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Using Virtual Reality Devices with Autistic Students in High School to Teach Social Communication Skills

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Using Virtual Reality Devices with Autistic Students in High School to Teach Social Communication Skills

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CHAPTER ONE

Making friends and keeping friends are important skills for high school students to learn. When there are issues with communication, it can affect a students' ability to socialize, which in turn, can affect their ability to make and keep friends. When working with students with Autistic Spectrum Disorder (ASD), you often see that they have challenges socially. The behaviors they exhibit, and their verbal or nonverbal communication skills can cause them to have deficits in all areas of social interaction (Jeffs, 2009). Building socialization and communication skills both in school and in their daily lives can allow students to build relationships.

General Problem/Issue

Examples of deficits students with ASD may have are a lack in social skills, such as, communication skills. These students do not develop social skills like developing peers. Their use of repetitive language, hand flapping, or repetitive behaviors in daily activities can create barriers for socialization. Being able to communicate effectively is an important part of school life, especially in high school.

Many instructional strategies have been studied and utilized to determine which provides the best fit for ASD students. It is important that the use of instructional approaches and strategies are part of treatment. Strategies such as video modeling, social stories, and peer mentoring have been used and are part of a promising practice (Ogilvie, 2011). In recent years, the idea of using virtual reality has been making an entrance into the world of education. This study involves the use of virtual reality for the instruction of social communication skills with ASD students in high school. The goal is to use the virtual

environment as an instructional tool to practice social skills. The result of this study will add information to existing research on social skills instruction.

Virtual reality is not a new technology or a new idea in education for that matter. John Woodward, the author of a study done in 1992 stated "The use of virtual reality systems for special education would seem to be limitless" (p. 8). More recent studies have shown that when using virtual reality, it can provide a "supportive environment" (Jeffs, 2009, p. 253) for those with special needs.

In my years of experience, I have learned that each ASD student has their own specific communication needs. Communication cues that work for one students may not work for all. It is hard to find a communication system that works for all ASD students in my classroom. After researching different instructional methods for communication, I determined that using virtual reality is an effective instructional strategy. I plan to research the effects of using virtual reality on the social skills of ASD students. By using the virtual reality technology, I hope to see an increase in social skills by monitoring the frequency of the students' initiation, responses to questions, comments, maintaining conversation, and closing conversation.

Subjects and Setting

Participants in this study were selected from the population of students at a public high school in Thief River Falls, Minnesota. There are approximately 570 students in grades 9-12th attending the school. Students range between the ages of 14 to 21 years. They start at the high school in 9th grade, and can continue past 12th grade, until the school year in which they turn 21 years old. There are eleven students who participate in the high school's resource classroom. Of those eleven, there are two diagnosed with severe autism spectrum disorders and who are in the moderate/severe category of disabilities.

This study focused on two students who participated in the high school's resource classroom. These students are in the resource room at least 45 minutes daily to learn and practice social communication skills.

Participants. There were two high school students that participated in the study. One student was a junior and one was a sophomore, both being males. The boys' ages were 15 and 17. According to the Gilliam Autism Rating Scale (GARS) and the Autism Spectrum Rating Scales (ASRS), both of these students have moderate to severe delays with critical thinking skills as well as social language skills. They also have delays in their ability to develop conversational skills, with their peers and to interact with others. Thus, they attend a class to learn social communication skills.

Table 1

General Information of Participating Students

Student	Age	Gender	IQ*	GARS-II*	ASRS*
S1	17	M	89	102	76
S2	15	M	77	96	73

*IQ=Leiter-R

*GARS=2016

*ASRS=2016

Selection criteria. Prior to the beginning of the school year, special education students are grouped by their disability level and/or grade level. Those students with the most severe needs such as those labeled Moderate/Severe DCD or severe autism are placed under one case

manager and resource room. Two ASD students out of this group participated in the study. The group of selected students received social skills instruction using a simulated learning environment, and checklists were used to collect data prior to and after the instruction.

Description of setting. This study took place in a high school in a rural Northwestern Minnesota town with a population of about 8,000. In the school district, 27.3% of students receive free and reduced lunches, 1.6% are English learners, 16.3% qualify for special education services, and 0.3% are homeless. Within the district population, 87.4% are Caucasian students, 1.5% are Black/African American students, 6% are Hispanic/Latino students, .8% are Asian students, 1.5% are American Indian/Alaska Native students, 0% are Native Hawaiian/Pacific Islander students, and 2.8% report two or more races (Minnesota Report Card, 2017).

Informed consent. Permission was obtained from the Institutional Review Board (IRB) at Minnesota State University Moorhead and from the school district in which the study took place. The school district's IRB procedure was followed to obtain permission to conduct research.

Permission was obtained from all parents/guardians of the students involved in the study. There was a written form, outlining the exact procedures, along with any risks or benefits. Confidentiality was maintained throughout any written reports, data sheets, and verbal information. All students involved were protected at all times during the study. Parents/guardians were able to withdraw their consent at any point; they were aware of this through verbal and written notification.

Review of Literature

Research topic. Teachers in the high school DCD setting often spend a lot of time working with ASD students and teaching them in the areas where they have deficits. One of the

biggest areas that seems to be a common skill deficit is in the area of social skills. There are many instructional interventions available that can be used, however, teachers are often looking for a social skills program that is general enough to be work for each ASD student's needs. For the purposes of this study, the focus will be on the use of virtual reality devices (virtual reality head mounted display, virtual immersive environment) with autistic students in high school to teach social communication skills.

Definition of Terms

For the purpose of this study, the following terms are defined:

Autism Spectrum Disorder-A broad continuum of cognitive and neurobehavioral conditions that typically include impairments in socialization and communication coupled with repetitive patterns of behavior (Salend, 2011).

Peer based strategies-A type of cooperative learning arrangement where one student assists another in learning a new skill (Salend, 2011).

Virtual reality-A technology-based application that allows individuals to experience what it feels like to see, touch, smell, and move through artificial, three-dimensional, interactive environments that present computer-generated images and accompanying text depicting real or imaginary environments (Salend, 2011).

Social stories-Short, straightforward description of a social situation that gives the student accurate information about the situation, including (a) what to expect from the situation, (b) what may be expected of the student, and (c) how the student can respond to the situation in the socially appropriate way (Pankaskie & Chandler, 2010).

Video modeling-An instructional method that utilizes video footage of a model engaging in a target behavior in order to teach a new behavior or promote the occurrence of a new behavior (Clinton, 2016).

Instructional Strategies

There have been many studies done showing the effects of various different instructional strategies when working with students with autism. There are three common interventions that have been used to teach the social skills that ASD students may lack. These three are the most well-known interventions, and they include video modeling, social stories, and peer modeling. A more recent addition to the intervention tool box is virtual reality.

Instructional Strategies-Video Modeling. Video modeling consists of students watching videos that show positive examples of people engaging in the behavior that is attempting to be taught. One study stated that video modeling was a promising intervention for improving social skills. There are many advantages to using video modeling, including the modeling of targeted skills (Clinton, 2016). This study was done to review other existing literature on video modeling and its use in social skills training. Results from the studies reviewed showed that when using video modeling, moderate to strong effects were seen in over half the studies (Clinton, 2016).

Delano (2007), examined various studies that used video modeling as interventions. The research paper reviewed studies that used two different methods of video modeling. One type used other people as video models (adults or peers), and the second type used video self-modeling. There were also some comparison studies reviewed as well. Nineteen studies were identified and used for review and inclusion in this study.

Delano (2007) tells us that after reviewing the nineteen studies, the overall data suggests that video modeling interventions created positive gains in not only social-communicative skills but also functional skills, perspective-taking skills, and problem behavior. There were a few mixed results in several of the studies, however, overall results showed that video modeling can facilitate rapid skills acquisition, maintenance, and generalization across settings, people, and materials (Delano, 2007).

Another study done by Parsons (2006) used videotaped role-play with ASD students at the secondary level. There were eight ASD participants ranging in age from 14 to 21. These students participated in an after-school program, where they participated in a social skills class, physical education, game time, and computer time. Arguments that occurred or conflicts that arose during the physical education, game time, or computer time were used to teach those social skills during role-play. Parent, peer, and student surveys were used to collect data.

Parent surveys gave information on students' behaviors at home, which included self-isolation, attitudes toward socialization, anxiety over change, conversation skills, and attitudes toward the social skills class. Peer surveys gathered information regarding classmate evaluations and if students were learning from the actions of others. Finally, the self-reflective survey had ASD students examine themselves and provide information about their attitudes and their feelings.

The study was done in three phases: Phase 1) Student Descriptions, Phase 2) Job Interview Practice, and Phase 3) Student Interviews. During the first phase, each student's needs were evaluated and addressed using video role-play. During the second phase, students practiced job interview skills, which included requesting a job application, selecting a job, and

going through a mock interview. During the third phase, students were interviewed by teachers on autism. There were many observed positive changes seen as a result of the videotaped role-plays. Some of the changes in behavior that were seen were fewer conflicts during game time, students holding the doors for others after they had passed through, and students apologizing when making negative comments to others. Results indicated many positive strides that were made on social skills through the use of video modeling.

Instructional Strategies-Social Stories. The use of social stories can be done in classrooms to describe a social situation or social events. It uses social cues and defines the responses that are appropriate for the social situation (Gray & Garand, 1993). A social story is usually made up of different kinds of sentences, either descriptive, directive, or perspective and each has a purpose (Gray & Garand, 1993). They should be written from the perspective of the student and also written at the comprehension level of the student so vocabulary is at their ability level (Gray & Garand, 1993). And social stories are most effective when written for specific students and with specific situations in mind (Pankaskie & Chandler, 2012).

A study done in 2006 used social stories with three elementary students with a goal of increasing verbal initiations (Delano & Snell). The three students were given informal assessments prior to the study to determine their preferred activities and their academic comprehension and social skills. The students were also observed during classroom activities and play activities. Each student's reading comprehension level was evaluated to identify the appropriate level for presenting social stories. Then based on their reading level, two participants were given the picture symbol story and the third was given text + read aloud.

Generalization probes were used to assess the student's ability to transfer skills they learned to a general education classroom. Results showed that all participants had made

improvements in the resource setting. After the interventions, social engagement also increased during play sessions, showing a higher rate of target social skills. Probes showed that only two students generalized their social behaviors to the general education classroom. The findings suggest that using social stories can be an effective intervention for increasing social engagement.

Instructional Strategies-Peer Based Strategies. A third area of intervention that may be used are peer based strategies, which can include peer mentoring, buddy systems, and partner systems (Salend, 2012). This involves the increasing of social and/or academic interactions between students with and without disabilities. It can be done in many different ways and in combination with other instructional strategies. Pankaskie and Chandler tell us that "peer support has been used successfully to assist students with autism develop social skills" (p. 306).

A study done in England showed that peer mentoring has led to enhanced social and communication skills (Bradley, 2016). To be included in the study, the participants needed to have a diagnosis of autism made by a psychiatrist or pediatrician and be attending a mainstream secondary school. A total of 48 students participated in the study with twelve students diagnosed with autism and 36 students without autism. All students ranged in age from 11-12, with 16 of the students being female (four with a diagnosis of autism) and 20 of the students being male (eight with a diagnosis of autism). Students came from five different secondary schools that were located in the south-east of England.

Students were divided into peer mentoring groups, each of which had four students from the same class and one student with autism. Mentors were given an induction session to learn their roles, learn about confidentiality, learn when to withdraw from mentoring, and the

focus of the program. The students established the focus and content of the sessions with the help of the coordinator. Issues such as friendships, work skills, bullying, interests, and behavior were discussed. Students individually completed a self-report questionnaire both prior to and after their involvement in the peer mentoring program.

The study was designed to investigate a new peer mentoring program and see what impact it would have on students with autism who attended mainstream secondary schools. Results of the study show several key points. First, results showed a positive impact on self-esteem levels, decreases in bullying, and increases in social satisfaction for the students with autism. Second, the peer mentors also had a positive impact on student's social life and the feeling of being included. Third, there was an increase in the fact that students saw their peers as being a source of support. And fourth, being a peer mentor increased the likelihood that students with autism recognized that they could be a source of support for their peers.

This research study established that the peer mentoring program can be a way to enable both cooperation and social support in a school setting. Their approach of creating an equitable and inclusive environment for every student led to more understanding and acceptance between students with autism and students without autism.

Combining Instructional Strategies. All of these strategies have proven to be very effective for educators. The reduction of inappropriate behavior, the acquisition of skills and/or the increase of appropriate social interactions have been the goals for many of the studies using social stories. An early study was done by Thiemann and Goldstein (2001) which studied and evaluated the effect of using written text in the form of social stories and picture cues along with video feedback on the social skills of five students with autism. Two of the student's peers were also included and grouped with the autistic students. A multiple-

baseline design across two or three skills was used. The study used the targeted skills of securing attention, initiating comments, initiating responses and making contingent responses. After starting the intervention, the students showed improved rates of appropriate social behavior. The study also stated that two students also showed increases in initiation for requests and responses in the general education classroom. The study stated that there were some generalized results within the classroom. Results were shown when using a combination of visual cues but did not clarify the effects of using the social stories alone.

An article by Christine Ogilvie (2011) discussed the idea of using video models and peer mentors in social skills instruction. Again, the idea of combining the methods was addressed and the article stated that when using video modeling with peer mentoring, one can provide a "greater impact" (Oglivie, 2011). This article addressed different types of video modeling including video prompting, in-vivo modeling, video modeling and video self-modeling. It also listed the ten steps to video modeling. A key first step for teachers to create effective videos is making sure that the behavior that is being introduced or modified is identified. The next step would then be to find out where the student's skill level is for that behavior. The third step would be to choose student peers who can help in creating the video models. Then the task of creating the video is next. Once the video model is created, it is time to start the intervention. This is another time where peer mentors can be used. Together the students can review the video model and practice the skill. This combination can be a very effective tool to use with ASD students. Ogilvie did, however, state that "the more frequently students watch the video and practice the skills with their peer mentors, the more likely they will be to learn, maintain, and generalize the skills (2011, p. 26)."

Virtual Reality (VR)

As technology has increased and changed, so have the options for educators when dealing with instructional strategies. One method is the use of virtual reality. The Merriam-Webster's online dictionary defines virtual reality as an artificial environment which is experienced through sensory stimuli (such as sights and sounds) provided by a computer and in which one's actions partially determine what happens in the environment. In this computer-generated environment, the user can be exposed to many situations in a real-world environment.

There have been many studies done regarding the use of virtual reality since its creation. One of the earliest studies was done to identify new trends in technology and also identify the potential these technological finds may have. This study done by John Woodward (1996) stated that while the use of virtual reality is "seductive", the reality is that the success of virtual reality in learning depends on many factors, most importantly that the systems used are based in instruction methods that are supported (Woodward, 1996). Another study done in 1996 used virtual reality with ASD students as a tool for learning. This study was done to test the tolerance of the VR equipment and also to see how ASD students would respond to the computer-generated environments (Strickland, Marcus, Mesibov, & Hogan, 1996). The study involved two students and the goal was to have the students accept and wear the helmets, which would help them identify safety signs in the virtual reality environment. The goal was for this skill to generalize into the real world so that these students would be able to recognize real world safety signs. The introduction of this technology showed that virtual reality can lead to success as a teaching tool.

A newer study done by Parsons, Mitchell, & Leonard in 2004 sought to determine whether ASD students, using virtual reality as a representation of reality, could generalize skills of social appropriateness to their environment. There were 36 participants in this study, 12 of which had a diagnosis of ASD. All participants demonstrated a full-scale IQ of 70 or greater with the exception of one who's full-scale IQ was 66. The 12 ASD participants were between the ages of 13 to 18 and were considered high functioning. Each ASD participant was grouped with two other participants and matched by age, gender, verbal IQ (VIQ) and performance IQ (PIQ).

The participants were given training virtual environments to begin with to make sure that the students were comfortable with navigating and using the VR equipment. Once they completed four training trials, the Virtual Café environment was used to work on daily skills. This environment was more complex than the training environment with a more realistic look. Participants were given a checklist of tasks to perform while in the Virtual Café. Minimal prompting was given to students and when participants ask about upcoming tasks, they were directed back to the checklist that was provided. Some results from the study: for each task given in the Virtual Café, the ASD group scored lowest (except for the card shift test) and the PIQ group scored the highest. In general, the PIQ groups scored higher on tasks that either the ASD group and the VIQ group. Overall, the PIQ group seemed to be quickest in the areas of completing trials and navigation while the VIQ group had an uneven profile and the ASD group seemed to show improvements across the trials. One finding that was discussed was that ASD participants in this study, with lower IQ's, were more likely to err on tasks involving social judgement, which may suggest there is a link between social understanding and IQ.

Studies have also been done to test the acceptance and willingness of participants with ASD to use VR equipment. A study was done in 2016 with 29 participants, all of which had a previous diagnosis of ASD and IQ's ranging from 45 to 138. The purpose of the study was to investigate the willingness and acceptance of people with ASD to use VR head mounted displays. It also explored the sense of presence and the immersion of ASD participants (Newbutt et al., 2016). Of the participants of this study, the mean age was 32.02 and the majority of them were males.

A basic questionnaire about demographics was administered first as well as the Wechsler Abbreviated Scale of Intelligence (WASI). Once these were completed, subjects participated in Phase 1 experimental session where they used a head-mounted display (HMD) virtual reality technology (VRT). During Phase 1, participants were to navigate three simple VR scenarios, for approximately 10 minutes. Participants were asked after Phase 1 if they would like to return for the second phase and of the 29 participants, 23 chose to return. From those 23, eleven were chosen to participate in the next session, Phase II, which consisted of two longer VR experiences (about 25 minutes) which were more intense. After Phase II was completed, another questionnaire was given to participants about the immersion experience.

Here are some of the results from this study. During both phases, all participants were willing and able to wear the HDM. From the WASI, the participants were divided into two groups (IQ's less than or equal to 69, IQ's greater than or equal to 70). Results showed that IQ did not affect the acceptance of wearing and using the HDM. This study revealed, from the questionnaires given and observations, that ASD participants accepted the HMD and were willing to complete the VR experiences. These findings were important because they provided initial evidence that for this group of ASD participants, there was minimal negative effects

from wearing a HMD. These results help to shed light on how people with ASD react to and accept the use of HDM.

Summary. All of the literature that was reviewed and discussed points to a conclusion. This conclusion is that social skills intervention is needed for ASD students and while there are many different methods that have been used, there are very few that have incorporated the use of virtual reality.

Many of the studies showed a greater positive impact on students when using methods in unison with each other verses independently. And programs that incorporate virtual reality allow instruction to be done in a safe controlled environment where students are able to practice the skills they have learned. These studies have shown that virtual reality can be an effective method for teaching social skills to students with ASD.

Hypothesis Statement

Students with Autism Spectrum Disorder who are instructed using virtual reality will show a significant change from pre-test to post-test scores in social communication skills.

CHAPTER TWO

Research Questions

Teachers in the high school DCD setting often spend a lot of time working with ASD students and teaching them in areas where they have deficits. One of the biggest areas that seems to be a common skill deficit is in the area of social skills. And while there are many instructional interventions available that can be used, teachers are often looking for a social skills program that is general enough to be work for each ASD student's need. Here are two questions that I formulated regarding a less common intervention method.

1. Will high school students with ASD improve their social conversation skills through the use of virtual reality?
2. Will the high school students with ASD generalize the social skills learned in the virtual world into the classroom with their peers?

Research Methods

The social communication skill levels of the ASD students were reviewed using the student's current IEP data with a review of assessments used to determine what level of delays they possess. Due to the delays in critical thinking skills, and their ability to develop conversational skills, each ASD student in this study attends a class to learn social communication skills. Through the review of various studies, it is shown that virtual reality is an effective social skills intervention method.

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. Then during Phase B, instruction was provided 3 days a week for 4 weeks. After instruction, student interaction and performance were observed and recorded by the teacher using observation checklists.

Measurement Materials. This study involved the use of virtual reality for social skills instruction on the conversation skills of high school students with ASD. The goal was to use the virtual reality world to demonstrate appropriate social conversation skills. Therefore, data collection tools were specifically designed, and observable data was used.

Observation checklists were used during the study to collect data, recording student performance prior to and after the instruction. Prior to the first lesson, informal conversation skills were observed and recorded for 5 consecutive days using the Classroom Conversation Skills Checklist. This first checklist was used prior to instruction in the virtual world. It recorded student performance on greeting, conversation and closing. Each category included: 1) verbal greeting: including eye contact, personal space, and volume; 2) conversation: including asking a question, making comment on the topic, and asking a follow-up question; and 3) verbal closing: closing comment to end the conversation, saying "good-bye". The prompting hierarchy was rated as follows: No Response, 1 point; Direct verbal prompt, 2 points; Indirect verbal prompt, 3 points; No Prompts (independent), 4 points. Table 2 presents the checklist.

Figure 1

Classroom Conversation Skills Checklist

Student	Day 1	Day 2	Day 3	Day 4	Day 5	Total/Mean
Greeting						
Asking a question						
Making a Comment						

Asking a follow-up question						
Closing comment						
Closing						

Once the lessons in the virtual world were completed, informal conversation skills were observed and recorded for 5 consecutive days using the Conversation Skills Checklist after the Virtual World. This second checklist was used to evaluate the independent skills that students showed in social situations after being in the virtual world. The skills evaluated included: 1) greeting; 2) asking a question; 3) making a comment; 4) asking a follow-up question, 5) closing comment, and 6) closing. These tools were valid because the content being measured were the specific variables listed for the research. Same prioritizing points (1-4) were recorded, (See Figure 1).

Figure 2

Conversation Skills Checklist after the Virtual World

Student	Day 1	Day 2	Day 3	Day 4	Day 5	Total/Mean
Greeting						
Asking a question						
Making a Comment						
Asking a follow-up question						

Closing comment						
Closing						

In addition, a teacher checklist was also used to record data during the student's day in a class other than the student's social skills class. The teacher checklist was presented to general education teachers to record information about the student's social functioning in the general education classroom. The teacher checklists were completed prior to and after entering the virtual world.

Figure 3

Teacher's Checklist

Student Name: Rarely Occasionally Usually

1. Student is able to start conversation with a peer.
2. Student remains on-topic during a conversation.
3. Student does not interrupt others in conversation.
4. Student knows what information to share.
5. Student communicates well with peers.
6. Student is comfortable talking with friends.

Schedule. This research study was administered over a 4-week time period. Prior to the start of the study, the high school ASD students were taught how to navigate the virtual world for 20 minutes, twice a week for two weeks. Students were then taught appropriate social communication skills in lessons. Each lesson was delivered in class followed by a discussion on

the specific social situations. Then, the ASD students applied what they had learned in the virtual world. Teachers monitored the students' social interactions after being in the virtual world to record performance using a checklist.

Ethical Issues. An ethical issue anticipated was the possible stress on the ASD students' due to changes in their routine and the incorporation of the virtual reality devices. Many students in the classroom rely on their daily routines to be the same. Adding a new stimulus could have added undue stress onto the student. Another possible ethical issue could be the long-term effects of using virtual reality. There is limited research on the effects of students using virtual reality, especially ASD students. Exposure to the virtual reality environment should be limited in time.

Anticipated response. When any of the previously stated ethical issues transpired, they were dealt with on an individual basis. The use of social stories worked with the ASD students to help them anticipate the change to their routine and the addition of the use of virtual reality devices. The shorter lesson times helped shorten exposure time to the virtual reality device and environment, which was done as well to assist the ASD student with their anxiety. Parents were assured that confidentiality was to be maintained throughout the study and in any reports generated.

CHAPTER THREE

Description of Data

The results from the study are presented in Chapter 3. A visual graph is used to compare each students' performance in Phase A and Phase B. Also, a visual graph is used for each student to compare their Phase A against their Phase B. The effectiveness of this study was assessed on the social communication skills of each student by measuring their verbal communications.

Results. Each student's performance was evaluated using the observation checklist to record their six social communication skills: greeting, asking a question, making a comment, asking a follow up question, closing comment, and closing conversation.

Figure 4.1 presents the means of student conversation skills across the baseline, prior to instruction in virtual reality.

Figure 4.1 Means of Student Conversation Scores across Phase A

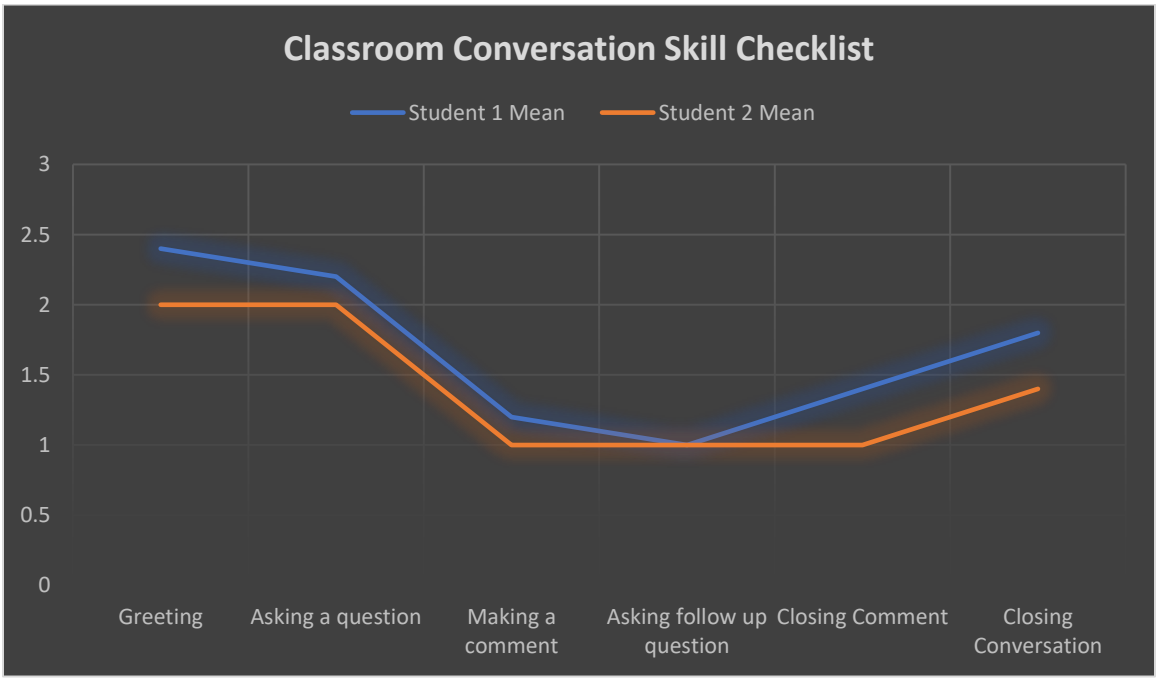


Figure 4.2 presents the means of student conversation skills after intervention, after instruction in virtual reality.

Figure 4.2 Means of Student Conversation Scores across Phase B

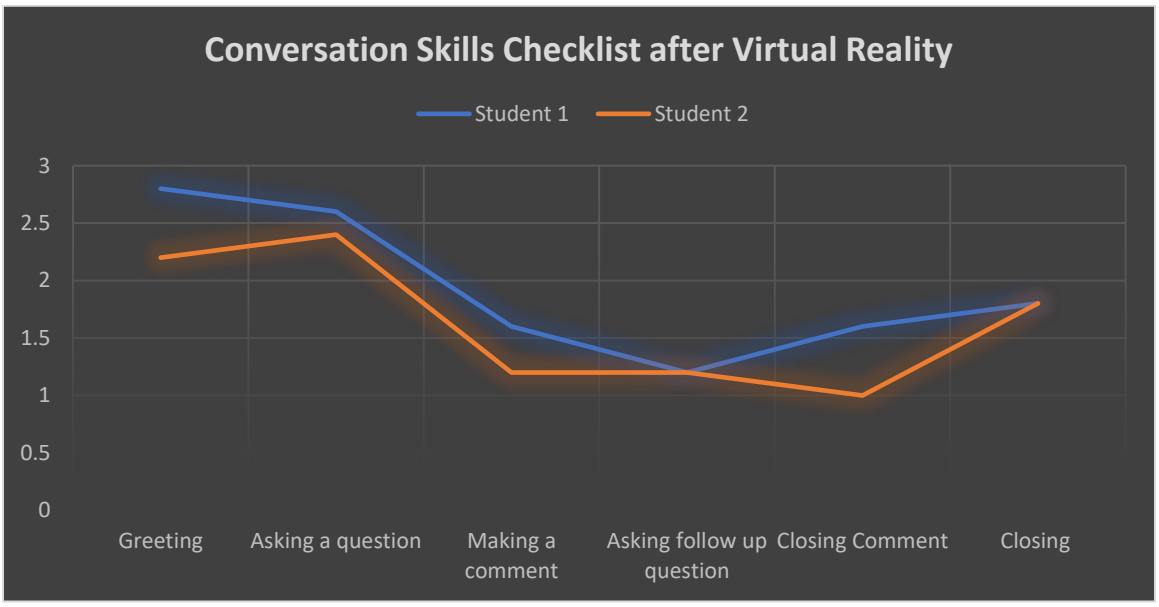


Figure 5.1 presents the means of conversation skills for Student A across the baseline and intervention.

Figure 5.1 Means of Student A Conversation Scores across Phase A and B

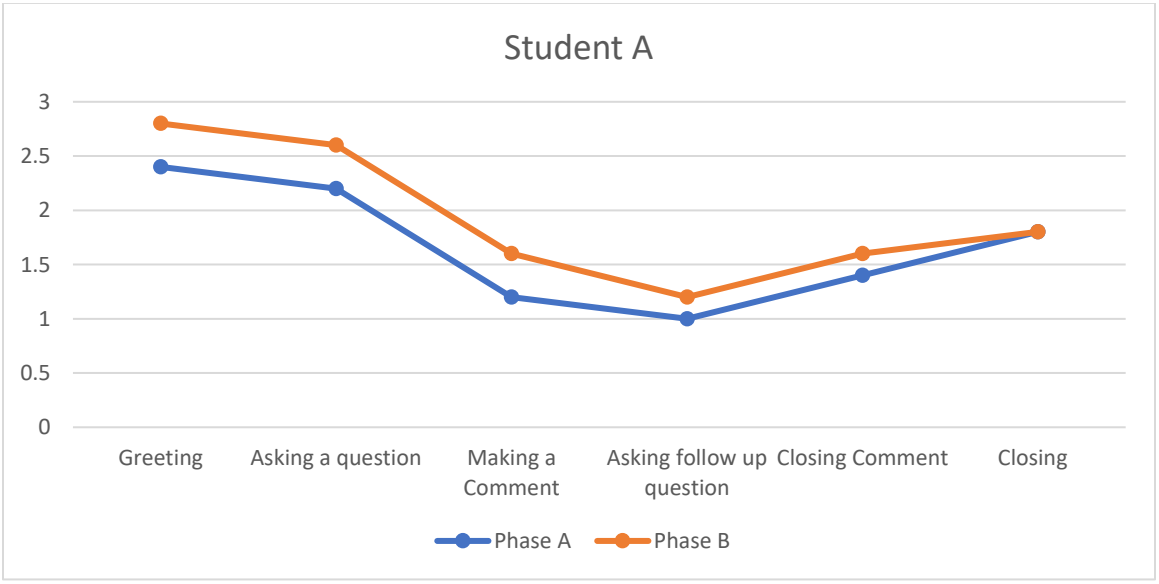
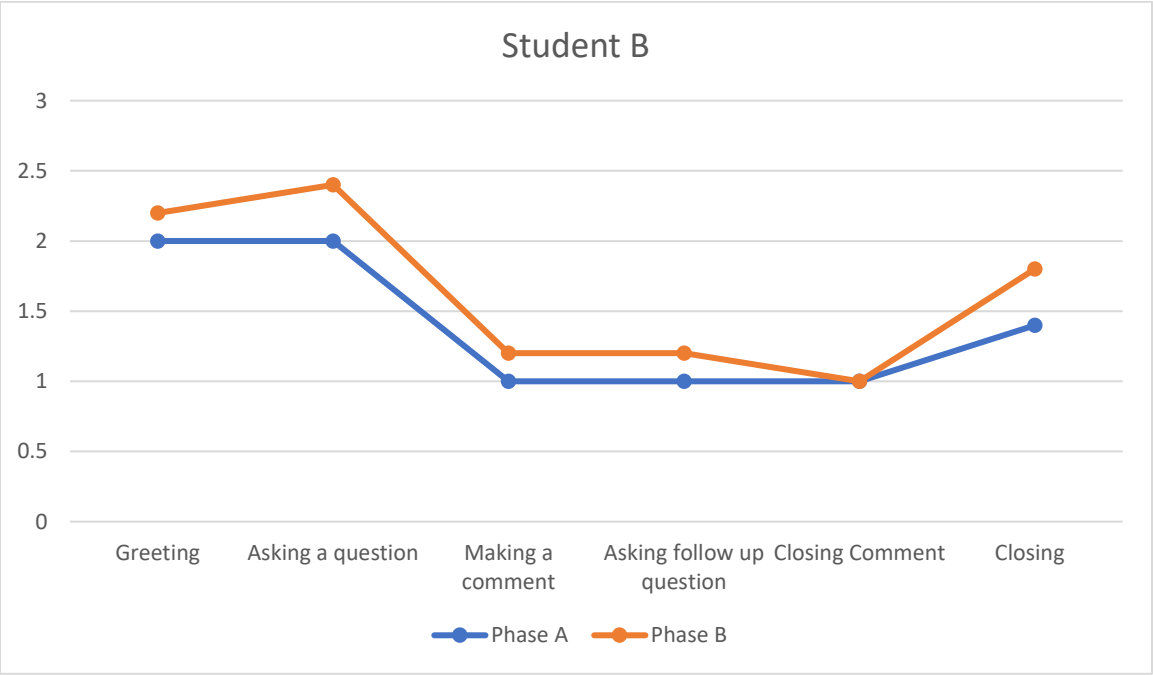


Figure 5.2 presents the means of conversation skills for Student B across the baseline and intervention.

Figure 5.2 Means of Student B Conversation Scores across Phase A and B



Student A was observed to increase in five of the six skills after the intervention; the largest increases were in Greeting (2.4 to 2.8), Asking a question (2.2 to 2.6), and Making a comment (1.2 to 1.6). Student B increased in five of the six skills too; the largest increases were in Asking a question (2 to 2.4) and Closing (1.4 to 1.8).

Table 2 presents percentages of teacher evaluation of student.

Table 2 Teacher Pre-and Post-Rating Scores in Percentages

Teacher Rating	Rarely		Occasionally		Usually	
	Pre	Post	Pre	Post	Pre	Post
1. Student is able to start a conversation with a peer.	75	65	25	35	0	0

2. Student does not interrupt others when engaged in conversation.	0	15	65	55	35	30
3. Student remains on topic during a conversation.	72	64	28	36	0	0
4. Student knows what information to share during conversation.	82	67	18	33	0	0
5. Student communicates well with his/her peers.	44	30	56	60	0	10
6. Student is comfortable talking with his/her friends.	80	71	20	29	0	0

Results of teacher rating showed some improvement with post survey scores being larger than pre. An example of increase was item 5, “Student communicates well with his/her peers.”. The score was 0 in the pre-survey and 10% in the post survey. Another example is item 2, “Student does not interrupt others when engaged in conversation”. Students scored 0 in the pre-and 15% in the post. Overall, most of the teacher responses indicate small successes. Thus, the study evidenced that the students were able to increase social communication skills through the use of virtual reality.

Instructional Materials

The Conversation Train and Speech Everyday Social Skills program. This book and video/worksheet program (www.everydayspeech.com) was used in Lessons 1 through 6, which were done prior to entering the virtual reality phase. The Conversation Train book created a visual approach for students to learn some of the basics of conversation by relating these steps to a train. Trains were used as metaphors for the elements of conversation. The book gave six areas of conversation skills to teach and to review which included: (1) starting a conversation; (2)

taking turns in conversation; (3) staying on track; (4) changing topics; (5) ending the conversation; and (6) putting it all together (Shaul, 2014).

Speech Everyday Social Skills program. This is social skills material using social skills videos, apps, and worksheets, which features middle and high school-aged children. This curriculum uses video modeling to demonstrate conversation skills like how to start a conversation by introducing yourself, listening with your body, making connected comments, and seeing someone else's side. The series uses demonstration of skills in different environments to help with generalization of skills.

Q Moment AR and Merge Cube. This is the virtual reality program and device used to practice social pragmatic skills. The Q Moment AR app is an Augmented Reality (AR) tool that is used to increase the emotional responsiveness in children with autism. The Merge Cube is a holographic toy. This allows a student to interact with 3D objects and not only uses virtual reality technology but also augmented reality (AR) technology. To activate the Q Moment app, the student needs the Merge Cube. The Merge Cube can be used with VR goggles and a smartphone or without VR goggles with the use of a smartphone or tablet. Learners see animated characters that help them navigate the virtual world, while figuring out social situations. In the social module, students view various roleplay situations and scenarios. Students and teachers are able to discuss and talk through to determine what the situation is about and what action should happen.

Instructional Procedures. Prior to participating in this study, students were taught how to place the virtual reality devices on their heads and how to work with the Merge Cube to be able to see the virtual characters. The students were exposed to the Merge Cube using various

free game apps and the VR device. Students were exposed to the virtual world using the Merge Cube for 15 minutes, three times 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 using videos and worksheets, which was followed by a brief discussion on the specific social scenarios they saw and then they participated in some role play. Then, students applied their social communication skills when participating in a virtual environment.

The topic of the first lesson was the conversation train. This lesson included: the teacher reading the Conversation Train book, followed by discussion and class activities on the areas of conversation skills to which included: (1) starting a conversation; (2) taking turns in conversation; (3) staying on track; (4) changing topics; (5) ending the conversation; and (6) putting it all together. Lessons 2 through 6 followed the video/worksheet program from Everyday Speech. In these lessons, the students watched a video demonstrating a group of students with appropriate and inappropriate conversations. These videos segments allowed students to view appropriate communication scenarios and showed them topics like introducing themselves, listening with their bodies, approaching a group, making eye contact, making connected comments, and seeing someone else's side. After the video presentation, the teacher led a class discussion to further clarify the skills by questions and answers. A worksheet was also used to expand knowledge and practice the skills. This was followed by applying the skills learned in the virtual world. Table 3 presents the lessons, topics, and procedures. Teachers monitored the students while in the virtual world and then recorded individual student's performance after practice in the virtual world using the checklist presented in Figure 2.

Table 3

Lessons/Procedures

Lesson	Procedure
1. Conversation Train	1. Conversation skills practice
Steps to conversations	a. Role play
2. Everyday Speech.	a) View video Approaching a Group.
When to start a conversation.	b) Role play starting a conversation in the virtual world.
3. Everyday Speech.	a) View video Introducing Yourself.
How to start a conversation.	b) Role play how to start a conversation in the virtual world
4. Everyday Speech.	a) View video Making Eye Contact.
Making eye contact/body language.	b) Role play taking turns in a conversation in the virtual world
5. Everyday Speech.	a) View video Making Connected Comments.
How to maintain a conversation.	b) Role play maintaining a conversation in the virtual world.
6. Everyday Speech.	a) View video Seeing Someone Else's Side.
How to end a conversation.	b) Role play how to end a conversation in the virtual world.

Measurement Procedures. The observation checklists and teacher checklists were used both at the beginning and the end of the study. *The Classroom Conversation Skills Checklist*. Prior to the start of the study and the first lesson, the students were observed on five consecutive days while their conversation skills were observed and recorded using the Classroom Conversation Skills Checklist by the teacher. These were used to assess the students' social conversation abilities in the classroom. The students were observed in a Communications class

with their peers to identify their social communication skills. They were observed during classroom activities when they were in group work with peers.

Conversation Skills Checklist after the Virtual World. Each student's face to face communication skills were recorded in class after going through all sessions in the virtual world. The students' ability to ask a question, make a comment, stay on topic, ask a follow-up question and respond to questions was recorded. Observations after the virtual world provided information on student responses to different social scenarios, such as greeting a person, introducing a topic, commenting on topics, asking questions, making appropriate sentences for high school, and closing a conversation.

Teacher's Checklist. The teacher checklist was used to record a students' social communication skills such as; ability to start conversation, not interrupting, remaining on topic, and forms of communication. The students' social communication skills were assessed in an academic setting using the checklist prior to virtual instruction and also after virtual instruction.

Research Questions

Will high school students with ASD improve their social communication skills through the use of virtual reality? The results showed that after the use of virtual reality teaching social skills, there was a small increase in most areas of student social communication. Students practiced using real world social scenarios in a virtual world. Because students with ASD are visual learners, practicing appropriate social behaviors through the use of imitation and viewing the models in the virtual world lead to some success.

Will the high school students with ASD generalize the social skills learned in the virtual world into the classroom environment with their peers? The results showed that the students increased minimally in scores after being in the virtual reality scenarios and

demonstrated the skills they learned with peers in the classroom. The teacher pre-and post-rating scores indicated that students were able to generalize some of the social communication skills in the classroom. The virtual world allows for the practice of high school social scenarios which increases the potential for generalization in the classroom and also in the real world.

Conclusions

The purpose of the study was to investigate the effectiveness of virtual reality when teaching social communication skills to high 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 teacher ratings. The results showed that students had small increases in their social communication skills after using virtual reality social communication scenarios. These scenarios contained examples of appropriate conversations as a model for students. Thus, the students' social communication opportunities increased compared to their performance in the baseline.

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.

Students with ASD struggle to develop, build, and maintain social relationships; virtual reality provides an opportunity to improve social engagement as well as social communication in school. The findings of this study support previous research (e.g. Parsons, 2006.) recommending social skills training for students with ASD. Future research is needed to validate the findings and also to expand to students of different ages and even different disabilities.

CHAPTER FOUR

The use of technology in school provides an effective way for teachers to teach and students to learn. One example is the use of virtual reality. This study attempted to teach social communication skills to high school students with autism by use of virtual reality, and created another option for teachers for social communication skills instruction. I believe that the use of technology provides more options for teachers in instruction and this in turn is very beneficial for students.

Action Plan

Although each student demonstrated some positive outcomes, there are some areas of improvement that need to be considered in order for virtual reality to be established as an evidence-based practice. There are very limited curriculum choices for teaching ASD students' social communication skills. The use of different programs to find out which is the most effective for teaching social skills to students with ASD is needed. It would be important to compare the Q Moment AR social pragmatics program with other VR programs that focus on teaching social skills to students with ASD.

It would also be beneficial to study the use of virtual reality for students of different ages, such as middle school students. Further, other skills and behaviors can be taught through the use of virtual reality in addition to the six specific communication skills. This study used the Q Moment AR and Merge Cube as the only program for the social skills training in the virtual world. Virtual reality programs teaching social communication skills are limited. Given the lifelong social communication difficulties associated with ASD, more information needs to be explored in terms of social communication skills taught through the use of virtual reality. This study demonstrates the effects of virtual reality on the social communication of high school

students with ASD in a resource room setting. Future research may extend beyond the intervention phase in order to determine the long-term benefits of virtual reality for students with disabilities. Further information is needed regarding the use of virtual reality with students with ASD as well as with students with other disabilities.

CHAPTER FIVE

Social experiences and relationships can be difficult for students with ASD. Using virtual reality provides opportunities for these students to practice social communication skills in a comfortable and safe environment. This opportunity should be considered by administration and school personnel in order to provide such an environment for students with disabilities. Teachers should be exposed to this virtual world to search for resources for their students.

Plan for Sharing

The school where this research study was conducted has monthly sessions called Common Prep. Once a month, teachers are expected to attend a learning session during their prep class period that is typically put on by administration. The focus of these sessions is creating a relaxed atmosphere to share new information and to provide a small group arena for learning. The results of this study will be shared with staff during a common prep session.

This common prep session was created for teaching staff as well as for administration and it will present an overview of autism as well as some evidence-based intervention approaches. The objectives for this session for attendees are as follows: to gain a basic understanding of the diagnosis of autism spectrum disorder, to learn some of its characteristics, to gain an overview of some key strategies for educating students with ASD specifically in the area of social skills, to gain an overview of current evidence-based approaches to intervention when working with ASD students, and to explore the use of virtual reality as an intervention method.

As the definition told us, Autism Spectrum Disorder is a “broad continuum (Salend, 2011)” which means that each student is different. When designing instruction or interventions, an individuals’ needs must be carefully considered. The primary focus of any instructional method, strategy, or intervention should be on improving communication skills, social skills, and

academic skills. By focusing on these ideas, you are focusing on quality-of-life outcomes for these individuals and the hope for a successful future.

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