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The use of virtual reality for teaching social skills to middle school students with autism

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THE USE OF VIRTUAL REALITY FOR TEACHING SOCIAL SKILLS TO MIDDLE SCHOOL STUDENTS WITH AUTISM

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Dedication

This thesis would have remained a dream without the love and support of my husband, Robert F. Fargo and my daughters, Linnea and Marissa. I am indebted to my many colleagues who supported me, especially Sarina Hoell for believing in me.

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Abstract

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The purpose of this study was to examine the effect on using virtual reality for middle school students with autism spectrum disorders (ASD) for learning their social conversation skills. Six students participated in the study to learn social skills in a simulated learning environment through six lessons. A multiple-baseline design across students with AB phases was used. The frequency of their initiation, responses to questions, comments, maintaining and closing a conversation, as well as prompt rating scores were recorded to evaluate students' performance. Results showed that the students improved their social skills and liked to learn in such a learning environment.

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Chapter 1

Introduction

Statement of Problems

Communication and socialization are very important skills for a student's success in school and essential life skills that allow students to build social relationships. These skills affect the way students perceive, relate and understand each other and challenge middle school students with Autism Spectrum Disorders (ASD). Students with ASD are "Characterized by varying degrees of impairment in three areas: (1) communication skills, (2) social interactions, and (3) repetitive behaviors" (Strock, 2004). This is a lifelong developmental disability that could be diagnosed during the first three years of a child's language and communication development, resulting from a neurological disorder that effects one's normal brain function and communication. The fundamental difficulty with socialization is the common thread for all students with ASD.

Students with ASD demonstrate deficits in communication and social skills. They are not able to keep up with their typically developing peers in social situations, for example, they may use repetitive language, twirl around, flap their hands and rock back and forth and have difficulties with changes or transition activities (Adams, Gouvousis, VanLue, & Waldron, 2004).These problems become severe when they are enrolled in middle school because the school structure and arrangement are flexible.

Changes are a daily function in middle school. These include schedule, teacher, and peer group changes throughout the day. Often, these changes affect students with ASD more than their typically developing peers. The students with ASD are unable to adjust themselves to meet

different requirements in multiple situations. Thus, they need to be taught how to react and communicate in positive and appropriate context in social situations throughout the day. Unlike their typical peers, they are socially clumsy and unaware of the social climate that surrounds them.

Being able to communicate is an important part of middle school life. Students are more concerned about their social status than their academic status, for example, sitting at the right lunch table with peers becomes more important than their academic grades. It is extremely difficult for these students to understand the specific social context and how to regulate themselves to fit into the social environment because of their social deficit and their lack of ability to respond appropriately when communicating with peers. Their lack of eye contact to the speaker is difficult for typically developing peers to understand. For example, the students may look out of the corner of their eye giving the impression that they are not interested in participating in the conversation. They may also become obsessed with random objects that are distracting to other students resulting in socially awkward situations. They may stand very close to people, intensely stare, and maintain abnormal body posture (Adams, Gouvousis, VanLue, & Waldron. *et al*, 2004). They are not able to read social cues that may affect their communication with peers and become isolated. In middle school, this social isolation may be serious and result in social suicide for some students. Communicating with peers is an important aspect of middle school and crucial to adolescents.

In today's school, more and more students with disabilities are included in general education classrooms. Students with ASD are often found to be placed with their non-disabled peers in the same class. Teachers are challenged to provide appropriate instruction to these students who have difficulty acquiring social skills. Thus, social skills are needed to embed into the curriculum to support these students in the classroom.

There are many instructional strategies for social skills training. Of these, using Social Stories has been suggested for students with ASD (Adams, Gouvousis,VanLue & Waldron *et al.* 2004). Developed by Carol Gray in the early 1990's, Social Stories are designed to help these students scaffold appropriate responses to different social situations. Individualized short stories focus on a specific social situation for students to practice and provide appropriate responses to the specific scenario. These social situations focus on social cues and appropriate reactions designed for individual students to facilitate their communication skills. The students are exposed to new reasons for responses and reactions to different situations by learning new social skills (Gray *et al*). Although evidence supports the use of social stories for individuals with ASD, efforts need to be focused on increasing the social communication skills using more timely interventions such as technology.

Technology as an instructional tool has become available in many schools and is the natural progression for all learners and may be more appropriate and effective for students with ASD (Ganz, Earles-Vollrath & Cook, *et al.* 2011). Using computers, students can view screen images and pictures. These images and pictures may serve as visual aids for learners. Technology also allows students to be videotaped, and post their images to review. This is called video modeling. Video modeling is a strategy that involves using videos to model skills for individuals to learn (Ogilive, *et al.*, 2011).

These video segments demonstrate desired behaviors for students to role play through video images and learn appropriate behaviors. Using video modeling, teachers can target the skill to be addressed, make a video, and create an individual intervention based on the student's needs. It is found that video modeling can be an effective tool for teaching communication skills to meet the student's needs, because they are motivated to see their own images and learn from their own models (Parsons, 2006). Thus, technology has provided an opportunity for these students to learn appropriate skills through visual images and video modeling.

Virtual reality is an example that shares the advantages of technology. The concept of virtual reality involves using computer technology to create an interactive environment that creates a simulated, three dimensional worlds that students can manipulate and explore while feeling that they are a part of that world. Virtual reality can target individual learning styles and customize the environments to encourage a learner's specific skills. It provides simulation that looks and feels real. In general, a virtual reality program includes: (1) the opportunity for the student to experience interpersonal and social interactions, (2) the ability to track the student's actions and adjust the images of the students on the screen in different social situation, (3) a virtual avatar that is perceived as a real person from the perspective of the student. In such virtual environment, the learners experience immersion into targeted scenarios where they can practice multiple real-life situations in a safe and controlled environment designed specifically for the individual student (Moore, Cheng, McGrath, & Powel, 2005).

Participating in a virtual reality environment allows students with ASD to interact as an avatar in a three dimensional world that looks realistic and incorporates impressive computer graphics. This is helpful for the students when responding to and learning how to control a social situation. The potential use of virtual reality for the student with ASD has been recognized. More

specifically, one advantage of this technology is that the "real-world" social interaction is minimized, resulting in reducing the source of anxiety for students with autism. Thus, they can practice specific skills to initiate a conversation and make friends. Participating in a virtual world provides the students with a safe environment that correspond to their needed skill for appropriate social interactions. In addition, virtual reality can help the students generalize communication and conversation skills into the real world. Technology application enables the use of virtual reality as a tool for measuring social interactions as well as assessing social cognition and behavior in real-life situations (Parsons, Mitchell, & Leonard *et al*, 2004). In the virtual world, students are represented as avatars and are able to interact with other avatars as if they were human. Technology advances in graphics help to create realistic experiences for the students. Therefore, virtual reality offers a realistic environment for the students to interact with, and provides an opportunity for social skills instruction for students with ASD.

Many different methods for teaching social skills are available and it is difficult for teachers to select the most appropriate method for their students. Reviewing research, it is found that social skills instruction has been implemented in elementary schools, while limited studies were conducted for middle and high school students. Different methods of effective instruction strategies were found to teach social skills such as using social stories, video modeling and virtual reality. However, it is difficult for middle school teachers to find effective instructional strategies for teaching social communication skills. Further research is needed for middle school students, especially those with ASD, on social skills instruction to improve their social functioning and peer acceptance.

Significance of the Study

Virtual reality shares the advantages of computer- based learning environments because it provides a simulation of the real world in which learners are able to practice skills. It is possible to customize the virtual environment to the specific profile and learning style of each learner which is also an advantage for a student with ASD. Virtual reality provides the students with an opportunity to experience real life scenarios in a safe environment created specifically for the particular student. The student's personal avatar is created to resemble the student's own unique features, making the social encounters appear real. Such a learning environment allows real time feed back to the students. In this learning environment students are able to practice the skill until they become proficient, enabling them to feel secure in learning the skill and generalizing the skill into the real world. Although there has been considerable discussion about the merits of using virtual reality for teaching social skills, research is needed for teaching social communication skills to students with ASD in middle school. Social skills are important in middle school where these students are transitioning into high school and these skills are necessary for their success as they grow into adulthood.

This study involves the use of virtual reality for social instruction on conversation skills to middle school students with ASD. The goal is to use the virtual world as a teaching tool to demonstrate appropriate social situations for students to practice. It is my attempt to encourage these students to interact with the avatar to learn appropriate social skills, especially how to start, maintain, and close a conversation. The results of my study will add information to the existing research on social skills instruction, especially for students with ASD in middle school.

Statement of Purpose

This study is designed to enhance the impact of using virtual reality to increase the conversation skills of middle school students with ASD. It attempts to increase their ability to initiate and maintain a conversation, so that these students can improve their understanding of social conversation and generalize the skills learned in the virtual world to the classroom with their peers.

Research Questions

The research questions are described as follows:

1. Will middle school students with ASD improve their conversation skills through the use of Virtual Reality?

2. Will the middle school students with ASD generalize the social skills learned in the virtual world into the classroom with their peers?

Chapter 2

Review of the Literature

Students with ASD have deficits in the area of social skills. They have difficulties in understanding social situations and effectively using social skills to interact and communicate with others. An emphasis on educational intervention has been placed on social and communicative competence for these students (Ogilvie, 2011). To enhance the opportunities for these students to learn appropriate social interaction and present prosocial behaviors, various strategies have been suggested in research. These include using social stories, video modeling, and computer based virtual reality.

Social Stories

A social story describes social situations in terms of relevant social cues and identifies appropriate responses for individual students to "read" social situations (Gray & Garand, 1993). It typically comprises two to five sentences that are (a) descriptive, including information about the setting, participants and actions; (b) directive, containing statements about the appropriate behavioral response; (c) perspective, describing feelings and reactions of others in the targeted situation; and (d) manageable, providing analogies with similar actions and responses using nonhuman subjects (Gray, 1994; Gray & Garand, 1993). Social Stories have been used as an intervention to teach students with ASD how to respond to different social situations in order to facilitate these students to learn appropriate social behavior and skills (Gray & Gerand, 1993).

There is evidence that many of the studies using social stories have been conducted with the goal of reducing inappropriate behaviors, along with targeting skill acquisition and increasing appropriate social interactions. In an early study, Thiemann and Goldstein (2001) evaluated the

effect of combining different visual cues (e.g., social stories, picture cue cards) with video feedback on specific social skills of five children with autism. Two typical peers were also grouped with each autistic child, and a multiple-baseline design across two or three skills was replicated across five triads. Targeted skills consisted of (a) securing attention, (b) initiating comments, (c) initiating requests, and (d) making contingent responses. Following initiation of the intervention, the participating children showed improved rates of appropriate social behaviors compared to their performance in the baseline. Two children also showed an increase of initiation for requests and responses when they were in the general education classroom. Essentially, this research indicated some possible benefits of using a combination of visual supports to improve social communicative skills of children with autism, but the specific effect of implementing the social story alone is unclear.

Another study by Delano and Snell (2006) used social stories to increase verbal initiations and contingent responses of three elementary male students with ASD in resource room settings. A multi-probe across participants design (Horner & Bare, 1978) was implemented to evaluate the effects of social engagement of the students. Three informal assessments to the participating students were administrated prior to the study to determine preferred activities and their social and academic comprehension skills. The students were observed during both play and classroom activities. To identify the appropriate method for presenting the social stories, each student's reading comprehension level was evaluated. Based on their reading level, the picture symbol story was given to two participants and *text + read* aloud were given to the other.

In addition, generalization probes were used to assess the student's ability to transfer skills learned to a general education classroom. Results indicated that all participants made improvements in the resource setting, whereas only two generalized their social behaviors to the

mainstream classroom. Although the findings are somewhat promising for elementary age students, the reliability of social stories was questioned as well as the components of the social story intervention. The results showed an increase of participating children during the intervention to peers, each student's performance varied as the intervention faded. It seems that more time may be needed for skill maintenance and generalization.

Scattone, Tingstrom, and Wilczynski (2006) evaluated the effectiveness of social stories to teach children with ASD appropriate social interaction with their peers. In their study, three boys between the ages of 8 and 13 who had been previously diagnosed with ASD participated. The students were selected because they did not initiate or respond to peers either appropriately or at all during free time activities. They were capable of speaking in complete sentences, but had intelligible speech.

Individual *appropriate social interactions* were defined as verbal, physical, or gestural initiation or response to a peer; a comment or question related to the activity or conversation; continued engagement in the same activity as peer; a response to a peer's comment or question with a comment related to conversation; an initiated comment or question related to the conversation; or a physical gesture such as nodding to indicate approval or disagreement (Scattone, Tingstrom, & Wilczynski, 2006).

The student performance was measured by the percentage of intervals of appropriate social interactions exhibited during 10 minute observations. There was no change for the first student after the introduction of the social story. The second student showed the largest increase in appropriate social interactions and the last one showed moderate increases.

It is found that the students were not able to generalize their skills, therefore, research suggests further investigations to determine if one social story is given to represent a social situation without the combination of another intervention is effective for positive behavior changes of students with ASD. It seems that social stories, when used as a single intervention to increase appropriate social interactions are limited in their effectiveness.

In order to help these students generalize their skills learned, social stories need to be more specific in addressing the individual student's goals. If a social story provides choices, it can be confusing to the students. Therefore, a story that targeted a specific skill may be required. Also, it is difficult to determine the role of a child's cognitive ability plays in relation to understanding social stories. It may be a difference when a student himself reads his own social story or is read by others. Student's age is another concern; it may influence the learning outcome of the social story as well. In Scattone, Tingstrom, and Wilczynski's study, only one student at the secondary level was included. Further studies are needed for middle school or high school students to examine the effect using social stories only as well as combining social stories with other interventions to improve social skills.

Social stories can be a successful intervention for increasing appropriate social skills of students with ASD (Smith 2001). It has a potential for a long term intervention to improve these students' social behaviors. However, a research review found that previous studies on social stories had problems, for example, the research designs of social stories are not rigorous, samples were small, and most were designed for elementary school students. Further research is needed for secondary school students to verify the findings.

Video Modeling

Video modeling involves a student watching videotapes of positive examples of adults, peers, or him-or herself engaging in a behavior that is being taught (McCoy, Hermansen, *et al.*, 2007). It is a versatile intervention that capitalizes on the potency of observational learning that may be well suited to address the educational needs of students with ASD. According to Delano (2007), video modeling is used broadly today and includes the use of the self as a model (video self -modeling) or another as a model (e.g., peer or adult), and individualized for the student to learn many skills (e.g., social, communication, functional) in a variety of settings (e.g., home, school, community).

Parsons (2006) examined secondary students with ASD using videotaped role-plays. Four female and eight male students with ASD from the age of 14 to 21 participated in the social skills class after school three and a half hours a day four days per week. Along with social skills training, the students also participated in physical education, game and computer time.

Data was collected through the use of parent, peer, and student surveys. The surveys were completed on the first day of class and again two weeks later. The parent survey provided information about student behavior at home that included self-isolation, attitudes toward socialization, anxiety over change, conversation skills, and attitudes towards the social skills class. The peer survey addressed the idea of classmate's evaluation about what was learned from the actions of others. The self-reflective survey, although difficult for students with ASD, required the students to examine themselves, provide information about themselves, and their feelings.

The procedures of the study were divided into three phrases. The first phase addressed individual student's need through the use of video. This provided the students with concrete evidence of how others see them. Results from the first phase were positive for increased name recognition, recognizing emotions, and increased name usage during greetings. The second phase of the study discussed job interview practice with the students. This phase focused on requesting a job application, job selection and interview. Students reported that they were more confident about their job application. In phase three the students were interviewed to discuss their perspectives about autism. It was found that some students were not familiar with the term (autism), other students thought someone else had autism, and some were able to relate autism to themselves. In this phase, teachers also reported that students addressed each other by name with fewer conflicts. In addition, students reported that they were able to recognize negative comments and were able to apologize for inappropriate social behaviors. The results indicate positive strides in the student's social skills through the use of video modeling along with the student's willingness to speak to unfamiliar peers and working in groups with confidence. The parent survey reported positive results as well. They indicated their children decreased time spent alone, increased in social participation and reduced social anxiety. Parents also reported that their children increased their reciprocal conversations with teachers in school and their ability to handle changes. These results indicated that these students were able to generalize some social skills from school to the home environment.

Video modeling as a strategy has preliminary support to improve a variety of skills of students with ASD (Ganz et al., 2006; Ganz, Cook, & Earls-Vollrath, 2007). The flexibility of video modeling is an advantage along with the ability to use video modeling alone or with another instructional strategy.

According to Ganz, Earles-Vollrath and Cook (2011), three basic steps for implementing video modeling for students with ASD were recommended. These are identifying the skills to be targeted, producing the video, and implementing the intervention. The first step is: Identify the Target Skill(s) with sub steps including assessment, listening, prioritizing, and defining skills. For example, a student's social strengths and deficits are defined; this may include comparing the target student's abilities to his peers, behavior sampling, questionnaires, and interviews. Based on the assessment results, a list is created and prioritized in order of importance. The target skills are objectively defined and based on observational data. Step 2 involves creating three to five videos for each skill in a variety of settings, models and scripts or task analysis to ensure skill generalization (D'Ateno, Mangiapanello, & Taylor, 2003). It is recommended for the models to be taught each script should be in the task analysis, then practice and perform while being videotaped (Ganz *et al*., 2006). Step 3 includes video segments being viewed daily and prior to the time of day the student is expected to demonstrate the skill. Although the students were of different ages with different abilities, they all participated in the same procedures with the same goal to increase appropriate social interactions, improve conversation and daily living skills, and to reduce inappropriate behaviors.

The results showed that visually based instruction with video modeling positively impacted these students (Ganz, 2006). Through video modeling they learned by observing their own behaviors in the video, imitating the appropriate behaviors and presenting it in the real environment. It is found that the combination of video modeling, direct instruction, and facilitated support within naturally occurring environments is more likely to lead to student success. One limitation of this study was the small class size and the short after school time. Therefore, the use of video modeling in social skills training merits further examination based on

student reactions and parental feedback. It is found that students with ASD are visual, which makes video modeling a naturally effective instructional method. Although there have been several comprehensive reviews in which researchers have examined the literature on video-modeling (e.g. Dowrick, 1999; Hitchcock, Dowrick & Prater, 2003), these reviews have not focused on secondary students with ASD. More research is needed regarding visual based instruction to enhance social skills.

Virtual Reality

Today, there are many new ways to teach students with ASD. One method is computer-based virtual reality. A virtual reality is defined as a computer-generated three-dimensional simulation of an environment. In this environment, the user can interact through an avatar designed to represent the user. By assuming the viewpoint of the avatar, the user becomes the avatar. This virtual environment allows for an authentic simulation of situations and the potential for generalization into the real world environment.

The potential of virtual environments for teaching students with ASD has been positively promoted in recent years. One of the earliest studies involving virtual reality as a learning tool for students with ASD was used by Strickland (1996). In this early study, the participants were wearing a head set for the feeling of total immersion into the virtual world. This computerized instruction for students with ASD could address sensory, generalization, visual, and individual needs. The study involved two students, seven and nine years of age wearing a helmet to identify street signs for safety in the virtual environment. The purpose was for the students to identify the signs and generalize the warning into their real- world environment. It was found that

introducing technology to the students at an early age was an important first step in exploring virtual reality as a teaching tool for students with ASD.

In Parsons, Mitchell, and Leonard's study, students with ASD and typical students that had the same verbal IQ or performance IQ along with gender and chronological age participated. Their purpose was to determine if the students with ASD could generalize social appropriateness to their environment. The participants had a basic understanding of the virtual environment as a representation of reality.

Of the 36 participants, 12 with ASD from the ages of 13 to 18 were high functioning. They were paired with two other participants from different schools and matched in the area of verbal IQ (VIQ) and performance IQ (PIQ) as well as age and gender. The students with ASD attended Special Needs Schools and were matched according to their VIQ, whereas the typical participants attended secondary inclusion schools and were matched according to their PIQ.

Preceding entering the virtual world, the participants were provided with practice sessions using the equipment to provide information of their ability to navigate through the virtual world. Students were also provided with demonstrations of required tasks and expectations

The students participated in a virtual café designed to enhance learning of daily skills. They had a checklist of tasks to perform with minimal prompting in the virtual café which included: Communication, the computer asking a question; interaction, responding to a question; and navigation, movement within the environment. Results from the virtual café environment found that the PIQ-match group scored higher on each task than the ASD group. No significant differences were found between the ASD participants and VIQ-match group on any of the individual tasks. The PIQ-match group scored higher than the ASD and VIQ-match groups in

general; however, the tasks in the virtual world did not pose a greater challenge for the ASD group than the VIQ-match group. It was found that the PIQ-match group was quicker than the other groups in the area of navigation. The ASD group showed improvements and benefited from practicing tasks in the virtual environment.

In the area of social appropriateness, the participants with ASD had a tendency to navigate between and very close to others in the virtual café. Parsons, Mitchell and Leonard (2004) indicated that this socially inappropriate behavior may be a difficulty with personal space and social understanding common in students with ASD. They argue that personal space is not seen by people with ASD.

It is suggested literal interpretations of a virtual environment could limit the usefulness of virtual reality as a social skills teaching tool because the participants need to understand that what happens in the virtual world is not a literal representation of what happens in the real life (Parsons, Mitchell, 7 Leonard, 2004). Virtual reality offers the opportunity for participants to learn appropriate behavior in safe and supported environments, and the virtual world is linked to real world behaviors and provides insightful student information. However, technology may not be suitable for every student; for example, the lack of understanding social situations in a virtual world may indicate a deeper difficulty with social appropriateness.

In another study, Mitchell, Parsons and Leonard (2006) evaluated six teenagers with ASD in a virtual environment along with video supports to allow authentic simulations of social situations in an effort to investigate the potential of virtual environments for teaching social understanding. The environment used in this study was developed to scaffold learning of social

understanding, prompts, and options to focus responses. This interactive learning through role play in virtual environments may support imagination and problem solving in a realistic context.

Four male and three female students with ASD participated in this study. They attended a school that exclusively admitted students with ASD and were between the ages of 14 and 16. The students were given the same tasks in two different orders. This was done to distinguish gains from the virtual environment or from gains due to practice. The video measures and the virtual environment experience took place on successive days over a six week period and consisted of two 40 minute virtual environment sessions for each participant.

The virtual environment used to teach social understanding was based around a four level café. Levels 1-4 were designed to increase social involvement with the higher levels containing more people in different places along with background noise. The program was designed to give visual and verbal feedback to encourage the participants to make appropriate social choices along with adaptations for individual needs. No scripted prompts were available for the participants and mistakes became social learning opportunities. Levels were repeated for understanding.

The second part of the study involved the participants watching video scenes three times to determine where they would sit in the café and on the bus. The first two were café scenes designed to assess the specific learning objectives addressed in the virtual environment, the following three videos were of busses designed to assess generalization from a café to a bus context. Participants showed improvement in judgment and reasoning about where to sit in some of the videos of real cafés and real busses. It was found that significant gains were more common directly following the virtual environment and skill generalization to another context did occur. It

is also found that positive communication students learned from virtual environments increased social awareness of individuals with ASD.

A limitation of this study questions if virtual environments directly impact social improvement in the real world along with the use of virtual environments as a lasting improvement for social appropriateness. It seems that using virtual environments is a natural extension from social stories and video modeling for students with ASD. This environment allows the students to perform in visual context where they are comfortable using computer based learning tool to gain from their experience socially. Middle school student who attend inclusion schools are at risk for social errors as they transition into high school. This is the population of students that can benefit from communication and social skills instruction through computer based virtual reality because they are able to perceive the virtual avatars as real human and use them to learn appropriate ways to adjust their behavior, emotion and memory. Students can immerse themselves in the virtual world in a way that is not possible using standard instruction methods. It is important for middle school students with ASD to see an environment that is familiar and natural to them, thus, virtual environments provide a safe learning experience for them.

Summary

All of the discussed literature points to the same conclusion. Social skills intervention is needed for students with ASD and no one intervention has been successful when used alone. Much research has been found for teaching social skills to students with ASD, few incorporate the use of virtual reality.

Social skills interventions impact student social behaviors in a positive way when used together. Virtual reality programs allow teachers to instruct, model, and offer students a safe controlled environment to practice skills learned. Students with ASD have shown gains in the area of appropriate social behavior with interventions.

Virtual reality is an effective method for teaching social communication skills to students with ASD. A review of the research has shown a majority of social skill intervention in the elementary grades, there are few studies in the middle and high school grades. Social skills interventions are most effective when offered at the elementary level and continued throughout middle and high school. This study will focus on the use of virtual reality intervention at the middle school level.

Chapter 3

Method

Setting

The study was conducted in a public middle school in southern New Jersey. There are 811 students in 6-8th grades attending the school. Of those, 30 are diagnosed with autism. These students are placed in a self-contained classroom to learn social communication skills for 50 minutes every day.

Participants

Six 8th graders, one girl and five boys with ASD participated in this study. The boys' ages ranged between 12 and 13 and the girl was 12. According to Social Skills Improvement System (SSIS) and Comprehensive Assessment of Spoken Language (CASL), these students had moderate delays with critical thinking skills as well as pragmatic and social language skills. They also had delays in their ability to develop conversational skills, with their peers and to interact with others. Thus, they all attend a class to learn social communication skills. Table1 presents the general information of participating students.

Table 1

General Information of Participating Students

Student	Gender	Age	IQ*	SSIS*		CASL*
				S-R	T-R	
1	M	13	117	83	90	83
2	M	13	87	82	95	80
3	M	13	117	81	89	84
4	M	13	91	79	95	79
5	F	13	94	82	100	81
6	M	13	79	75	95	78

*IQ=WICS4

*SSIS= 2013

*CASL= 2013

Instructional Materials

The Four Steps of Communication. This is a free downloaded lesson (www.socialthinking.com/what-is-social-thinking/four-steps-of-communication). It serves as Lesson 1 prior to entering the virtual world. The focus of this lesson was social emotional thinking and recognition of social communication through the process of 4 steps. These steps include: (1) thinking about people and what they think and feel; (2) being aware of your physical presence as well as the physical presence of others; (3) using your eyes to think about others and see what they are thinking about; and (4) using your language to relate to others.

Model Me Conversation Cues. This DVD program (www.modelmekids.com) was viewed prior to entering the virtual world in Lessons 2 through 6. This program demonstrated social skills by modeling appropriate peer behaviors in school. These models cover nonverbal cues, how and when to start a conversation, maintain a conversation by turn taking and closure.

InWorld. This is a virtual reality program developed by InWorld Solutions (www.inworldsolutions.net) which provides virtual environments and avatars specifically geared for social interaction for students with special needs. The program enables learners to practice their social skills in a non-threatening virtual space monitored by their teachers. To activate this program, each student and teacher needs a laptop computer. Learners are represented as avatars to maneuver around the virtual world, initiate computer interactions and transport to different locations in the world by using the up/down keys at the keyboard. Students and teachers also need to wear headsets with microphones for verbal communication. For example, participants can learn social skills in the virtual classroom and practice in a virtual lunch room, auditorium, suburban house, park, and soccer field. All virtual environments were similar to those in the real world.

Such environments can make the students transition easily and understand the social situations and practice the skills (See an example in Appendix A). A learner's body language, facial features and proximity are communicated by manipulating the avatars in the social scenarios. Thus, social skills can be targeted in a scenario for learners to understand and practice to reach the level of proficiency in each social situation.

Measurement Materials

Two kinds of checklists were used in the study, for recording student performance prior to, during, and after the instruction. The first check list was used prior to the virtual world. It included; 1) greeting: including body language, personal space, eye contact, facial expression, volume, and the verbal greeting; 2) conversation: including asking a question, responding to question on topic, making a comment on the topic, and asking a follow-up question; 3) closing: ending the conversation, saying "good-bye" verbally. Hierarchic prompts were rated as: Direct Verbal, 1 point; Gesture (facial expression), 2 points; Indirect Verbal, 3 points; No Prompts (independent), 4 points. Table 2 presents the checklist.

Table 2

Conversation Skill Checklist in the Classroom

Student	Day 1	Day 2	Day 3	Day 4
Greet the person				
Make a comment				
Ask a follow-up question				
Make a follow-up comment				
Make a closing comment				
Close the conversation				

The second check list evaluated the student independent skills applied in the virtual world. The data was collected during the 20 minute intervals, 3 days a week for 6 weeks. These skills included: 1) introducing the topic; 2) making a comment; 3) asking a question: 4) making a sentence, and 5) closing the topic. Same prioritizing points (1-4) were recorded, (See Table 3).

Table 3

Conversation Skills Check List in the Virtual World

Lesson # 1	Day 1 Date:	Day 2 Date:	Day 3 Date:
Student Name:	20 min.	20 min.	20 min.
	S1 S2 S3	S1 S2 S3	S1 S2 S3
Introduce the Topic			
Make a Comment			
Ask a Question			
Make a Sentence			
Close the Topic			

Additionally, a Student Self-Check list provided information about the way the student felt about how he/she communicated with other people.

Table 4

Student Self Checklist

Student Name	Usually	Occasionally	Rarely
1. I change the way I communicate based on the situation.			
2. I am able to start a conversation with a peer.			
3. I watch other people's body language during a conversation.			
4. I try not to interrupt others when engaged in a conversation.			
5. I remain on-topic during a conversation.			
6. I know what information to share during a conversation.			
7. I communicate well with my peers.			
8. I am comfortable talking with my friends.			
9. I talk differently with adults than I do with my peers.			

In addition, Teacher Checklist presents the teachers' checklist to record information about the student's social functioning in the general education classroom. Both student and teacher check-lists were completed pre and post entering the virtual world.

Table 5

Teacher's Checklist

Student Name:	Usually	Occasionally	Rarely
1. Student changes the way he/she communicates based on the situation.			
2. Student is able to start a conversation with a peer.			
3. Student watches other people's body language during a conversation.			
4. Student tries not to interrupt others when engaged in a conversation.			
5. Student remains on-topic during a conversation.			
6. Student knows what information to share during a conversation.			
7. Student communicates well with his/her peers.			
8. Student is comfortable talking with my friends.			
9. Student talks differently with adults than with his/her peers.			

Instructional Procedures

Prior to participating in this study, students were taught how to navigate through the virtual world using their avatars for 50 minutes, twice a week, for two weeks.

The students were taught appropriate social communication skills in 6 lessons to review appropriate communication skills. Each lesson was delivered in class followed by a brief discussion on specific social scenarios. Then, students applied their social communication skills by participating in a virtual environment.

The topic of the first lesson was high school electives. This lesson included: the student choosing 1 elective for high school, explaining why the elective was picked to 2 peers in the virtual world, using appropriate eye contact, physical presence and body language. Lessons 2 through 6 followed the DVD program called Model Me Conversation Cues. In these lessons, the students watched a video demonstrating a group of the same aged students with appropriate and inappropriate conversations. This video segment allowed students to view appropriate communication to start, maintain and end conversations, also to avoid inappropriate approaches to failing a conversation. After the video presentation, teacher led a class discussion to further clarify the skills by questions and answers. This was followed by applying the skills learned in the virtual world. Table 6 presents the lessons, topics, and procedures. The two teachers monitored the students in the virtual world and recorded individual student's performance using the checklist presented in Table 3.

Table 6

Lessons and Procedures

Lesson	Procedure
1. High school electives	1. Lecture format in the classroom.
	a) Role play the 4 steps of communication in the virtual world.
2. Model Me Conversation Cues.	a) View DVD When to start a conversation.
When to start a conversation.	b) Role play when to start a conversation in the virtual world.
3. Model Me Conversation Cues.	a) View DVD How to start a conversation.
How to start a conversation.	b) Role play how to start a conversation in the virtual world
4. Model Me Conversation Cues.	a) View DVD How to take turns in a conversation.
How to take turns in a conversation.	b) Role play how to take turns in a conversation in the virtual world
5. Model Me Conversation Cues.	a) View DVD how to maintain a conversation.
How to maintain a conversation.	b) Role play how to maintain a conversation in the virtual world.
6. Model Me conversation Cues	a) View DVD how to end a conversation.
How to end a conversation.	b) Role play how to end a conversation in the virtual world.

Measurement Procedures

Observation checklists and student checklists were used at both beginning and end of the study. *Conversation Skills Checklist in the Classroom*. Prior to the first lesson, 4 consecutive days of informal conversation skills was observed and recorded using the Conversation Skills Checklist in the Classroom by the teacher to assess student social conversation abilities in the classroom. The students were observed in Humanities class with peers to identify social communication skills. They were observed during classroom activities when they were in group work with peers.

Conversation Skills Checklist in the Virtual World. Each student's face to face communication within appropriate physical space was recorded in 3 trials for each lesson in the virtual world. In each trial student's body language, personal space, facial expression, eye contact and volume of their voice were recorded. In addition, their ability to ask a question, make a comment, stay on topic, ask a follow-up question and respond to questions was recorded. Observations in the virtual world provided information on student responses to different social scenarios, such as introducing a topic, making a comment, asking a question, making a middle school appropriate sentence and closing a conversation.

Student Self-Checklist. This Student checklist was used for student self-assessment. Each student individually completed his/her own evaluation and returned it to the teacher, prior to and after the lessons in the virtual world. The checklist identified each student's thoughts about his/her ability to socially communicate with other middle school students. The student checklist rated student abilities to communicate in different situations, starting conversations, paying attention in conversations, staying on a topic, knowing what information to share and communicating with peers, friends, adults and strangers.

Teacher's Checklist. The teacher recorded student social communication skills such as; body language, facial expression, eye contact, personal space, empathy, ability to join-in a conversation, complimenting others and asking appropriate questions in the Humanities class, a regular education classroom. Student social communication skills in the academic setting were assessed through the checklist prior to taking part in the series of lessons involving the virtual world and at the end of the 6 week study.

Research Design

A single subject design across students with A B phases was used. During Phase A, each student's social conversation skills were recorded. During Phase B, students were grouped in 2 teams, and one group started one day ahead. Instruction was provided 3 days a week for 6 weeks. Student performance was observed and recorded by the teacher using observation checklist.

Inter-observer Reliability

A speech-language therapist from the school served as a second observer for the study to check with the teacher, the primary observer, to insure accurate observations.

Data Analysis

A visual graph was presented in Chapter 4 to compare student performance in Phase A and B. The results of pre and post student and teacher's checklists were compiled to evaluate student's social and communication skills, rating scores were calculated in percentages. The effectiveness of the study was assessed on the students' social communication skills by measuring verbal communication intervals of social communication interactions exhibited by each student during the 20 minute sessions across baseline and intervention phases. In addition, both student and teacher rating scores were calculated in percentages and demonstrated in tables in Chapter 4.

Chapter 4

Results

Student's performance was evaluated using the observation checklist to record their six skills: greeting, comment, follow up question, follow up comment, closing comment, and close conversation.

Table 7 presents means and standard deviations of student conversation skills across the baseline and intervention.

Table 7 *Means and SD of Student Conversation Scores across Phase A and B*

	Phase A (Baseline)		Phase B (Intervention)	
Student A	Mean	Standard Deviation	Mean	Standard Deviation
Greeting	1.5	1.0	4.0	0.8
Comment	2.4	0.5	4.0	0.9
Follow Up Question	2.0	0.9	3.0	0.5
Follow Up Comment	2.0	0.6	4.0	0.7
Closing Comment	1.0	0.6	4.0	0.8
Closing Conversation	2.0	0.8	4.0	0.7
Student B				
Greeting	1.7	1.1	4.0	0.7
Comment	2.2	0.9	6.0	0.5
Follow Up Question	1.2	0.5	5.0	0.7
Follow Up Comment	1.5	0.5	6.0	0.5
Closing Comment	2.0	0.5	4.0	0.5
Closing Conversation	2.5	1.0	5.0	0.4
Student C				
Greeting	1.0	0.0	1.5	0.0
Comment	1.7	0.5	2.0	0.5
Follow Up Question	1.2	0.5	1.5	0.0
Follow Up Comment	1.2	0.5	2.0	0.5
Closing Comment	1.2	0.5	2.0	0.5
Closing Conversation	1.7	0.5	3.0	0.5

Student D				
Greeting	2.0	0.8	4.0	0.5
Comment	2.7	0.4	4.0	0.5
Follow Up Question	2.7	0.6	5.0	0.4
Follow Up Comment	2.2	0.0	5.0	0.5
Closing Comment	3.0	0.5	5.0	0.5
Closing Conversation	3.5	0.4	6.0	0.4
Student E				
Greeting	2.0	0.8	4.0	0.5
Comment	2.5	0.8	4.0	0.8
Follow Up Question	2.0	0.5	4.0	0.5
Follow Up Comment	2.0	0.8	4.0	0.5
Closing Comment	2.5	1.0	4.0	0.8
Closing Conversation	2.7	0.8	6.0	0.4
Student F				
Greeting	1.5	0.4	2.0	0.5
Comment	1.7	0.4	4.0	0.4
Follow Up Question	1.7	0.5	3.5	0.6
Follow Up Comment	1.5	0.4	4.0	0.5
Closing Comment	1.2	0.0	3.0	0.5
Closing Conversation	2.2	0.4	4.0	0.4

Student A was observed an increase in each of the six skills during the intervention; the largest increase was Closing Comment, from 1.0 to 4.0. Student B increased all six skills too; the largest increases were in Follow-Up Question from 1.25 to 5.0 and Close Conversation from 2.75 to 6.0. Student C increased all six skills and showed the largest increase in Close Conversation from 1.75 to 3.0. Student D showed increases from baseline to intervention for each of the six skills, the largest increase was Follow-Up comment from 2.25 to 5.0. Student E showed increases in each of the six skills, the largest increases was Close Conversation from 2.75 to 6.0. Student F showed increases each of the six skills with the largest increase in Closing Comment from 1.25 to 3.0. During the intervention when the virtual reality was presented, all students showed an increase in their skills learned.

Table 8.1 presents percentages of student self-rating scores.

Table 8.1

Student Pre and Post Self Rating Scores in Percentages

Student Self- Rating Items	Usually		Occasionally		Rarely	
	Pre	Post	Pre	Post	Pre	Post
1. I change the way I communicate based on the situation.	83	94	17	6	0	0
2. I am able to start a conversation with a peer.	50	75	50	25	0	0
3. I watch other people's body language during a conversation.	50	60	50	35	0	5
4. I do not interrupt others when engaged in conversation.	34	72	66	28	0	0
5. I remain on topic during a conversation	33	83	67	17	0	0
6. I know what information to share during conversation.	100	100	0	0	0	0
7. I communicate well with my peers.	66	83	18	14	16	3
8. I am comfortable talking with my friends.	83	97	0	3	17	0
9. I speak differently with adults than I do with my peers.	66	83	34	17	0	0

Table 8.2 presents percentages of teacher evaluation of student.

Table 8.2

Teacher Pre and Post Rating Scores in Percentages

Teacher Rating	Usually		Occasionally		Rarely	
	Pre	Post	Pre	Post	Pre	Post
1. Student changes the way he/she communicate based on the situation.	34	57	66	43	0	0
2. Student is able to start a conversation with a peer.	50	75	34	25	16	0
3. Student watches other people's body language during a conversation.	68	83	16	27	16	0
4. Student does not interrupt others when engaged in conversation.	50	75	34	20	16	5
5. Student remains on topic during a conversation.	0	50	67	30	33	20
6. Student knows what information to share during conversation.	0	40	17	30	83	20
7. Student communicates well with his/her peers.	0	45	66	35	34	20
8. Student is comfortable talking with his/her friends.	16	50	16	40	68	10

Results of student self-rating showed that all post survey scores are larger than the pre. Two out of the nine items in the student self-rating showed a large increase. One is item 4, “I do not interrupt others when engaged in a conversation”. The score was 34% in the pre survey and 72 in the post survey. Another is item is 5, “I remain on topic during a conversation”. Student scored 33 in the pre survey, and increased to 83. The results of the student self-rating show that all students’ self-ratings increased after virtual reality intervention comparing to the pre survey.

Results of teacher rating showed all post survey scores are larger than pre. Three out of the nine items in the teacher rating showed a large increase. One is item 5, “I remain on topic during a conversation”. The score was 0 in the pre survey and 50% in the post survey. Another is item 6, “I know what information to share during a conversation”. Students scored 0 in the pre and 40 in the post. One more is item 7,” I communicate well with my peers”. Students scored 0 in the pre and 45 in the post. Overall the student and teacher responses indicate success. Thus, the study evidenced that the students were able to increase social communication skills through the use of virtual reality.

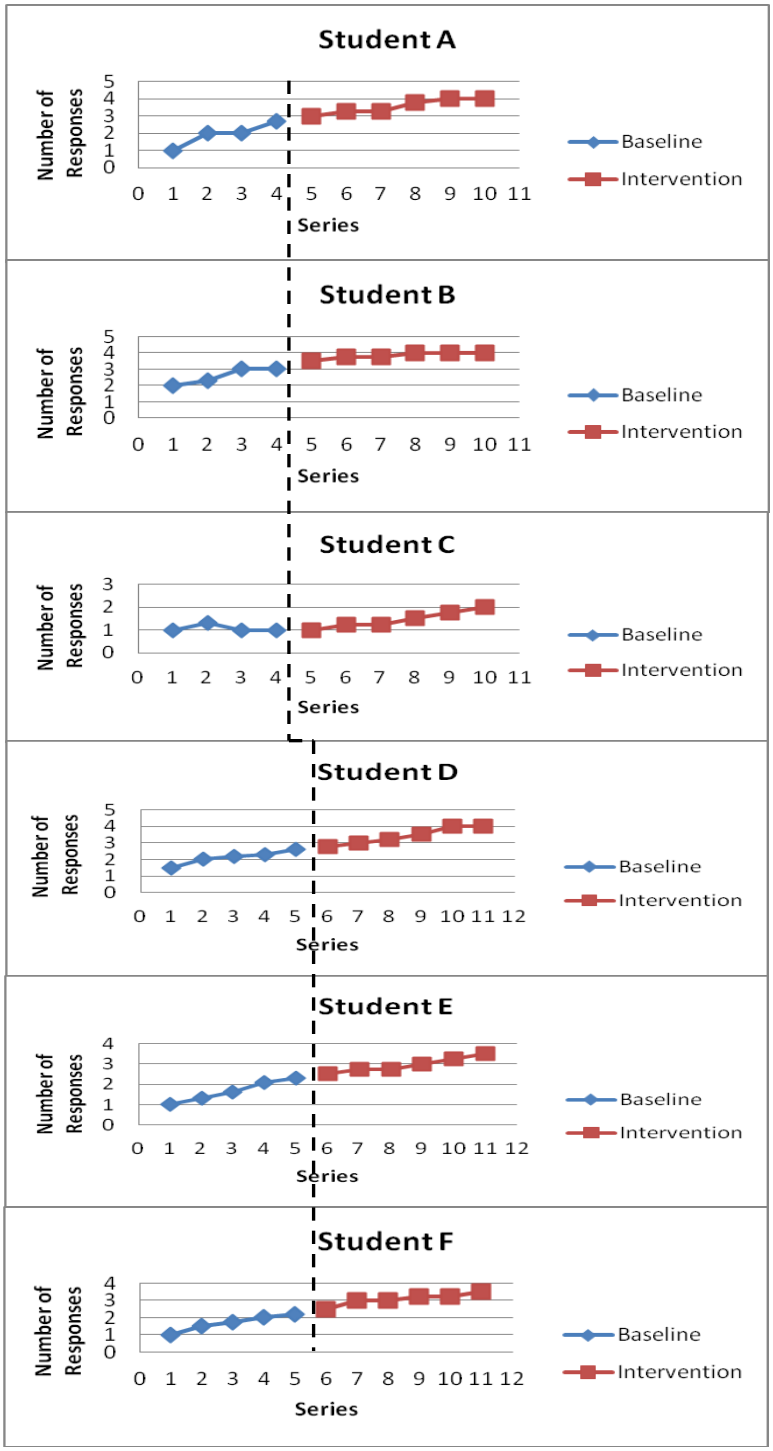

Figure 1 presents student communication skills across phases A and B.

Figure 1

Individual Student Performance across Phase A and B

Chapter 5

Discussion

The purpose of the study was to investigate the effectiveness of virtual reality for teaching social communication skills to middle school students with ASD. The study attempted to evaluate the application of virtual reality to improve these students' conversational skills in social communication with their peers. The six target social skills were evaluated by student conversation scores across phases A and B, and student and teacher self-ratings. The results showed that students increased their social communication skills when they were in virtual reality because social communication scenarios were developed containing an example of appropriate conversations as a model for these students. Thus, their social communication opportunities increased compared to their performance in the baseline.

The first research question asked that if the use of virtual reality would increase social communication skills of middle school students with ASD. The results showed that the use of virtual reality for teaching social skills increased student social communication opportunities. Students practiced in a real world social situation in a virtual world. This allowed the learners to attain long-term effects of social communication opportunities through practice in a non-threatening environment where skills can be practiced and are designed specifically for the individuals. Students with ASD are visual learners, imitating appropriate social behaviors through their practice and view the models in the virtual world that lead to their success.

The second research question asked if the students could generalize their social communication skills into the classroom environment. The results showed that the students gained scores in virtual reality and also demonstrated these skills learned to the classroom. The student and teacher pre and post self- rating scores indicated that students were able to generalize social communication into the classroom. The virtual world allows for applicable simulation of middle school scenarios which increase the potential for generalization into the real world. Thus, using similar conversations from the virtual world in the real world has important implications, namely, that conversations generated in the virtual world contributed to student skill generalization in the real classroom situations.

Limitations

Though all of the students demonstrated positive outcomes, some areas of improvement need to be considered in order for virtual reality to be established as an evidence-based practice. Locating and trying various programs to find out the most effective for teaching social skills to students with ASD is needed. Students with ASD differ in abilities as the same as their typically developing peers; thus, it is complicated to determine if the virtual reality program "Let's Get Social" is more effective than other programs. It would be beneficial to compare this program with other programs that focus on teaching social skills to students with ASD.

The second limitation was consistency of educational environment and instructional delivery due to renovations taking place in the school building. Our classroom changed locations during the intervention. We went from our self-contained classroom to a portion of the faculty dining room. It was difficult to implement the intervention program with teachers having lunch and talking next to our classroom. Students with ASD are typically sensitive to sound and smell

and difficult to adjust the change. There were often loud outbursts, food smells, and laughter that was distracting to the students in this location.

The third limitation was the length of the study, although students made some improvements in social communication, a longer intervention period may need to practice the skills. It would also be useful to examine the use of virtual reality for students of different ages, such as high school students. Further, in addition to the six specific communication skills, other skills as well as behaviors can be taught through virtual reality.

Recommendations

This study used "Let's Get Social**"** as the only program for the social skills training in the virtual world. Further information may be needed using other programs. Given the lifelong social difficulties associated with ASD, more information needs to be explored in terms of social communication skills taught through virtual reality. Future research may extend beyond the intervention phase to determine the long-term benefit of virtual reality to student with disabilities. Also, this study demonstrates the effects of virtual reality on the social development of middle school students with ASD in an inclusion setting. Thus, as the number of students diagnosed with ASD increases, so will the demand for effective strategies that can be implemented in public schools.Further information is needed regarding the use of virtual reality with students on the spectrum as well as typical students, and students with other disabilities.

Students with ASD struggle to develop social relationships; virtual reality provides an opportunity to improve social engagement in school. The findings of this study support pervious research (e.g. Parsons, 2006.) recommending social skills training for students with ASD. Future

research may need to validate the finding and expand to different ages of students with disabilities.

Implications

Students with ASD struggle to develop social relationships with others. Virtual reality provides an opportunity for these students to practice social skills in a comfortable environment. This opportunity should be considered by school personnel and administration in order to provide such an environment for students with disabilities. Teachers need to be trained and exposed to this virtual world to search for resources for their students. Technology should be popularly used in classrooms to support teacher and students in teaching and learning process.

The purpose of virtual reality is to provide students an opportunity to learn appropriate social communication behaviors in certain social situations. It may create another social communication environment for some learners who are not feeling comfortable to face real persons, but like to practice in a situation in a virtual world. Teachers should make every effort to obtain information regarding the social skills training for their students. Intervention strategies (e.g., social stories and video modeling) implemented along with virtual reality may be necessary to increase the opportunities to teach social communication skills. Virtual reality intervention can provide a chance for students to learn appropriate social skills that lead to their success in school.

Conclusion

Using technology in school provides a creative way for teachers' instruction and students' learning. Virtual reality is one example. This study attempted to use virtual reality for teaching social communication skills for students with autism, and created a new avenue for

social skills instruction. I believe that more teachers are interested in using technology in their instruction, more students will benefit.

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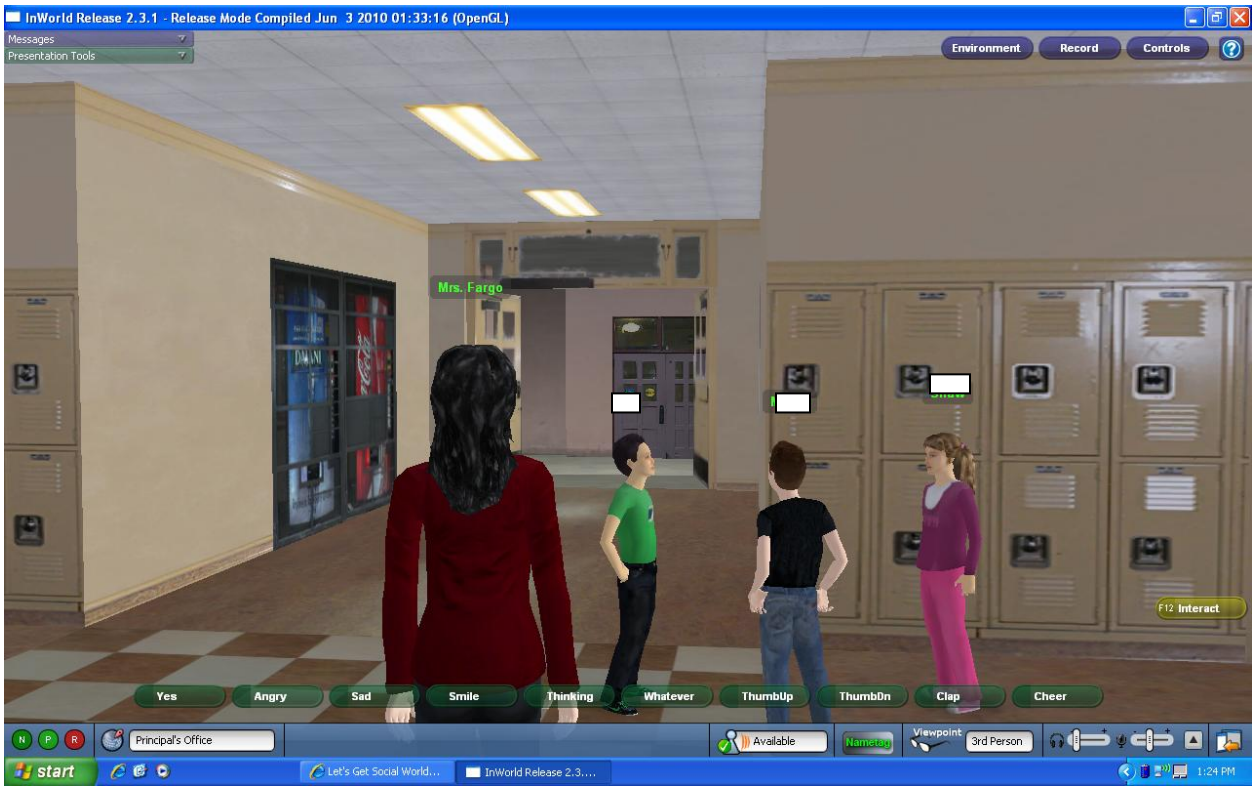
Appendix A- Group A and Group B in Virtual World

Group A



Group B


InWorld Release 2.3.1 - Release Mode Compiled Jun 3 2010 01:33:16 (OpenGL)
Messages
Presentation Tools
Environment
Record
Controls
Mrs. Fargo
F12 Interact
1 Yes
2 Angry
3 Sad
4 Smile
5 Thinking
6 Whatever
7 ThumbUp
8 ThumbDn
9 Clap
0 Cheer
School Lunch Yard
Available
Nametag
Viewpoint
3rd Person
start
Let's Get Social World...
InWorld Release 2.3....
Document1 - Microsof...
1:29 PM

Appendix B. An example of a Lesson Plan

Instructional Time: 20 minutes,

Materials: Lap-top computers, "Let's Get Social "virtual reality program, head-sets and checklist.

Learning Objective: Students will learn the six conversation skills in a conversation using High School Electives: 1) Greeting 2) Comment,3) Follow-up question,4)Follow-up comment ,5) Closing comment and 6) Close the conversation without teachers' prompting.

Instructional Procedures:

1. Teachers will ask students to log on to lap-top computers and enter the virtual world "Let's Get Social". Students will put on head sets and transport to the designated area: lunch room.
2. Teachers will introduce the conversation concepts by role playing a sample conversation in the virtual world.

Teacher One: Greeting- Hi, What's up.?

Comment- Can't believe we are going to high school next year.

Student A: Follow-up question. Are you going to High School East or High School West next year?

Teacher One: I am going to East next year because that is where my sister goes.

Student A: I did not know you have a sister. What grade is she in?

Teacher One: She is a senior. So sorry, I have to run. I am late for class. Talk to you later.

Student A: Ok , see you later.

Teacher One: Bye.

Student A: Bye

3. Teacher will open a discussion regarding how the conversation went. She will explain the specific parts of the conversation and ask the students for examples. Students will then practice conversation skills in the virtual world.

4. Two groups of three students are grouped together to have a conversation about what electives they are planning on taking next year using the six conversation skills the teacher introduced. All students will take turns speaking in the conversation and their conversations will be scored by the teacher.

An example of a student's closing comment could be: "Since we are taking the same elective, I hope we are in the same class. Oh, it is getting late, Got to go.".

5. Teacher will observe and collect individual data on student conversation.