning to enter the field of virtual worlds. For each reflection, I considered the following prompts and addressed those that seemed most useful at the time of reflection.

1. *What issues and problems emerged during the virtual exploration?*
2. *Which are the highlights from the lesson plan presentation?*
3. *What am I learning about the 3D space and those that I am observing?*
4. *What is working well, and why?*
5. *What is not working well, and why?*
6. *What are my biases?*
7. *What are the participants' biases?*
8. *What are the instructor's biases?*
9. *Are there any connections between what I am observing and relevant research literature?*
10. *Are there any confusing or contradictory experiences?*

I addressed any additional questions that seemed useful at that moment. I also conducted a pre- and post-intervention interview with myself.

Sixth Instrument: Instructor Pre-Interview

Within a week prior to the intervention, I conducted an interview with the instructor to gauge his perceptions of the usability of virtual worlds for special education. The interview consisted of the following questions:

1. *In your own words, what is your overall perception of the usability of Second Life for special education?*
2. *How do you rate the overall usability of Second Life for special education purposes on a 10-point rating scale (1=useless, 10=extremely useful)?*
3. *What do you hope to achieve with the 7-Step Virtual Worlds Teacher Training intervention?*
4. *Which virtual worlds features do you perceive as benefits for special education students?*
5. *Which virtual worlds features do you perceive as challenges for special education students?*
6. *What do you anticipate working well and why?*
7. *What do you anticipate not working well and why?*
8. *In your opinion, to what extent do virtual worlds have potential to practice social skills?*
9. *How can the participants benefit from this intervention?*
10. *Please explain why it is justified to spend five hours on this intervention.*

Seventh Instrument: Instructor Post-Interview

Within a week after the intervention, I conducted a post-interview with the instructor to gauge his perceptions of the usability of virtual worlds for special education. The interview consisted of the following questions:

1. *In your own words, what is your overall perception of the usability of Second Life for special education?*
2. *How do you rate its overall usability on a 10-point rating scale (1=useless, 10=extremely useful) for special education purposes?*
3. *What issues and problems emerged during the virtual exploration?*
4. *What did you learn about the 3D space and those that you observed?*
5. *What was working well, and why?*
6. *What was not working well, and why?*
7. *Were there any confusing or contradictory experiences?*
8. *Please describe any biases toward virtual worlds that you may have.*
9. *How would you describe the participants' biases?*

Comparison of Instruments with Similar Studies

As mentioned earlier, there are two studies about virtual worlds teacher training that have used a systematic approach. I will first offer comparisons with Guzzetti and Stokrocki (2013) and then with Campbell (2009).

Guzzetti and Stokrocki (2013). Similarities with the instrumentation of the intervention include: observation field notes, open-ended, short answer questionnaires recording the participants' teaching experiences, final reflection questionnaire to describe the usability of virtual worlds for education, comments on the group processes, and difficulties during the training. The eight stages of the training in Guzzetti and Stokrocki encompassed a combination of the following activities that are similar to the intervention of the present study: examine educational projects in Second Life, reading articles about Second Life theory and research, read about Second Life applications, view YouTube videos, visit websites on educational projects using Second Life, write reflections, read and watch Second Life tutorials, take a guided tour in Second Life, accomplish quests with pre-assigned partners, provide suggestions for future courses, and write reaction papers on Second Life's appeal and usability.

Compared with Guzzetti and Stokrocki, this intervention offered the following unique features: (a) selection, trial, analysis, and modifications of existing Second Life lesson plans developed by other educators; (b) extensive preliminary and post-survey measuring the participants' attitude toward the usability of Second Life for special education; (c) my blogback to the participants' written reflections; (d) the development of tentative lesson plans by the participants, with peers' feedback; (e) the systematic framing of each step by inquiry; (f) the validation of each step of the training by the

participants' ratings in the post-survey; and (g) reflections on the special affordances for special needs students.

Campbell (2009). The data collected in this pilot study included a preliminary and post-questionnaire completed by pre-service teachers, focus group interviews, and an online journal. Similarities include the collaborative virtual explorations, written reflections, field observations, and the collaborative development of learning activities, and groups presenting their ideas to the class. Except for the development of learning activities, the intervention of the present study offered the same additional features as in the comparison with Guzzetti and Stokrocki (2013).

Selecting Second Life

Second Life is the virtual tool that was used for the intervention. Second Life features prominently in education and the research literature (Gamage et al., 2011; Salt et al., 2008). Almost all reports of educational activity in multi-user virtual environments are about Second Life (Salt et al., 2008). Dalgarno and colleagues (2013) have recently investigated the use of virtual worlds in Australia and New Zealand. Of the 62 respondents (out of 117 respondents) who indicated that they had already used a virtual world in their teaching, 78% reported using Second Life. In a survey by Kirriemuir (2010) involving virtual worlds in 42 UK universities, Second Life was reported to be by far the preferred choice. A database search conducted in April of 2013 of the EBSCO database for peer-reviewed articles revealed hundreds of articles about Second Life, but only seven articles were found for Active Worlds and one for Adobe Atmosphere, both of which are virtual worlds. No articles were found about the use of other popular virtual worlds in education, such as Croquet, Olive, Blaxxun, OnLive Traveler!, Twinity, Open

Sim, Project Wonderland, Blue Mars, Cloud Party, Hypergrid Business, Oculus Rift, or OS Grid, although Kirriemuir (2010) reported that by late 2009, other virtual worlds were beginning to be mentioned more frequently by his survey respondents, such as OpenSim and Reaction Grid, which allows to maintain a "closed" environment that is not publicly accessible and where content can be imported from and exported to Second Life.

Data Collection Procedures

Research-Based Design

The intervention design was based on the guidelines emanating from Chapter 2 (Table 3). These guidelines included the need for a pedagogical rationale, synchronicity, scaffolding, consideration of prior experience, technical support, stimulating spaces, and functional design. The intervention was designed with the unique virtual worlds teaching skills in mind. Table 10 displays the connection between these guidelines (first column), a summary of the extrapolated 3D teaching skills (second column), while the third column specifies how each of the guidelines has informed the design of the intervention.

Table 10

Alignment of Intervention Design with Empirical Guidelines and Unique Teaching Skills

Guideline	Extrapolated 3D Teaching Skills	Transfer to the Intervention's Design
Pedagogical Rationale	Virtual worlds are only valid for education if supported by a solid pedagogical rationale. Reflection on why rather than how to use a virtual space is paramount. Course objectives and well-aligned activities in virtual worlds must be closely connected.	In Step 3, the participants designed a tentative lesson plan framed by a pedagogical rationale. Groups discussed how the unique affordances of virtual worlds support the learning objectives of their hypothetical lesson plan. In Step 6, the participants evaluated a lesson plan based on questions such as how Second Life enhances learning and how the course objectives are aligned with the virtual activities.
Synchroni-city	Encouraging and managing virtual communication purposefully helps to keep the virtual group together. A system must be in place to know who is speaking.	In Step 3, both the instructor and the facilitator modeled how to encourage and manage virtual communication in Step 3, which was conducted synchronously in small groups. The use of Skype for voice communication increases the sound quality and indicates who is speaking, which facilitates interaction.
Scaffolding	Continuous scaffolding in open-ended, ill-structured environments is critical. The instructor communicates procedures, goals, and clear expectations prior to a virtual session. An experienced mentor and facilitator offers support.	Clear goals of the intervention were communicated at the beginning of the intervention. Clear task objectives have been provided for Steps 3 and 6. Clear expectations were communicated at the beginning of each step. During Step 3, the facilitator provides technical assistance, if needed.
Prior Experience	Evaluating students' prior experience and technical skills is critical. These factors impact students' attitude toward the use of virtual worlds in education and determine the amount of scaffolding.	In Step 1, the preliminary survey inquired about the participants' technology background and their virtual worlds experience. Step 1 was customized to the participants' Second Life experience (start-up manual).
Stimulating Spaces	Using creative and visually stimulating virtual spaces is critical to support experiential learning.	The Second Life regions used in Steps 3 and 6 have been carefully selected. Most have been designed with an educational goal in mind and are taking full advantage of the creativity and the unique affordances of virtual worlds.
Functional Design	The instructor recognizes the varying functionality of virtual spaces and reflects on which transient space best accommodates which task.	Each of the selected regions that were explored in Step 3 provides a variety of spaces with different functionality.
Technical Support	The instructor is able to troubleshoot and willing to collaborate with a technical facilitator. The instructor and the participants demonstrate the willingness for technical growth beyond the pedagogic transition into a virtual teacher.	Throughout the intervention, the instructor and the facilitator provided assistance, whenever needed. Also, they demonstrated that the intervention is a quest that enables the participants to make informed decisions about the usability of Second Life for special education, rather than an attempt to convince them of its potential.

Inquiry Approach

Figure 4 shows how each of the steps specifically aligned with inquiry-based learning. The participants received a copy of Figure 4 at the beginning of the intervention to have a sense of the steps and their purpose through the lens of inquiry-based learning.

Inquiry Approach	Step 1-Introduction. Inquiry starts with student-generated questions. The overarching question that guides this intervention is, "How usable is Second Life for social skills practice?" Complete inquiry prior to evidence-based conclusion.
	Step 2-Unique Affordances & Resources. Discuss empirical affordances of virtual worlds for both general and special education. Acquire background for virtual exploration task. Learn how to locate appropriate educational Second Life regions.
	Step 3-Virtual Exploration. Engage in hands-on virtual experience by conducting group investigation of the usefulness of Second Life for social skills practice.
	Step 4-Lesson Plan Presentation. Communicate and justify lesson plan created in Step 3. Give priority to evidence and formulate explanations.
	Step 5-Written Reflection. Express, clarify, justify, and represent ideas and beliefs.
	Step 6-Lesson Plan Analysis. Try out, examine, critique, and modify existing Second Life lesson plans developed by other educators. Examine procedures and rationale. Reflect on usability for social skills practice. Discuss modifications.
	Step 7-Post-Survey. Demonstrate ability to make informed decisions about the potential of Second Life for special education and collaborative learning. Evaluate the intervention's effectiveness. Reflect on unanswered questions and future use.

Figure 4. Alignment of each step of the intervention with inquiry-based learning.

The 7-Step Virtual Worlds Teacher Training Workshop

In this section, I will describe the seven steps in detail.

Step 1-Preliminary Survey. Step 1 had two purposes: First, to give participants a chance to generate any questions they may have about virtual worlds; second, to measure the participants' attitude toward the usability of virtual worlds for special education by means of an 11-item attitude scale; third, to measure their perceptions of the usability of Second Life for social skills practice by means of a 10-point rating item; and fourth, to collect demographic information and details about their technology background.

First, the instructor presented the informed consent form, which provided an overview of the intervention. The instructor informed participants that completion of the preliminary survey constituted implied consent and that he would provide alternative assignments if someone wished to opt out. Next, the instructor shared the link to the preliminary survey on Survey Monkey and the participants completed it in class. Measuring the participants' preliminary attitude provided data to answer the second research question. Step 2 was divided into the unique affordances of virtual worlds and resources for educators interested in using virtual worlds.

Step 2a-Unique Affordances. The purpose of Step 2a was to provide a scaffolded introduction to the topic of virtual worlds in education, contextualize the intervention, and share research-based findings about the unique affordances of virtual worlds for education.

During the same class period as Step 1, participants watched two videos: The Maya video (5:30 min.) at http://www.youtube.com/watch?v=mIwFGqg2rPU

demonstrated the potential of Second Life for experiential learning. Maya Island, an exemplary island for educational purposes, was conceptualized and designed by graduates of the first virtual worlds teacher certification program offered by the University of Washington. The interview about autism (2 min.) at http://tinyurl.com/myoes3w highlighted its potential for people with autism. There was a short debriefing in class to provide an opportunity for reflection and discussion. Next, the instructor introduced the five unique benefits as identified by Dalgarno & Lee (2010, Appendix G) and offered a brief overview of the research revolving around the special affordances of virtual worlds for individuals with social skills challenges.

Step 2b-Resources. The purpose of this step was to provide an overview of the intervention, the inquiry cycle (Appendix F) that framed the workshop, and to share virtual world resources for educators. The instructor walked the participants through each step of the inquiry cycle to demonstrate that each activity of the intervention was sequential and intricately linked with the other activities. The inquiry cycle started with an open-ended question for investigation: "How usable is Second Life for special education purposes?" Overall, participants completed seven steps during which they built knowledge from first-hand collaborative experiences and refined their conclusions. Throughout the process, students were repeatedly confronted with the question of the meaningfulness of virtual worlds for special education, with a focus on social skills practice. Next, the instructor showed a three-minute screencast (http://tinyurl.com/p9eq8lt) in class, which I had recorded to provide tips on how to join virtual communities of educators interested in teaching in Second Life, how to locate

Second Life destinations according to subject areas, and how to keep up with progress in virtual worlds research. The instructor shared the following resources electronically:

- Bignell, S., & Parson, V. (2010). *Best practice in virtual worlds teaching. A guide to using problem-based learning in Second Life.* Retrieved September 16, 2013 from: http://previewpsych.org/BPD2.0.pdf
- Savin-Baden, M. (2010) *A Practical Guide to Using Second Life in Higher Education.* Maidenhead: McGraw-Hill.
- A compilation of science-related Second Life islands at http://tinyurl.com/p3q46az
- My Scoop it! page about Virtual Worlds Teacher Training at: http://www.scoop.it/t/virtual-worlds-teacher-training

Step 3-Virtual Exploration. The purpose of the third step (Appendix H) was to engage participants in a first-hand exploration of Second Life as a key step in their exploration of the usefulness of Second Life for education. Participants brainstormed on potential activities (how to use Second Life for special education with a focus on social skills practice) and reflected on the rationale of using one Second Life destination for education.

The second meeting was held virtually. Both the instructor and I met in Second Life with small groups of three to four. Participants logged in to Second Life from home to ensure a stable, hard-wired internet connection[3] and met with their group members. Each session involved Skype for voice communication, which means that Second Life and Skype were running simultaneously. Skype not only offered much better sound quality, but it was also easier to recognize who was speaking because, in a Skype group

[3] A good high-speed, stable internet connection is required at all times. According to the technical FAQ of the Second Life Community (2012), a wireless connection is usually not sufficient to run Second Life smoothly. The best option is to be hard wired to the internet. "WiFi", a short range wireless connection between a computer and the wireless router or modem, may work with Second Life if the router is in a central position, but it is not recommended. An ethernet cable is faster and better. Satellite internet is not recommended either due to possible signal delays. Finally, a wireless 3G or 4G connection, using an iPhone, for example, is definitely not recommended for Second Life.

call, the speaker's picture blinks in Skype. If Second Life voice is used, there is a tendency for echoing and feedback. Speaking is indicated by green waves over an avatar's head, but if there is feedback, the green waves are activated over several avatars even if only one of them is speaking. This problem makes it difficult to discern who is speaking, apart from the fact that echoing and feedback reduce the sound quality quite considerably. Pilottesting has shown that most issues can be resolved by using Skype.

We avoided text chat in Second Life in order to avoid cognitive overload. Group meetings were held at different times in order to allow the instructor and me to join, facilitate, and video record the meetings. The instructor requested the participants' Second Life and Skype names via Google Forms one week prior to Step 3. He reminded them that they needed a mouse and stable internet access, an updated Second Life viewer (or an alternative viewer such as Firestorm) as well as Skype. I befriended everyone on Skype and Second Life so that I could start a Skype group call and troubleshoot in Second Life, for example, teleport someone to my location.

The participants explored Second Life collaboratively in groups of three to four (two groups of three, three groups of four). Groups chose one destination out of 17 pre-selected destinations ahead of time. The exploration guide is shown in Appendix I. Some destinations are labeled "top islands", which are destinations that I perceive as exemplary in terms of their educational value. The remaining destinations are categorized according to grade-level appropriateness (K-12 or undergraduate/higher education) and according to themes, such as history, science, fantasy, and so on. All destinations have been carefully tested for their appropriateness based on the following criteria: stimulating environment, providing learning resources, promoting collaboration, offering various functional spaces,

and offering an experience that would otherwise be impossible or impractical. If the participants felt that the description of the 17 Second Life destinations in the exploration guide (Appendix I) was not sufficient, they could watch a video on Youtube on each of the destinations. I provided the instructor with a list of links to videos.

Participants were given 30 minutes to explore one destination of their choice and then reconvened in-world to brainstorm on tentative learning activities. They had to specify the learning objectives, determine the student group for whom the activities were designed, develop a rationale supporting the use of a virtual world for these activities, rate the Second Life destination for special education students as well as agree on potential modifications of the island. They submitted their notes to the instructor. My role was to provide an overview of the highlights on a specific sim (region) or, if the participants preferred, a guided tour. I also offered troubleshooting. The role of the instructor was to keep the participants focused on the task and to prompt discussion.

Step 4-Lesson Plan Presentation. The purpose of Step 4 was to help the participants make an informed decision about the usability of the explored Second Life regions by asking them to communicate and justify their tentative lesson plan. An additional purpose of this step was to provide participants with feedback opportunities, which may contribute to the re-conceptualization of their beliefs and further advance their familiarity with virtual worlds use in education.

At the second class meeting, which was held a few days after the virtual exploration, participants were first given more time (approx. 20 minutes) to prepare their presentation. They presented their findings generated in Step 3-Virtual Exploration to the class and showed screenshots. The presentations were video recorded. The presentation

checklist (last page of Appendix H) outlined the elements, which needed to be presented. I believe that this was an efficient way to share first-hand experience and ratings about four other Second Life destinations (total of five groups). Participants had reached the first milestone in their investigation. At this point, they were expected to be able to make an informed decision about the usability of Second Life for special education, based on first-hand experience.

Step 5-Written Reflection. The purpose of the six reflection prompts (Appendix C) was to propel deep reflection in the participants about the usability of Second Life for special education with a focus on social skills practice and key components of effective virtual worlds training.

The participants wrote the reflection during the same class meeting as Step 4, that is, immediately after the lesson plan presentations. The reflection step offered an opportunity for participants to express, clarify, justify, and represent their beliefs about their new experiences in a non-traditional learning environment. Writing a reflection can also help educators understand the problems that their own students will encounter in future explorations of virtual worlds and to design assignments with these issues in mind. All questions were open-ended prompts. As mentioned earlier, the participants posted their reflections to Canvas. To further stimulate the participants' reflection and to engage in a conversation with them, I posted a "blogback" (coined by Mitchell, 2013) to each participant before the next class session. In class, the participants got a chance to read my blogback and wrote an answer to my question. The purpose of this process was to ensure that the participants would actually read my blogback and to engage them in a conversation that propels further reflection.

Step 6-Lesson Plan Analysis. The purpose of Step 6 was to try out, examine, critique, and modify an existing lesson plan designed around an educational Second Life region.

In the third class meeting, one week after the reflections have been posted, participants chose and analyzed one existing lesson plan (Appendix D) from a selection of nine lesson plans[4], which had been developed by other educators and which were available online. I then created an overview of these destinations (last page of Appendix D) with brief descriptions of each Second Life sim, the subject matter, the Second Life hyperlink (SLurl), and the grade level for which the lesson plan had been designed. The participants received a printout of their selected lesson plan.

With a partner, they carried out each step at the university's Mac laboratory. Each participant navigated Second Life at an individual computer station. Practically, this means that two collaborating participants each work at their own computer but sit next to each other to facilitate informal communication. A few participants had difficulties logging in, which is why they shared a computer with their partner. During or after the virtual fieldtrip, partners engaged with each other to discuss the four prompts. Each pair submitted their written answers to the four prompts.

Step 7-Post-Survey. The purpose of Step 7 was for participants to demonstrate that they were able to make informed decisions about the potential of Second Life as an educational tool in the realms of special education, with a focus on social skills practice.

During the same class period as Step 6, participants completed the post-survey (Appendix E) in class.

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[4] These lesson plans are available online at: http://tinyurl.com/lrqhoyu

Data Analysis

Quantitative Data Analysis

As mentioned earlier, items 3-13 of the preliminary survey were equivalent to items 13-23 of the post-survey. Each participant's answers to these 11 items were coded and summed to obtain a cumulative attitude score (max. = 55) regarding his or her perception of the usability of Second Life for special education. The class means in the pre- and post-survey were calculated. To explore the difference in means, a series of non-parametric Wilcoxon signed-rank tests were performed in SPSS. The significance level was set at $p < .05$. The same procedure was repeated for the comparison of the ratings in summary item 14 of the preliminary survey, which corresponded to item 24 in the post-survey. Data preparation before the SPSS analysis encompassed the following steps: download results in Excel format from Survey Monkey; highlight negatively keyed items in red; code answers into numbers (for positively keyed items: 5=Strongly agree, 4=Agree, 3=*Don't know*, 2=Disagree, 1=Strongly disagree); reverse code negatively keyed items (for negatively keyed items: 1=Strongly agree, 2=Agree, 3=*Don't know*, 4=Disagree, 5=Strongly disagree) so that higher scores indicate more agreement, that is, higher perceived usability of virtual worlds for education; sum all Excel columns for item means (divided by the number of respondents, N=18); sum all rows for individual attitude score; calculate mean attitude score (sum of all attitude scores divided by N=18); sort column with student names alphabetically and make certain that all columns are sorted accordingly to ensure perfect match between preliminary and post-survey results. Finally, add empty column after the "name" column and enter respondent numbers.

Qualitative Data Analysis

The qualitative data emerged from multiple sources, namely, from the open-ended items of the preliminary and the post-survey, the reflection, the lesson plan analysis prompts, the researcher journal, and the pre- and post-interview with the instructor. Rereading of the raw data allowed identifying recurring themes through open-coding. I combined overlapping codes into recurring themes, used color codes for each recurring theme and the corresponding text passages for better visualization and separation, labeled themes with abbreviations to facilitate data management, and organized the themes around research questions. For each research question, I copied/pasted data into separate documents, clearly indicating the source for later verification.

The categories constructed during data analysis should meet certain criteria. Categories should be responsive to the purpose of the research; exhaustive; mutually exclusive; the categories should be as sensitive to the data as possible; and, conceptually congruent, that is, the categories should be at the same level of abstraction (Merriam, 2009, p. 186). After my interrater reliability team, which will be introduced later in this chapter under Reliability, and I had established the reliability of a first draft of my codes, I entered the codes into NVivo, a qualitative data analysis software, for the purpose of coding comparisons and generating frequencies. Table 11 displays potential categories and codes based on Nussli et al. (2014).

Table 11

Potential Categories and Codes

Categories	**Codes**
Practical applications	Collaboration:
	Toward joint goals
	With people students would not normally be able to work with
	Social skills practice / Modeling of behavior
	Get students interested in subjects they might otherwise find less interesting
Benefits	Experiential learning
	Increased engagement
	Exploring the impossible or impractical
	Multi-sensory input
	Learning at one's own pace
	Spatial representation (e.g., math)
	Making abstract concepts more real
Concerns	Crashes/getting logged off
	Lack of computer literacy
	Poor eye-hand coordination impairs navigation
	Need for extensive teacher and student preparation
	Accessibility issues (internet connection)
	Visually overwhelming, distracting from learning
	Exposure to strangers, safety issues
Reasons for increased motivation	Anonymity encourages some students to participate more actively
	Increased student control/autonomy
	Students are motivated by competition
	Similarity to video games
	Students are motivated by all types of technology
An ideal virtual space	Provides space for social interaction practice
	Treasure hunts, educational games, etc.
	User-friendly (more user-friendly than Second Life)
	Content specific to subject matter
	Everything must be labeled
	Role plays similar to social stories to learn behavior
	Small islands, sims
	Career island for high school students in transition
	Choice of activities
Teacher guidelines	Familiarize with Second Life extensively before using it with students
	Continuous support
	Teacher should do a test run and have so many students log in to Second Life before "real" fieldtrip.
	Troubleshooting skills
	Teacher tries out lesson before implementing it
	Teacher encourages creativity
	Teach students explicit, clear and simple steps
	Provide ample time and direction
	Stick to learning objectives to prevent distraction
	Isolate students on private Second Life sims or screen content for appropriate
	Assess computer literacy beforehand
Teacher training	Build teacher confidence/good comfort level with Second Life
	Share sample lesson plans for different ages and subjects
	Try out lesson plans developed by each other
	Provide extensive virtual practice

Preliminary Codes

Prior to the interrater reliability meeting, preliminary codes were developed in the first two rounds of reading. In a first reading, data were labeled with the emerging themes/categories. In a second reading, codes were created. Next, similar codes were collapsed. Each code received an extensive code description based on both the participant responses and virtual worlds research. It was ensured that codes were mutually exhaustive and clearly delineated.

Pilottesting the Preliminary Codes

Pilottesting the data sets prior to the actual interrater meeting helped to get a better idea of the feasibility and timing. The pilottester coded each of the seven data sets under timed conditions, totaling three hours. The original code chart consisted of eight themes and 53 codes used for the pilottesting. Based on the results of the pilottesting and an interview with the pilottester on potential ambiguities, some of the themes and codes were merged, which resulted in seven themes and 42 codes used for the interrater reliability meeting.

The first major change involved the rewording of the code descriptions. The pilottester suggested clearer differentiations in some cases, for example *Objectives* and *Assessment* or *Facilitation & Support* and *Teacher Preparation*. Switching the order of the data sets was the second critical change. In the interrater meeting, we started with the easy datasets (Level 1). The pilottesting, however, (unintentionally) started with the intermediate data set (later labeled Level 2), which took twice as long (101 minutes) as Level 1 (50 minutes). The process of calibration proved successful, as evidenced by a good amount of agreement on most codes. All disagreements were negotiated and

resolved smoothly and efficiently. Due to time constraints, only the pilottester coded data set 8 (Level 3), which was the most complex task because it required applying the entire code chart (42 codes) and using several codes for each participant quotation.

Frequency of Final Codes

The number of themes was eight prior to pilottesting, seven prior to and after the interrater reliability meeting, and was reduced to three after the NVivo analysis. The number of codes was 53 prior to pilottesting, 42 prior to the interrater meeting, 41 after the interrater meeting, and was reduced to 18 after the NVivo analysis.

All data (open-ended items preliminary and post-survey, written reflection, answers to lesson plan analysis prompts) pertaining to each research question (RQ1) were uploaded to NVivo and coded using the seven themes and 41 codes validated at the interrater meeting. NVivo determined the frequency with which codes were applied. Using the function "nodes most common", NVivo generated the high-frequency codes. The most common codes had frequencies ranging from as low as 6 and as high as 38. Next, I examined the NVivo frequencies of all codes (Appendix J). I realized that there were codes that had also been used moderately frequently, although they were not among the most common codes identified by NVivo. Thus, those codes with a total frequency of >10 were retained as well.

Figure 5 displays the final six themes (bold) in the top row, three of which emerged as the most frequent, namely, Virtual World Pedagogy, Virtual World Benefits, and Virtual World Challenges. The most common codes (white) display the frequencies in parentheses. The less common codes (grey) were retained for later reference.

Virtual World Pedagogy	Virtual World Benefits	Virtual World Challenges	Unique Benefits and Challenges for Special Education	Ideal Virtual Destination	Prerequisites for Using Virtual Worlds in Teaching
Teacher Training & Support (39)	Collaboration (27)	Distraction (29)	Reduced Stress (32)	Private / Confined / Safe (14)	Tech. Access (11)
Activities & Applications (35)	Experiential / Exploratory (25)	Tech. Issues (27)	Social Skills Practice (21)	Simple	Student Preparation
Learner Support (26)	Interactive (15)	Lack of Appropriateness (19)	Repeated Practice	Education Focus	Students' Prior Tech. Background
Curriculum (19)	Impossible / Impractical (14)	Learning Curve (15)	Access Physical Challenges	Visually Realistic	
Virtual Classroom Management (15)	Contribution to Learning, incl. Active Learning (11)	Obstacle	Violent Students		
Groups	Novelty	Griefers			
Objectives	Safe	Time-Intensive			
Assessment	Enjoyment	Avoid Real World			
	Spatial				
	Increased Engagement				

Figure 5. Six themes (bold) and 41 codes after interrater reliability meeting. White codes (with frequencies in parentheses) identified as "most common nodes" in NVivo; less frequent codes in grey.

Next, I coded the transcripts of the pre- and post-intervention interview with the instructor. To narrow the focus, I only applied the 18 high-frequency codes that had emerged from the participant data. There was a large overlap of codes between the instructor's statements and the participant data. In sum, this means that from the 41 codes validated by the interrater group, 18 codes were ultimately retained, which, in turn, were categorized into three major themes, which will be described in Chapter 4.

The code *Distraction* was merged with two other codes, namely, *Entertainment/Game* and *Overstimulation.* This decision was based on the similarity of statements across the three codes. To avoid having themes with one only one or two codes, some of the 18 high-frequency codes needed recategorizing. I collapsed several codes under the three themes that had emerged as the dominant themes. The final themes are introduced in Chapter 4.

Validity

Validity of Quantitative Instruments

Three strategies were applied to secure validity of the quantitative survey items. First, to ensure construct-related evidence of validity, the items were generated from the key dimensions that emerged from a review of the literature (Barbour & Reeves, 2009; Fetscherin & Lattemann, 2008; Salmon, 2009; Verhagen, Feldberg, van den Hooff, Meents, & Merikivi, 2011; Warburton, 2009). Second, a test review panel of six individuals reviewed the survey items. Third, an online pilot test was administered to 32 educators in 2012. Fourth, a pilot test was conducted with a different set of 31 educators in 2013. Each of the four strategies to secure validity will be briefly described.

Construct-related evidence of validity. "Usability" is the degree to which using Second Life may enhance learning (Fetscherin & Lattemann, 2008). With respect to teaching, something may be labeled as usable if it makes learning more effective, if it is easy to use, and if affordances are provided that traditional teaching cannot offer. Usability is influenced by many factors, some of which were addressed by Salmon (2009). Some of these factors include: how teachers view the potential of virtual worlds for learning and instruction, the extent of teachers' awareness of the potential of virtual worlds, if virtual worlds can be adapted to any discipline or context, how well collaborative learning is supported by virtual worlds, the possibilities and constraints of virtual worlds, if teachers are interested enough in exploring virtual worlds to spend extra time and efforts in preparation, if students are interested enough in virtual worlds to get involved, how to redesign assessment measures, how to facilitate Second Life sessions, what influence virtual worlds have on learning, if teachers feel confident about designing virtual learning activities, if technology requirements (up-to-date computers) are in place, if support is available, and if the advantages of a 3D virtual and social environment outweigh the drawbacks (Salmon, 2009). All these questions address usability based on a variety of criteria, such as assessment ease, efficiency of group work, benefits for learning, technology requirements, willingness to learn, and willingness to spend time adjusting traditional teaching material to meet new requirements.

Test Review Panel. The item pool was reviewed by an equal number of female and male reviewers (N=6), consisting of native and nonnative speakers of English with and without Second Life expertise, with varying degrees of computer expertise, and from varying age groups. One reviewer has a Ph.D. in physics, one has a Ph.D. in linguistics,

one has a Master's degree in social psychology, one is a high school graduate, one is a doctoral candidate and special education teacher, and one reviewer is a musician and information technologist with a Bachelor's degree. No gender, cultural, or handicap bias was detected. Their comments resulted in a few minor revisions of the survey items before the survey was piloted with 32 educators and one major revision, namely, the addition of a sixth response option *don't know*. More details about the response options will follow under Reliability.

Pilot test. The 11 items that were used in the intervention were part of a 48-item pilot survey, which was tested with 32 educators in 2012. The purpose of the pilot test of the original 48-item survey was to explore the practicality of the data collection, to measure the amount of time needed to complete the survey, to determine ambiguities, and to establish internal consistency. The survey was piloted with 13 doctoral students at USF, 13 graduates of the Monterey Institute of International Studies (MIIS) with a Master's in Teaching English to Speakers of Other Languages (MA TESOL), and 6 of my acquaintances, all of whom had extensive teaching experience in various fields. Eighty-one percent of the pilot testers described themselves as having no or very little virtual worlds experience. Sixty-six percent had more than 11 years of teaching experience, whereas 22% had less than five years of teaching experience. A minority of 12% had between five and 11 years of teaching experience. The USF pilot testers were very diverse in terms of the subject matter they teach, whereas the MIIS pilot testers were very homogeneous because they are all English language teachers. In sum, the sample was homogenous in terms of Second Life experience, heterogeneous in terms of teaching experience, and mixed in terms of their subject matter expertise.

Validity of Qualitative Instruments

Triangulation is probably the most well-known strategy to support internal validity (Merriam, 2009). Denzin (1978) proposed four types of triangulation: the use of multiple methods, multiple sources of data, multiple investigators, and multiple theories to confirm emerging findings. In the intervention, three types of triangulation were used: mixed-methods, a combination of data collection instruments (open-ended items of the preliminary and post-survey, written reflection, participants' answers to lesson plan analysis prompts, and researcher journal), and three theories to frame the study, namely, inquiry-based learning, experiential learning theory, and sociocultural theory. Although I was the only person to code all the data, the three interraters coded part of the data and validated the preliminary codes. The use of NVivo provided complementary validity.

Patton (2002) argued that credibility depended on the researcher's integrity, which can be demonstrated by looking for data that support alternative explanations. The failure to find evidence for contrary explanations lends support to the explanation that the researcher generated. Thus, I filtered the data for alternative explanations.

Reliability

Reliability of Quantitative Data

Original 48-item survey. Despite a high level of internal consistency, the first reliability analysis conducted after the pilot test with 32 educators in 2012 showed that 24 out of 48 items self-destructed due to either one or a combination of the following problems: low subscale reliability, low corrected item-total correlation, poor discrimination, or too many nonanswers (defined as at least 22% of participants who have not answered an item by choosing *Don't know)*. It is assumed that the nonanswers of the

original 48-item survey were caused by three factors: First, the response choice *Don't know* may have been confused with the response choice *Neutral.* Second, 30 out of the 32 pilot testers reported having no experience in virtual worlds. The original survey included questions that were difficult to answer if the respondent did not have a clear idea of what a virtual world was and could accomplish. Third, the pilottesters watched a five-minute video demonstration of the *Exploratorium* (Second Life destination) that failed to demonstrate several concepts that were addressed in the survey, such as group work, types of users, and assessment. This video clip should have been chosen more carefully. As a result, many respondents were unable to answer questions revolving around these concepts.

Changes in the revised survey. A critical change has been implemented in terms of the measurement format. While the original 48-item scale used a 6-point Likert-type scale (*Strongly agree, Agree, Neutral, Disagree, Strongly disagree, Don't know*), the revised scale uses a 5-point Likert-type scale (*Strongly agree, Agree, Disagree, Strongly disagree, Don't know*). *Neutral* was omitted as a response to the excessive numbers of nonanswers observed in the pilot test. The second critical change refers to the number of items. As mentioned earlier, 24 out of the original 48 items had self-destructed. Of the 24 remaining items, those that referred to group work, types of users, and assessment were eliminated, which left 12 items.

Current survey reliability. These 12 items of the original 48-item survey, with the new 5-point Likert-type scale, were piloted again in two pilot-studies (Oh & Nussli, 2014; Nussli et al., 2014), both as a preliminary and post-survey with a total of 31 educators. For the twelve items, overall reliability for the preliminary survey was

alpha .79 and .83 for the post-survey. Two items, however, were identified as potentially vulnerable, namely item 2, "I am confident that I can find someone to support me in facilitating the use of SL" and item 4, "I fear that students already spend too much time on the computer".

For item 2, the corrected item-total correlation was negative at -.07 for the preliminary survey while it was .37 for the post-survey. Without item 2, Cronbach's alpha would have increased from .79 to .83 in the preliminary survey and remained the same at .83 for the post-survey. Similarly, for item 4, the corrected item-total correlation was only .19 for the post-survey, as opposed to .42 for the preliminary survey. Cronbach's alpha would have decreased from .79 to .77 in the preliminary survey but increased from .83 to .85 in the post-survey. Subsequently, a third reliability analysis was run with only 10 items. Cronbach's alpha increased from .79 to .82 for the preliminary survey; it also increased from .83 to .85 for the post-survey. Based on these results, it was decided that item 2 would be eliminated while item 4 would be retained. Thus, the overall reliability of the remaining 11 items of the attitude scale is .83 (same alpha for preliminary and post-survey). The 11 items correspond to items 3-13 in the preliminary survey and to items 13-23 of the post-survey.

Reliability of Qualitative Data

The three strategies described under Validity also contributed to the reliability of the qualitative results. In addition, I provided a full evaluative account of each step of the intervention and the associated results. To demonstrate that the results are consistent with the data collected (Guba & Lincoln, 1994), I meticulously kept an audit trail to explain how I arrived at the results, namely, how categories were derived and how decisions were

made throughout the inquiry (Merriam, 2009). A researcher journal was kept for a running record of any problems, issues, ideas, interaction with the data, and any other observations. To establish interrater reliability, I enlisted the help of three qualified colleagues all of whom are currently working on their dissertations, using qualitative data analyses. They agreed to a three-hour long meeting to apply my preliminary codes to a substantial amount of data.

Interrater Procedures

Due to the large number of codes, it turned out that there was a risk that the coders (i.e., interraters) would be overwhelmed if confronted with all codes right from the outset. To ensure that the coders could slowly develop a shared understanding of the topic and codes, the codes were presented theme by theme (i.e., seven themes = seven data sets), starting with a relatively easy data set to code, then spiraling up (after discussions) to a more complex data set to code. The conversations after the coding of each data set were critical to ensure a shared understanding of the codes.

One day prior to the three-hour interrater reliability meeting, the three coders received a link to a 12-minute screencast introducing my dissertation topic, describing the coding process, and providing instructions. During the rater-process, the three coders coded a small but common data set of participant responses. As soon as they finished, they submitted their codes to me by email. I copied and pasted these into a master file that also showed the pilottester's and my own coding. After each data set, I started a Skype group call so we could compare our codes. I informed the coders about my observations based on the master grid, that is, where we had agreed or disagreed. We then addressed and resolved ambiguities, which helped to adjust our collective thinking based

on the different codes. After completion of each data set, I emailed the next data set. The coders spent about ten minutes on each of the easy Level 1 data sets and about 15 minutes on each of the intermediate Level 2 data sets. *Easy* was defined as encompassing themes with only a few codes (between two and five codes) and where each participant quotation could be described with one code rather than with several codes. The intermediate Level 2 datasets consisted of themes that had more codes (between eight and 10) and where participant quotations had a complexity that required using several codes. After each data set, we would talk over potential differences for about 10 to 15 minutes.

Protection of Human Subjects

An application was sent to USF's Institutional Review Board for the Protection of Human Subjects (IRBPHS) to seek approval for the intervention. This research adheres to the ethical standards of USF's IRBPHS. The study investigated the key components of effective virtual worlds teacher training and special educators' perceptions of the usability of Second Life for special education purposes. The rights of all participants involved in this research were protected. Other than rare cases of motion sickness due to the navigation in a virtual environment, no physical, mental, or emotional risks were anticipated. Although the intervention was an integral part of the coursework, participation in the study was voluntary. The instructor offered to provide alternative assignments to those special education teachers who wished to opt out (although no one chose to do so). A list of steps taken to address ethical considerations is provided below.

1) A consent form was given to each participant. The form included the study's purpose and a description of the data collection methods (Appendix A). Submission of the preliminary survey constituted implied consent.

2) All participants were provided the opportunity to ask questions about the research before and during the study.
3) All participants were assured that they would remain anonymous, that is, their identities would not be included in the study nor provided to any outside observer. It was, however, not possible to assign numbers to students due to the fact that the intervention was an integral part of the coursework. Therefore, both the instructor and I were aware of the participants' real identities.

Role of the Researcher

"Although I have a focus on using technology for learning, especially (or perhaps, only) when it allows us to do things we couldn't do otherwise, I'm also a big believer in face-to-face sessions" (Good, 2013). My own perceptions of technology adoption align perfectly well with Good's description. If I had to describe myself in terms of Rogers' (1962) five adopter categories in terms of technology adoption, I would categorize myself as "early adopter" in some areas of technology and as "early majority" in other areas. From most advanced to least advanced, the categories include: innovators ("techies"), early adopters ("visionaries"), early majority ("pragmatists"), late majority ("skeptical"), and laggards (unlikely to adopt technology as a pedagogical tool).

While I have a slightly positive bias toward the potential of virtual worlds for educational purposes, it is not my intention to convince the study's participants of the need to incorporate virtual worlds in their teaching. I have been immersed in virtual worlds for over two years now and I am aware of the numerous challenges that can undermine an educator's endeavor to use virtual worlds in teaching. My role in the intervention was for support purposes only, except when I wrote my blogback to the

participant's written reflections in Step 5. My goal was to take a neutral stance and act as a guide who walks the participants through a maze of virtual opportunities and who asks purposeful questions that guide their reflective processes. I wanted to help equip the participants with the necessary experience and background knowledge in order to make informed decisions on the usability of virtual worlds. The researcher journal helped me to reflect on and come to terms with my role as a participant researcher and to address any biases that I noticed. It was also a way to prompt self-study and gain insights about my teaching and research practices.

Summary

This section presented the methodology for this exploratory case study to investigate special education teachers' perceptions of the effectiveness of a systematic 7-Step Virtual Worlds Teacher Preparation Workshop and to determine a change of attitude in the special education teachers as a result from engagement in the intervention. The intervention was expected to enable special education teachers to make informed decisions about the usability of virtual worlds for special education purposes, especially for social skills practice, evaluate the benefits and challenges of virtual worlds, and to assess their potential for collaborative learning. The instrumentation for both the quantitative and qualitative data collection was specified. The instruments are included as appendices. Each item on each instrument was aligned with the research questions. Data analysis, reliability, validity, and potential limitations were addressed in detail.

CHAPTER 4

RESULTS

The purpose of this study was to determine special education teachers' perception of the effectiveness of a systematic virtual worlds intervention to enable these teachers to make informed decisions about the usability of Second Life for students with social skills challenges, to determine whether the intervention led to a teacher change of attitude, and to determine the participants' perceptions of the usability of virtual worlds for special education (especially for students with social skills challenges), the benefits and challenges of virtual worlds as well as their usability for collaborative learning. This chapter describes the statistical analysis of the preliminary and post-survey and the qualitative analysis of the written reflection, the lesson plan analysis, and the responses to the open-ended items of the post-survey. The intervention was guided by the following primary research questions:

1. What are special education teachers' perceptions of the effectiveness of the systematic 7-Step Virtual Worlds Teacher Training Workshop in terms of enabling them to make informed decisions about the usability of virtual worlds for special education?
2. To what extent is there a teacher change of attitude toward the usability of virtual worlds for special education resulting from engagement in the systematic 7-Step Virtual Worlds Teacher Training Workshop?
3. What are special educators' perceptions of the usability of virtual worlds for special education, especially to practice social encounters for individuals with social skills challenges?

Two sub-questions are embedded within the third research question:

4. What are special educators' perceptions of the benefits and challenges of virtual worlds for special education?
5. What are special educators' perceptions of the potential of virtual worlds for collaborative learning?

Descriptive Context for Research Questions

In this section, descriptive information from the preliminary and post-survey is provided. These statistics will help guide and inform the study.

Teaching Experience. While each of the 18 participants had some teaching experience, 78% (14) had taught less than a year, 11% (2) between 1 and 2 years, 6% (1) between 7 and 10 years, and 6% (1) between 11 and 15 years. They were teaching a variety of subject matters in special education settings, as shown in Table 12.

Table 12

Subject Matter Expertise

Participant #	Subjects Taught
1	All subjects (special education grades 3-5)
2	All subjects under a multiple subject credential
3	Social Studies and English
4	English Language Arts (ELA), World Cultures, Career Aspirations, Dance
5	Multiple subjects, including reading, writing and math
6	Math, Science, History, English
7	History, Math, Science, Language Arts and Life Skills
8	Multiple Subjects
9	Special Day Class (SDC) K-2nd grade class, teaching all subjects
10	Math, Science, guitar
11	Math
12	Resource Specialist Program (RSP)
13	Special Education – Emotionally disturbed students (ED)
14	Science, ELA, Math
15	Special Education
16	SDC: Math, LA, Science, History
17	English and Social Studies
18	Special Education (World and US History, Algebra, and English)

Age. Most students were between 20 and 30 years old. Fifty percent (9) of the participants were between 20 and 25, 33% (6) between 26 and 30, 11% (2) between 31 and 35, and 6% (1) between 41 and 45 years old. Eighty-nine percent (16) were female and 11% (2) were male.

Technology use. When asked about their daily use of technology, answers varied between less than an hour and more than 10 hours. The average was approximately five hours a day (Table 13).

Table 13

Daily Technology Use

Answer Options	Response Percent	Response Count
less than 30 minutes	-	-
30-60 minutes	6%	1
1 hour	-	-
2 hours	6%	1
3 hours	28%	5
4 hours	6%	1
5 hours	22%	4
6 hours	6%	1
7 hours	17%	3
8 hours	-	-
9 hours	6%	1
10 hours	-	-
more than 10 hours	6%	1

*The percentages do not add up to 100% due to rounding procedures.

Technological expertise. When asked to rate how tech-savvy they considered themselves on a scale from 1 to 10 (1=*I dislike technology and I don't feel comfortable using it.* 10=*I love technology and I am very good at using it.),* all answers ranged between 3 and 10, with a mean of 7.33 and a mode of 7. Only three participants rated their technological expertise as between 3 and 5, which is rather low, whereas 15 participants rated themselves somewhere between 6 and 10, which is moderately high to very high (Table 14).

Table 14

Technological Expertise

Rating Options	Response Percent	Response Count
1	-	-
2	-	-
3	6%	1
4	-	-
5	11%	2
6	6%	1
7	45%	8
8	-	-
9	17%	3
10	17%	3

When asked to describe themselves in terms of the technology adoption lifecycle model based on Rogers' diffusion of innovations theory (1962) with regard to using technology for learning and instruction, a majority of 72% (13) perceived themselves as either innovators or early adopters (Table 15).

Table 15

Technology Adoption

Answer Options	Response Percent	Response Count
Innovator ("techies", guaranteed to adopt technology as a pedagogical tool)	17%	3
Early adopter ("visionaries", will adopt technology earlier than majority)	56%	10
Early majority ("pragmatists", will adopt technology as soon as majority of teachers does too)	17%	3
Late majority ("skeptical", reluctant to adopt technology)	11%	2
Laggard (unlikely to adopt technology as pedagogical tool)	-	-

*The percentages do not add up to 100% due to rounding procedures.

When asked about their experience with virtual worlds, 72% (13) stated that they were inexperienced users (rare use), while 28% (5) used virtual worlds occasionally. All participants had had a brief exposure to Second Life in October 2013, as described in Chapter 3. In the preliminary survey they were asked to describe their previous experience with virtual worlds. Fifteen participants mentioned having used Second Life

in the fall. Five specifically mentioned that the experience had been troublesome due to technical issues and expressed doubts about any learning impact. Only two participants reported having previous experience either in gaming or in game-like environments, such as Second Life, Guild Wars, and the SIMS. In the comment section of the preliminary survey, one participant summarized her previous experience as follows, which encompasses several frequently voiced concerns.

> I just can't see Second Life as a teaching tool. It's too distracting and just from my previous experience earlier this year, that teacher who was using it displayed and modeled it awfully. If i can see it be implemented correctly and effectively, I would be more than happy to try it. At this time, I just feel like, what is the point of teaching through it? What if a student is doing something they shouldn't be doing while on it?

Research Question 1: Effectiveness of the Intervention

The first research question asked, "What are special education teachers' perceptions of the effectiveness of the systematic 7-Step Virtual Worlds Teacher Training Workshop in terms of enabling them to make informed decisions about the usability of virtual worlds for special education?" A variety of quantitative and qualitative data informed this research question, divided into three sections, namely, the perceived effectiveness of the 7-Step intervention, design suggestions for effective virtual worlds teacher training, and virtual world pedagogy.

Perceived effectiveness of the intervention. First, items 2 through 10 of the post-survey asked about the participants' perceptions of the effectiveness of each of the seven steps of the intervention. Table 16 displays the results with response counts in parentheses.

Table 16

Effectiveness of Intervention

Item	Ineffective	Rather ineffective	Reasonably effective	Quite effective	Very effective
1-Preliminary survey questions prompting reflection about participants' perceptions of the usability of Second Life for special education.	6% (1)	-	67% (12)	22% (4)	6% (1)
2a-Watching two videos (the Maya Island video and the video about the use of virtual worlds for individuals with social skills challenges) and reading & reviewing a summary of empirical research about the unique benefits of virtual worlds by Dalgarno & Lee (2010) and the special benefits of virtual worlds for special education students with social skills challenges.	-	6% (1)	61% (11)	33% (6)	-
2b-Learning about and getting access to optional virtual worlds resources (e-book, PDF on virtual worlds best practices, virtual worlds Scoop it!, compilation of science-related Second Life destinations), official Second Life Destination Guide, and how to join educational groups in Second Life.	-	6% (1)	78% (14)	17% (3)	-
3-Virtual exploration of one educational Second Life destination of choice, followed by the collaborative development of a tentative lesson plan for students with social skills challenges to practice social encounters.	-	11% (2)	28% (5)	33% (6)	28% (5)
4-Lesson Plan presentation: Sharing lesson plan ideas in class.	-	11% (2)	33% (6)	33% (6)	22% (4)
5-Written reflection prompts providing opportunities for reflection about practical ways of using Second Life; followed by individual feedback on participants' reflections (blogback).	-	11% (2)	50% (9)	17% (3)	22% (4)
6-Lesson Plan Analysis. Trying out, evaluating and modifying an existing lesson plan from an online repository of Second Life lesson plans (MSIT Second Life Lesson Plans).	-	22% (4)	44% (8)	17% (3)	17% (3)
7-Post-survey questions prompting reflection about your perception of the usability of Second Life for students with social skills challenges to practice social encounters.	6% (1)	11% (2)	56% (10)	28% (5)	-
Total Frequency	**2**	**14**	**75**	**36**	**20**

Overall, the participants were quite satisfied with the intervention. Steps 3 and 4 received the best ratings with most answers under "Quite effective" and "Very effective." There are no other steps that received a similarly high level of positive responses. All other steps had most responses under "Reasonably effective." When asked how well the intervention had prepared them to make informed decisions about the usability of virtual worlds for students with social skills challenges to practice social encounters (item 11), 56% (10) reported "reasonably well," and 33% (6) "quite well," whereas 11% (2) were rather unsatisfied ("not so well)."

Design suggestions. Item 12 of the post-survey was the second source of information to address the first research question. From a selection of 10 components, the participants chose those components that they would incorporate into an effective virtual worlds workshop for special educators (Table 17).

Table 17

Components of Effective Virtual Worlds Teacher Training

Components	Response Percent	Response Count
1. Having access to a list of pre-tested Second Life destinations, categorized according to age groups and subject matter	94.4%	17
2. Learning how to locate specific Second Life islands that align with subject matter content, such as mathematics	83.3%	15
3. Scaffolded introduction to Second Life	77.8%	14
4. Having access to virtual worlds resources for educators	72.2%	13
5. Having access to an experienced in-world facilitator	72.2%	13
6. Familiarize with research about the unique benefits (affordances) of virtual worlds for education and the special benefits for special education students with social skills challenges	66.7%	12
7. Start with educator-generated questions about using virtual worlds for educational purposes	61.1%	11
8. Collaborative exploration of one Second Life destination of your choice	55.6%	10
9. Collaborative development of learning activities framed by a pedagogical rationale (why use a virtual world for a specific learning objective rather than a non-3D environment?)	50.0%	9
10. Analysis of a Second Life lesson plan	44.4%	8

The top five components were: having access to a list of pre-tested Second Life destinations (17), getting instructions on how to locate subject-appropriate destinations (15), receiving a scaffolded introduction to Second Life (14), having access to resources for educators (13), and having access to an experienced in-world facilitator (13). The analysis of a Second Life lesson plan (8) was the least popular element with less than half of the participants choosing it. As shown in Table 17 above, Steps 3 and 4 were not among the top-rated components when the participants were asked which components should be part of the training. All other components, except for the lesson plan analysis, were more popular.

Virtual world pedagogy. The third source of information emerged from the qualitative data. The data reduction process described in Chapter 3 resulted in three final themes with a total of 18 codes (Figure 6).

Virtual World Pedagogy	**Virtual World Benefits**	**Virtual World Challenges**
Teacher Training & Support (39)	Reduced Stress (32)	Distraction (29)
Activities & Applications (35)	Collaboration (27)	Tech. Issues (27)
Learner Support (26)	Experiential / Exploratory (25)	Lack of Appropriateness (19)
Curriculum (19)	Social Skills Practice (21)	Learning Curve (15)
Virtual Classroom Management (15)	Interactive (15)	Tech. Access (11)
	Impossible / Impractical (14)	
	Contribution to Learning, incl. Active Learning (11)	

Figure 6. Three final themes (bold) and 18 codes, with total frequencies in parentheses.

While the first theme, *Virtual World Pedagogy*, further informs the first research question about the design of effective virtual worlds teacher training and will be discussed next, the second and third theme will be addressed under the fourth research question. Detailed code descriptions are displayed in Appendix K.

Virtual World Pedagogy describes how virtual worlds can be implemented pedagogically and practically; addresses the requirements, training, and support of 3D virtual teachers and students; the type of activities that could be undertaken in virtual worlds; the extent of learner support; and the curricular alignment of virtual worlds.

A key area that emerged from the qualitative data was teacher training and support. The participants highlighted the need for continuous support during their transition into virtual teachers. They highlighted the importance of teachers preparing themselves thoroughly before sending students to a virtual world, not only to develop the ability to troubleshoot but also to sensitize themselves toward potential frustrations that students might encounter. “I think how we have been trying it out with other teachers and using activities as well as coming up with our own is a really good way because it helps us see things from the students’ eyes.” Going through a similar experience will enable teachers to relate to students’ experiences better. Teachers should “understand the possible errors students might encounter so that they are able to provide technical support to their students.” Patience and sufficient time emerged as crucial prerequisites. The most important message seemed to be that teachers should know a specific virtual destination extremely well before teleporting students to that destination.

It was also suggested that virtual fieldtrips be framed by model lesson plans so the teachers would not have to spend time on creating these themselves. Several participants

highlighted that this 7-Step intervention was much more successful and less stressful than their fall experience with the ESL instructor. They appreciated being shown how virtual teaching and learning can work and how technical issues can be addressed, which has made them feel much better about their ability to handle any issues that may arise. In-depth Second Life training was mentioned several times, for example in the form of "an online training program that walks you through the Second Life mechanics", not only to avoid frustrations but also to avoid losing time on troubleshooting issues. One participant asked if "there was a way to find or search for certain islands with ease." Because participants were always given a choice of preselected destinations, there was no need for them to search for educational destinations themselves, although the procedure of locating educational destinations was shown very briefly during an introductory screencast in Step 2 of the intervention. The importance of a technical troubleshooter was emphasized. The following participant quote summarizes the general trends:

> Teachers should explore and experience Second Life for themselves, so they know the benefits as well as frustrations that students may experience during the Second Life experience. Teachers should also be made aware of and trained on how to use special features that may not be obvious (such as being able to access a video in the middle of a Second Life game, etc.). Teachers should also be trained on what to do or how to handle common technical glitches that may occur during Second Life.

Once teachers have reached a sufficient comfort level with virtual worlds, the focus changes to the practical incorporation and curricular alignment of virtual learning activities. The participants have raised questions such as how virtual worlds can be used to enhance their instruction, how virtual activities can be tied to Common Core Standards, how the teachers can best take advantage of virtual world affordances, and how, specifically, lessons can be planned around virtual worlds. Surprisingly, only three

participants had questions about the empirical effectiveness of virtual worlds. “Is there proof that Second Life has been effective in teaching?” Some participants were more concerned with the practical implementation of virtual worlds in a classroom setting, for example, by projecting Second Life on the screen rather than having each student work individually in front of a computer. In the same vein, the instructor explained in the post-interview that he had developed a better understanding of the potential of virtual worlds for education and their practical incorporation.

> I believe there’s more potential than what I have observed before. Some of them are already talking about using this in their classroom, not with all the students being on a computer, but maybe the teacher role-modeling or navigating in Second Life and going into museums and other islands and also asking one of the students to come up and participating as someone who’s controlling the avatar.

Several participants were interested in learning how to use virtual worlds to address the specific needs of their students. The 7-Step intervention was geared toward students with social skills challenges, such as students with autism, but those participants who worked with students with different types of challenges may have been left wondering how they could use Second Life.

> My students, if anything, have emotionally [*sic*] problems/post-traumatic stress in their lives, so if there is a way to show how it is effective for this [*sic*] students (i.e. maybe some type of therapy?), I think that would be more useful for my colleagues & I [*sic*].

One participant raised a topic that has been widely covered in virtual world research, namely, the pedagogically wise use of virtual worlds. “Additionally, teachers should use their islands wisely and look for the best ways of how to incorporate this lesson into other standards for different subjects (i.e. art, marine science life, sustainability, etc.).” Finally, having access to model lesson plans was brought up again, which makes sense given that virtual lesson design has been reported as being much more time-intensive than preparing

a regular lesson plan. “I know I will always have questions as I learn more, one would be if there is a bank of lesson plans that other teachers have made for SL (…) so you do not need to reinvent the weel [*sic*].”

Next, the participants reflected on pedagogically sound activities and applications. The favorite activities mentioned by the participants were timed scavenger hunts and games incorporating other topics/subjects, which should not only improve on-task behavior but would also be fun for students and promote socializing. Several participants, however, pointed out an apparent lack of games. “I saw a lot of cool and interesting things on the islands but I did not see many games.” While most destinations, indeed, failed to provide games, they offered numerous hands-on activities, such as *Genome Island, the Exploratorium,* and *Sploland.* The participants stated that virtual worlds could be used for the practicing of everyday skills, such as “telling time, counting money, learning about public transportation, budgeting skills, and many other skills that can help to make students successful in normal every day experiences.” It was suggested that activities be framed by clear, direct, and simple tasks. “Yet the activities should be rich in content and engagement.” Interactivity was pointed out by this participant, “This world should be able to incorporate activities (such as writing activities, flashcards, games) that allows students to interact with each other more easily than just doing a ‘scavenger hunt’ or doing a ‘gallery walk’ or ‘exploring’.” While some of the suggested activities seemed to be borrowed from traditional lines of instruction, the following participant, for instance, exhibited out-of-the box thinking:

> I would like to see a social dining place, where students can order food and make small talk. Maybe an amusement park where they can wait in lines and ride roller coasters. You could have a rehearsed, set event occur that students can repeat and interact with. For example, have a 3D reenactment of the JFK assassination that

> students can walk through, fly through, and see how the events unfolded. They can explore the conspiracy theories. Or maybe the Berlin wall falling, etc.

Overall, the participants' ideas for activities indicated excellent classroom applicability of virtual worlds. Key descriptors of such activities include: *open-ended, snapshots for assessment, creativity, scaffolding, labeled maps, goal achievement contingent on teamwork, mutual support, communication, social skills practice, exploration,* and *inquiry.* One participant captured a variety of intriguing facets, "I would create a virtual lesson that encourages students to interact with each other in a productive and appropriate manner. A scavenger hunt, creative building or exploring activity, and other investigatory practices can be utilized in Second Life, allowing students to explore the world together." The usability of virtual worlds for the practice of everyday situations was highlighted very frequently. "Any situation where students are interacting with another individual would be beneficial. Maybe a situation wherein a student has to ask for help, or directions, or where a student perform [*sic*] some sort of transaction, like buying a soda, or video game, etc." One participant warned, however, that, "Social gatherings may be too much since it can be too socially overstimulating, turning the student's interest off." Throughout the participants' reflections on the practical implementation of virtual worlds, they emphasized the importance of learner support.

Key descriptors of learner support included *guided, structured, scaffolded,* and *direction.* In this 7-Step intervention, structured guidance was key to smooth procedures, satisfying user experiences, and achieving learning. Many participants mentioned that a good plan to walk the student through the steps of a well-structured virtual activity was essential. Some were wondering to which extent virtual worlds could be adapted "to the needs of each student with different needs." The (over)abundance of visual stimuli,

interactive objects, and content was viewed as beneficial by a few participants, whereas most participants tended to perceive it as harmful. Some participants suggested scaffolding a virtual activity with explicit teaching and coaching before and during a virtual fieldtrip. To facilitate conversation and communication in a structured way, participants recommended offering unobtrusive, structural support, such as good lead questions and sentence starters.

> I would give my students sentence prompts to help them with things to say and a 'cheat' sheet for responses such as if they ask 'do you....' your answer will start with 'yes' or 'no'. In real life using sheets would be hard to use but in Second Life know [*sic*] one needs to know you are using them.

Participants again pointed out that while some pieces of the lesson would be structured, free exploration was a critical component to take advantage of what virtual worlds have to offer. Because some participants had experienced difficulties with teleportation, a typical statement was,

> We believe that a teacher needs to transport the students to [*sic*] direct spot of where the tour begins. When we first got to the island, we were so lost and had no idea where to go, and the map didn't help much.

This recommendation is not surprising because many of the virtual spaces explored in the workshop were large with several subsections, which is why it was easy to get disoriented. Some participants raised several new issues, namely, the superiority of virtual worlds over videos under certain circumstances. One participant described the importance of scaffolding to counteract the impact of overabundance. "There is [*sic*] some problems with total choice. It is very complex and overwhelming, so maybe something guided that is optional, so students can be spoon fed information instead of drinking from a fire hydrant." The need to accommodate diverse learning styles was

emphasized as well as the need for more structure than might be necessary in a face-to-face lesson, for example by using checklists.

> Also, we noticed that much of the information provided in the exploration-based lesson included clicking on a visual and reading a lot of text. This may present a challenge for students who have reading difficulties or do not learn best in this way. Providing multiple methods of input throughout the virtual world (video, audio, etc.) may help.

In the same vein, the participants raised many questions about virtual classroom management. The general trends of the participants' responses showed that they were not only concerned about a lack of control over their students, but also about their students getting lost inadvertently, unable to orient themselves and find back home. The overabundance of space was mentioned again in connection with the fear of losing students. During the fieldtrips in Steps 3 and 6, several participants had to be teleported (back) to their destination quite often, which explains why some were more worried about getting lost than others. "I think if there was a way to tether your avatar to a 'home' location or another individual may be beneficial." Setting ground rules was of paramount importance. But the most important feature that emerged was having total control over all avatars and what they can wear and do and where they can go, evidenced by statements, such as "A teacher has total control over the environment: what the avatars look like, what items are in it, what the avatars can do, etc." and "Also, it would be nice for the teacher to have total control over ALL the avatars (not let them go to another world, make them go to a place in the world)." Finally, another intriguing comment was made about the impact of the visual stimuli on the following of ground rules, "How do I ensure that students follow my instructions in Second Life when they can become distracted by

all the interesting features SL offers?" Intricately linked with virtual classroom management is the question of an ideal virtual space.

The key descriptors of an ideal island for special education students with social skills challenges were *private, confined,* and *safe.* The participants voiced recommendations about the characteristics of an ideal virtual space for their students. With the exception of a few small destinations, the participants experienced fieldtrips to large destinations with different sections, such as *Roma,* which would normally take several hours (or days) to explore. Some destinations even had platforms in the sky (*Genome Island*), in space (*International Space Museum*) and underwater (*Imzadi, Abyss Observatory*). Teleporting from one area to another can be difficult, for example from one planet to another. Therefore, it is not surprising that the participants would prefer "an Island that is very basic and small", such as a "Museum or other closed spaces". *Safety, control,* and *privacy* emerged as additional key constructs. "I think restrictions on the island would need to be standard", "a small, controllable environment, "I imagine a safe world where no other intruders can come in", "I think an ideal Second Life island for special education would include auditory and visual input and a safe space that is used only by students in special education."

The participants' recommendations made in the area of *Virtual World Pedagogy* have informed guideline suggestions for the design of effective virtual world teacher training. These guidelines will be summarized in Chapter 5 under Implications for Practice. Next, quantitative data were analyzed to address the second research question.

Research Question 2: Change in Attitude

The second research question asked, "To what extent is there a teacher change of

attitude toward the usability of virtual worlds for special education resulting from engagement in the systematic 7-Step Virtual Worlds Teacher Training Workshop?" The purpose of this question was to measure quantitatively whether the participants had a change in attitude after the intervention.

Items 3-13 of the preliminary survey were equivalent to items 13-23 of the post-survey. Each participant's answers were summed to obtain an attitude score (max. = 55) regarding their perception of the usability of Second Life for special education. The class means in the pre- and post-survey were 33.78 (*SD = 6.61*) and 37.56 (*SD = 5.37*), respectively. To explore whether the difference in means was statistically significant and given the small sample size (N=18) and inability to verify the assumptions required of a parametric test, the Wilcoxon signed-rank test was performed. Results indicated that there was a statistically significant increase in mean attitude as a result of the training participants received in Second Life ($z = 3.06$, $p = .00$, $r = .51$). An effect size of .51 can be interpreted as a large effect large using thresholds of .1, .3, and .5 for small, medium, and large effect sizes, respectively. For all items, except for item 9, the special education teachers' attitude towards virtual worlds use in education increased (Table 18).

Table 18

Item Means, Item Mean Differences, and Standard Deviations, Results of Wilcoxon Signed-Rank Test for Differences Between Means on the Attitude Survey

Item #	Pre-Survey		Post-Survey			
	Item Means	***SD***	**Item Means**	***SD***	**Item Mean Differences**	***SD***
1	2.28	1.18	2.33	1.08	0.06	1.21
2	3.94	0.87	4.11	0.90	0.17	1.25
3	2.39	1.29	3.06	1.30	0.67	.84
4	3.28	1.13	3.72	1.02	0.44	1.34
5	3.83	0.62	4.11	0.76	0.28	.89
6	3.44	1.15	4.28	0.75	0.83	.86
7	3.00	1.19	4.06	0.54	1.06	1.06
8	3.33	1.08	3.61	0.92	0.28	1.02
9	3.50	0.79	3.44	1.04	-0.06	.64
10	2.56	1.25	2.50	0.92	-0.06	1.21
11	2.22	0.88	2.33	0.97	0.11	.76
Class means	***33.78***	***6.61***	***37.56***	***5.37***	**-**	**-**

As shown in the second last column under Item Mean Differences, items 3, 6, and 7 show the largest gains. Item 3 ("I fear that students already spend too much time on the computer") was negatively keyed and reverse-coded for data analysis, which indicates that the participants' fear about excessive computer time actually decreased. Item 6 ("Second Life can be used to experience content that would otherwise be inaccessible (e.g., because it is historically lost, too distant, too costly, imaginary, futuristic or impossible to see by the human eye") also emerged as a key topic in the qualitative data. Item 7 ("I think that students would enjoy the experience of a virtual learning environment (in a supervised exploration)") represents the participants' perception of whether Second Life makes learning more interesting. This gain is also supported by the qualitative data in that the participants acknowledged that virtual worlds can promote learning generally and active learning in particular.

The last column of Table 18 displays the standard deviations of the item mean differences. For example, item 7 ("Second Life makes learning more interesting") has a mean item difference of 1.06, which means that the average change on item 7 was an increase from the preliminary to the post-survey of about 1 point. The standard deviation for this mean item difference is also 1.06, which reflects a good variation in difference scores for this item, that is, the differences probably had a high range. For example, some participants' score increased by 3 points, whereas the score of several participants for item 7 did not increase at all.

The post-survey attitude score of 78% (14) of the participants increased, whereas the scores of 16% (3) decreased. No change was noted for 6% (1) of the participants. As shown in Table 19, no attitude score was below 30 at the post-survey, and both the median and the means were higher at the post-survey as well.

Table 19

Range, Median, Mean, and Standard Deviation of Attitude Scale

	Pre-Survey	**Post-Survey**
Range	22-42	30-48
Median	31.5	36.5
Mean	33.78	37.56
SD	6.61	5.37

Reliability analyses of the preliminary and post-survey (11 item-attitude scale) were conducted again. The overall reliability was alpha .79 and .72 for the pre- and post-survey, respectively.

Research Question 3: Usability

The third research question asked, "What are special educators' perceptions of the usability of virtual worlds for special education, especially to practice social encounters for individuals with social skills challenges?" A 10-point rating item (item 14 of the pre-

survey, equivalent to item 24 of the post-survey) measured the participants' perceptions of the usability of Second Life for social skills practice, specifically for students with social skills challenges.

The mean usability ratings in the pre- and post-survey were 5.56 (*SD = 1.76*) and 6.11 (*SD = 1.60*), respectively. The median increased from 5.0 at the preliminary survey to 6.0 at the post-survey. A Wilcoxon signed-rank test did not reveal a statistically significant difference between the mean usability ratings ($p = .14$). An analysis of change between the preliminary and post-survey showed that the usability ratings of 44% (8) increased, whereas those of 16% (3) decreased and those of 39% (7) remained unchanged. Figure 7 displays the number of participants (y-axis) and their usability ratings (x-axis) on a 10-point rating scale in the pre- and post-survey with a relatively even spread of ratings in the medium and upper half of the scale, that is, between 5 and 8.

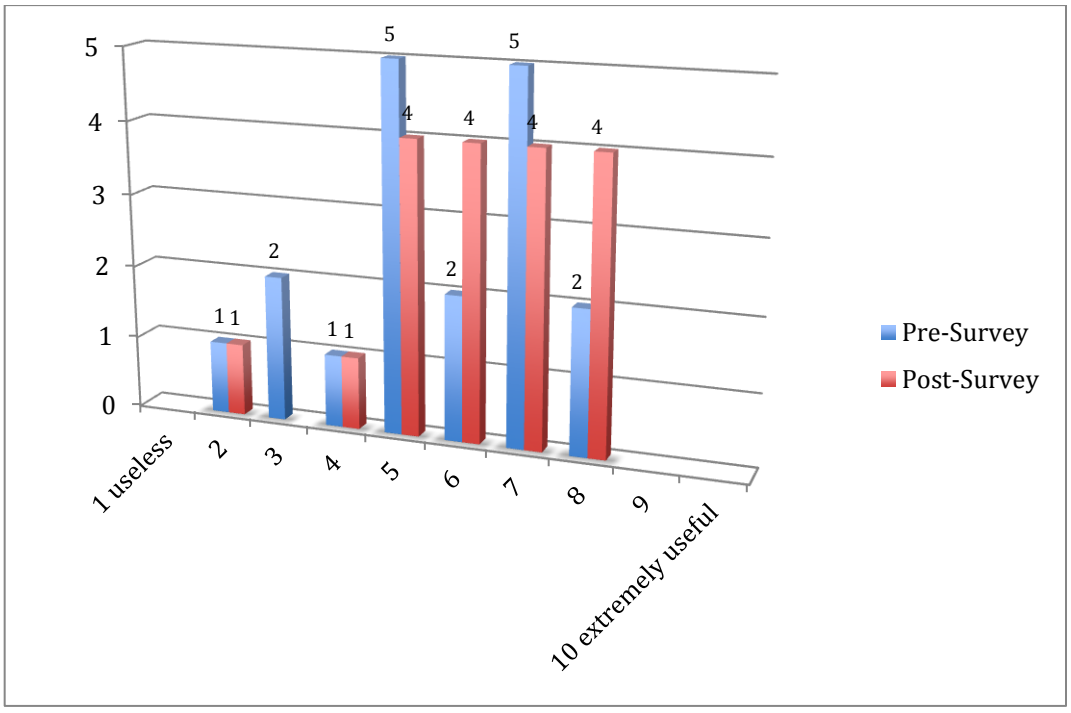

Figure 7. Comparison of usability ratings on a 10-point rating scale.

The instructor's perception of the usability of Second Life for virtual worlds

increased from a 7 before the intervention to an 8 after the intervention, although he voiced concerns about the steep learning curve. Once teachers master the technology, the instructor highlighted that he would rate the usability even higher.

In Step 5 (written reflection), the participants were asked if virtual worlds, such as Second Life, should be used in special education. A majority of 77% (14) tended to be in favor of using Second Life, albeit with a number of reservations. Specifically, eight participants (44%) agreed that virtual worlds could be used if technical difficulties could be resolved. All answers that included no more than one concern were allocated to this category. Six participants (33%) selected the response option "It depends" and had more than one concern, such as that the use of virtual worlds depended on the target population, access to technology, group size, meaningfulness and impact of activity, organization, time, and safety aspects. Generally, this second category was also supportive of using virtual worlds in special education. Twenty-two percent (4), however, were categorically against using virtual worlds in special education.

Research Question 4: Benefits and Challenges

The second and the third theme specifically address the fourth research question, which asked "What are special educators' perceptions of the benefits and challenges of virtual worlds for special education?" This question was addressed by qualitative data exclusively. I will first focus on the benefits.

Virtual world benefits. The benefits encompass a variety of affordances of virtual worlds for education compared with more traditional means of instruction, such as teaching online in 2D platforms. The are two key foci: first, the special affordances for students with social skills challenges, namely, the aptness of virtual worlds for social

skills practice in a stress-reduced environment, and second, the contribution of virtual worlds to learning.

Special affordances for students with social challenges. The participants strongly agreed that virtual worlds offer an excellent platform to practice social skills for students with social skills challenges, especially because the virtual environment can serve as a safe space where students can practice talking to real people (i.e., humans behind avatars) without the feeling of self-consciousness. When prompted to think about possible scenarios, several participants emphasized the value of virtual worlds to practice everyday situations.

> I also think that the features should mimic real life situations people have to deal with in order to get students accustomed to those situations (e.g. how to make a deposit at the bank, how to buy food in a grocery store, etc.).

> One virtual environment I would design for my students to interact with is a department store. One important scenario I want students to experience is choosing an item they like, waiting in line to check out, having a cashier ring up their item(s), give the cashier cash to pay for the item and make sure they receive exact change.

The notion of using virtual worlds for something other than academic instruction was introduced as follows, "A virtual world that has activities and scenarios which teach my students self-regulating and relaxation skills." Another participant pointed out the potential of virtual worlds to serve not only as a practice platform for adolescents but also to experience something new.

> I think a virtual world where students get to explore a local university to get them excited for the potential to go to college. Many of the students I work with have never been on a college campus so this would give them not only an insight on what it would be like to be a college student but also helps them work on their social skills.

The following scenarios were typical of the scenarios developed for repeated practice opportunities of everyday skills for students with social skills challenges.

> If I could design a virtual environment specifically for my group of students, I would create it around the social stories we cover in class every week. I would probably create a classroom/school similar to ours and within the classroom/school there would be various scenarios they encounter. There will be different activities that they would have to practice. For example, last week we did a social story on how to play with the play dough with other peers and how to play with the wooden blocks. Students could use Second Life to practice these social skills. First scenario, they could walk into the classroom, sit at the table with play dough and find a friend to go over the rules to playing with the play dough (i.e. don't eat it, don't through [*sic*] it, and don't mix the colors). Then they could practice playing with the play dough together in Second Life. Second scenario, they can walk out to a playground and go over the rules on using the outside equipment, then demonstrate the rules to a peer (i.e. going down the slide not up the slide, waiting in line for the monkey bars, going only one direction on the monkey bars, not running on the play structure, etc.). Third scenario, they can practice going on the school bus (waiting in line, not running, not pushing, sitting quietly on the bus, not getting out of their seat, etc.).

The potential superiority of virtual worlds for social interaction over other online media emerged as another topic. "The question that comes up is, what makes virtual worlds better than a regular online curriculum? An online curriculum is focused on content, while virtual worlds incorporate social interaction. That's what makes virtual worlds advantageous, when socializing is incorporated," which points to the social affordances of virtual worlds. In a similar vein, the instructor, too, highlighted *Social Skills Practice* as a special affordance.

> And especially with students with autism, they don't like looking at the person face to face or directly in the eyes. So this could be a good practice for them or being able to go into a situation or an environment or learn social skills that way before they do it in person. So, this could be a really good transitional activity for them before they actually have to achieve this social skill.

Participants appreciated that students would not only get to practice their social skills with a partner, but that they would also learn about the universe, for example when

exploring the solar system at the *International Space Museum* or *Exploratorium.* Another way to practice social encounters in the initial stages would be to "have some mock avatars with scripted conversations that can be used as reminders for students. Teachers can select the situation they want to demonstrate and the avatars will perform the scenario." One participant established a link between the Common Core Standards and social skills practice in virtual worlds, which circles back to the importance of initially practicing everyday skills in virtual environments before attempting to transfer these:

> The common core standards are all about preparing students for real life and work and job worlds instead of just teaching them dry material. In order for this objective to be completed, specific, real life instances need to be emulated in the virtual world so students can apply the skills acquired in the virtual world to the real world more readily and easily.

Several statements, however, indicate that there is still considerable room for improvement in terms of the expressiveness of avatars, which is an important aspect of emotion recognition training for students with social skills challenges.

> I think it would be really beneficial (though difficult given that Second Life is pretty well established) to have more facial expressions and body language of the avatars. That way students with social challenges can get used to seeing and recognizing these elements of every day social interactions.

Similarly, the participants strongly agreed that not having to communicate face-to-face with another person would greatly reduce the stress in students with social skills challenges, especially because there was no need to make eye contact, as evidenced by the following statements, "I think Second Life would benefit students who struggle with social skills by providing a stress free environment for them to interact in" and "without some of the difficulties of physical body language, eye contact, etc. that come with in-person social interactions." The potential of virtual worlds to help students with social skills challenges make friends was also pointed out. "I can see it as a way for students to

interact with others without having to actually to [*sic*] interact, face-to-face, and they can make friends online." Several participants highlighted the reduced anxiety associated with computer-mediated communication. "People often feel more comfortable expressing themselves online which is a benefit for students with social skills challenges." Especially communicating through an avatar was perceived as appealing. "This would help kids communicate with less stress because they are in a virtual world and speaking through their avatar."

The potential benefit of watching someone else model social interactions, followed by practice, was stressed as well. "Some of my students have a lot of social anxiety and would really benefit from interactions online. They would really benefit from watching appropriate social interactions and then practicing the interaction with a peer." Not only students on the autism spectrum, but also students with emotional and behavior disorders might benefit.

> What is good is that students do not interact with each other in a physical space. While this may appear to be bad, it is ideal for students with behavioral and emotional problems. They are being funneled in a very specific environment that eliminates issues such as negative attention and acting out.

The virtual environment saves students with social skills challenges the embarrassment of blushing, "having to look away, or trying to avoid the social interaction altogether." One participant, however, pointed out a potentially critical limitation, "If students are severely impacted with social anxieties and problems, they may still avoid interaction in this platform." The comment that, "The experience could easily become stressful for students if the information is not mapped out for them beforehand" circles back to the importance of scaffolded, guided tours, and well-structured tasks. One participant developed the

following scenario for adolescent students with social skills challenges, emphasizing the affordances of stress-free and real-world transfer.

> Finally, a third scenario that my scholars would benefit from is having them practice applying for a job, or a mock interview. I teach middle school, but most of my students are slated for a career path, not a college path. I would like an environment for my students to practice requesting a job application, filling it out, and requesting an interview. Students could potentially practice interviewing as well. I think Second Life would be a great way for my scholars to get exposure and practice in a stress free environment before they are go out into the "real world."

Despite the participants' strong agreement on the suitability of virtual worlds as a stress-reduced practice platform, some participants articulated doubt about the transfer of skills to real life. "Second Life can teach students how to have a conversation without having to have literal face-to-face contact, however that might increase their anxiety when they are in situations which require face-to-face contact." There were also concerns about using voice chat with students who are reluctant to speak. "However many of my students may not feel comfortable to talk so would they be able to communicate in a different way?" The potential of virtual worlds as a practice platform before venturing out to the real world was mentioned repeatedly. One participant summarized the benefits of virtual worlds for social skills while also pointing out that these benefits are merely hypothetical.

> For example, a student who stresses about social interactions will probably feel more comfortable guiding an avatar through the environment and using a microphone communicate with someone because they do not feel the social pressures in a firsthand encounter with another. Once the student engages and learns conversational norms on the [*sic*] second life, they can go out and start a conversation more readily in the real world. Of course, this is all in theory, as many students may not feel more at ease in the virtual world.

Finally, doubts about practical implementation were articulated too, despite an overall positive attitude towards virtual worlds as a practice platform. "I honestly think Second Life would be good use in special education for students with social skill needs, however

realistically I see it being very hard to implement." Another key area revolved around learning, that is, what and how can be learned in virtual worlds.

Learning. Experiential and exploratory learning clearly emerged as an asset of virtual worlds throughout the data. Although most participants highlighted the need for structured and guided learning, several pointed out that they also wanted their students to have the opportunity for free exploration, as evidenced by statements such as "(…) but to leave elements of choice and freedom, so that students are encouraged to explore" and "However, we also want to allow our students to use a higher level of thinking and to do some exploring of their own." Participants agreed on the usefulness of the experiential and exploratory components of the 7-Step intervention. Going into Second Life with a group and a tour guide was perceived as enhancing the hands-on learning experience. One participant summarized the superiority of virtual worlds over traditional learning environments under certain conditions:

> I felt that *Roma* was a great island to explore because it brought our avatars into [*sic*] simulated Roman destination. It was a lot more interesting that [*sic*] reading about Rome in a textbook. Features that I used and enjoyed were the Youtube video clips, horseback riding, visiting Roman prisons, reading about Roman life, and viewing an ancient Roman map.

The experiential and exploratory nature of virtual worlds also lends itself to inquiry learning. "The Second Life environment creates an inquiry-based lesson because students have to explore the virtual world in order to learn more about the solar system, astronomy, and other scientific-based knowledge." Virtual worlds were perceived as multisensory and exploration-based tasks were seen as enhancing their students' experience and learning about a subject matter. "If you can get the hardware working I think that this is a great thing for all students especially special education students because it lets everything

be multi sensory and hands on" and "It also provides them different media by which they can learn the same concept, for example getting to experience a dust storm on Mars, visually seeing the difference in planets' size/color/shape." Exploratory learning in virtual worlds is intricately linked with another unique affordance of virtual worlds, namely, activities that are impossible or impractical in real life.

Virtual worlds were perceived as enabling an experience that would be too risky in the real world. One participant stressed the freeing experience of doing something without fear. "Being able to 'explore' ocean life without being in the ocean (For example, I LOVE the ocean but I have no desire to Scuba Dive or go deep into it – this gives me a chance to feel as if I am scuba diving)." Among the venues that the participants identified as impossible or impractical in the real world were historical landmarks or past events that could be re-enacted or witnessed, such as the holocaust at the *U.S. Holocaust Museum* in Second Life. "You can gain history and information on a location past or present by being in the virtual world" and "explore a whole new world (past, future, space, ocean… somewhere you CAN'T go in real life)." The participants reported having enjoyed the immersion into a different world. "It was also really fun to go on a chariot ride; this is something I would not be able to do in real life. I like SL because you are immersed into a different world, where you can do things that you (sometimes) cannot do in real life."

The visual appeal was perceived as another unique feature. "Some of the benefits were the beautiful environments that we were able to interact with that we wouldn't be able to otherwise." Swimming with marine animals was another asset that participants identified. Similar to the participants, the instructor identified the ability to experience

something impossible or impractical in real life as one of the key affordances and pointed out its motivational power.

> It also gives them motivation, maybe interest to be in a different setting. It might motivate them to learn more about certain topics, for example, if they're underwater they could ask about the fishes that they see. If they're in outer space they could ask about the stars and the planets.

In a similar vein, exploratory and experiential learning is closely connected with interactive learning, which emerged as another important area of learning.

The participants' answers revealed an appreciation for the interactivity of objects in Second Life because the tactile access to objects accommodates kinesthetic learners. "Some unique benefits of this specific immersive virtual world include tactile access to information. For example, you can click on the information button to find out more about that piece of art." Second Life was also perceived as promoting interaction with other avatars in a relatively safe environment. "I forsee [sic] that student can use this to interact with others all over the world in a way that is low risk for the students." In this example, students can interact not only with a volcano, for example by jumping into it, but they can also do it together with someone else. "We would have students go on a partner scavenger hunt through the volcano so they would have to interact with each other," again pointing to the social affordances of virtual worlds. Finally, one participant associated the interactivity with enhanced student engagement. "Due to Second Life's interactive nature, students might remain more engaged throughout the course of the lesson." The affordance of manipulating objects and witnessing their impact was highlighted as well. "It is way more fun to play with magnets on a life size scale then [*sic*] see [*sic*] a video of what they can do."

General trends indicate that almost all participants acknowledged the learning potential in virtual worlds. Especially the analysis of the lesson plans in Step 6 raised their awareness of their usability for education as they were trying out each step of the lesson plans that had been developed by other teachers. The following statement is from a pair who collaborated on the lesson plan analysis task and demonstrates that the participants felt that they had learned something new, for example about the solar system.

> It gives students a chance to see the different planets in our solar system. They can read different facts about the planets (i.e. there are 27 known moons for Uranus). Students have to learn the order of the planets, which gives the opportunity to learn about the relationships between planets.

Learning in virtual worlds was not only associated with increased engagement but also with fun. "I think that many children would greatly enjoy Second Life as an educational tool because it provides a variety of forms of information input that the student controls. Instead of just getting talked to or shown powerpoints all day, the students can operate in an environment that is naturally inviting and friendly." The power of visualization, especially in the hard sciences, to make a phenomenon less abstract was pointed out too. Although the participants identified a great number of benefits, they also pointed out several challenges.

Virtual world challenges. The third theme describes a variety of caveats revolving around the use of virtual worlds. As mentioned earlier, the findings also inform the fourth research question about virtual worlds benefits and challenges. The key areas of concern are a lack of appropriateness, distraction from learning, and technical issues.

A strong trend was that participants were very concerned about their students encountering inappropriate content in Second Life. Two groups who had encountered lingerie shops and bars in *Paris 1900* shared their concerns with their peers when they

presented the lesson plan they had developed to the rest of the class. Another group had explored *Imzadi* (underwater area) and gathered at a wet bar after scuba diving where they could freely access cocktails. This experience reinforced the concept of inappropriateness, especially for elementary school students. Therefore, it was not surprising that almost all participants voiced concern about the appropriateness of Second Life for lower grades, although most participants tended to be supportive of using virtual worlds in education in general. "I am not sure if I would actually recommend Second Life however, I could see it being more useful for college or later high school."

The awareness of inappropriate venues seemed to be closely associated with the teacher's preparation and knowledge of a specific virtual destination, as mentioned earlier in the discussion of virtual world pedagogy. "Teachers need to be aware of inappropriate places or things so their students aren't exposed to those while [*sic*] during their activity." The fear of discovering inappropriate content or people during an activity was palpable throughout the data. "You do not want to find out there is something wrong with the island when your students are in there." Some participants stated that they would feel responsible if their students encountered something inappropriate and suggested choosing virtual destinations with a general maturity rating (G) so that students "are free to explore the island in its entirety."

Another pattern that emerged was finding virtual destinations that are not only free of inappropriate content, but that were age- and subject-appropriate. "Also, show the teachers islands that are appropriate for kids to visit." Even on G-rated islands there may be content that could be considered inappropriate in some cultures or for some age groups, which makes the need for a thorough exploration of a virtual destination by the teacher

even more urgent. One such example is G-rated *Hallucinations Island*, where visitors are led through the minds of patients suffering with schizophrenia. Although the exhibit helps the visitor understand auditory and visual hallucinations, the experience can be quite uncomfortable and even scary. For example, a voice keeps saying, "You're the most evil person in the world." Virtual memorials, such as the G-rated *Operation Enduring Freedom Memorial* dedicated to soldiers who lost their lives in Afghanistan is another example. Some students who lost relatives in a war may feel that it is inappropriate to remember them in a game-like virtual environment. While most G-rated islands may be free of inappropriate content, they may not necessarily have activities and content appropriate for a certain age.

Students' safety and protection from griefers (i.e., strangers' avatars who try to harass others by using violence or inappropriate language) became evident as well as the participants' concern how to separate students from the provocative nature of some of the content as well as the provocative nature of female avatars. "How do we ensure that students will not be exposed to inappropriate content or 'stranger danger' while on Second Life?" Concerns about possible inappropriateness were aggravated by the fear of distraction from learning.

Distraction leading to overstimulation and off-task behavior was a frequent concern. "I do worry that SL may be distracting for students who have a hard time focusing and it might seem more like play time than learning time." Several participants anticipated that their students would display off-task behavior. "I think it will be distracting to my students, they will focus more on messing around than learning." The

concerns about potential distraction from learning were so strong that some doubted a substantial learning effect.

> As a teacher of elementary students, I feel strongly that all or most of my students would be so distracted by the visuals and more fun elements (running around, swimming, flying, etc.) that any academic or social benefits would be slight.

Most participants were worried that students would get distracted by visuals and novel fun elements, such as swimming, flying, etc. Because the overabundance of visual stimuli was seen as the main culprit in causing distraction, many participants expressed their preference for simpler and more streamlined environments. "I would create an environment similar to Second Life however without all the details that can cause it to be overwhelming." Another suggestion was to link the virtual exploration with a face-to-face component to ensure that students would not get completely lost in the virtual world. An important reason why the participants were concerned about distraction seemed to be that they feared a control issue. "These distractions can cause an issue with following the teachers' instructions."

Technical issues constitute the third and final area of challenges. The general trend of responses indicates that participants were worried about the unpredictability of technology, about access to technology, and the learning curve that is generally believed to be steep. The participants experienced a number of technical issues, which made some of them hesitant to try out Second Life with their own students.

> There were a lot of technical issues when exploring Second Life. I had to reboot my computer every time my avatar would freeze up. This made my experience on Second Life less enjoyable. It got to the point that I just quit using Second Life and had to partner up with a classmate to complete our assignment. These problems make me hesitant to use Second Life with my class.

Interestingly, the instructor was less concerned about students finding the technology challenging for two reasons. His first reason was that the majority of today's K-12 students are digital natives and may have an easier time to learn a 3D technology than teachers, "I am sure after going through all these steps, they have realized that once you learn the skills you can move pretty easily." The second reason was that some of the participants' may tend to underestimate their students. "Sometimes teachers have low expectations of their students' skills because mainly for special ed teachers they assume that their students may not be able to do certain things just because of the complex task or the complexity of movement in VWs." The instructor also stated that "there's more potential in these islands than for their students getting frustrated", whereas a few participants voiced the opposite.

Another common issue was that an in-world mechanism, such as riding on an object, may not have worked all the time. The sporadic failure of an interactive experience can be disappointing because it may prevent students from completing a task. The researcher journal offers a detailed account of all the technical issues that arose during the fieldtrip in Steps 3 and 6 and resulted in the following list of issues, which may be useful for other educators to investigate prior to their first virtual teaching experience:

- problems with a specific virtual destination (in this case *Paris 1900*)
- the need for a very frequent (ideally weekly) update of Second Life Viewer
- the need for an alternative Second Life viewer software, such as Firestorm
- the importance of having spare avatars
- the need for a technical facilitator in addition to the instructor who guides the activity
- consideration of the facilitator's time spent on troubleshooting
- consideration of the participants' time spent on logging off and rebooting
- the pros and cons of using Skype for voice communication rather than using Second Life in-world voice
- finding out-of-the box solutions
- slow internet connection

- the need for a hard-wired internet connection
- difficulties with Second Life functions (access to the inventory)
- inferior Skype sound quality
- sound interference caused by Second Life voice (echo effect, feedback)

The general trend also indicates that the participants were concerned about the lack of user-friendliness of Second Life and that their special education students may not be able to overcome the steep learning curve. "As a functioning adult, I struggled with navigating my avatar and had to be transported to where my group was." On the one hand, they assumed that because they themselves had already experienced a good amount of technical challenges, their special education students might be completely overwhelmed. "As someone who is not accustomed to using [*sic*] computer or video game, navigating Second Life successfully was a challenge for me. I got stuck on basic things like teleporting, walking, and getting my avatar dressed!" On the other hand, a few participants mentioned that this experience in Second Life (as opposed to the first Second Life experience in October 2013) was much better and that navigation was becoming easier. As a reminder for the reader, these participants had already spent two and a half hours in Second Life at the time, most of which was spent either sitting and listening to the ESL instructor's lecture or troubleshooting. Therefore, it is not surprising that some participants found navigation challenging for a lack of practice opportunities in the fall. Although the participants had received a highly pictorial Second Life manual with instructions how to use Second Life, some comments suggested that the manual may not have been used to learn Second Life navigation and communication. This, in turn, may indicate that Second Life is actually quite intuitive to use. On average, it seems to take less than an hour to have a reasonably good command of the basics of navigation. Some of the pilot-testers did not need any preparation time at all.

Another emerging trend was that participants were concerned about the necessary technology. “I still see the accessibility at home and at school as a challenge.” It was suggested that the school should provide the necessary technology, that is, high-end computers with good graphics cards and high-speed internet rather than asking students (or teachers in training) to access Second Life on their own computer. In other words, some participants would have preferred to be in the university’s computer lab as a class rather than operating their own computer from home. Another concern was the setup of computers, which refers to the setting of preferences, for example to allow or block music, media, voice enabling, etc. In sum, the key recommendations were “making sure there is internet access, make sure there are enough working computers, and that the necessary equipment is available and functioning.” One participant asked whether there was an app for iPads that is user-friendlier. Indeed, a Second Life app called *SL Go* was launched in March 2014 but incurs charges (9.95 dollars per month or one dollar per hour), whereas Second Life is free. But the fact that virtual worlds are starting to be more mobile seems promising.

Research questions three and four were qualitative in nature, whereas the fifth question was addressed by both qualitative and quantitative data.

Research Question 5: Collaborative Learning

The fifth and final research question asked, “What are special educators’ perceptions of the potential of virtual worlds for collaborative learning?” Collaboration emerged as one of the high frequency codes in the qualitative data analysis. The interdependence among partners to achieve a goal was evident across all participant statements, for example by implementing activities “where two people have to use an

object to activate it" and activities that require talking with each other and guiding each other, such as in a scavenger hunt. "During this activity, the student would work together as one leads using the map and the other focuses a little more on the scavenger hunt finding piece. Together they work together on determining the next location." Virtual worlds were also perceived as being useful to foster spontaneous interaction. "Where they would have to collaborate in order to complete the assignment within an environment that would also encourage spontaneous interaction (commenting on what they see, deciding where to go next, etc.)." One participant eloquently summarized the benefits in terms of collaboration:

> The collaboration would come from the activty [*sic*], as students would be required to come up with answers together. The very nature of exploring an island or environment together is inherently a collaborative activty [*sic*] since as the students learn new things about their environment, they will want to share it with their partner so they could understand their surroundings better.

Several items of the post-survey inquired about the participants' perceptions of the compatibility between virtual worlds and collaborative learning. Item 28 asked whether they thought that their group's outcome (in the development of a tentative lesson plan) had been better than if they had been working alone. All but two agreed that the group's outcome had been better. The following statement is representative of their answers.

> Yes, I think my group's outcome was better than had I been working alone. Exploring the island with classmates, we each saw different activities that we could do with certain components, and that brought more variety and diversity to our lesson.

Collaboration also made the activities more enjoyable, as evidenced by the following statement, "Yes. By enabling multiple people to bounce ideas off of one another, the experience was greatly enhanced. Had i done this on my own, i wuold [sic] not have enjoyed it as much."

Item 29 asked whether they had enjoyed working with a partner. Eighty-nine percent (16) responded "very much" (highest rating) and 11% (2) chose "quite a bit" (second highest rating). Item 30 asked to what extent the collaboration had motivated them to put in greater efforts into the completion of the assignment. The answers were more varied here. The majority felt enhanced motivation to various extents. Forty-four percent (8) selected "very much," 22% (4) selected "quite a bit", and 17% (3) reported having felt motivated "reasonably well." Three outliers (17%) felt barely motivated by the collaboration. Item 31 asked about the extent to which they had felt a sense of community with their partner. The most frequent choice was "very much" (61%, 11). The remaining responses were spread over three response options: "quite a bit" (17%, 3), "reasonably well" (11%, 2), and "barely" (11%, 2).

Item 32 asked how well they had been able to meet the learning objectives of the Second Life assignments. Only 17% (3) chose "very well", with the most frequent answer being "quite well" (44%, 8). "Reasonably well", the middle response option, was chosen by 22% (4), and 17% (3) selected "barely." Item 33 asked if their partners had asked critical questions that had helped them reflect on their understanding. All participants agreed to a certain extent by selecting either "sometimes" (28%, 5), "quite often" (50%, 9) or "all the time" (22%, 4). Similarly, when asked (item 34) whether they had had discussions with their partners that had helped them to correct their understanding, all participants, but one, agreed, with the majority indicating "sometimes" (50%, 9), 28% (5) choosing "quite often", and 17% (3) choosing "all the time." One outlier (6%, 1) chose "no, never." Item 35 asked how well, overall, collaborative learning could be satisfied in Second Life. All participants reported that Second Life was suitable,

to varying degrees, for collaborative learning. The most frequent answer was "quite well" (44%, 8), the second frequent answer was "reasonably well" (39%, 7) and the least frequent answer was "very well" (17%, 3).

Finally, in item 36, I was interested in learning about the participants' perception of the inquiry process. Specifically, the question was, "How useful was the inquiry process of experiencing, investigating, and analyzing Second Life first-hand in order to make informed decisions about its use in education?" The majority replied that it had been useful to varying degrees. The most frequent answer was "quite useful" (44%, 8), the second frequent answer was "reasonably useful" (33%, 6), but only 17% (3) found it "very useful." One outlier (6%) chose "rather useless."

Unexpected Data

Rather than exploring all the low-frequency codes, I will focus on a few selected codes that I had expected to emerge as high-frequency codes. One of these low-frequency codes was *Time-Intensive.* The time that it takes teachers to create virtual activities and lesson plans and align these with the course objectives has been frequently mentioned in virtual worlds research. In addition, virtual fieldtrips can be time-consuming because the troubleshooting of technical issues is a potential time-waster. Yet, there were only few references to the time-consuming nature of teaching and learning in virtual world. "I am concerned how students will navigate the virtual world and how much time will be spent trying to familiarize them with the site versus actually using it for academics."

The instructor and the researcher had done all the preparation for the participants in this 7-Step intervention, such as pretesting and selecting suitable virtual destinations, which means that the participants did not experience the full scope of preparing virtual

activities. Yet, some participants must have realized the extent of the work that would have to be done to make a virtual fieldtrip possible. “It is a lot of work for a teacher to look ahead of time at things, plan/create/make notecards for their students.” Clear and well-structured instructions were recommended as a measure to ensure efficiency. “Offer students step-by-step instructions from entry through the tour of the virtual world so they do not spend a lot of time wandering around trying to figure out what the next steps are.”

Another topic that was hardly raised was transfer. Only a few participants articulated doubt about the transfer of social skills learned in virtual worlds to real-life situations. In this regard, escape from face-to-face contact emerged as a key concern.

> I think students with social skills challenges already escape to virtual worlds in various ways to escape actual social interaction. While Second Life presents a better simulation of real world possibilities (than video games, for example), it can still present distance from real-world social interactions.

One participant even raised a possible exacerbation of fear of face-to-face contact caused by virtual social skills practice. “Second Life can teach students how to have a conversation without having to have literal face-to-face contact, however that might increase their anxiety when they are in situations which require face-to-face contact.” Another participant articulated a similar concern even more dramatically, “However, just from my own knowledge of what I know, I feel like I have heard of people getting lost in the online world, not wanting to socialize in real life (like the movie ‘Her’).” One participant provided very sound advice that may be applicable to all user groups regardless of whether they have social skills challenges or not, “We have to make sure that students know that Second Life is still a virtual world, not reality.”

Summary of Findings

Overall, the eighteen special educators found the 7-Step Virtual Worlds Teacher Training Intervention useful because it helped them develop the ability to make informed decisions about the usability of Second Life for special education purposes. Most of the seven steps of the intervention received high ratings, although the participants suggested a number of improvements. The five top rated components were: having access to a list of pre-tested Second Life destinations, getting instructions on how to locate subject-appropriate destinations, receiving a scaffolded introduction to Second Life, having access to resources for educators, and having access to an experienced in-world facilitator. The cumulative attitude scores based on the 11-item attitude scale suggest that their attitude toward using Second Life for educational purposes has become more positive as a result of the intervention at a statistically significant increase ($p = .00$, $r = .51$). The 11-item attitude scale inquired about the participants' fears, their perceptions of the affordances and challenges of virtual worlds, and their enthusiasm and preparedness to use virtual worlds in their own classroom.

In a separate summary item, the participants were asked to indicate their perception of the overall usability, that is, classroom applicability, of Second Life for social skills practice, specifically for students with social skills challenges. A 10-point rating scale was used to measure the perceived usability. Although the mean usability was higher after the intervention, which is in support of the results of the 11-item attitude scale, a Wilcoxon signed-rank test did not reveal a statistically significant difference between the mean ratings ($p = .14$). Overall, a majority of the participants (76%) was

supportive of the idea of using virtual worlds in special education despite a variety of concerns.

Three themes emerged from the qualitative data, namely, *Virtual World Pedagogy*, *Virtual World Benefits*, and *Virtual World Challenges*. Overall, they encompassed 18 codes. *Virtual World Pedagogy*, the first theme, demonstrated the participants' concern about the practical implementation of virtual worlds, designing lesson plans, having access to lesson plan templates for specific age groups and subject matters, and aligning virtual instruction with course objectives and Common Core Standards. This theme also reflected the participants' ideas for potential activities and classroom applications, some of which were more traditional (e.g., scavenger hunts), while others were more innovative (e.g., historical reenactments). Two key ideas were particularly accentuated, namely, the need for pedagogical and technical facilitation during the participants' transition into virtual teachers and the participants' desire for a well-structured, confined, safe virtual region with built-in scaffolding. One of the strongest tensions that emerged from the data was the participants' wish to have control over their students in-world and their wish to let students explore freely.

The second theme, *Virtual World Benefits*, revealed the participants' strong support of the potential of virtual worlds for students with social skills challenges. There was strong agreement that this platform promotes social skills practice without the stress of face-to-face communication. Other benefits, such as exploratory and experiential learning, were more of a general nature and did not specifically pertain to special education, although they seem important to enhance students' motivation, regardless of their background.

The third theme, *Virtual World Challenges*, was dominated by the participants' concerns about exposure to inappropriate content and griefers (rogue users) as well as distraction from learning caused by overstimulation. Technical issues were an omnipresent challenge, although they were not serious enough to prevent participants from engaging actively during the intervention. Yet, the combination of technical issues, the steep learning curve associated with Second Life, and the unpredictability of technology in general prompted many participants to conclude that at this point they would not want to use virtual worlds in their own instruction. Only a few participants supported virtual worlds with no or few reservations. Further concerns were voiced about the transfer of skills learned in-world to real life settings and about the risk that students would start to prefer virtual communication with avatars over real life communication.

CHAPTER 5

SUMMARY, LIMITATIONS, DISCUSSION, AND IMPLICATIONS

Chapter 5 is divided into a summary of the study, limitations, a discussion of the key findings (organized around research questions), implications for practice outlining 14 practical recommendations and introducing a revised 4-Step Virtual Worlds Teacher Training model, implications for research, and a brief summary.

Summary of the Study

Although the use of 3D virtual worlds has greatly increased, there is a lack of research that addresses the preparation of teachers to effectively use these virtual environments in teaching (Guasch et al., 2010; Guzzetti & Stokrocki, 2013; O'Connor & Sakshaug, 2009; Pérez-García, 2009; Storey & Wolf, 2010). Virtual worlds hold great promise for supporting students with social skills challenges, such as students with autism, by offering them a safe virtual platform for the practice of social encounters (Bernardini et al., 2013; Burstin & Brown, 2007; Cobb, 2007; DeAngelis, 2009; Fusar-Poli et al., 2008; Neel, 2006; Parsons & Cobb, 2010; Parsons & Mitchell, 2002; Smith et al., 2007; Stichter et al., 2014; Trepagnier et al., 2011). In particular, virtual worlds have potential as a common platform where students can get together to practice peer interaction, collaboration, take advantage of the benefits of experiential learning, all under the guidance of a virtual teacher and without having to be in the same room (Stichter et al., 2014). Research reporting on specific teacher training for the use of virtual worlds in special education, however, is difficult to locate, which indicates the need to provide special education teachers with training opportunities in virtual worlds so they can help their students take advantage of the potential benefits of virtual worlds for

social skills practice.

The purpose of this study was (a) to determine special education teachers' perception of the effectiveness of a systematic 7-Step Virtual Worlds Teacher Training intervention to enable them to make informed decisions about the usability of Virtual worlds for students with social skills challenges, (b) to determine whether the intervention led to a teacher change of attitude, and (c) to determine the participants' perceptions of the usability of virtual worlds for students with social skills challenges, the benefits and challenges of virtual worlds as well as their usability for collaborative learning. Data were obtained from seven instruments, namely a pre- and post-survey, a written reflection, the participants' answers to the prompts of a lesson plan analysis task, a pre- and post-interview with the instructor, and a researcher journal. Mixed methods were used for data analysis. An 11-item attitude scale, built into the pre- and post-survey, underwent a rigorous process to determine validity and reliability. The coding of the qualitative data was subject to an interrater reliability process with three experienced coders.

A total of 18 special education teachers (female N=16, male N=2) enrolled in a graduate technology course participated in the study. All of them already had basic Second Life experience from a two and a half hour workshop in October 2013. The participants completed the preliminary survey in Step 1; watched two video clips depicting the educational potential of Virtual worlds in Step 2a; received access to educational resources about virtual worlds in Step 2b; collaboratively explored an educational destination in Second Life where they brainstormed on potential activities for a specified target group in Step 3; presented their lesson plan ideas to the class in Step 4;

wrote individual reflections about their experiences and perceptions of the usability of Virtual worlds for students with social skills challenges and individually received feedback (blogback) from the researcher to prompt further reflection in Step 5; tried out, critiqued, and modified lesson plans designed by other educators in Step 6; and completed a post-survey inquiring about their perceptions of the effectiveness of the workshop, their attitude toward Virtual worlds for special education purposes, and their perception of the compatibility of Virtual worlds with collaborative learning in Step 7.

Three constructivist epistemologies informed the study, namely, inquiry-based learning, sociocultural theory, and experiential learning theory. The intervention was important because it helped the participating teachers to develop an understanding of the pragmatics of 3D technology integration into their teaching. The findings of this study have informed the design of a revised 4-Step Virtual Worlds Teacher Training Model that will be introduced in the conclusion and that can be used in other teacher education programs with minor adjustments.

Summary of Findings

Overall, the eighteen special educators found the 7-Step Virtual Worlds Teacher Training Intervention useful because it helped them develop the ability to make informed decisions about the usability of Virtual worlds for special education purposes. Most of the seven steps of the intervention received high ratings, although the participants suggested a number of improvements. The five top rated components were: having access to a list of pre-tested Second Life destinations, getting instructions on how to locate subject-appropriate destinations, receiving a scaffolded introduction to Second Life, having access to resources for educators, and having access to an experienced in-world facilitator.

The cumulative attitude scores based on the 11-item attitude scale suggest that their attitude toward using Virtual worlds for educational purposes has become more positive as a result of the intervention at a statistically significant increase ($p < .05$, $r = .51$). The 11-item attitude scale inquired about the participants' fears, their perceptions of the affordances and challenges of virtual worlds, and their enthusiasm and preparedness to use virtual worlds in their own classroom.

In a separate summary item, the participants were asked to indicate their perception of the overall usability, that is, classroom applicability, of Virtual worlds for social skills practice, specifically for students with social skills challenges. A 10-point rating scale was used to measure the perceived usability. Although the mean usability was higher after the intervention, which is in support of the results of the 11-item attitude scale, a Wilcoxon signed-rank test did not reveal a statistically significant difference between the mean ratings ($p > .05$). Overall, a majority of the participants (76%) was supportive of the idea of using virtual worlds in special education despite a variety of concerns.

Three themes emerged from the qualitative data, namely, *Virtual World Pedagogy*, *Virtual World Benefits,* and *Virtual World Challenges*. Overall, they encompassed 18 codes. *Virtual World Pedagogy,* the first theme, demonstrated the participants' concern about the practical implementation of virtual worlds, designing lesson plans, having access to lesson plan templates for specific age groups and subject matters, and aligning virtual instruction with course objectives and Common Core Standards. This theme also reflected the participants' ideas for potential activities and classroom applications, some of which were more traditional (e.g., scavenger hunts), while others were more

innovative (e.g., historical reenactments). Two key ideas were particularly accentuated, namely, the need for pedagogical and technical facilitation during the participants' transition into virtual teachers and the participants' desire for a well-structured, confined, safe virtual region with built-in scaffolding. One of the strongest tensions that emerged from the data was the participants' wish to have control over their students in-world and their wish to let students explore freely.

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the transfer of skills learned in-world to real life settings and about the risk that students would start to prefer virtual communication with avatars over real life communication.

Limitations

The intervention had several limitations. First, the activities of this study were limited to Second Life. On the one hand, different results might have emerged in other virtual worlds. On the other hand, it can be assumed that Second Life is a fair representation of virtual worlds due to a number of shared characteristics, such as the use of avatars, 3D immersiveness, and communication through text and voice chat (Dickey, 2011). It is important to remember that the purpose of the intervention was to enculturate teachers into the use of virtual worlds rather than the use of Second Life. Second, while the participants' experiences can be expected to generalize to similar virtual environments, the sample (N=18) cannot be generalized to a wider teacher population. Furthermore, the participants, all of whom special educators, were not emblematic of all instructors. The intent of the intervention, however, was not necessarily to generalize to a larger population but to provide a full evaluative account that can be taken into account in the design of other studies and teacher training workshops. Working with special education teachers exclusively may actually constitute an additional asset rather than a limitation because there is, to my knowledge, no literature about virtual worlds teacher training for special education teachers.

Third, the sample is smaller than that normally used in quantitative studies but comparable to the samples used in similar qualitative and mixed-methods studies. Fourth, convenience sampling was used in this study. Fifth, the submission of the assignments and surveys required students to identify themselves. Anonymous submission was not an

option because the intervention was an integral part of the graded coursework. Thus, there was a small risk that the participants might have manipulated their answers in order to please the instructor, who was in charge of the intervention and administered the data collection instruments. The sixth limitation was related to the nature of qualitative research. A large amount of data was gathered through multiple instruments. Data analysis necessarily involved reducing and synthesizing the data into themes, as described in Chapters 3 and 4. This task required emphasizing some data while devaluing other data. A meticulous audit trail documents the data reduction process.

Seventh, depending on the quality of the participants' internet access and computer graphic card, technical issues arose that were detrimental to the participants' virtual experience and were bound to affect their attitude score toward the usability of virtual worlds in education. Eight, the participants had already been exposed to Second Life in an earlier course so they necessarily started the intervention with a bias. Ninth, reliability has only been demonstrated for 11 survey items, which were used both in the preliminary and the post-survey. Tenth, there may have been a gender bias due to the fact that 16 out of 18 participants were female. Finally, this self-study also involved a critical examination of my own perceptions and potential biases toward the usability of virtual worlds for education as well as the instructor's perceptions. In addition, the long-standing collaboration between the instructor and myself may also have introduced certain biases.

Despite these limitations, the findings have resulted in solid recommendations aimed at assisting special education teachers as well as teacher educators in the implementation and use of virtual worlds in education for special education students with social skills challenges.

Discussion and Conclusions

The participants' perceptions were full of tensions reflecting both their supportive stance toward virtual worlds and their skepticism. The fact that these participants tended to start the intervention with a negative bias from a virtual experience made in October 2013 may have exacerbated this tension. Despite high consistency with previous research, there have been a number of surprises and inconsistencies. The first contradiction concerns the impact of the participants' technology background.

Descriptive Context for Research Questions

The assumption that tech-savvy people will have no difficulties using virtual worlds is not always true (Savin-Baden, 2010). As pointed out in Chapter 1, NMC Horizon (2012) reported that children born in the early 1980s, 1990s, and 2000s have grown up as digital learners who enter or graduate from higher education with hundreds of hours of gaming experience. Most (83%) of the participants of the present study were between 20 and 30 years old, that is, they were born in the 1990s. Only two of the 18 participants reported having gaming experience, which is inconsistent with the NMC report (2012). The majority reported an advanced technology background with a self-reported computer experience of 7.33 (on a 10-point rating scale), but at the same time they also reported being inexperienced users of virtual worlds. The findings suggest that even digital natives may not always feel comfortable using technology (Inman, 2010). This is one example of a number of tensions that will be tangible throughout the discussion. The discussion is organized around the five research questions and follows the same order as Chapter 4.

Research Question 1: Effectiveness of the Intervention

The first research question asked, "What are special education teachers' perceptions of the effectiveness of the systematic 7-Step Virtual Worlds Teacher Training Workshop in terms of enabling them to make informed decisions about the usability of virtual worlds for special education?"

Perceived effectiveness of the intervention. Overall, the results indicated that 89% of the participants found the intervention effective to varying degrees ("reasonably effective," "quite effective" or "very effective"). Eleven percent found it "rather ineffective." In the post-survey, items 2 through 10 asked about the participants' perceptions of the effectiveness of each of the seven steps of the intervention. The first noticeable issue was that Step 3 (hands-on exploration of a virtual destination, including collaborative design of learning activities) and Step 4 (sharing potential learning activities in class) were perceived as much more effective than Step 1 (preliminary survey), Step 2 (affordances of virtual worlds, educators' resources), Step 5 (written reflection), Step 6 (lesson plan analysis), and Step 7 (post-survey). This finding is not surprising because the virtual fieldtrip allowed them to immerse themselves in experiential learning and experience virtual worlds from the perspective of a learner, which concurs with Traphagan et al. (2009) who proposed that a virtual world is ideal for using experiential learning.

Design suggestions. Based on a second source of information, however, the perceptions seemed to differ. Item 12 of the post-survey asked the participants to choose those components (from 10 given options) that they would incorporate into an effective virtual worlds workshop for special educators. In this item, Step 3 and 4 only received

56% and 50%, respectively, of the votes, whereas the other steps, except for Step 6-Lesson Plan Analysis (44%), had ratings of 60% or above. The components that were rated higher were (also shown in Table 17, Chapter 4):

- *Educational destinations:* Having access to a list of pretested virtual worlds destinations, categorized according to age groups and subject matter (94%)
- *Finding subject-matter specific locations:* Learning how to locate specific virtual worlds destinations that align with subject matter content, such as math (83%)
- *Training:* Scaffolded introduction to virtual worlds (78%)
- *Resources:* Having access to virtual worlds resources for educators (72%)
- *Technical Facilitator:* Having access to an experienced in-world facilitator (72%)
- *Research:* Familiarize with research about the unique benefits of virtual worlds for education and the special benefits for special education students with social skills challenges (67%)
- *Inquiry:* Start with educator-generated questions about using virtual worlds for educational purposes (61%)

Especially the five top-rated choices point to the participants' need for support, both pedagogical and technical, that facilitates their virtual enculturation. They also point to a feeling of disorientation, as evidenced by the need to locate educational regions. Step 6-Lesson Plan Analysis received the least favorable ratings of the 10 options, which may have been prompted by the fact that these lesson plans had not been designed for special education. Part of the task was to modify the lesson plans to better suit the needs of special education students. Some participants, however, indicated that they would have appreciated lesson plan templates. Although they did not specify that these templates should be geared toward the needs of special education students, it can be assumed that this is what they meant. They had received access to an online repository of virtual worlds lesson plans developed by other educators. I was, however, unable to find any lesson plans specifically designed for special education.

The above findings lead to the question how the intervention can be improved. One way to improve the intervention would be to have participants teach a mini-lesson. Such a simulation would reinforce the experiential aspects, which would help them

experience what it means to be a 3D virtual teacher, having to address questions such as how to avoid that technology leads the pedagogy (de Freitas & Oliver, 2006). Educators will benefit from making exact plans before starting to teach virtually. Planning instruction in a virtual world requires more care and accuracy and a clear rationale for each phase of learning (Alvarez et al., 2009; Davey, 2005; de Freitas & Neumann, 2007; Ollé & Kristof, 2014; Silva et al., 2010). In a virtual space, it is more challenging to know what the students are doing and in which phase of a task they are than in a real-life environment. Incorporating a mini-teaching episode would provide opportunities to practice these skills.

Another way to improve the intervention would be to give more time to process the information. In Step 2, for example, the participants watched a 3-minute screencast outlining several virtual world resources for educators but did not have the possibility to try out the resources. Although they had received an extensive list with over 300 virtual educational spaces in Second Life worlds as well as an ebook offering practical guidance to using Second Life in higher education, it is very unlikely that they were able to spend time exploring these in their own time. The participants' comments in the post-survey indicated that they would have benefited from spending more time on these resources. Finally, another option to improve the workshop would be to explore a virtual world that is more age-appropriate for their students, such as *Minecraft, Quest Atlantis,* or *Whyville.* A frequent comment was that Second Life might be inappropriate for younger students. The third data source informing research question one was qualitative in nature.

Virtual world pedagogy. Three themes were identified in the analysis of the qualitative data, namely, *Virtual World Pedagogy* (six codes), *Virtual World Benefits*

(seven codes), and *Virtual World Challenges* (five codes) (Figure 6, Chapter 4). Rather than discussing all 18 codes that emerged under the three themes, only the most important findings will be discussed. For the first theme, only those areas will be discussed that have impacted the redesign of the workshop model. The second and third theme will be discussed under the fourth research question.

Teacher training and support emerged as a key area. Its subareas, namely, familiarity with Second Life; mentoring, coaching, & ongoing support; and technology support have consistently emerged as key topics in previous research (e.g., Dickey, 2011; Good et al., 2008; O'Connor, 2009-2010; Oh & Nussli, 2014). In the present study, they have manifested themselves in the teachers' concerns about the practical implementation of virtual worlds into their teaching; questions about classroom management; access to a coach or mentor for ongoing pedagogical guidance; access to tested resources and virtual regions to ease the newcomers' transition into virtual teachers; and access to a technical facilitator while teaching in-world.

The study's findings concur with Omale et al. (2008) who recommended that virtual tasks be well-structured, with clearly defined student roles and responsibilities. This study also reinforces findings by Storey and Wolf (2010) who emphasized the importance of clearly identified learning outcomes, pedagogical and technical scaffolds to support understanding, assessments, and knowledge building interaction. The participants of this study perceived learning about a virtual world by trying it out as useful because exploring it through the lens of a student helps to sensitize the participants toward understanding possible student errors, potential successes, and frustrations. Although the participants frequently mentioned technical issues, they also pointed out

that it had been useful to see the types of problems that could appear and how these could be addressed, which indicates that seeing someone model troubleshooting helped to increase their self-confidence in their own troubleshooting abilities. For example, the participants experienced a much better sound quality in Skype, which was used in this study, compared to the serious sound issues that several of them experienced in October 2013 with the use of Second Life voice communication.

The instructor and I also modeled how to divide our responsibilities, that is guiding the task (instructor) versus technical troubleshooting (researcher), which concurs with previous research. Ollé and Kristof (2014), for instance, highlighted the need for having multiple teachers and facilitators in-world at the same time. While it could be argued that most schools do not have the resources to provide multiple teachers and facilitators to support an in-world experience, it is critical that teachers new to virtual worlds receive maximal technical support initially as well as pedagogical mentoring over a longer period of time (Silva et al., 2010), which could be achieved by developing a peer-support network where more experienced virtual teachers support newcomers.

The participants were especially interested in curriculum-related areas and practical procedures, that is, how, specifically, virtual activities can be incorporated into their teaching and aligned with objectives. One possibility to help teachers see how virtual worlds can be applied practically is to share empirical articles with them that describe in detail how a lesson was taught, why it was taught that way, why the authors chose a virtual world as a medium for instruction, and if the learning gain was superior to other modes of transmission. Virtual worlds research offers numerous examples of

practical classroom applications, although most of them are in higher education and rarely address the needs of special education students.

The data revolving around learner support emerged as another key topic and seems particularly relevant given that virtual environments tend to be ill-structured (Hills & Hannafin, 2001). This topic reveals another potential schism between the challenges of virtual worlds. On the one hand, virtual destinations may be considered inappropriate because they are overstimulating due to a lack of structure and an overabundance of visual stimuli. Contrary to the participants' concerns, it has been shown that children with autism had no negative sensory experiences from being immersed in reality rich virtual worlds (Wallace et al., 2010). On the other hand, the visual appeal may actually constitute one of the key motivators for the use of virtual worlds.

As expected, the scaffolding of learning activities emerged as another key topic, although it was also considered important to give students the freedom of exploration, which is in line with the principles of inquiry-based learning and experiential learning. The participants recognized that virtual teachers need to provide more structure than might be necessary in a face-to-face lesson, for example by using checklists. Careful scaffolding (Delwiche, 2006; Mayrath et al., 2007; McVey, 2008; Rappa et al., 2009; Sanchez, 2007) and well-structured class management and organization in virtual worlds are vital because unpredictable, open-ended, or less structured activities in virtual worlds tend to decrease student engagement (Penfold, 2008).

The participants' wish to offer strong guidance is not surprising because some of them reported occasional disorientation themselves. Many were unable to find a region and needed teleporting by the researcher, although they had access to the Second Life

hyperlink. The feeling of disorientation was also addressed in Boland (2009). Although she reported that her participants' confusion and disorientation reduced with time and experience in-world, it seems critical to address these threats during virtual world teacher training because a feeling of disorientation can undermine teachers' and students' self-confidence in their technical abilities and thereby reduce their willingness to use virtual worlds. Confusion and disorientation can be avoided by presenting teachers with clear instructions on how to find educational destinations and by confining an activity to a designated space within a larger area. Social cohesion may also have a positive impact. As the participants were reflecting on learner support, they also raised questions of classroom management.

The data categorized under virtual classroom management revealed a potential control issue. The participants realized that classroom management in a 3D space is different than in a real-world classroom. Having control over students emerged as an important topic, especially because most of the participants were teaching younger students. This control issue seems to be linked with the participants' fear of inappropriateness. Another common fear among the participants was to lose their students in the virtual space. It makes sense that teachers of younger students, special educators in particular, would be concerned about losing track of their students and that they may have a traumatizing experience. The teachers' desire for control, however, raises the question of whether too much teacher control hampers students' motivation and sense of exploration. Previous research suggests that giving students the opportunity to personalize their avatars increases their sense of social presence (Annetta, Klesath, & Holmes, 2008). Striking a balance between control and free exploration seems essential.

The next topic, characteristics of an ideal destination for social skills practice, reinforces the idea of control. The participants recommended using a small, controllable, and safe space from which students could not leave on their own will and which would be locked to other users to avoid outside contact and potential harassment by griefers (rogue users). Although only one participant reported an encounter with a griefer, a majority of the participants seemed to be concerned about the open, publicly accessible space, which, again, circles back to the control issue. This finding is not surprising in the light of the novelty of virtual spaces for those educators who are beginning users and who might feel uncomfortable in these environments. To reduce educators' fear of intruders and inappropriateness, schools may consider creating their own networked spaces, which are only accessible to students.

The next section addresses the change of attitude resulting from the intervention.

Research Question 2: Change in Attitude

The second research question asked, "To what extent is there a teacher change of attitude toward the usability of virtual worlds for special education resulting from engagement in the systematic 7-Step Virtual Worlds Teacher Training Workshop?" The purpose of this question was to measure quantitatively whether the participants had a change in attitude after the intervention. The results of the 11-item attitude scale suggest that the participants' attitudes toward the use of virtual worlds for social skills practice increased as a result of the intervention at a statistically significant level ($p = .00$), which indicates a reconceptualization of the participants' beliefs (Vygotsky, 1978), similar to the results of the pilot studies (Nussli et al., 2014; Oh & Nussli, 2014). At the beginning of the workshop, they had reservations about the use of virtual worlds for education, but

after being immersed in the environment and after exposure to empirically identified unique affordances and special affordances for students with social skills challenges, they had a positive change in attitude. The large effect size (r = .51) indicates that the difference between the preliminary and post-survey attitude is large enough to be practically meaningful.

The increase from a mean score of 33.78 (*SD = 6.61*) to a mean score of 37.56 (*SD = 5.37*) was equally spread over the entire range (22 to 42 in the preliminary survey, 30 to 48 in the post-survey). These findings indicate that for the majority of the participants, the intervention has made, if not a big difference, a noticeable difference compared with their initial attitude, which was tarnished by their negative Second Life experience in October 2013. This positive change alone justifies the intervention because, with the increasing use of virtual worlds and educational games, it seems critical that today's 21st-century educators are aware of the potential and the classroom applicability of these 3D tools. In addition to the 11-item attitude scale, their attitude was measured through a usability rating, which will be discussed next.

Research Question 3: Usability

The third research question asked, "What are special educators' perceptions of the usability of virtual worlds for special education, especially to practice social encounters for individuals with social skills challenges?" A 10-point rating item (one question) was used to answer this question. The findings indicate that the participants' attitude toward the usability of virtual worlds for students with social skills challenges has improved, although the mean ratings failed to increase enough to reach a statistically significant level (p = .14). The median went up from 5.0 to 6.11. The fact that a majority of 77% was

supportive of incorporating virtual worlds in special education teaching, to varying degrees and with certain limitations, suggests that, on the one hand, the participants recognized the potential and unique affordances of virtual worlds for special education students with social skills challenges. On the other hand, they were able to weigh the benefits against the challenges, such as technical issues, safety aspects, (lack of) appropriateness, or (lack of) access to technology.

The focus of the discussion will now switch from pedagogical matters to the benefits and challenges of virtual worlds.

Research Question 4: Benefits and Challenges

The fourth research question asked "What are special educators' perceptions of the benefits and challenges of virtual worlds for special education?" and will be addressed by discussing the data revolving around the second and third theme emerging from the qualitative data, starting with the benefits.

Virtual world benefits. The potential of virtual worlds for education is widely recognized. A careful analysis of benefits and challenges, however, will help to determine whether an alternative, more easily accessible medium might not achieve similarly good results, possibly in less time (Dalgarno & Lee, 2010), which is also in line with the findings of the present study. Two of the key benefits that emerged is that virtual worlds offer immense potential for the practicing of social skills at a distance, combined with reduced stress due to the absence of face-to-face contact (Stichter et al., 2014).

Special affordances. The potential of virtual worlds for social skills practice, specifically for students with social skills challenges, emerged as a key topic, which is one of the most important findings of this study. Overall, the participants agreed that

virtual worlds offer students with social skills challenges an excellent platform to practice social encounters, especially because the virtual environment could be a safe space where students can practice talking to real people (i.e., with humans behind avatars rather than robot avatars, so-called chatbots) without the feeling of self-consciousness and with reduced anxiety. These findings are echoed in previous research (e.g., Cobb et al., 2002; deAngelis, 2009; Gorini et al., 2009; Neel, 2006; Newbutton & Donegan, 2010; Parsons & Mitchell, 2002; Rutten et al., 2003). As pointed out by Stichter et al. (2014), social skills intervention programs in virtual environments, such as iSocial, hold great promise to gain social competence. This trend, in turn, points to an increasing need for qualified teachers who can deliver this training.

Some participants pointed out the lack of expressiveness of avatars, similar to Inman (2010). The elements of metacommunication that are so meaningful in offline environments, such as gestures, facial expressions, posture or mimics are missing mostly from virtual communication (Ollé & Kristof, 2014). Better expressiveness and more gestures are necessary to recognize and get used to these elements of every day social interactions. Otherwise, transfer to real-life settings may be limited.

The participants' identification of reduced stress is in strong agreement with previous research (e.g., Bernardini et al., 2013; Burstin & Brown, 2007; Cobb, 2007; DeAngelis, 2009; Neel, 2006; Parsons & Cobb, 2010; Parsons & Mitchell, 2002; Smith et al., 2007; Trepagnier, 1990) describing virtual environments as risk-free and stress-reduced learning space to practice socially appropriate responses without real-life implications (Neel, 2006). Saving students the embarrassment of social mistakes also echoes previous research (Strickland, 1997). Many participants highlighted that students

with autism often feel more comfortable communicating online due to the absence of face-to-face contact (Fusar-Poli et al., 2008; Parsons & Mitchell, 2002; Smith et al., 2007). The participants of this study were also aware of potential risks for students on the autism spectrum, such as less willingness to interact in the real world (Parsons & Mitchell, 2002) and the rote learning of appropriate behavior without learning the social real-life implications (Neale et al., 2002; Rutten et al., 2003). It has been suggested that the appeal of computer-based communication might remove individuals with autism even more from real life social contact (Howlin, 1998). There is no evidence that computer-mediated communication exacerbates the social-communicative problems in autism (Rajendran, 2013). On the contrary, computer-mediated communication has been shown to facilitate interaction with others (Alcorn et al., 2011) either directly or through the help of a facilitator. Parsons et al. (2006) provided examples of dialogues between individuals with autism and a facilitator while engaging in social skills practice tasks in a virtual environment. The facilitator not only guided the user through tricky tasks, but also established the link to real life social interaction during immersion in a virtual environment.

One participant articulated doubt about the transfer of skills to real life. Indeed, conclusions from previous research are limited due to wide variability in participant samples, small sample sizes, and a lack of direct evaluation of participants' responses (Parsons & Cobb, 2011), although a literature review by Parsons and Cobb (2011) suggested that some children can, indeed, transfer procedural, rule-based skills learned in virtual environments to real-life settings. Parsons et al. (2006), for instance, reported

encouraging results from users with autism who remembered social knowledge gained during their virtual sessions.

Learning. Experiential and exploratory learning emerged as a key benefit, which is also in agreement with previous research (Dalgarno & Lee, 2010; de Freitas & Neumann, 2007; Jarmon et al., 2009). The participants of the present study described that they were able to learn by doing and to reflect on their own understanding (Chew & Heung, 2010). One inconsistency with previous research, however, was hardly any participants reported whether they had been able to observe the outcomes of their actions or test their hypotheses about the world, which are critical elements of the experiential learning cycle concept according to Kolb (1984). A likely reason for the absence of such comments is that the participants did not have enough time and opportunities to experiment or visited regions with few interactive elements. Thus, it is recommended that virtual activities framed by experiential learning theory be conducted on destinations that offer a multitude of hands-on tasks, such as *Sploland, Genome Island, Exploratorium,* and *Oddprofessor's Museum and Science Center.* Another recommendation is that the designers of virtual spaces with an educational focus are encouraged to maximize the number of built-in hands-on tasks.

Intricately linked with experiential learning is the participants' perception that they can experience something that is too risky in real life or something that they are afraid of doing in real life, such as swimming with marine life. Experiential and exploratory learning is intricately linked with the affordance of doing something that would be impossible or impractical otherwise. The frequent mention of experiencing something impossible or impractical, which is in line with the unique affordances

identified by Dalgarno & Lee (2010), reflected the participants' enthusiasm and even passion about virtual worlds. Similar to Dickey (2011), the participants reported believing that their students would like the environment because of the game aspect and because they could visit different periods in history or other countries. Although the participants identified many benefits, they also pointed out a number of challenges.

Virtual world challenges. Key areas of concern were a lack of appropriateness, distraction from learning, and technical issues. A strong trend was that the participants were very concerned about inappropriate content in Second Life. The participants' conclusion was that virtual destinations must be appropriate for specific ages and grade levels. Exposure to adult content has also been criticized in previous research (Dickey, 2001; Inman, 2010). Of the participants in Inman's study, 74% indicated that they would not use a virtual world due to the possibility of inappropriate content, and 79% feared harassment from outside avatars, which echoes the results of this study. In a similar vein, the majority of the participants in a study by Childs et al. (2012) reported that their encounters with griefers in Second Life and exposure to inappropriate content led to a sense of anxiety. These concerns combined with the perception of Second Life as a game without any educational merit resulted in many students' refusal to take part in the virtual activities at all (Childs et al.). Therefore, it is not surprising that almost all participants of the present study voiced concern about the appropriateness of Second Life for lower grades, although most participants tended to be supportive of using virtual worlds in education in general, which, again, demonstrates a tension between their fears and their enthusiasm related to virtual worlds. Another challenge was distraction.

The participants' concern about the risk of distraction echoes findings of Dickey (2011) and Dalgarno et al. (2013) but is inconsistent with Inman (2010). Only 24% of Inman's participants found themselves distracted inside Second Life. The comments of the participants of the present study indicate that they feared that all the interesting features that Second Life offers might detract their students from learning, which is why they suggested simpler and more streamlined environments. While some participants found the virtual environment motivating and appealing because of the rich visual stimuli, others found it distracting for exactly the same reason. This dichotomy is hard to explain but could be associated with the participants' different student populations. A simpler, more streamlined environment would impose limits on the authenticity of the representation, such as a virtual experiment that is not 100% accurate, and could lead to missing steps in the real world process (Dalgarno et al., 2013). Students may be picking up the wrong cues and make the wrong assumptions about the real world if a virtual environment fails to demonstrate realistic, real-world behavior (Neale, Cobb, & Wilson, 2000). The benefits and challenges of authentic (e.g., realistic) environments versus streamlined environments must be carefully considered. Authentic environments may be too complex, whereas streamlined environments may be too simplistic. Participants with autism in a study by Cobb et al. (2010), for instance, commented that the appearance, behavior, and interface methods in the virtual *Social Café* would have to be much more realistic in order to facilitate the learning of social skills.

The third major area of challenges is concerned with technical issues. As expected, the fear of technical issues emerged as a key factor why the participants reported being hesitant to incorporate virtual worlds into their own teaching, which reinforces previous

research (e.g., Brown et al., 2011; Dalgarno et al., 2013; Eaton et al., 2011; Ellis & Anderson, 2011; Guzzetti & Stokrocki, 2013; Ketelhut & Schifter, 2011; Kirriemuir, 2010; Mayrath et al., 2011; Minocha et al., 2010; Neely et al., 2010; Oh & Nussli, 2014; Omale et al., 2009; Storey & Wolf, 2010). Some participants of the present study expressed their preference for working in the same physical space, namely, the computer lab, when using Second Life in order to avoid software and hardware problems. Their statements were similar to Inman (2010) who reported that communication was such a serious issue for his participants that they actually chose to complete their group-building project in person in the computer lab so that they could speak directly to their group members sitting next to them. These findings lead to two recommendations, namely, that the first few sessions be done with peers, the instructor, and a technical facilitator together in a computer lab and that virtual worlds be used for a series of learning events rather than a one-time event (Boland, 2009).

In the same vein, the participants in a study by Boland (2009) reported 114 times that what they hated most was that the Second Life platform would freeze or crash, their computers were frozen and had to be rebooted, and that they had to wait for slow updates before they could use the program. Boland's participants recommended having more of the 3D models to help handle the large number of students using them, having more instructional videos, and getting more help to use Second Life. The latter two recommendations align well with the findings of the present study. Generally, the unpredictability of Second Life made many participants hesitant to try it out with their own students, which supports Neely et al. (2010) who reported that technological barriers, besides institutional opposition and limited familiarity, prevent some instructors from

fully implementing virtual worlds into their curricula. The main technological problems identified were bandwidth, firewalls and other IT policy issues, hardware requirements, audio problems, and general technology problems, which concurs with Dalgarno et al. (2013).

Although many technical issues can be anticipated and prevented by thorough preparation, some problems are, indeed, erratic. Something that works on one computer may not work on another. The participants' data, the instructor's comments in the pre- and post-intervention interview as well as the researcher's accounts in the researcher journal indicate that the presence of technical issues has affected the participants' usability ratings. Several recommendations how to address technical issues were outlined in Chapter 4. These included the need for a hard-wired internet connection, using Skype for voice communication, the support of a technical facilitator, finding out-of-the box solutions, and very frequent updates of a Second Life viewer (including doing a 'clean install'). The final research question further informs the social affordances of virtual worlds.

Research Question 5: Collaborative Learning

The fifth and final research question asked, "What are special educators' perceptions of the potential of virtual worlds for collaborative learning?" Previous research indicates that virtual worlds have potential as a common platform where students can get together to practice collaboration (de Lucia et al., 2009; Ho et al., 2011; Konstantinidis et al., 2010; Schmeil et al., 2012; Warburton & Pérez-García, 2009; Yang et al., 2009), which is in strong agreement with the perceptions of the participants in the present study. Most participants agreed that collaborative tasks should have built-in

mechanisms to make the accomplishment of the task contingent on collaboration. Besides the accomplishment of a task, students might be able to develop a sense of community and cohesion through collaboration in a virtual space (Fusar-Poli et al., 2008). Similar to previous researchers (Brown et al., 2008, Delwiche, 2006, Good et al., 2008, Jarmon et al., 2008; Mayrath et al., 2007), all of whom used Second Life for group projects, almost all participants of the present study expressed satisfaction with the collaborative elements of the 7-Step intervention. Similar to Campbell (2009), they reported that they would not have been able to experience this new technology as effectively on their own. The participants also appreciated being able to explore Second Life together with an experienced team. Without the support of peers and facilitators, a virtual journey can easily turn into a nightmare (Ollé & Kristof, 2014).

A majority of the participants of the present study stated that they had felt a sense of community, similar to the pilot-studies. It is possible that this sense of cohesion experienced in Second Life extends to real life, similar to the reports of distance learners described in Edirisingha et al. (2009). Most participants strongly endorsed that the group's outcome was better than if they had been working individually. Particularly the diversity of perspectives was appreciated. Similar to Edirisingha et al., they enjoyed undertaking tasks together, which points to an appreciation for synchronicity. Without synchronicity, they would not have been able to take advantage of the social and communicative affordances of their co-presence (Edirisingha et al.), which has been shown to increase motivation (Gamage et al., 2011).

Implications

The study revolved around effective virtual worlds teacher training, teachers' perceptions of the usability of virtual worlds for social skills practice for students with social skills challenges, their perceptions of the benefits and challenges of virtual worlds for special education, and their perceived compatibility between virtual worlds and collaborative learning. The findings suggest that the teachers' attitude toward the usability of virtual worlds for special education, with a focus on social skills practice, has improved as a result of the intervention. They perceived their Second Life experience as promoting collaborative learning. The participants provided several suggestions for effective virtual worlds teacher training that have informed the design of a revised 4-Step Virtual Worlds Teacher Training model that other educators can adjust to their needs.

The participants concluded that virtual worlds offer immense potential for students with social skills challenges. The next step is to move from 'potential' to 'demonstrated effectiveness' of virtual worlds for students with social skills challenges, as suggested by Parsons and Cobb (2010). Research reporting on specific teacher training for the use of virtual worlds in special education is difficult to locate, which indicates a need to train special education teachers so they can help their students take advantage of the potential benefits of virtual worlds for social skills practice. The 7-Step intervention has accomplished this purpose by offering a carefully scaffolded and systematically designed workshop promoting inquiry, experiential learning, and reflection.

The findings also suggest that a teacher training workshop for special education teachers needs to incorporate resources that are specifically geared toward special student populations, such as students with social skills challenges, in order to be effective. The 18

participating teachers have become aware of the numerous affordances and a number of challenges associated with using virtual worlds in class. Their attitude toward the usability of virtual worlds for special education purposes has become more positive as a result of the workshop. All five affordances of virtual worlds (as compared with tasks made possible by 2D alternatives) that Dalgarno and Lee (2010) identified in their systematic analysis of research literature and project reports are supported by the present study, namely, enhanced spatial knowledge representation, increased motivation and engagement, richer and more effective collaborative learning, greater opportunities for experiential learning, and using virtual worlds to experience something that would otherwise be impossible or impractical leading to improved contextualization of learning. These are the five affordances that may have the most potential to enhance a traditional classroom. The quasi-realism of a 3D environment mediates a sense of group presence, which may enhance engaging group learning interactions and promote the effectiveness of distance learning (Franceschi et al., 2009). The findings of a study by Franceschi et al. suggest that remote collaboration in discussions or group projects with individuals from around the world can be as good in 3D virtual worlds as being physically together.

Despite the benefit of the above affordances, the tension between feeling overwhelmed by virtual worlds and feeling supportive of virtual worlds for special education purposes was tangible throughout the study. Although most participants' attitude toward the usability of virtual worlds for special education improved, it did not change enough to make them want to incorporate virtual instruction at this time. Many participants, however, pointed out that they would support virtual instruction once there is no longer cause for concern about inappropriateness, technical issues, access to

software and hardware, and so on. The participants seem to have taken a first step toward their transition into virtual teachers. They may need more positive experiences to think that using virtual worlds for instruction is a good investment of their time.

Implications for Practice

Recommendations. The findings have led me to suggest 14 recommendations aimed at assisting educators in making informed decisions about the usability of virtual worlds for students with social skills challenges, at teacher educators in designing effective virtual worlds teacher training workshops, and at the designers of educational virtual spaces. Ten of the 14 recommendations have been incorporated into a revised model, which will be presented in the next section, and the last four recommendations are intended to inform and guide the entire training. Recommendations 1 through 3 have been integrated into Step 1-*Introduction* of the revised model.

Recommendation 1. The teacher training offers extensive virtual worlds training, especially at the beginning, with a focus on navigation and communication. In addition to basic virtual worlds training (walking, flying, zooming in and out, changing perspectives, dressing one's avatar, etc.), teachers are also trained in using special features that may not be obvious, such as being able to access a video in the middle of a virtual world game, downloading information from notecards, accessing equipment necessary for task fulfillment in their inventory (such as scuba equipment), having a private chat conversation, and learning about sound parcels.

Recommendation 2. The teacher educator shares resources that are specifically tailored to the teachers' students, for example, lesson plans for students with social skills

challenges or for students with emotional behavioral disorders. (This recommendation also informs Step 3-*Evaluation*.)

Recommendation 3. Ample time is spent on exploring the shared virtual world resources for educators so that teachers learn how to locate age-appropriate and subject-related destinations. Rather than only providing access to the resources, a specific task would prompt browsing of the materials and encourage discussion.

Recommendations 4 through 7 have been incorporated into Step 2-*Exploration* of the revised model.

Recommendation 4. Special education teachers interested in having students practice social skills inside a virtual world consider using either a private region in Second Life that can be locked off to other users or a virtual world other than Second Life to avoid the risk of being exposed to inappropriate content even in regions with a rating of "general maturity." When taking students to a destination that contains potentially inappropriate material, such as lingerie shops in *Paris 1900,* student activity is confined to a small, non-threatening area. In addition to the design of small, confined areas, designers of virtual environments may wish to explore the development of virtual spaces that serve the purpose of teaching, with built-in scaffolding, while avoiding overstimulation caused by visual stimuli.

Recommendation 5. Increased use of chatbots, also called robot avatars, in a safe, confined virtual space. Chatbots can provide 24/7 communication and interaction, thereby offering repeated practice opportunities for social skills training without the stress associated with face-to-face communication.

Recommendation 6. Striking a balance between authentic and streamlined environments is essential. The visual stimuli in 3D virtual worlds are very appealing to many users but can be confusing to others. Teachers may want to start with simplified regions and then move on to more ambiguous regions to practice the same set of social skills.

Recommendation 7. The training includes interactive experiences with hands-on objects to observe visual outcomes of one's actions, for example injecting bacteria into mice in a virtual biology laboratory *(Genome Island).*

Recommendation 8 has been incorporated into Step 3-*Reflection* of the revised model.

Recommendation 8. Participating teachers read and reflect on empirical articles describing the practical implementation of virtual worlds into teaching and the learning effects, for example a history lesson taught in a virtual world.

Recommendations 9 and 10 have been incorporated into Step 4-*Assessment* of the revised model.

Recommendation 9. Participants individually prepare their own mini-lesson and teach it to their peers.

Recommendation 10. The training includes a discussion of learning effects (when is instruction in virtual worlds superior to other modes of instruction?)

Recommendations 11 through 14 have not been integrated into the revised model. Rather, they are intended to inform and guide the entire training. Their implementation may also depend on the target population.

Recommendation 11. Depending on the teachers' student population, the workshop may include the exploration of age-appropriate virtual worlds, for example *Minecraft, Quest Atlantis, Active Worlds,* or *Whyville* for younger students.

Recommendation 12. Striking a balance between teacher control and letting students explore seems essential in order to take full advantage of the potential of virtual worlds to enhance students' motivation.

Recommendation 13. Participating teachers conduct a careful analysis of benefits and challenges to determine whether an alternative, more easily accessible medium might not achieve similarly good results, possibly in less time.

Recommendation 14. Better expressiveness and more gestures are necessary to recognize and get used to these elements of every day social interactions.

Revisiting the intervention. The above recommendations have informed the revised 4-Step Virtual Worlds Teacher Training Workshop, which encompasses four steps describing the major learning phases a transitioning teacher has to go through, namely, introduction, exploration, reflection, and assessment. These four pedagogical steps replace the seven, rather mechanical steps of the original intervention. All of the components used in the revised model were either in the original intervention or they have been added after analysis of the study. Two critical factors of the training are ongoing access to pedagogical guidance and technical facilitation. For comparison purposes, Figure 1 displays the 7-Step intervention that was already introduced in Chapter 1.

Virtual Worlds Teacher Training Intervention	Step 1: Preliminary Survey
	Step 2: Unique Affordances & Resources
	Step 3: Virtual Exploration
	Step 4: Lesson Plan Presentation
	Step 5: Written Reflection
	Step 6: Lesson Plan Analysis
	Step 7: Post-Survey

Figure 1. Overview of the intervention.

Figure 8 displays the revised 4-Step model. The new additions (blue) match recommendations 1 through 10 outlined earlier.

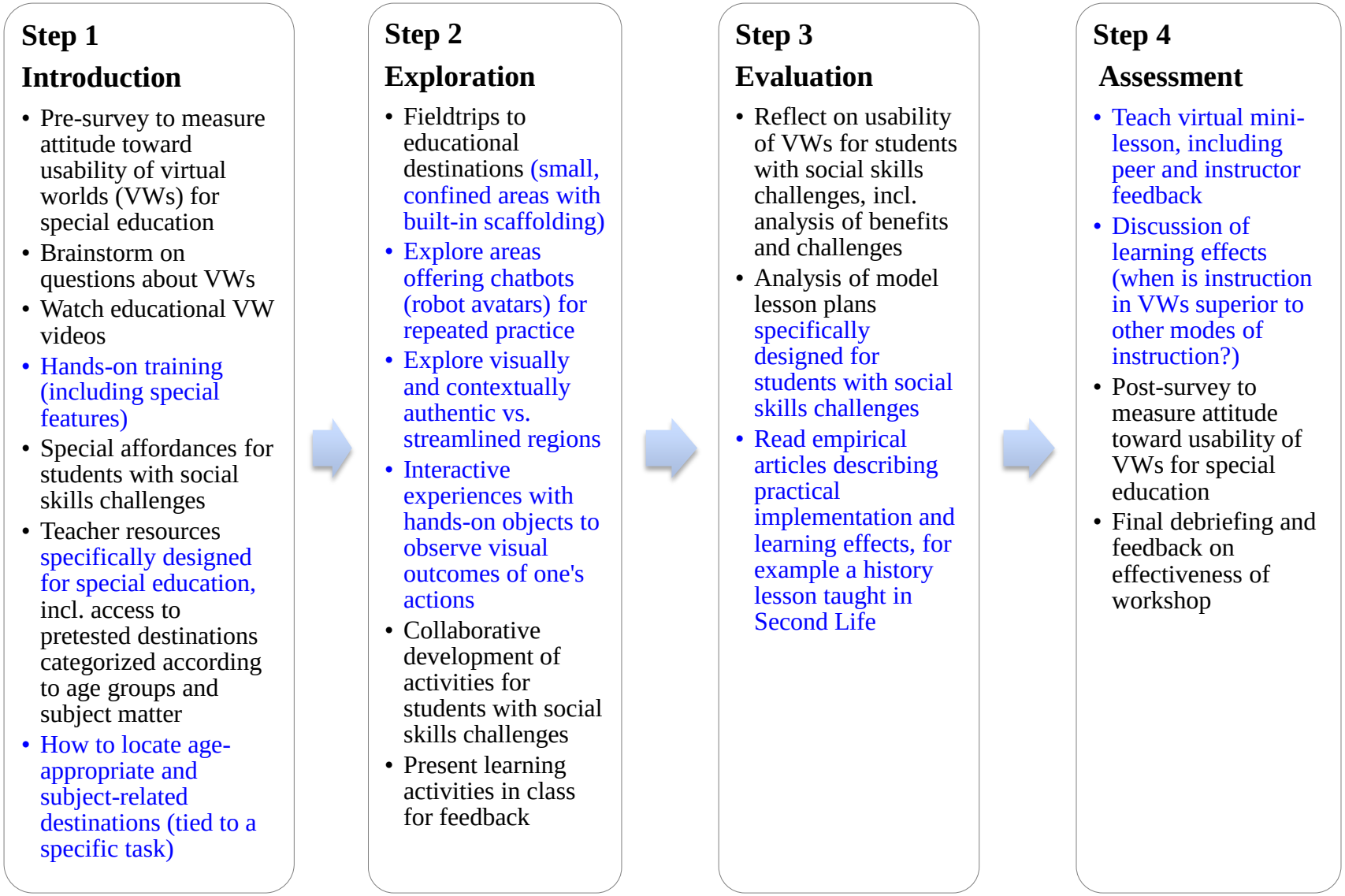

Figure 8. Revised 4-Step Virtual Worlds Teacher Training Workshop (new additions in blue).

Admittedly, the question of the implementation of virtual worlds teacher training into teacher credential programs is a difficult one due to time constraints and a lack of freedom in teacher education. More realistically, optional training for teachers interested in virtual worlds could be offered via professional development. Each of the four steps suggested in Figure 8 could be offered as an individual module (with increasing difficulty and immersion) in a half-day long workshop.

Implications for Research

Virtual worlds teacher training. It is recommended that the revised 4-Step model be tested on a variety of teacher populations in special education in different 3D virtual worlds. After the teacher training, the participating teachers get the opportunity to teach in-world themselves for a longer period of time. In a follow-up interview, these teachers could provide valuable information to further improve the design of the teacher training workshop. It is also recommended that the workshop be conducted with more male participants to determine a possible gender bias toward virtual worlds. Special educators using virtual worlds for instruction may wish to start an online repository of lesson plans specifically designed for their student population, for example for students with social skills challenges so that other educators will not have to start from scratch. Future research could also investigate the correlations between technology background and perceptions of the usability of virtual worlds for education, similar to Inman (2010), but with larger sample sizes.

Usability of virtual worlds for social skills training. The potential of virtual worlds for social skills practice raises a number of new questions that were inspired by Cobb et al. (2002) and that are relevant for special educators planning to incorporate

virtual worlds in their instruction, such as,

> What social skills can be supported by this technology? (…) How important is it that we replicate real situations in virtual environments and how 'realistic' do these need to be? How do we know that users will understand and interpret these virtual environments as we expect them to? And how can we support learning of skills that can be generalized and applied in the real world? (p. 13)

Parsons and Cobb (2010) pointed out that researchers still comment on the potential of virtual worlds for autism rather than their demonstrated effectiveness. One way to demonstrate their effectiveness would be to show that skills learned in virtual environments actually transfer to real life. Future research could also investigate which type of social skills, such as every day skills, play skills, initiating conversation, turn-taking, social problem-solving, switching between topics, sharing ideas, ending a conversation, coping with teasing, understanding implicit rules, recognizing emotions in self and others, can be trained most effectively in 3D virtual worlds. Future studies should be conducted with larger sample sizes than previous research and the practice sessions should more often be followed up with interviews with the participants to learn how they perceived the usefulness of the training, as demonstrated in Parson et al. (2006).

More longitudinal and follow-up studies are needed (Irish, 2013), especially to investigate transfer to real-world situations and the impact of facilitators. Parsons (2005), for instance, highlighted that it was unknown whether it was the technology itself that helped improve the participants' social skills or the facilitator guiding them through the social skills practice task in a virtual environment. Future research could also illuminate the benefits of social skills training for vocational purposes. Adults with autism often find it very difficult to secure employment due to their communicative challenges affecting job interviews, team interactions, group work, and informal social interactions (Cobb et

al., 2010). The workplace of the future may increasingly look like virtual worlds. Therefore, the learning of collaborative skills in a 3D space may be a practical approach to learning social and work-related skills simultaneously. As our conception of collaboration is evolving, the use of virtual worlds for social practice is a possible way to provide students on the autism spectrum with access to work-related collaborative technologies.

The findings of the present study could further inform the design of virtual worlds teacher training in so far as virtual world model activities and lesson plan templates could be tailored to specific social skills. Furthermore, it is recommended that investigations of the potential risks of using virtual worlds for students on the autism be intensified. It seems that most of the previous research has focused on identifying benefits rather than risks. Given that teacher control emerged as an important topic in the present study, it would be interesting to find out how much control on the part of the educator is necessary to ensure an effective learning experience in a virtual environment without excessively restricting the users' freedom of exploration and sense of active participation, which might lead to demotivation. Another line of inquiry could investigate the impact of virtual immersiveness on students with social skills challenges. For example, at which point do social gatherings in virtual environments start to cause anxiety in students with social skills problems? What are the defining characteristics of an anxiety-reducing virtual environment promoting social contact? A final recommendation for future research is the investigation of mobile virtual worlds to investigate whether these would reduce issues related to hardware and software requirements, thereby increasing teachers' willingness to use virtual worlds.

Summary

The purpose of this study was (a) to determine special education teachers' perception of the effectiveness of a systematic 7-Step Virtual Worlds Teacher Preparation Workshop in terms of enabling them to make informed decisions about the usability of virtual worlds for students with social skills challenges, (2) to determine whether there is a teacher change of attitude resulting from engagement in a systematic intervention, and (3) to determine the special education teachers' perceptions of the usability of virtual worlds for special education (especially for students with social skills challenges), the benefits and challenges of virtual worlds as well as their usability for collaborative learning. Eighteen special education teachers collaboratively explored one prominent example of virtual worlds, namely Second Life. They were guided in a variety of critical and purposeful virtual explorations, which were framed by an inquiry-based approach promotion exploration, analysis, and reflection. Mixed-methods data analysis and triangulation were based on the analysis and synthesis of a preliminary survey, a first-hand exploration of educational destinations in Second Life, the collaborative development of a lesson plan specifically designed for social skills practice for students with social skills challenges, a written reflection, the collaborative analysis of lesson plans designed by other educators, and a post-survey.

The change of attitude towards the usability of virtual worlds in education as a result of the workshop based on an 11-item attitude scale was statistically significant with a large effect size. Social skills practice and repeated practice opportunities in a stress-reduced environment emerged as the key benefits of virtual worlds for students with social skills challenges. Various challenges, such as a lack of appropriateness, distraction

from learning, and technical issues were identified. Fourteen guidelines for virtual worlds teacher training have been suggested, which have informed the design of a revised 4-Step Virtual Worlds Teacher Training model. Other teacher educators may find this model useful, which may only need minor adjustments depending on the target population. The findings are also relevant for the designers of educational virtual spaces. The study concludes with recommendations for future research in the use of virtual worlds for special education purposes.

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APPENDIX A

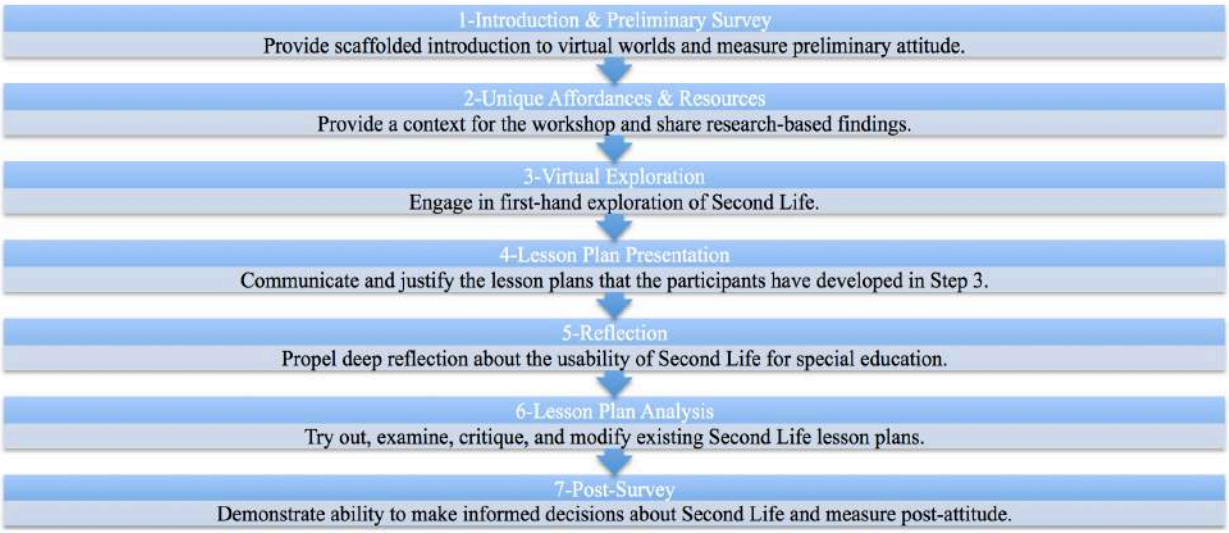
Informed Consent Form

Informed Consent Form

Dear Potential Participant,

You are being asked to participate in a research project (a) exploring special educators' perceptions of the usability of virtual worlds for educational purposes and (b) investigating the key components of effective virtual worlds teacher training.

The workshop is an integral part of the course work in your technology class with Dr. Kevin Oh. If, however, you wish to opt out, please contact Dr. Oh for alternative assignments. The duration of the workshop will be 5 hours (four hours in class plus 70 minutes of synchronous group activity in Second Life and Skype from your home). If you agree to participate in the study, you agree to the following:



The preliminary survey asks demographic questions, questions about your technology background, and your perception of the usability of virtual worlds for special education. The post-survey asks about your perception of the individual stages of the workshop, about key components of effective virtual world teacher training, and about your perception of the usability of virtual worlds for education.

There are no known risks or discomforts involved. Your participation will be beneficial to you in that the process will assist you in making informed decisions about using virtual worlds in special education. This research will help to align teachers' professional development with the needs of the digital century.

Completion of the first step – submission of the preliminary survey – constitutes implied consent. If you have any question about the study, you may contact Dr. Kevin Oh or me at nnussli@gmail.com Thank you in advance for your participation. It's much appreciated.

Natalie Nussli, Doctoral Student, Learning & Instruction, School of Education, University of San Francisco
Phone: (805) 238 3435, Email: nnussli@gmail.com, My Scoop it! page: http://www.scoop.it/t/second-life-and-virtual-worlds

APPENDIX B

Preliminary Survey-Step 1

Preliminary Special Ed Teacher Survey Spring 2014

***1. Please enter your name here:**

PART I: YOUR OWN QUESTIONS

***2. Please jot down a couple of questions that you have about using virtual worlds in education and that will guide your "virtual worlds quest" in the next couple of weeks:**

PART II: SECOND LIFE POTENTIAL FOR EDUCATION

***3. I am apprehensive of the thought of having to use SL for teaching.**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

***4. I like the fact that multimedia can be integrated into SL.**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

***5. I fear that students already spend too much time on the computer.**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

Preliminary Special Ed Teacher Survey Spring 2014

***6. I fear that students are already too overwhelmed with other tasks and activities to want to explore something new.**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

***7. I think that students would enjoy the experience of a virtual learning environment (in a supervised exploration.)**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

***8. Second Life can be used to experience content that would otherwise be inaccessible (e.g., because it is historically lost, too distant, too costly, imaginary, futuristic or impossible to see by the human eye.)**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

***9. Second Life makes learning more interesting.**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

***10. Second Life is for entertainment only.**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

***11. Working with Second Life looks like fun.**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

***12. Working with Second Life looks like so much fun that it will distract students from the actual learning task.**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

***13. I cannot wait to use Second Life for my own teaching.**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

Preliminary Special Ed Teacher Survey Spring 2014

***14. In your opinion, how useful is Second Life for students with social skills challenges to practice social encounters? Please indicate on a scale from 1 (useless) to 10 (extremely useful).**

	1 useless	2	3	4	5	6	7	8	9	10 extremely useful
,	○	○	○	○	○	○	○	○	○	○

***15. Based on what you may already know about virtual worlds, where do you see potential benefits and challenges of Second Life for students with social skills challenges?**

PART III: PREVIOUS EXPERIENCE

***16. How long have you taught?**

- ○ never
- ○ less than 1 year
- ○ 1-3 years
- ○ 4-6 years
- ○ 7-10 years
- ○ 11-15 years
- ○ more than 15 years

***17. What subject matter do you teach?**

PART IV: DEMOGRAPHIC INFORMATION

***18. What is your age?**

- ○ 20 to 25
- ○ 26 to 30
- ○ 31 to 35
- ○ 36 to 40
- ○ 41 to 45
- ○ 46 to 50

Preliminary Special Ed Teacher Survey Spring 2014

***19. What is your gender?**

- female
- male

PART V: TECHNOLOGY USE

***20. How many hours do you use technology every day?**

- less than 30 minutes
- 30-60 minutes
- 1 hour
- 2 hours
- 3 hours
- 4 hours
- 5 hours
- 6 hours
- 7 hours
- 8 hours
- 9 hours
- 10 hours
- more than 10 hours

***21. As how tech-savvy would you describe yourself on a rating scale from 1 to 10? (1 = I dislike technology and I don't feel comfortable using it. 10 = I love technology and I am very good at using it.)**

1 Dislike	2	3	4	5	6	7	8	9	10 Love it

***22. How would you describe yourself in terms of using technology for learning and instruction?**

- Innovator ("techies", guaranteed to adopt technology as a pedagogical tool)
- Early adopter ("visionaries", will adopt technology earlier than majority)
- Early majority ("pragmatists", will adopt technology as soon as majority of teachers does too)
- Late majority ("skeptical", reluctant to adopt technology)
- Laggard (unlikely to adopt technology as pedagogical tool)

Preliminary Special Ed Teacher Survey Spring 2014

***23. How much virtual worlds experience do you have? (A virtual world is a three-dimensional immersive virtual environment, such as Second Life, Active Worlds, Blaxxun, Minecraft, Hypergrid, Twinity, Croquet, Exit Reality, World of Warcraft, Quest Atlantis, etc.)**

- no experience (never used Second Life)
- inexperienced (rare use)
- neutral (occasional use)
- experienced (frequent use)
- very experienced (very frequent use)

***24. Please describe your previous experience with virtual worlds.**

25. Please add any comments here:

Thank you for your time.

APPENDIX C

Reflection Prompts – Step 5

Activity 5: Written Reflection (30 minutes, in class)

- The purpose of this reflective blog-type activity is two-fold: First, to give you an opportunity to voice concerns or ideas that were not raised in class or during group work and second, to give you time to think about the educational potential of Second Life for special education, with a focus on practicing social encounters for students with social skills challenges. The following questions are designed to guide you through your reflections.

- Please make sure to check the charts displaying the unique benefits and challenges of virtual worlds for education.

- Please post your reflections to the designated area in Canvas.

- You have up to 30 minutes (in class) to write your reflection.

- <u>Your work should offer an insightful evaluation of your virtual experience, with evidence of purposeful reflection and critique.</u>

<u>Six Prompts:</u>

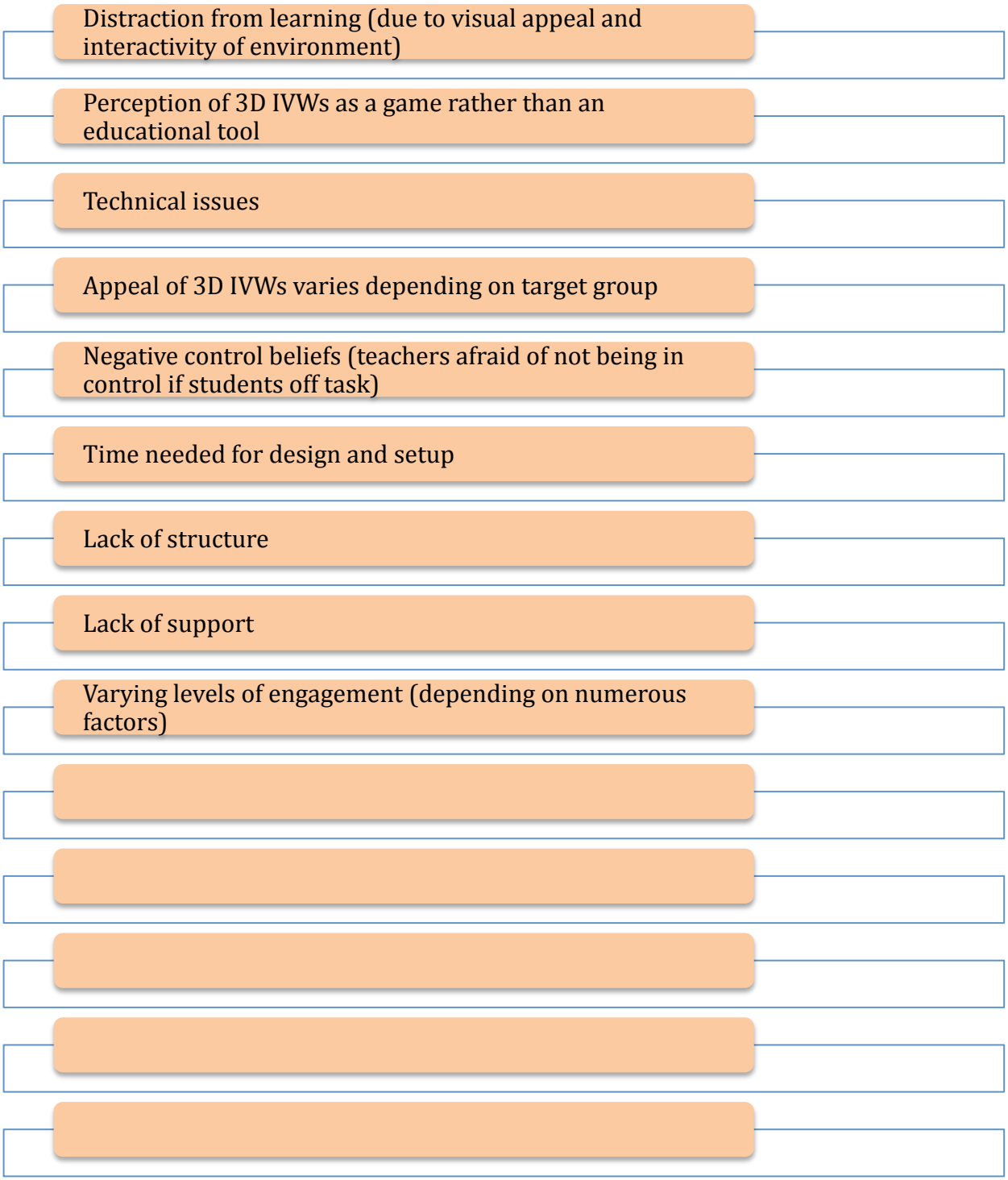
1. Research suggests that virtual worlds offer potential unique benefits to develop social and communicative skills and provide educational intervention for individuals with social skills challenges, such as autism or Asperger (Mitchell, Parsons, & Leonard, 2006). *Question: How would you create a virtual lesson that:*
    - enhances interactivity among individuals with social skills challenges,
    - supports a sense of collaboration, and
    - where individuals with social skills challenges experience less stress than in a face-to-face situation?

2. What guidelines (i.e., best practices) would you establish for teachers when they incorporate Second Life in their own teaching?
3. How can we best train special education teachers for the use of Second Life in their own teaching?
4. What are some of the benefits and challenges you encountered during your familiarization with Second Life?
5. What is your conclusion at this point? Should virtual worlds, such as Second Life, be used in special education? Why or why not?
6. Finally, what should an ideal Second Life island for special education look like? What features would you like to see? (Imagine making recommendations to Second Life designers and developers.)

Benefits (Affordances) of Virtual Worlds

(Bailey & Moar, 2011; Barab, Kay, Barnett, & Keating, 2000; Childress & Braswell, 2006; Clark, 2009; Dalgarno, 2002; Dalgarno & Lee, 2010; Gamage, Tretiakov, & Crump, 2011; Good, Howland, & Thackrey, 2008; Lu, 2010; Mantovani, 2001; Neely, Bowers, & Ragas, 2010; O'Connor, 2009-2010; Omale, Hung, Luetkehans, & Cooke-Plagwitz, 2009; Pérez-García, 2009; Prensky, 2001; Warburton, 2009.)

Challenges of Virtual Worlds



(Annetta et al., 2008; Cheal, 2009; Dickey, 2011; Foley & Kobaissi, 2006; Galas, 2006; Neely, Bowers, & Ragas, 2010; Kennedy-Clark, 2011; Kirriemuir, 2010; Lim, Nonis, & Hedberg, 2006; Silva, Correia, & Pardo-Ballester, 2010; Storey & Wolf, 2010; Warburton, 2009; Wimpenny, Savin-Baden, Mawer, Steils, & Tombs, 2012)

APPENDIX D

Lesson Plan Analysis Prompts-Step 6

Activity 6: Analyzing a Second Life Lesson Plan (45 minutes plus debriefing, in class)

The purpose of this step is to try out, examine, critique, and modify an existing Second Life lesson plan of your choice.

- With a partner, please choose one lesson plan that sounds interesting to you from a selection of 9 lesson plans on the next page. You will have access to these lesson plans on Canvas.
- Follow each step of the lesson plan in Second Life. You and your partner will each navigate in Second Life at your own computer station. Don't share a computer but make sure to sit next to each other in front of two adjacent computers so you can communicate easily.
- During or after the virtual "fieldtrip", you and your partner will engage in a discussion of the four prompts below. Together, please submit your written answers to your instructor by email.
- You have 45 minutes for the entire activity, including typing and submitting your answers.
- After this exploration, please be prepared to share the highlights of the Second Life destination and the lesson plan that you examined in class *(What did you like or dislike about the Second Life destination and the lesson plan? For which age and subject matter is the lesson plan appropriate? Please name two highlights of the island and/or the lesson plan.)*

Four Prompts:

1. How does the Second Life activity specifically contribute to students' learning, if at all?

2. How would you modify the Second Life activity, as described in the lesson plan you have chosen for analysis, to better suit the needs of students with social skills challenges?

3. What can Second Life achieve in this lesson what other physical or two-dimensional environments, such as videos, cannot achieve? In other words, which unique benefits of immersive virtual worlds can you identify?

Do you anticipate any challenges in addition to the ones mentioned in the lesson plan?

Activity 6: Lesson Plan Analysis **9 Lesson Plan Samples Second Life**
(http://msitsecondlife.wikispaces.com/Lesson+Plans)

Developer	**SL location**	**Lesson Title**	**Subject Area & Audience**
Campbell	International Spaceflight Museum, Spaceport Alpha http://maps.secondlife.com/secondlife/Spaceport%20Alpha/26/112/23	The Earth and Beyond	Earth/Environ. Science 8th grade
Gaydon	Spaceport Alpha http://maps.secondlife.com/secondlife/Spaceport%20Alpha/26/112/23	Exploring the nine planets	Astronomy Undergrad
Gima	Whimsy, Beautiful and Dangerous, Visitors Welcome http://maps.secondlife.com/secondlife/Whimsy/1/108/3	Volcanoes	Earth science 5th grade
Gundawar	Genome Island, Genome: http://slurl.com/secondlife/genome/137/87/29	Cells Genes and Molecules	Biology Freshman
Marina	Paris 1900 http://maps.secondlife.com/secondlife/Les%20Champs%20Elysees/1/60/24	How did France obtain the Eiffel Tower?	History of France 9th grade
Nguyen et al.	StarTrek Museum of Science http://maps.secondlife.com/secondlife/New%20Eridani/105/106/1442	Scavenger Hunting The StarTrek Museum	Astronomy and chemistry (space and elements) High school
Quinn	Exploratorium: http://maps.secondlife.com/secondlife/Exploratorium/162/105/23 This Slurl teleports an avatar directly to the Eclipse Exhibit on Exploratorium Island.	Eclipse exploration	Astronomy 10th grade
Weisman	Imzadi http://maps.secondlife.com/secondlife/Imzadi/106/163/21	Under water exploration	Marine animals 2nd grade
Nataly, Jessica, and Kulsoom	Campus d'Art – Heart of the Canal District http://maps.secondlife.com/secondlife/Schwanson%20Schlegel/92/171/25	Art exploration	History and Social Science 7th grade

APPENDIX E

Post-Survey-Step 7

Post-Survey Special Ed Teachers Spring 2014

***1. Please enter your name here:**

PART I: YOUR OWN QUESTIONS

***2. In the preliminary survey, you jotted down a couple of questions that you had in terms of virtual worlds. Please write down any questions that may have remained unanswered.**

PART II: AN EFFECTIVE VIRTUAL WORLDS WORKSHOP FOR EDUCATORS

Please rate the following activities in terms of their effectiveness in enabling you to make informed decisions about virtual worlds for educational purposes:

***3. Activity 1-Preliminary survey questions prompting reflection about your perception of the usability of Second Life for special education.**

- ineffective
- rather ineffective
- reasonably effective
- quite effective
- very effective

***4. Activity 2a-Watching two videos (the Maya Island video and the video about the use of virtual worlds for individuals with social skills challenges) and reading & reviewing a summary of empirical research about the unique benefits of virtual worlds by Dalgarno & Lee (2010) and the special benefits of virtual worlds for special education students.**

- ineffective
- rather ineffective
- reasonably effective
- quite effective
- very effective

Post-Survey Special Ed Teachers Spring 2014

***5. Activity 2b: Learning about and getting access to optional virtual worlds resources (e-book, PDF on virtual worlds best practices, virtual worlds Scoop it!, compilation of science-related Second Life destinations), official Second Life Destination Guide, how to join educational groups in Second Life.**

- ineffective
- rather ineffective
- reasonably effective
- quite effective
- very effective

***6. Activity 3-Virtual exploration of one educational Second Life destination of your choice, followed by the collaborative development of a tentative lesson plan for students with social skills challenges to practice social encounters.**

- ineffective
- rather ineffective
- reasonably effective
- quite effective
- very effective

***7. Activity 4-Lesson Plan presentation: Sharing lesson plan ideas in class.**

- ineffective
- rather ineffective
- reasonably effective
- quite effective
- very effective

***8. Activity 6: Lesson Plan Analysis. Trying out, evaluating and modifying an existing lesson plan from an online repository of Second Life lesson plans (MSIT Second Life Lesson Plans).**

- ineffective
- rather ineffective
- reasonably effective
- quite effective
- very effective

Post-Survey Special Ed Teachers Spring 2014

***9. Activity 5: Written reflection prompts providing opportunities for reflection about practical ways of using Second Life; followed by individual feedback on your reflections (blogback).**

- ineffective
- rather ineffective
- reasonably effective
- quite effective
- very effective

***10. Activity 7: Post-survey questions prompting reflection about your perception of the usability of Second Life for students with social skills challenges to practice social encounters.**

- ineffective
- rather ineffective
- reasonably effective
- quite effective
- very effective

***11. Overall, how well has this workshop prepared you to make informed decisions about the usability of virtual worlds for students with social skills challenges to practice social encounters?**

- not well at all
- not so well
- reasonably well
- quite well
- very well

Post-Survey Special Ed Teachers Spring 2014

***12. Which of the following components should be part of an effective virtual worlds workshop for special educators? (Please check all that apply.)**

- [ ] Start with educator-generated questions about using virtual worlds for educational purposes
- [ ] Scaffolded introduction to Second Life
- [ ] Having access to virtual worlds resources for educators
- [ ] Familiarize with research about the unique benefits (affordances) of virtual worlds for education and the special benefits for special education students with social skills challenges
- [ ] Collaborative exploration of one Second Life destination of your choice
- [ ] Collaborative development of learning activities framed by a pedagogical rationale (why use a virtual world for a specific learning objective rather than a non-3D environment?)
- [ ] Analysis of a Second Life lesson plan
- [ ] Having access to an experienced in-world facilitator
- [ ] Having access to a list of pre-tested Second Life destinations, categorized according to age groups and subject matter
- [ ] Learning how to locate specific Second Life islands that align with subject matter content, such as mathematics

13. What other training components can you think of? Which components were missing in this workshop?

PART III: VIRTUAL WORLDS POTENTIAL FOR EDUCATION

***14. I am apprehensive of the thought of having to use SL for teaching.**

- ○ Strongly agree
- ○ Agree
- ○ Disagree
- ○ Strongly disagree
- ○ Don't know

***15. I like the fact that multimedia can be integrated into SL.**

- ○ Strongly agree
- ○ Agree
- ○ Disagree
- ○ Strongly disagree
- ○ Don't know

Post-Survey Special Ed Teachers Spring 2014

***16. I fear that students already spend too much time on the computer.**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

***17. I fear that students are already too overwhelmed with other tasks and activities to want to explore something new.**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

***18. I think that students would enjoy the experience of a virtual learning environment (in a supervised exploration.)**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

***19. Second Life can be used to experience content that would otherwise be inaccessible (e.g., because it is historically lost, too distant, too costly, imaginary, futuristic or impossible to see by the human eye.)**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

***20. Second Life makes learning more interesting.**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

***21. Second Life is for entertainment only.**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

***22. Working with Second Life looks like fun.**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

***23. Working with SL looks like so much fun that it will distract students from the actual learning task.**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

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***24. I cannot wait to use Second Life for my own teaching.**

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don't know

***25. In your opinion, how useful is Second Life for students with social skills challenges to practice social encounters? Please indicate on a scale from 1 (useless) to 10 (extremely useful).**

1 useless	2	3	4	5	6	7	8	9	10 extremely useful

***26. What kind of activities in virtual worlds are particularly suitable for students with social skills challenges to practice social encounters?**

***27. Based on your experience in this workshop, where do you see potential benefits and challenges of Second Life for students with social skills challenges?**

You're almost done! Just a few quick rating questions about collaborative learning and the inquiry approach.

PART IV: COLLABORATIVE LEARNING IN SECOND LIFE

***28. Do you think that your group's outcome (in the development of a tentative lesson plan) was better than if you had been working alone? Please explain.**

***29. Did you enjoy working with your partner?**

- not at all
- barely
- reasonably well
- quite a bit
- very much

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***30. To what extent did the collaboration motivate you to put in greater efforts into the completion of the assignment?**

- [ ] not at all
- [ ] barely
- [ ] reasonably well
- [ ] quite a bit
- [ ] very much

***31. To what extent did you feel a sense of community with your partner?**

- ○ not at all
- ○ barely
- ○ reasonably well
- ○ quite a bit
- ○ very much

***32. How well were you able to meet the learning objectives of the SL assignments?**

- ○ not at all
- ○ barely
- ○ reasonably well
- ○ quite well
- ○ very well

***33. Did your partner ask critical questions that helped you to reflect on your understanding?**

- ○ no, never
- ○ barely
- ○ sometimes
- ○ quite often
- ○ all the time

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***34. Did you have discussions with your partners that helped you to correct your understanding?**

- no, never
- barely
- sometimes
- quite often
- all the time

***35. Overall, how well can collaborative learning be satisfied in SL?**

- not at all
- barely
- reasonably well
- quite well
- very well

One final question about the inquiry approach of the virtual worlds workshop

***36. How useful was the inquiry process of experiencing, investigating, and analyzing SL first-hand in order to make informed decisions about its use in education?**

- useless
- rather useless
- reasonably useful
- quite useful
- very useful

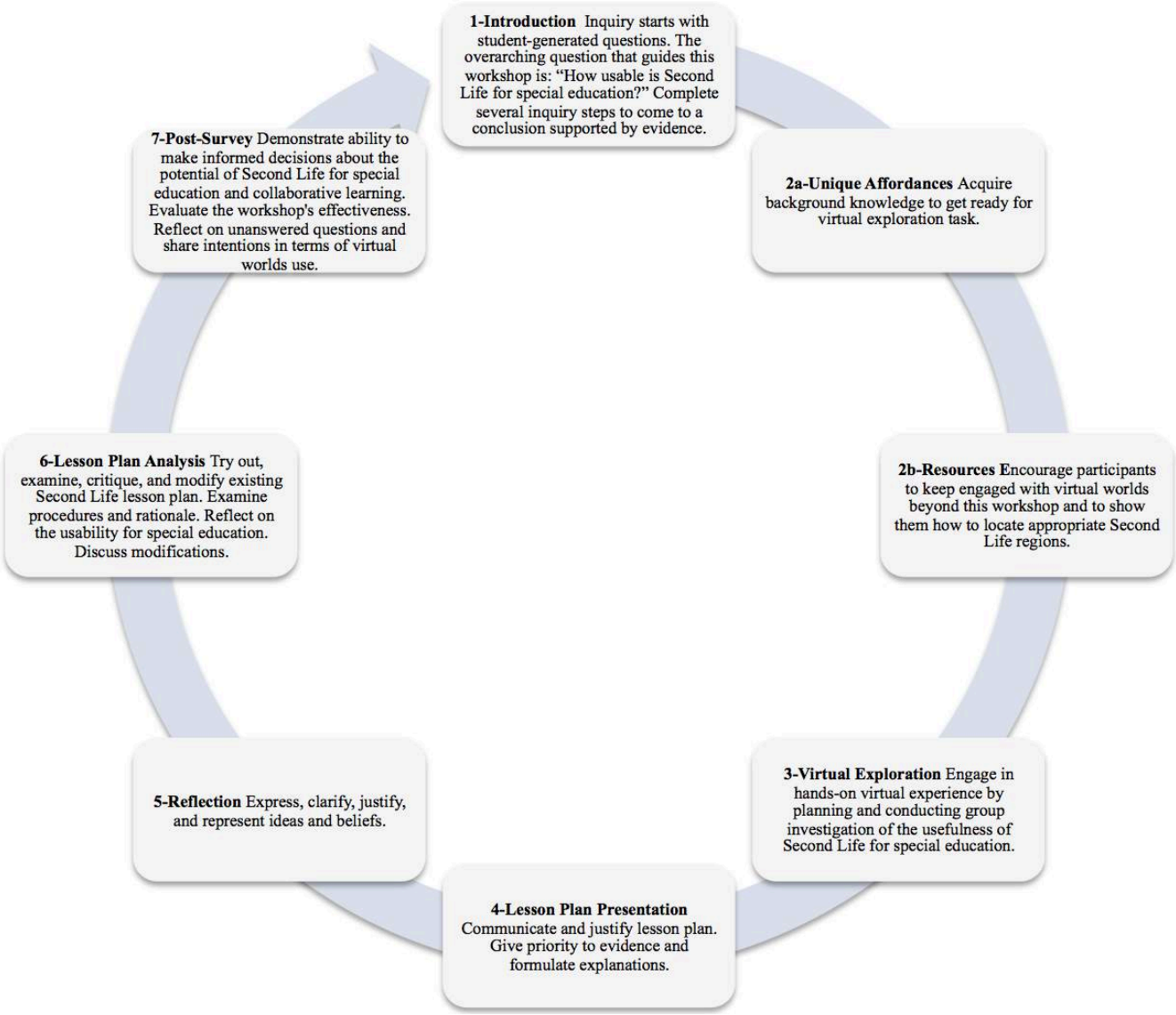
37. Thank you for your time! Please add any other comments here.

Thank you for your time.

APPENDIX F
Inquiry Cycle-Step 1

The 7-Step Virtual Worlds Teacher Training Workshop

Purpose of Each Step from the Perspective of Inquiry-Based Learning

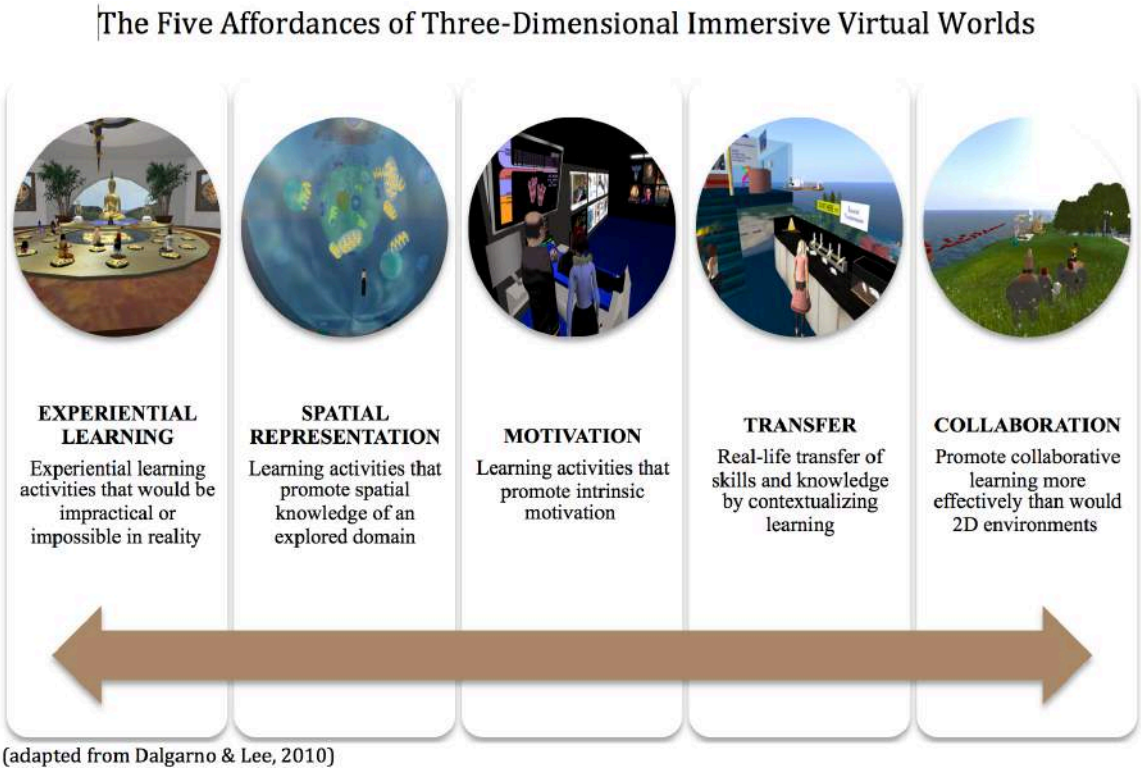


APPENDIX G

Unique Affordances-Step 2

Activity 2a: Unique Benefits of Virtual Worlds

Please be prepared to engage in a brief class discussion about which benefits seem to have the best potential for your current or future students.



(adapted from Dalgarno & Lee, 2010)

Benefit 1: EXPERIENTIAL LEARNING
Simulations allow learners to practice skills or undertake learning tasks, and this is particularly appropriate when the tasks involved are expensive, dangerous or risky to undertake in the real world (Dalgarno & Lee, 2010, p. 19).

Benefit 2: SPATIAL REPRESENTATION
The ability to move freely around, view the virtual environment from any position and manipulate objects within it has the potential to assist in the development of spatial knowledge beyond what is possible through non 3-D alternatives (Dalgarno & Lee, 2010, p. 18).

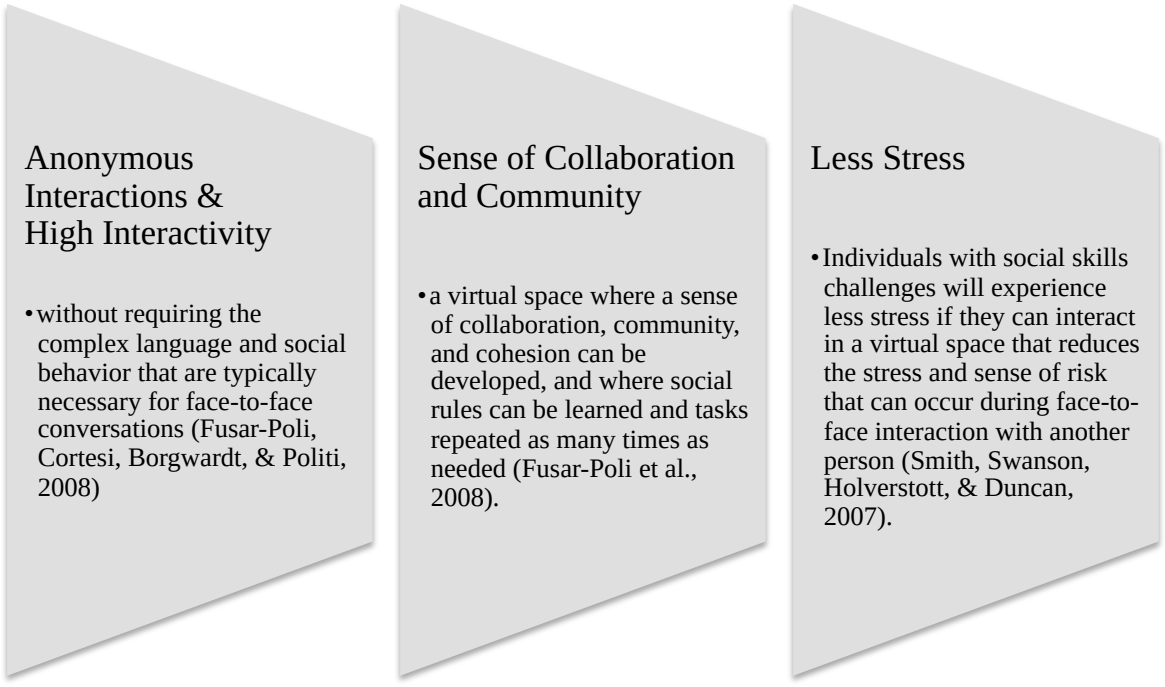
Benefit 3: MOTIVATION
Game- and narrative-based approaches, when used in conjunction with virtual worlds, contribute to learner motivation and engagement (Garris, Ahlers & Driskell, 2002; Mitchell & Savill-Smith, 2005). The high degree of fidelity and the natural interface of virtual worlds may increase the likelihood that learners will experience a feeling of flow (Csikszentmihalyi, 1990) as they become psychologically immersed within the environment (Dalgarno & Lee, 2010, p. 20).

Benefit 4: TRANSFER
Authentic context make concepts more transferable to the real world (Neely, Bowers, & Ragas, 2010, p. 107).

Benefit 5: COLLABORATION
Virtual worlds allow learners to engage simultaneously in shared tasks in real time. Mennecke, Hassall and Triplett (2008) report on how students undertake a scavenger hunt activity in Second Life, in which they co-experience and explore the virtual world as they embark on a mission to discover interesting places (Dalgarno & Lee, 2010, p. 22).

Special Benefits of Virtual Worlds for Individuals with Social Skills Challenges

A review of studies suggests that virtual environments have potential in special education, such as for the practice of social encounters (Newbutt & Donegan, 2010). Virtual worlds help to develop social and communicative skills and provide educational intervention for individuals with social skills challenges, such as autism or Asperger (Mitchell, Parsons, & Leonard, 2006). The figure below summarizes special benefits for students with social skills challenges.



Key References

Dalgarno, B., & Lee, M. J. W. (2010). What are the learning affordances of 3-D virtual environments? *British Journal of Educational Technology, 41*(1), 10-32.

Fusar-Poli, P., Cortesi, M., Borgwardt, S., & Politi, P. (2008). Second Life virtual world: A heaven for autistic people? *Medical Hypotheses, 71*(6), 980-1.

Mitchell, P., Parsons, S., & Leonard, A. (2007). Using virtual environments for teaching social understanding to 6 adolescents with autistic spectrum disorders. *Journal of Autism and Developmental Disorders*, *37*(3), 589-600.

Neely, J. C., Bowers, K. W., & Ragas, M. W. (2010). Virtual possibilities: A constructivist examination of the educational applications of Second Life. *Journal of Interactive Learning Research*, *21*(1), 93-110.

Newbutt, N.A., & Donegan, M. (2010): *A brief review: Assistive technology and autism, a proposal for virtual tools for improved communication and emotional recognition.* In: Society for Information Technology & Teacher Education (SITE) 2010 21st International Conference, 31 March 2010, San Diego, CA, United States. (Unpublished)

Smith, M. B., Swanson, T.C., Holverstott, J., & Duncan, M. M. (Eds.) (2007). *Autism spectrum disorders: A handbook for parents and professionals.* Westport, CT: Praeger Publishers.

APPENDIX H

Virtual Exploration-Step 3

Activity 3: Virtual Exploration and Special Education Lesson Plan Development (70 minutes, from home)

The purpose of this task is:

- to visit **<u>one</u> out of 17 pre-selected** Second Life regions (also called destinations, sims, islands).
- to brainstorm on potential learning activities for students with social skills challenges to practice social encounters.
- to reflect on the rationale of using the Second Life region for education (WHY would/should you use them?).

60 minutes: You have 30 minutes for exploration and 30 minutes for collaborative brainstorming during which you create a tentative lesson plan.

Task 1:

Format: groups of 4 or 5

Please take 30 minutes to explore one Second Life destination together with your group members. Please choose one of the pre-tested Second Life destinations from the "Exploration Guide". As you are exploring the destination together, share your impressions with your colleagues. The goal is to discuss the potential use of this specific Second Life destination for special education students with social skills challenges and collaboratively develop a tentative lesson plan in the template on page 3, with a focus on practicing social encounters. Please take a few snapshots during your exploration.

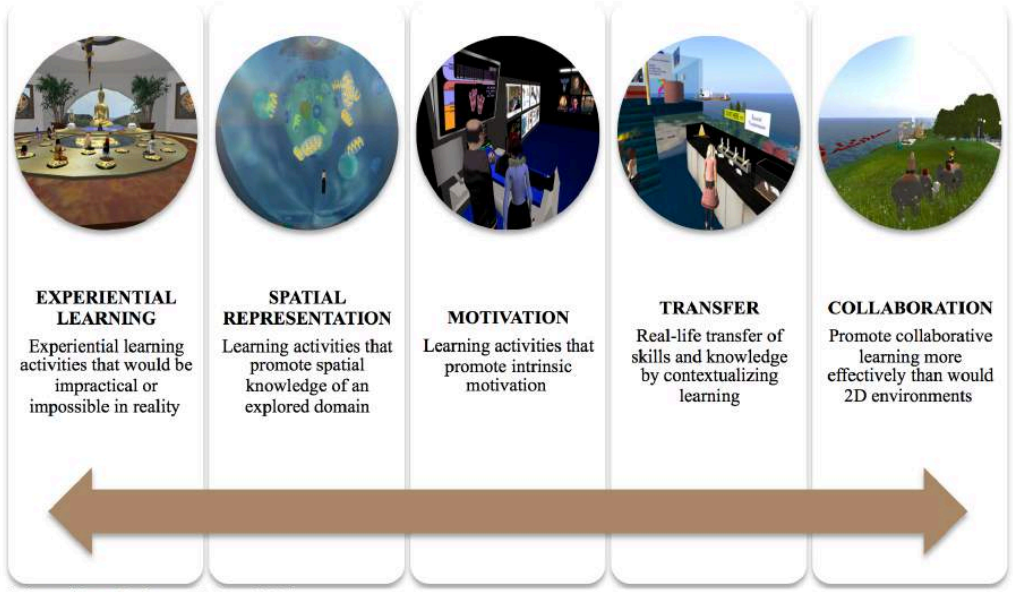
Activities: Please brainstorm on the kinds of activities you could design for your special education students. Example: *Your students could visit the Nefertari Tomb on Museum Island (Sunny Breeze) together, examine and talk about the wall paintings and co-create their own story built around these paintings. In doing so, they can investigate Egyptian customs with respect to everyday life, burials, etc.*

Student group: Please briefly describe your student group. Example: *This activity is designed for a 7th grade special education history class.*

Objective(s): Please briefly describe the objective of your hypothetical lesson plan. Example: *The objective is two-fold: Students engage in creative narratives together and they get a sense of what life was like in old Egypt.*

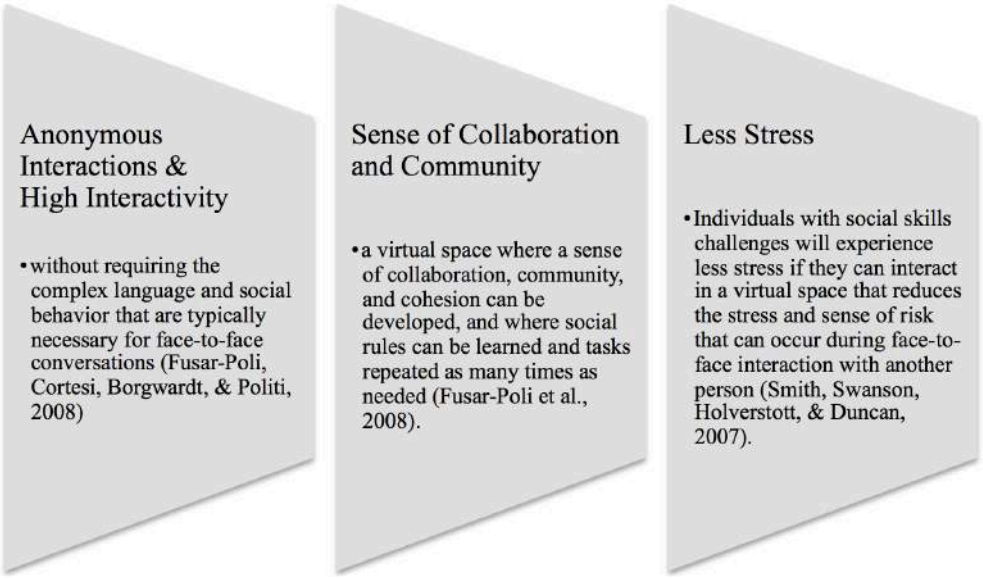
Rationale and unique affordance(s): Discuss why you would want to use Second Life for the activities you are planning. Why can't you do the same activities in a physical classroom or in a two-dimensional online platform (such as Canvas)? In Step 2, you have received a handout about the unique affordances of virtual worlds and their special affordances for special education (for your convenience, please see the charts below). *Of these benefits, which best fit your Second Life destination and why?*

The Five Affordances of Three-Dimensional Immersive Virtual Worlds



(adapted from Dalgarno & Lee, 2010)

Special benefits of virtual worlds for individuals with social skills challenges



Lesson Plan Presentation: You will be asked to share your group's ideas in class and to submit your tentative lesson plan to the instructor. Please go over the checklist on page 5 to make sure you have addressed everything.

Optional - Roles: You may want to consider the following roles: One of you could be in charge of **timing and organization,** someone is the **record keeper** who takes notes for the lesson plan, someone is **clarifier** to ask clarifying questions, and one of you is the **summarizer** who summarizes what the group has decided in terms of activities, student population, objectives, and rationale.

Lesson Plan Template – Please submit this page and the next page to your instructor by email, together with your snapshots.

Name of Second Life Location:

Objective(s): Please specify the knowledge and skills you want your students to learn in this unit.

Student group: For whom are you designing these lessons?

Planned activities: (please outline step-by-step)

Special Education Focus: Which features make this lesson plan particularly suitable for special education?

How, specifically, does your lesson plan support social skills practice?

Assessment: Please describe how you will evaluate your students' performance. If students work in groups, how will you consider individual accountability?

Rationale & unique benefits: Why is this unit important? How does it contribute to your students' learning? What can be achieved in Second Life that cannot be achieved in another, non-3D environment?

Snapshots: Please attach a few snapshots when submitting your lesson plan.

Task 2:

1. How would you rate your island in terms of its usability for students with social skills challenges to practice social encounters? Please explain.
2. How would you modify the Second Life destination, if at all, to better suit the needs of students with social skills challenges and your needs as a teacher?

Name of your Second Life destination: _____

1. Your Rating (Please explain your rating.)	**2. Suggested Modifications**

Lesson Plan Presentation Checklist

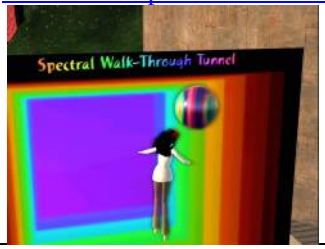
In your presentation in class, please make sure to address the following:

- ☐ Have you specified the student group for which you have designed your lesson?
- ☐ Have you formulated a clear objective? (What are the learning gains that you hope for your students to achieve?)
- ☐ Have you outlined HOW you would use the Second Life destination in your classroom? (What exactly would your students do?)
- ☐ Have you clarified WHY it would make sense to use Second Life in your classroom? (What can you accomplish by having your students work in Second Life that would not be possible otherwise?)
- ☐ Have you pointed out the special benefits of your virtual learning activities for students with social skills challenges?
- ☐ Have you rated the island's usability for students with social skills challenges to practice social encounters? Have you explained your rating?
- ☐ Have you outlined how you would modify the Second Life destination to better suit the needs of individuals with social skills challenges and your needs as a teacher?
- ☐ Have you made a few snapshots?

APPENDIX I

Exploration Guide-Step 4

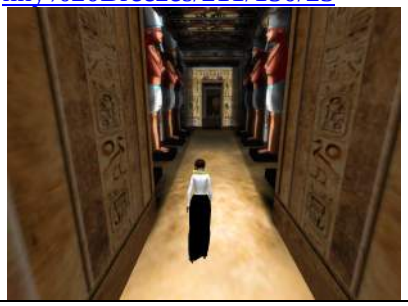
Second Life Destination Guide (Educational regions)

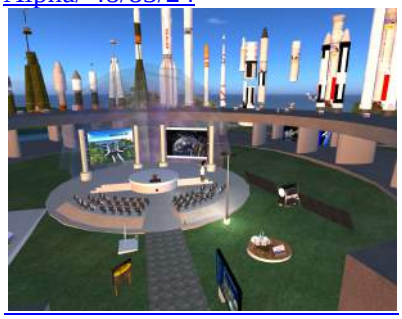
Topic	Name of Second Life Island and SLurl:	Description
Marine Biology TOP ISLAND	Abyss Observatory http://maps.secondlife.com/secondlife/Second%20Earth%203/128/128/27 	A museum of ocean science and technology, which celebrates the sense of wonder people often have about the mysteries of the deep sea. Visitors can even travel 2,000 meters down into the dark depths of the ocean floor. This is a very large region. Make sure to work in a group of 4 at the very least. K-12 and higher education
Science / Genetics TOP ISLAND	Genome Island http://slurl.com/secondlife/Genome/180/64/33 	This site includes a number of simulations and virtual experiments related to the study of genetics. On this site, students can find a large-scale replica of an eukaryotic cell which they can enter and interact with as well as models of DNA. Step inside a rotating plasma membrane, check out elaborate dioramas, and play interactive games designed to teach students and scholars alike more about the micro world. Lots of hands-on activities. This is a very large region. Make sure to work in a group of 4 at the very least. Undergraduate biology
Science TOP ISLAND	Exploratorium http://slurl.com/secondlife/Exploratorium/107/90/25 	Based on the Exploratorium Museum in San Francisco, this in-world exhibition area features several interactive attractions including The Tent of Elucidation, The Illusion Pavilion, Pi, Henge Circle and much more. Lots of hands-on activities. K-12
Science TOP ISLAND	SploLand http://slurl.com/secondlife/Sploland/185/75/25 	Interact with more than 100 Exploratorium-inspired exhibits at SploLand, an interactive science museum. Travel around the solar system on Halley's Comet. Many exhibits on optical illusions. Lots of hands-on activities. K-12

Other interesting islands:

Art and Fantasy	The Museum of Surrealism http://maps.secondlife.com/secondlife/Enchantment%20Island/77/47/26 	Salvador Dali, Le surréalisme, René Magritte, André Breton, Edward James, The Pleasure Principle, Joan Miró, Catalan, Dada, Max Ernst, André Masson, Cubism, Picasso, anti-gravity boots K-12
Culture	Virtual Morocco http://maps.secondlife.com/secondlife/Casablanca/134/86/26 	The Hassan II Mosque, the marketplace, Old City, gardens, cafe, and beach. K-12
Culture (French)	Paris 1900 http://slurl.com/secondlife/Paris 1900/146/26/2 	FRANCE PARIS - Tourism, Tour Eiffel, Arc de Triomphe, Moulin Rouge, PARIS Concorde, Les Champs Elysées, Notre Dame. K-12

Ecology	Etopia Eco Village http://maps.secondlife.com/secondlife/Etopia%20Island/191/54/22 	Learn more about how to participate in a socially and environmentally sustainable world at Etopia Island, a place to explore and learn. Take an interactive quiz, ride a gondola, hop on a train or even ride a bike through this futuristic vision of a sustainable world. K-12
Fantasy	St. Michel The Jules Verne Museum http://maps.secondlife.com/secondlife/Lily/220/124/53 	The first museum in Second Life to honor and celebrate the creative genius of Jules Verne. Visitors can take an underwater voyage here. With a full-size submarine to explore, this museum offers insight into the life and work of French science fiction writer Jules Verne. Caution: The exploration of the submarine needs advanced navigation skills, with skilled camera control. Tall avatars won't fit into the submarine! K-12
Fun (Under-water)	Imzadi Island http://maps.secondlife.com/secondlife/Imzadi/128/128/2 	Scuba dive in a coral reef (make sure to take the automated tour) where whales & dolphins swim overhead. Relax on tropical beaches, enjoy pools & clubhouse, play a game of chess or backgammon. K-12

History	Holocaust Museum http://maps.secondlife.com/secondlife/US%20Holocaust%20Museum1/1/35/27 	"Witnessing History: Kristallnacht, the 1938 Pogroms" is a virtual exhibit within the U.S. Holocaust Memorial Museum. You walk through the streets of a ghost town and see the general destruction of anything Jewish, the shattered Jewish shop window, and the replicas of Nazi propaganda. You can enter a secret hiding room that was used by Jews in an attempt to escape the Nazi attacks. You can listen to witnesses' audio narratives. K-12
History	Roma http://maps.secondlife.com/secondlife/ROMA/128/128/2 	Using the objects and notecards on this site, students can learn more about the buildings, lifestyle and politics of Ancient Rome. K-12
History	Renaissance Island http://maps.secondlife.com/secondlife/Renaissance%20Island/220/227/27 	Elizabethan England, Renaissance, Tudor, medieval. "Pray ye visit this enchanted land that recalls a time when lords and ladies danced in the Royal Court of King Henry VIII. Many skilled artisans worked tirelessly to ensure that every castle, abbey, and monastery in the Parish of St. Minutia remain faithful to their historic forebears." A few hands-on activities. K-12
History & Archeology	Sunny Breezes, Museum Island http://maps.secondlife.com/secondlife/Sunny%20Breezes/211/150/23 	Archeological land. Babylonia, Hanging gardens, Petra, Pont du Gard, Ara Pacis, Pompeii, Agrigento, Trojan's column, Arch of Constantine, Rhodes, Temple, Nefertari tomb, Rome, Delphi, Abu Simbel, Tivoli, Efesus. Alicanasso, Buddha. K-12 and higher education

Science Fiction (and fun)	Star Trek Museum of Science http://maps.secondlife.com/secondlife/New Eridani/118/118/1442 	Teaching real science in a Star Trek Format. Beam up to 10-Forward. Explore exhibits on astrometrics, engineering, warp theory, starship design, bridge recreations, two working holodecks and more. K-12
Science	Oddprofessor's Museum and Science Center (Deaf Rochester Institute of Technology) http://maps.secondlife.com/secondlife/Mujigae/152/230/141 	Professor Oddball teaches physics to deaf students. 17 different activities to reinforce topics practiced in real-life labs and to allow students to apply knowledge to "physical" situations without having to set up a large amount of equipment in a lab. Each activity is directed towards a specific basic physics concept or definition. Each activity will accommodate several students at a time to allow collaborative learning. Activities Guide: http://people.rit.edu/vjrnts/secondlife/Science_Center_Guide_2012.pdf Undergraduate physics
Space	Spaceport Alpha – General – International Spaceflight Museum http://slurl.com/ secondlife/Spaceport Alpha/ 48/83/24  The Second Life Planetarium at Spaceport Alpha (same island). http://slurl.com/secondlife/Spaceport%20Alpha/24/53/22	The International Space flight museum has a display of rockets, places to watch NASA video and you can even ride a rocket. You can observe planet alignments of the past and future. The Museum hosts exhibits and conducts events. Don't forget to visit The Second Life Planetarium at Spaceport Alpha (same island), see description below.  Touch the floor to start the show. The planetarium holds only few avatars but gives a very informative presentation, a good way to brush up on your astronomy before you need to teach the topic. K-12

If you find it challenging to pick a Second Life destination based on the information in the Virtual Exploration Guide, you may want to check out some of the video demos below.

The Abyss Observatory: https://www.youtube.com/watch?v=uzD92u-Lqw0

Genome Island: https://www.youtube.com/watch?v=WTs00jualio

Exploratorium: https://www.youtube.com/watch?v=GM4EDCKZlUs

Sploland: https://www.youtube.com/watch?v=huI3nj35_Tw

Virtual Morocco: https://www.youtube.com/watch?v=F64sd9rGgbA

Paris 1900: https://www.youtube.com/watch?v=M2uWuqIc8Vo

Etopia Eco Village: https://www.youtube.com/watch?v=I8Ae301pMb0

Imzadi Island:
https://www.dropbox.com/s/y0c92dy92xxxqe6/Step%208%20Imzadi%20Island%20plus%20Lesson%20Plan.mp4

Holocaust Museum: https://www.youtube.com/watch?v=Hk2uN7flh4s

Roma: https://www.youtube.com/watch?v=X2qLPiZ4Zg8

Renaissance Island: https://www.youtube.com/watch?v=kCYYD1jCzcc

Star Trek Museum of Science:
https://www.dropbox.com/s/5cykj450p3dwwl0/StarTrek%20Demo_only%20play%20if%20we%20can%27t%20go%20live.mp4

Oddprofessor's Museum and Science Center deaf Physics Students:
https://www.youtube.com/watch?v=7c--QvEmBMo

Spaceport Alpha – International Spaceflight Museum
https://www.youtube.com/watch?v=M0liNM2xk-w and
https://www.youtube.com/watch?v=JjfZ0imm6U4

Last update: April 8, 2014

APPENDIX J

Code Frequencies (NVivo)

Name	Sources	References
Direct Quotes	5	24
Ideal Virtual Destination	0	0
EDUCATION FOCUS	3	6
PRIVATE, CONFINED, SAFE	3	14
SIMPLE	2	8
VISUALLY REALISTIC	1	1
Prerequisites for using virtual worlds in class	0	0
STUDENT PREPARATION	2	8
STUDENTS' PRIOR TECH. BACKGROUND	3	7
TECH. ACCESS	3	11
Unexpected	1	1
Unique benefits and challenges in special education	0	0
ACCESS PHYSICAL CHALLENGES	1	2
REDUCED STRESS	3	32
REPEATED PRACTICE	2	4
SOCIAL SKILLS PRACTICE	3	21
VIOLENT STUDENTS	2	2
Virtual World Benefits	0	0
COLLABORATION	3	27
CONTRIBUTION TO LEARNING, INCL. ACTIVE LEARNING	2	11
ENJOYMENT	3	9
EXPERIENTIAL, EXPLORATORY	4	25
IMPOSSIBLE, IMPRACTICAL	2	14
INCREASED ENGAGEMENT	2	3
INTERACTIVE	4	15
NOVELTY	2	10
SPATIAL	4	5
Virtual World Challenges	0	0
(LACK OF) APPROPRIATENESS	3	31
AVOID REAL WORLD	1	6
DISTRACTION	3	15
ENTERTAINMENT, GAME	3	6
OVERSTIMULATION	2	8
GRIEFERS	2	8
LEARNING CURVE	3	15
OBSTACLE	3	4
TECH. ISSUES	3	27
TIME-INTENSIVE	2	5
Virtual World Pedagogy	0	0
ACTIVITIES, APPLICATIONS	2	35
ASSESSMENT	2	10
CURRICULUM, IMPLEMENTATION	3	19
GROUPS	2	5
LEARNER SUPPORT	3	26
OBJECTIVES	1	2
VIRTUAL CLASSROOM MANAGEMENT	3	15
Virtual world teacher training	0	0
TEACHER TRAINING & SUPPORT	2	39
TEACHERS' PRIOR TECH. BACKGROUND	0	0

APPENDIX K

Detailed Code Descriptions

Theme 1: Virtual World Pedagogy

Teacher Training & Support	*Familiarity with Second Life:* If teachers want to use Second Life in teaching, they not only need to be thoroughly familiar with Second Life functions, but they also need to have explored the virtual destinations that they will be using with their students. In addition, they have to develop troubleshooting ability. For example, they need to be able to help a student whose Second Life Viewer freezes. After experiencing Second Life themselves in several practice sessions, teachers can better relate to students' experiences and potential frustrations when they start to use Second Life.
	Mentoring, Coaching, & Ongoing Support: Ongoing support is critical to ease teachers' enculturation into virtual worlds. Teacher educators, mentors, and coaches show teachers around in Second Life and have them engage in activities that will help to see how they can use the virtual space with their own students. The mentors and coaches share templates of lesson plans designed for virtual worlds and advise teachers on virtual assessment. Teachers new to Second Life should receive maximal and ongoing support from their schools.
	Technical Support: In addition to pedagogical support, teachers should also be able to rely on technical support. The importance of having access to a technical troubleshooter while using Second Life with students is paramount. For example, if one student's avatar gets stuck and can no longer navigate, it would be difficult for the teacher to help this one student while guiding the rest of the class through a virtual assignment. That is why a second person in addition to the virtual instructor is important. This second person would be a technical facilitator/troubleshooter and would only be concerned with technical issues while the virtual teacher focuses on pedagogical matters.
Activities & Applications	This code inquires about different types of activities in virtual worlds and how they can be used as a practical classroom application. Examples include scavenger hunts, automatized tours, games, role-plays, historical re-enactments, mimicking real life situations, using voice communication, interviews, and answering landmark-based questions (e.g., in virtual Notre Dame in *Paris 1900*). Desirable features include "simple" and "rich in content." The *Activities & Applications* code is different than *Curriculum/Implementation* in that it describes specific examples of practical things that we can do in virtual worlds, whereas *Curriculum/Implementation* more generally describes virtual pedagogy and methods of implementation and is not concerned with the practical, basic details of activities.
Learner Support	This code includes two areas. (1) *Differentiating instruction* to meet the needs of diverse learner types. The environment offers different ways of input (visual and auditory) to accommodate different needs. "Differentiating instruction means that a teacher observes and understands the differences and similarities among students and uses this information to plan instruction" (D.H., personal communication). (2) *Scaffolding*, the second area of this code, was mentioned much more often. It involves, for example, structured and guided activities, focused questions, sentence starters, and frequent check-ins with students. Because many Second Life destinations are ill-structured and open-ended with no clear mission to accomplish, it is important for the teacher to define the purpose of a virtual exploration and provide strong guidance, at least initially until students become comfortable using virtual worlds for learning.
Curriculum	This code revolves around (1) how to align virtual world activities with lesson plan objectives, curriculum, and Common Core State Standards and (2) how to implement virtual worlds practically, that is, the practical procedures to

	incorporate virtual activities into teaching. For example, a virtual teacher training should demonstrate how to incorporate technology, social skills, and science into one virtual lesson. An ideal virtual worlds teacher training should incorporate an activity where participants can create their own virtual lesson plans and where they receive templates and models of lesson plans that they can adapt. Model lesson plans for special education would be desirable. Statements revolving around the effectiveness of using virtual worlds in education were also included in this code.
Virtual Classroom Management	Virtual classroom management is different than classroom management in a brick-and-mortar classroom. One reason is that the teacher cannot control the students in the same way. Having control over what students are doing (e.g., if they wander off to a place where the teacher does not want them to go) requires new parameters (e.g., the teacher may want to have computer-regulated control over students' avatars). Teacher control also includes keeping students from changing their clothes to something inappropriate or adding inappropriate body parts to their avatar. Another reason is that the virtual environment with its visual stimuli may cause off-task behavior. To ensure on-task behavior, virtual classroom management needs to be carefully planned.
Private/Confined/Safe	This code concerns the creation of a safe, confined destination with private access to increase student safety. In this limited space, students explore a predesignated and safe environment.

Theme 2: Virtual World Benefits

Social Skills Practice	Using Second Life to help students with social skills challenges practice social encounters, such as practicing turn-taking in conversations, buying a bus ticket, etc. The code description of *Social Skills Practice* is different than the one of *Interactive* in that the former is specifically concerned with conversation practice for students with social skills challenges, such as students with autism. These students may practice everyday situations in Second Life, that is, situations that require empathy, that train the recognition of emotion in another person, and situations that help to learn what are appropriate things to say in a conversation, such as asking whether one can sit next to someone else's avatar in a virtual bus, ordering a beverage in a virtual restaurant, asking a sales clerk in a virtual grocery store for help, etc. The code *Interactive,* however, refers to any interaction between avatars or between avatars and objects and does not emphasize social skills practice. For example, students could play bingo together in Second Life, which would not necessarily require social skills. They would play in the same team, but each could pick up a letter without talking to anyone else. One avatar could teleport someone else's avatar to another destination. While these two avatars interact, again, they do not necessarily practice social skills with each other.
Reduced Stress	Virtual worlds may reduce stress in people with social skills challenges, such as people with autism. There is no face-to-face contact, which alleviates the anxiety of talking to someone. Communication is less direct because it is computer-mediated. People with social skills challenges often prefer computer-based interaction. This code is intricately linked with *Social Skills Practice,* but because the participants specifically pointed out the potential for stress-reduced conversations, two codes seemed necessary for better differentiation.
Collaboration	This code can be described as learning from each other, going into Second Life as a group rather than alone to benefit from mutual support, and using virtual worlds to undertake tasks together rather than for communication purposes only. A virtual task must be collaborative in order to complete an assignment (i.e., an activity must be contingent on partner work in order to be deserve the label collaborative).
Experiential/	Experiential learning means hands-on learning where users are immersed in a

Exploratory	simulation. Exploratory learning is a component of experiential learning with a focus on discovering new things, going off the beaten path, being innovative, and led by intuition.
Interactive	In an interactive environment, one interacts not only with others but also with objects, such as riding in a weather balloon or injecting bacteria into virtual mice. Interactivity with objects provides tactile access for kinesthetic learners. The two differences between the code *Interactive* and the code *Collaboration* is that one can interact with others without necessarily collaborating on a task and that one can interact with objects by manipulating these, for example by starting a meteorite show, flipping something over, or by clicking on a TV screen to experience auditory and visual hallucinations. One can take a chariot ride through old Rome, engage in a bow-and-arrow competition, or build something, for example a work of art. The *Collaboration* code, however, refers to tasks that are contingent on teamwork. Although both codes involve interaction, there is a different focus.
Impossible/ Impractical	This code encompasses experiences in virtual worlds that would otherwise be impossible (because it is too risky or because it no longer exists) or impractical (too expensive, too far away, etc.).
Contribution to Learning, incl. Active Learning	Rather than being just for fun, virtual worlds may also contribute to learning. This code also addresses active learning where the student takes an active stance in his or her education instead of passively receiving input from a teacher or other source (video, book, etc.). As the sample quotations show, this code is intricately linked with exploratory and experiential learning.

Theme 3: Virtual World Challenges

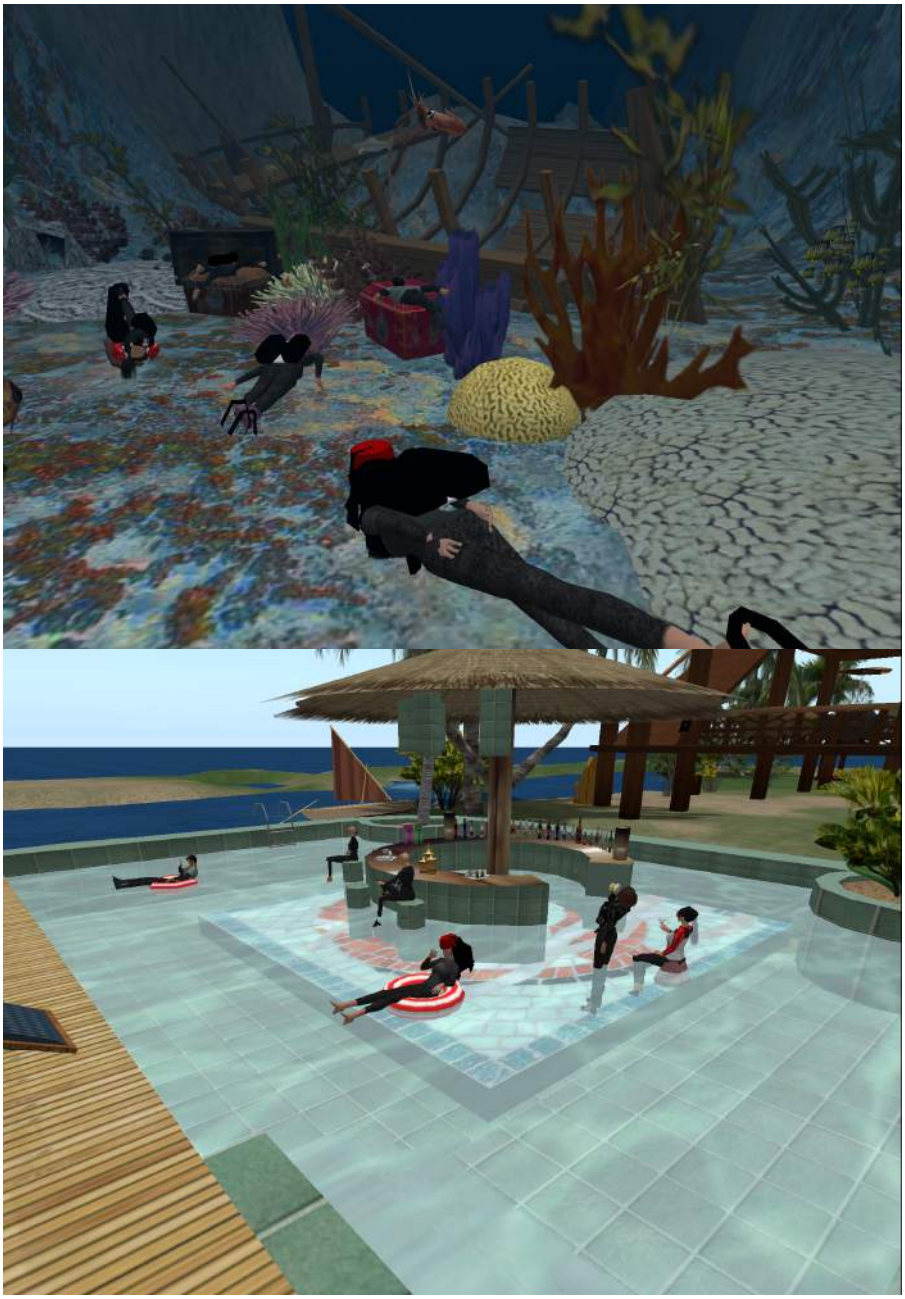
Distraction	Distraction and off-task behavior can become issues in virtual worlds. The visual appeal, the novelty, the overabundance of objects, the perception of Second Life as a game rather than a learning platform, and the interactivity with other avatars and objects can all detract from the learning tasks.
Technical Issues	The code describes a variety of technical challenges. If the Second Life Viewer (or any other viewer for that matter) crashes, if the computer is too slow, if Second Life does not operate smoothly, if the graphics card is too weak to load Second Life visuals properly, if the internet is too slow, if students get kicked out of Second Life, if the computer freezes, etc. This code is intricately linked with the code "Technology Access."
(Lack of) Appropriateness	Virtual destinations must be appropriate for specific ages and grade levels. It would be inappropriate, for example, if third graders were confronted with lingerie shops or bars or explicit adult content in a virtual destination. Because Second Life has not been designed with a focus on education, many Second Life destinations offer content that may, indeed, be inappropriate for students. Also, Second Life has generally been used in higher education with older students (minimum age for Second Life is 16) rather than with elementary school kids.
Learning Curve	Second Life is known to have a steep learning curve. It takes time to familiarize oneself with Second Life, especially if one wants to use it for learning and instruction. Having to overcome the initial learning curve can be frustrating and overwhelming. The curve is exacerbated by the rather low user-friendliness of Second Life. For example, it is easy to get stuck. The only option is to force quit Second Life and possibly even reboot the computer. The concept of learning curve also includes the ease or difficulty with which someone navigates through the virtual world. A user with impaired hand-eye coordination will find navigation challenging. The most challenging aspect, however, seems to be in-world voice communication. This code is intricately linked with the code *Technical Issues.*
Technology Access	This code encompasses providing access to enough high-end computers that meet the requirements to run Second Life smoothly as well as fast and stable high-speed

	internet. Not all students can be expected to have the required hardware and high-speed, hard-wired internet. This code was initially categorized under a theme called *Prerequisites to Use Virtual Worlds with Students*, but after the elimination of the theme, it seemed to fit in best under "Challenges" because most participants stated that their students may not have access to the required technology.

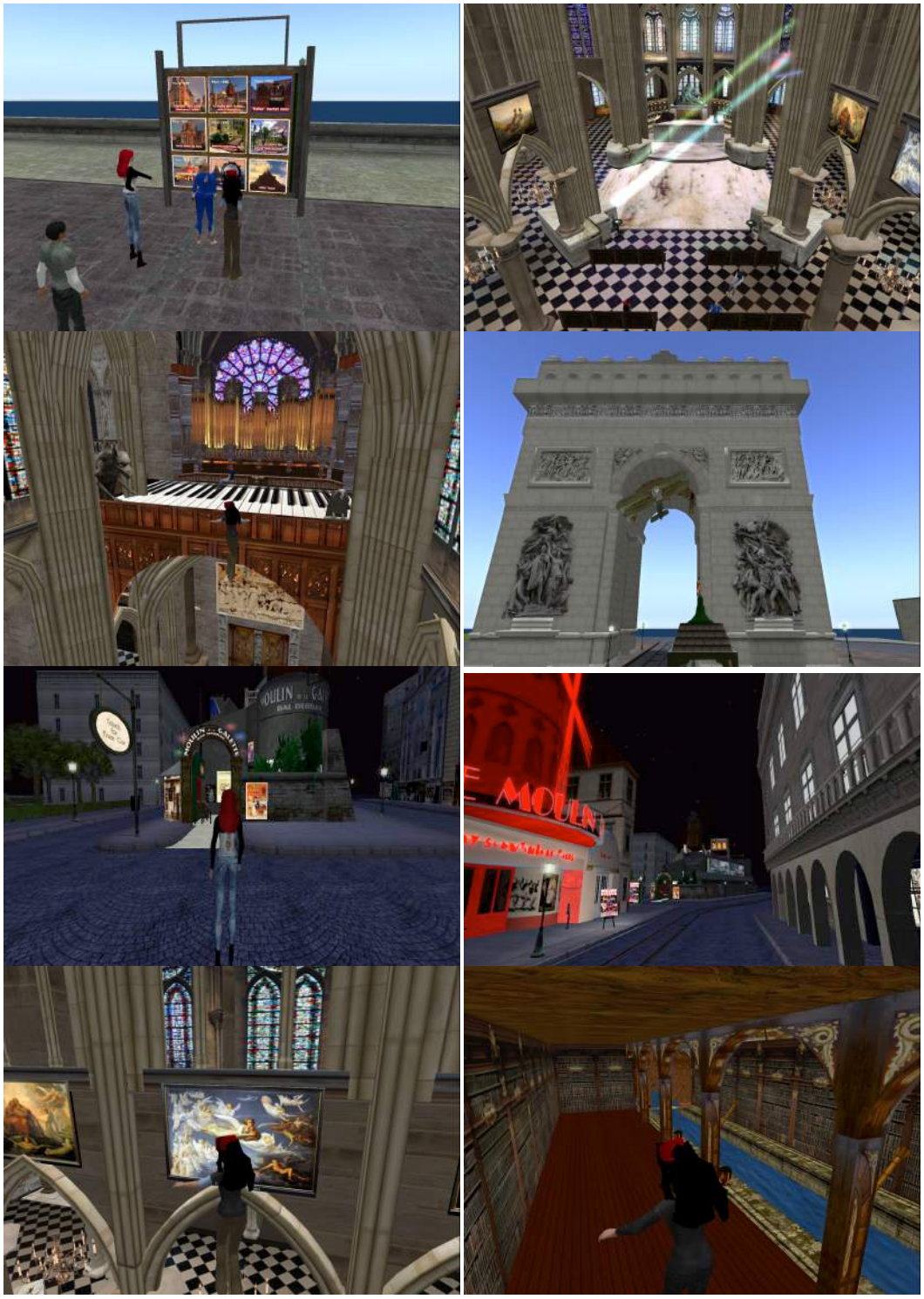
APPENDIX L

Pictures

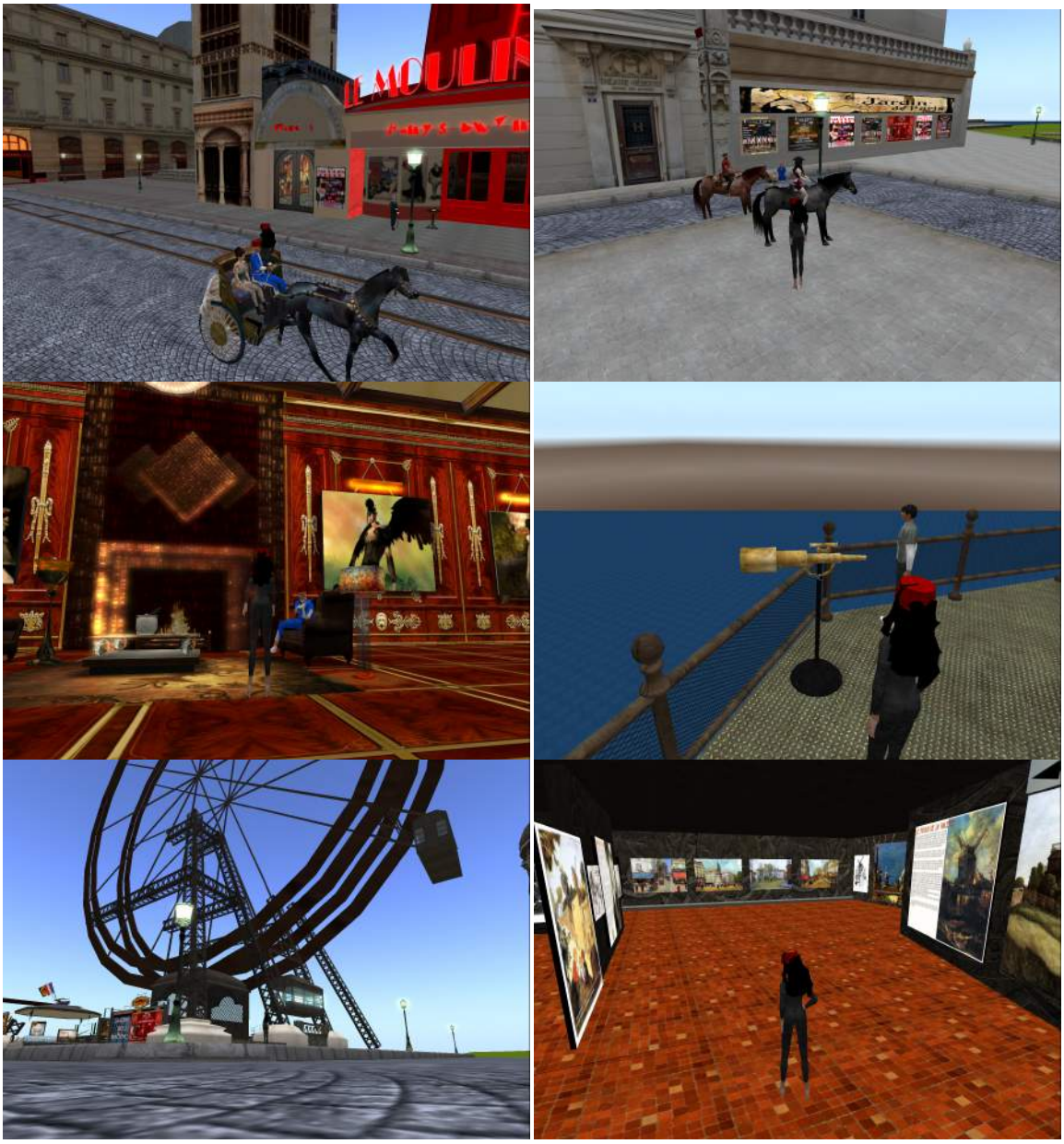
Imzadi Island: Underwater Exploration and Wet Bar



Paris 1900 Group 1



Paris 1900 Group 2



Etopia

Roma