The Social Validity and Efficacy of a Virtual Reality Intervention for Improving Middle School Students' Social Communication:

A Randomized Controlled Study

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Abstract

The extent to which an intervention is perceived as socially valid significantly influences whether the intervention is selected, implemented, and maintained (Kern & Manz, 2004). Social skill interventions and evidence-based practices are often ranked with low social validity by adolescents (McCoy et al., 2016). Interventions delivered through virtual reality (VR) report increased social validity with this population due to life like features improving motivation and engagement (Hew & Cheung, 2010; Mikropoulos & Natsis, 2011). Despite evidence on the positive feelings, there is limited research on the effectiveness of VR delivered instruction for building social competence in students.

This study utilized a randomized control trial (RCT) to investigate whether a VR-based social skill intervention, Virtual reality Opportunities to Integrate Social Skills (VOISS), could be as effective as an evidence-based intervention, the Program for the Education and Enrichment of Relational Skills (PEERS) at improving the expressive communication knowledge and skill application of middle school students. This study also sought to understand student social validity ratings (i.e., acceptability, appropriateness, and feasibility) of the VR intervention (VOISS) versus the PEERS intervention.

Participants within ten classrooms in four states were randomly assigned to VOISS (N=60) and PEERS (N=60). In both conditions, participants experienced an estimated 300 minutes of the intervention spread out over one to four months. Using the norm-referenced Clinical Evaluation of Language Fundamentals-5 Pragmatic Profile (CELF-5 PP) and a knowledge-based assessment, participants were assessed pre and post intervention to determine social communication skill acquisition and application. All participants were also given an adapted Children's Intervention Rating Profile (CIRP), the Intervention Appropriateness Measure

(IAM) and the Feasibility of Intervention Measure (FIM) to determine their ratings of each intervention's acceptability, feasibility, and appropriateness. Results indicate that a VR intervention (VOISS) has the potential to provide an effective and socially valid means of delivering social communication instruction to middle school students.

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Definitions of Key Terms

The following terms and operational definitions were used in this dissertation:

Acceptability is the extent to which a service, practice or intervention and its implementation is deemed agreeable or satisfactory (Proctor et al., 2011).

Appropriateness is the perceived fit, relevance, or alignment of an intervention or practice in a specific context for a specific issue with the expectation or current role (Weiner et al., 2017).

Autism Spectrum Disorder (ASD) is a developmental disability that affects communication, social interaction, and repetitive behaviors (Munkhaugen et al., 2019).

Augmented Reality (AR) enhances the real world by overlaying digital content on real-world elements and often provides the user with a feeling, through the technology, of something tangible being placed in one's environment (Carreon et al., 2020).

An **avatar** is an image that symbolizes individuals seen within a virtual environment (Carreon et al., 2020).

A **CAVE** is a computer environment that uses surround vision projection and allows two or more people to simultaneously experience a fully immersive virtual environment without requiring HMDs (Carreon et al., 2020).

Effective is defined in this study as the extent to which the intervention taught the targeted skill as measured by pre and post knowledge and perceptions of skill implementation.

An **emotional skill (ES)** is a skill learned to accurately express, read, and understand emotions between or among individuals in social interactions as well as the skills needed to understand and regulate one's own emotional state (Riggio et al., 1989).

Expressive Communication (EC) is defined as skills that allow an individual to convey ideas, wants, needs, and other complex thoughts through the oral, written, or sensory gesture system (Wilson et al., 2019).

Extended reality (XR) is essentially MR that is further connected, intelligent, and immersive. It is an umbrella term referring to all real-and-virtual collaborative environments and the areas

incorporated among them generated by wearables. XR takes massive amounts of detailed and personal data (i.e., a person's emotions, likes, interests) and synthesizes this information to make a virtual experience even more indistinguishable from an authentic experience (Kwok & Koh, 2021).

Feasibility is the extent to which an intervention or practice can be or has been successfully implemented within a given context (Weiner et al., 2017).

A **head-mounted display (HMD**) is a wearable headset that covers the user's eyes to allow them to see and experience a three-dimensional immersive environment (Bozgeyikli et al., 2018).

Immersive VR provides an environment in which a virtual world entirely surrounds the user via an HMD (Carreon et al., 2018)

Mixed reality (MR) combines technologies into a continuous scale of VR and AR, which allows the user to interact with and manipulate physical and virtual elements (Carreon et al., 2020).

Non-Immersive VR is a screen-based simulation that provides elements of appearing to be in a virtual world, such as avatars that appear as real people (Carreon et al., 2020).

Presence within a simulated environment (e.g., video, computer, virtual environment, AR, HMD) can be defined as the psychological state of processing stimuli from various senses to create a feeling of being in one place when the person is physically in another location (Mestre, 2005; Witmer & Singer, 1998).

Receptive communication refers to the understanding by an individual of what is being communicated to them through external stimuli, such as gestures or facial expressions (Schalick et al., 2012).

Role play is when students are given activities ranging from highly controlled guided conversations to improvised drama activities illustrating expected actions for a given situation during which students are told who they are, what their opinions are, and what they know (McCoy et al., 2016).

Social communication (**SC**; pragmatic communication) refers to the use of language in relation to context and includes elements of both expressive and receptive communication (Mandy et al., 2017).

A **social-emotional (SE) skill** is a core competence that incorporates both social and emotional instruction to enable someone to recognize and manage emotions, set and achieve goals, make responsible decisions, handle interpersonal situations constructively, learn, communicate, fulfill individual needs, interact with others, understand one's wants and needs, develop relationships, and protect oneself (Elias et al., 1997; McKown, 2017).

Social narratives are short descriptions of social situations with relevant cues highlighted and examples of appropriate responses (Dowd & Tierney, 2005).

A **social skill (SS)** is a socially acceptable learned behavior that enables someone to avoid or escape negative social interactions and to interact effectively with others (Gresham & Elliott, 1990).

Social validity (SV) is critical to an intervention's success and consists in determining what aspects of an intervention are appropriate, desired, generalized, and maintained (SV; Fox & McEvoy, 1993).

Video modeling (VM) involves creating a video using peers, adults, or the student selected for intervention as a model of appropriate social skills and behaviors, which is later watched by the selected student (Bellini et al., 2007a).

A **virtual environment (VE)** is a text- and graphics-based environment simulated by a computer, iPad, phone, or HMD that brings realistic digitally generated images and sounds into one's actual environment (Carreon et al., 2020)

Virtual reality (VR) brings a three-dimensional environment to the user which allows the user to interact with computer-generated objects which appear real (Carreon et al., 2020).

Chapter 1: Introduction

The Challenge

Social-emotional (SE) competence is necessary for students to interact in educational environments, attain academic success, develop peer relationships, and achieve quality long-term life outcomes (Alzahrani et al., 2019; Mahoney et al., 2018; Merrill et al., 2017; Rhoades et al., 2011). Teachers report that increased SE skills improve school attendance, classroom climate, collaboration, workforce readiness, and lifelong outcomes (Bridgeland, et al., 2013; Koegel et al., 2014). Greenberg and colleagues (2017) found that 95% of surveyed teachers believed SE skills to be teachable within the school setting. Yet, general and special education teachers alike report feeling inadequate in providing social and emotional learning (SEL) to students (Anyon et al., 2016; Dobbins et al., 2010). This feeling of incompetence increases substantially for general education teachers who report a lack of knowledge of evidence-based practices (EBPs) for SE and behavioral development (Stormont et al., 2011). Teachers' beliefs about their ability to provide effective SEL influence their fidelity to SEL implementation and SEL success for students (Schonert-Reichl 2017). As a result, educators often do not provide SEL with consistency, fidelity, or in a systematic manner (Durlak et al., 2011).

Ensuring teachers have the necessary training to understand and implement SEL with fidelity can be difficult, causing administrators to argue that SEL curricula and instruction are cost and time-prohibitive (Lee, 2016). However, a study at Columbia University found that for every dollar invested in quality SEL, 11 dollars were saved that would otherwise have been spent on remediation, dropout prevention, recovery, and interventions (Belfield et al., 2015). Teaching is a stressful occupation. Research shows teachers are often overworked, underpaid, and at elevated risk for poor social-emotional wellbeing (Schonert-Reichl 2017). Teachers do not have

time to add one more thing to their already hectic days. Yet, teachers with knowledge of quality SE interventions and who possess SE competencies are more likely to manage challenging student behaviors, engage in positive student relationships, have more time for instruction in their days, and are less likely to leave the profession (Jennings & Greenberg, 2009; Schonert-Reichl 2017). Therefore, an understanding of the skills within SEL and how to develop these skills may increase teacher retention and provide better mental health outcomes for the entire school community. For educators to successfully gain knowledge of quality SE practices and develop SE competencies, it would be helpful to provide SE tools that (a) are accessible, (b) are easily implemented in a timely manner, (c) provide systematic quality instruction to students of varying abilities, and (d) offer a method by which the teacher can gain knowledge of SEL skills, measures, and interventions.

Federal Mandates for Social Emotional (SE) Development

The Individuals with Disabilities Education Improvement Act (IDEIA, 2004) mandates the implementation of scientifically based research "disseminating information about innovative, effective, and efficient curricula designs, instructional approaches, and strategies, and identifying positive academic ***and social learning opportunities***" (20 U.S.C. § 1463). Even though the use of EBPs for students with disabilities is mandated in both IDEIA (2004) and No Child Left Behind (NCLB, 2002), many service providers continue to implement ineffective practices (Cook & Odom, 2013; Lilienfeld et al., 2015). Lack of knowledge of EBPs, limited training, lack of time for planning, and limited social validation are documented to influence the routine use of EBPs (Cook & Odom, 2013; Rapp et al., 2010). Hence, it is essential to conduct research to understand the social validation of intervention tools and the EBPs within adopted interventions

to determine the intervention's possible effectiveness, maintenance, and fidelity prior to the intervention's use for students with disabilities.

The Every Student Succeeds Act (ESSA, 2015) and the Supreme Court's decision in Endrew F. v. Douglas County School District (2017) mandate that ***all students*** progress toward appropriate, ambitious goals and developmental standards. ESSA and Endrew F. required increased PD for teachers and supports for students' academic and SE needs. In response, many states use Title I and Title IV to strengthen SE instruction programs (CASEL, 2020). Currently, all 50 states have SEL standards for early childhood (i.e., preschool, Kindergarten) and nearly half of all U.S. states have adopted K-12 SEL standards (CASEL, 2020). However, without knowing whether practitioners value SE intervention delivery methods or whether they show a statistical improvement in SE development, this funding may be wasted on tools and practices that will either not be utilized by practitioners or not show SE improvements for students.

The Core Skills Needed for SE Development

Several theoretical frameworks, curricula, assessments, and programs have been developed to provide an organizational and conceptual approach to the SE development of students. There are over 100 SEL frameworks each, utilizing varying SEL definitions, domains, and competencies (Berg et al., 2017). The commonalities of all SEL frameworks primarily entail that they include intrapersonal skills, interpersonal skills, regulation of emotions, and problem-solving, are developmentally appropriate and culturally sensitive, have some form of empirical evidence supporting the framework, and rely on evidence-based resources for evaluation and implementation (Blyth et al., 2019). Initiatives, such as The Collaborating Districts Initiative, which partnered with 20 urban school districts implementing a system-wide SEL program (CASEL, 2017) and The Collaborating States Initiative, a collaborative effort involving 25 states

serving more than 60% of U.S. students (Dusenbury & Weissberg, 2018) have been working tirelessly to determine and promote core SEL for students through school-based SEL programs.

A meta-analysis of school-based SE programs delivered from kindergarten to 12th grade (Durlak et al., 2011) determined all 213 programs have an aspect of expressive and receptive communication, intrapersonal and interpersonal skills, and self-regulation. For this study, there was a need to focus on one domain. Therefore, the emotional development frameworks and social skill frameworks were analyzed to determine the following overlapping areas: 1. expressive skills, 2. decoding skills, and 3. regulation skills, which operate in two domains: (a) nonverbal (i.e., emotional communication; Riggio, 2005) and (b) social (i.e., expressive and social communication; Riggio & Carney, 1989). For this study, four separate SE experts analyzed both domains to determine the social communication domain (expressive and receptive) contained the most substantial number of irreversible discrete skills.

The domain selected was the expressive communication domain which includes the same skills labeled as social communication in many interventions (Riggio & Carney, 1988). Expressive communication (EC) is defined as skills that allow an individual to convey ideas, wants, needs, and other complex thoughts through the oral, written, or sensory gesture system (Wilson et al., 2019). Expressive communication within social skills curricula often falls into the broader social communication (pragmatic) domain. Pragmatics and social communication are used interchangeably when speaking within SE competencies as both terms refer to the use of language in relation to context (Conlon et al., 2019; Mandy et al., 2017).

Social Validity (SV) Framework

SE interventions for adolescence are reported to be ineffective unless they go beyond building individual competencies and consider whether the skills, environment, and instruction

within the intervention are appropriate and acceptable (Berg et al., 2017; Jennings & Greenberg, 2009). Determining what aspects of an intervention are appropriate, desired, generalized, and maintained is critical to an intervention's success and is known as social validity (SV; Fox & McEvoy, 1993). The SV framework provides a measure in which to look at three elements of an intervention: (a) the goals (i.e., importance/justification), (b) the procedures (i.e., appropriate/acceptability), and (c) the outcomes (i.e., meaningful/importance; Armstrong et al., 1997; Kazdin, 1977). SV is not something an intervention has or lacks but a multidimensional process consisting of numerous variables, including intervention acceptability and importance (Finney, 1991). Social validity should be a supplemental measure to the direct measurement targeted by treatment (Callahan et al., 2017). Still, it may be crucial in understanding intervention use as the actual intervention outcomes. Understanding primary aspects of social validity (i.e., technology preferences, use, knowledge acquisition) within interventions is essential to determining the method most likely to be available, selected, implemented in a timely manner, and maintained by students and their educators. Social validity data is also an important predictor of the acceptability of an intervention by participants and implementers (Baer et al., 1987).

Social-Emotional Interventions for Adolescents

Meta-analytic research reveals explicit SEL in schools (e.g., directly taught and rehearsed SE skills) improves elementary students' SE competencies, particularly when a program's theory, climate, assessments, and progress monitoring are well aligned (Jones et al., 2017). However, findings for similar explicit SE interventions for adolescents suggest they are less likely, overall, to produce expected gains in competencies (Yeager, 2017). The SE pressures adolescents face continue to rise. Emergency room visits related to depression, anxiety, and

similar conditions for adolescents in the US rose 28% between 2011 and 2015, and, between 2019 and 2021, emergency room visits for suicide attempts increased 51% for adolescent girls (Richtel, 2021). The National Center for Health Statistics reported an estimate of 6,600 deaths by suicide among the 10-24 age group in 2020. This population must be provided with quality, evidence-based intervention, but it is often difficult to know where to start.

It is essential to identify SE instruction that is motivating, acceptable, and evidence-based for adolescents. Traditional EBPs addressing social skill deficits (e.g., role-playing, video modeling, direct instruction; McCoy et al., 2016) have not been as motivating for adolescents as elementary-age students. Yet, the Committee for Children (2019) review found that evidence-based SEL mitigates youth suicide risk factors. A public school district in Utah implemented evidence-based SEL to all elementary and middle school students and two years later noted decreasing rates of youth substance abuse and suicidality, despite an increase in both in neighboring counties (Posamentier et al., 2023). Taylor and colleagues' research (2017) showed that evidence-based SE instruction for adolescents has positive long-term outcomes across students with diverse prior experiences, needs, and cultural priorities. It is necessary then to understand ways to assist in making these effective SEL methods more interactive and motivating for adolescents.

The brain's method of processing emotions during adolescence undergoes a dramatic transformation (Blakemore & Mills, 2014), providing an ideal time for meaningful SEL. The neural and hormonal changes at the onset of puberty offer a second opportunity for development in all SE domains (Blakemore & Mills, 2014; Crone & Dahl, 2012). Yet, finding quality SE programs to assist adolescents in dealing with SE struggles and life transitions can be difficult as most programs tend to be reconstructed initiatives created for younger children and do not

provide the flexibility necessary for a dynamic and continuous transaction embedded within the context of the student's cultural environment (Sawchuk, 2021). Technology may help reduce this barrier because it has the unique ability to 1. provide the flexibility necessary to embark on experiences not easily constructed within a classroom, 2. assist students of varying abilities in increasing learning productivity within and outside the classroom; 3. improve feelings of social acceptance by peers; 4. increase engagement and motivation to learn; 5. decrease frustration; 6. offer confidential practice in skills; and 7. tailor the intervention to the student (Alghazo & Al-Otaibi, 2016; Glantz et al., 2003). With the increasing comfort of adolescents with technology, particularly students with ASD (Kuznekoff & Titsworth, 2013), emerging forms of technology should be further explored as a viable SE intervention delivery option.

Virtual Technology's Role

Technology is readily available and often used in public schools throughout the US because it allows schools to deliver instruction more efficiently (Pickard et al.,2016). Technology can assist students in increasing learning productivity within and outside the classroom while improving feelings of social acceptance by peers and decreasing frustration (Alghazo & Al-Otaibi, 2016). Although technology has been used to enhance social skills for decades (Chelkowski et al., 2019; Ennis-Cole, 2011), virtual reality (VR) for instruction for students is emerging.

VR provides a digital simulation of an artificial environment, often three-dimensional, where a person physically interacts with technology and is immersed so that the senses perceive a "real world." VR may involve a head-mounted display (HMD) such as an Oculus Rift or older technology such as three-dimensional (3D) glasses inside a CAVE (i.e., a virtual environment with three to six projectors directed on the walls, floor, and ceiling of a small room). VR exists

on a continuum from non to fully immersive (Carreon et al., 2020). For example, head-mounted displays (HMDs) are considered fully immersive because users do not experience outside stimuli. The same situation presented through an iPad would be regarded as non-immersive, as the user can perceive their physical surroundings while interacting with the virtual environment. With the advancements in VR technology, VR is now accessible and affordable for K-12 schools (Oigara, 2018) and should be considered a viable tool for instructional delivery.

In classrooms where teachers must provide instruction in SS acquisition and development without training, technology can help deliver systematic instruction utilizing research-based methods (Miller & Bugnariu, 2016). Miller & Bugnariu (2016) reported that VR provides specialized curriculum content with increased standardization of procedures, decreased social pressure, increased opportunities for practice, and increased student motivation. Research shows students may obtain increased knowledge retention and application following a VR intervention than in other forms of technology (Krokos et al., 2019). With limited time and resources, educators must develop their students' SS competencies (Corcoran et al., 2018), and the quality of teachers' implementation of SS instruction affects student outcomes (Reyes et al., 2012; Sullivan & Sadeh, 2012). Therefore, it is necessary to understand if this available and applicable technology (i.e., VR) can significantly improve students' social skills.

Adolescents report direct social skill instruction from adults and peers to be unpleasant, pressuring, and sometimes intrusive (Bottema-Beutel et al., 2015). Students often prefer shared activities, activity-based learning, and an indirect instructional approach over direct instruction in social skills (Giangreco, 2010). Yet, students with ASD do not readily learn prosocial behaviors through observational learning and need direct social skill instruction (Plavnick & Hume, 2014). However, when direct instruction occurs through virtual technology, due to decreased anxiety

and increased motivation, students are often more willing to engage and learn (Howard & Gutworth, 2020; Miller & Bugnariu, 2016). Virtual technology can make prior research-supported practices (e.g., teacher-guided direct instruction) more meaningful and effective while also providing instructional strategies (e.g., guided experience within the target environment) otherwise not available to students (Dass et al., 2011). While considering that students, particularly those with high incidence disabilities, tend to learn and rely on the visual features of an intervention (Kunda & Goel, 2011), VR's use of lifelike visual displays may increase the effectiveness of an intervention once presented in paper or video format.

The Social Validity of VR for Intervention Delivery

Two separate literature reviews (Mosher & Carreon, 2021; Mosher et al., 2022) explored the social validity of VR to provide systematic and individualized social skill instruction to students with ASD and are provided in chapter two. These systematic reviews pointed to virtual technology improving social skills for students with ASD. However, the reviews also made apparent the need for conclusive research on the ability of VR to improve the targeted social skills of students. Current VR research tends to rely on perceptions of improvement without considering quantitative measures. The reviews also point to the need to understand the preferences of students and implementers on the choice of technology to deliver the intervention, as this preference is shown to influence the intervention's continued use (Carreon et al., 2020; Kim et al., 2020; Mosher & Carreon, 2021). The prior lack of research in these areas is partly due to the limited number of virtual technologies designed to teach SE skills to middle school students and the absence of the ability to use the same intervention within the varying technologies.

Effective SE Instructional Elements in Virtual Reality

Like any quality intervention delivery method, VR must incorporate core elements of effective SE instruction. Bellini and colleagues (2007b) outlined key aspects of VR also found in effective SE instruction, which includes: (a) the ability to increase reliable intervention dosage, (b) the ability to learn and practice in authentic settings, (c) the ability to match the intervention to the individual student's skill deficits, (d) the ability of the intervention to be employed with fidelity, and (e) the ability of the intervention to be accessed, selected, and maintained. VR can provide timely, continued access to experiences in a realistic environment allowing for an infinitely higher number of practice and learning attempts than are typically available within schools. VR also has the unique ability to replicate the same experience as often as necessary for acquisition. For example, Self and colleagues (2007) used a non-immersive VR intervention to instruct students on appropriate responses to a fire alarm. Students utilized a computer simulation to learn and practice what to do and where to go when a fire alarm sounds. Emergency drills in schools can typically only be replicated a specific number of times throughout the school year. On the other hand, VR can provide this near authentic experience at the push of a button.

SE skills are best acquired when delivered in the setting where the skill is most often applied (Radley et al., 2017). VR can provide the same skill instruction within multiple school, home, and community environments. When skills are taught and practiced in familiar settings, skill acquisition, maintenance, and generalization markedly improve (Gresham, 2015). Many forms of VR can be programmed to target global SE skills and specific targeted skills within a given intervention. For example, Cheng et al. (2010) found a need to work with students on the particular skill of empathy. They utilized a VR delivered intervention that addressed multiple SE skills but were only able to present the aspects of empathy to students.

Finally, VR can deliver systematic instruction without straying from the initial intended intervention script. For example, Adjorlu and colleagues (2017) utilized teachers in the intervention creation. They determined that direct instruction to students through a headset during the three scenarios displayed better fidelity to intervention protocol than the same teachers presenting instruction in the classroom to students. It is necessary then to examine the final aspect of quality SE interventions that researchers have yet to establish: the intervention's ability to be accessed, selected, and maintained by implementers and students.

Purpose

Understanding whether VR can improve SE skills for students will assist educators in confidently making decisions to adopt these technologies in schools (Gleason, 2017). Researchers report that VR provides a practice environment and constrains viewing areas and auditory input, which may help students with disabilities focus on relevant stimuli (Charlop-Christy & Daneshvar, 2003). Four primary advantages have been listed for using VR to deliver interventions to students: 1. the ability to tailor the intervention to the student; 2. the ability to control the material presented; 3. the potential to provide experiences not available in the real world; and 4. the ability to provide confidential practice in skills (Glantz et al., 2003).

The extent to which an intervention is perceived as socially valid significantly influences whether the intervention is selected and implemented (Kern & Manz, 2004). A strong correlation exists between beliefs about an intervention and the use of that intervention (Hew & Brush, 2007). VR offers significant advantages for enhancing classroom learning due to the reported positive beliefs from VR users about the technology's content delivery (Hew & Cheung, 2010; Mikropoulos & Natsis, 2011; Rajendran, 2013). Prior to VR's use in classrooms to improve

middle school students' SE competencies, the social validity and efficacy of such an intervention versus a research-based intervention would be beneficial.

Evidence-Based Practices (EBPs)

Currently, there are several evidence-based practices (EBPs) for teaching social skills. Two of the practices fit well with technology integration and require minimal training prior to effective implementation: social narratives and video modeling (Hume, & Odom, 2011; Wong, et al., 2015). Video modeling and social narratives appear to be particularly beneficial when introducing and teaching a variety of skills to individuals with autism, such as expressive communication (Charlop & Milstein, 1989; Wong, et al., 2015), emotion processing (Corbett, 2003), perspective taking (Charlop - Christy & Daneshvar, 2002; LeBlanc et al., 2003), and play skills (D'Ateno et al., 2003; Wert & Neisworth, 2003). Charlop and colleagues (2002) have documented a long history of success in using video modeling to improve social communication skills, especially for students with autism. As far back as the 1980s, research reveals video modeling's success when Charlop and Milestein (1989), through a scripted conversation on the topic of toys presented through video modeling, found statistical improvements in the acquisition of basic conversational speech for students. Gresham and Elliott have also documented a long history of success in using social narratives to improve social communication skills, especially for students with autism (Gresham, 2015, 2017; Gresham & Elliott, 2008).

Video modeling (VM) uses audio-visual technology (i.e., iPhone, iPad) to help teach students specific skills. Based on Bandura's Social Learning Theory (1977), VM involves students learning by watching and imitating others' actions. There are four different types of VM: 1. Video Modeling (VM), where students watch videos of others modeling the desired behavior or skill and imitate the behavior or task; 2. Video Self-Modeling (VSM), where students watch

videos of themselves often taped and edited by the educator to highlight the desired behavior or completion of the skill; 3. Point of View Modeling (POVM), where students watch videos (recorded by themselves or others) from their perspective in a manner that feels as if the video is being seen through the eyes of the observer; and 4. Video Prompting (VP), where the video serves as a cue for the steps of a task which requires a set task analysis of the fundamental skill. When using VM, the person demonstrating the target skill may be other students, adults, or animated depictions. According to Bellini and colleagues (2007a) and Plavnick and colleagues (2013), both VM and VSM are valuable tools in teaching social skills to students with disabilities.

Social narratives are short descriptions of social situations where relevant cues are highlighted, appropriate response examples are given, and models of these examples, which illustrate the behavioral and physical considerations to implement a targeted skill, are offered (Dowd & Tierney, 2005). For example, there may be a social narrative on how to adapt behavior when talking in the library which utilizes pictures as well as social and physical cues of others implementing a quiet voice within a library scene as well as someone in a gym situation responding at a different level of voice. Several systematic reviews of research on social narrative interventions for students with disabilities have found social narratives to be an effective practice to teach social skills, and promote effective and appropriate social communication (Gresham, 2015, 2017; Gresham & Elliott, 2008). Traditionally, social narratives are presented by an adult who reads the story to the student. Today, technology has increased the delivery options for such narratives, making narratives available to students independent of an adult. Software programs, applications, simulations, augmented reality, and virtual environments are used to present narratives to students. Social narratives remain an evidence-based practice

whether they are read to children or presented in VR programs (Ghanouni et al., 2019). However, there is a need for additional research on the effectiveness of social skill instruction through VR mediums (Bernardini, 2014).

Interventions Chosen

Virtual reality Opportunities to Implement Social Skills (VOISS; Smith et. al., 2022) was chosen as the first VR intervention because it is specifically designed for middle school students, incorporates numerous SE skills, has social scenarios that have been validated by researchers and educators, and can be delivered across multiple devices (i.e., Chromebook, iPad, HMD). Since some forms of technology delivery (i.e., iPads, Chromebooks) are more available in schools than others (i.e., HMDs), utilizing familiar technology to deploy both the VR intervention and the research-based intervention would be helpful. VOISS is a free stand-alone technology-based interactive program targeting students ages 10-15 with varying disabilities through 142 virtual social scenarios. Time constraints will not allow the entire intervention to be implemented. Rather, a section of this intervention (i.e., 18-22 scenarios) will be chosen that are in line with the control group's content.

Due to the this author's affiliation with the VOISS program, additional VR interventions were initially targeted to be implemented as well as VOISS to separate participant groups. This would allow researchers to compare a mix of VR interventions alongside the control research-based intervention. However, after an extensive search was conducted, an additional VR intervention with an adequate number (i.e., more than 10 scenarios) of validated social scenarios instructing middle school students was not located. Author one reached out to programmers, curriculum developers, educators, and students in 12 states to determine what VR intervention existed that contained: (a) research-based instructional methods, (b) validated content, (c) was

acceptable for use with middle school students with pragmatic delays, (d) provided instruction in either expressive communication or social communication, and (e) had over ten social scenarios to adequately form an intervention. Floreo, AcclimateVR, and Kinful were the only three interventions that were provided. After careful review of these three interventions, it was determined that none fit these criteria. Floreo focused on teaching social and life skills to people diagnosed with autism spectrum disorder and did not have enough scenarios for use. Kinful utilized student created scenarios and lacked validity behind the instruction provided. AcclimateVR was the closest possibility but this VR intervention is in its infancy and does not currently have enough scenarios to comprise a full intervention in social communication.

Nine systematic literature reviewers on VR interventions that instruct school age students on social and communication skills (Bellani et al. 2011; Carreon et al., 2022; Howard & Gutworth, 2020; Lozano-Álvarez et al., 2023; Merchant et al.,2014; Miller & Bugnariu, 2016; Mosher & Carreon 2021; Mosher et al. 2022; Sansosti et al., 2015) were examined to determine if VR interventions were missed in this initial search. This resulted in identifying OASIS curriculum, WISE Virtual Reality Social Emotional Learning, Kinful, VirtualSpeech, Ovation, Opensimulator, InMind2VR, and Second Life. The literature presented each of these as a VR intervention for students. However, upon examination, this was not accurate. VirtualSpeech and Ovation provided a practice environment with feedback, rather than an intervention and were primarily geared toward improving public speaking. InMind2VR was created as an adventure game for a younger population. The WISE Virtual Reality Social Emotional Learning focused solely on emotional fitness. Second Life was found to be an online multimedia platform that allows people to create an avatar for themselves and then interact with other users but does not provide an intervention. Opensimulator, OASIS curriculum, and Kinful were discovered to be

VR platforms that allow students or researchers to design, develop, and test 3D social skill simulations. None of the identified programs utilized validated instruction in social communication to middle school students. Therefore, VOISS was the only selected VR intervention for use in this study.

The Program for the Education and Enrichment of Relational Skills (PEERS; UCLA PEERS Clinic, 2020) was selected as the control intervention because it is documented as one of the only evidence-based social skills treatments for students ages 10 to 25 with autism, learning disabilities, behavior disorders and additional social-communication difficulties (Factor et al., 2022). PEERS demonstrates desired behaviors through video modeling and role plays that can be delivered across multiple devices (i.e., Chromebook, iPad, TV; Estabillo et al., 2022). Laugeson and colleagues (2012) and Estabillo and colleagues (2022) indicate that adolescents using a portion of the PEERS intervention (i.e., VM, Role Plays) made significant improvements in knowledge and implementation of pragmatic communication, social cognition, social awareness, social motivation, assertion, cooperation, and responsibility. Each PEERS video focuses on a social interaction in a manner consistent with video modeling and has produced large effects in social knowledge improvement (Estabillo et al., 2022; Zheng et al., 2021). The video modeling procedures in the PEERS intervention are used in a manner that includes an accurate, research proven implementation guide for video modeling (Estabillo et al., 2022). To implement PEERS in its entirety requires significant training. However, to implement video modeling accurately does not require the same degree of training as other evidence-based pragmatic communication interventions (Corbett, 2003).

PEERS was originally designed as a social skills program to include 14 weekly face-to-face meetings with participants and their parents (Laugeson & Frankel, 2010). Since this time,

PEERS has been adapted for use by its creators to be implemented with parents or educators and administered in person or online. In past research, technology delivered sections of PEERS resulted in high levels of satisfaction with the intervention and no technical difficulties (Estabillo, 2022). Only a section of the PEERS program will be implemented in this study, due to time constraints, but evidence suggests that abbreviated sections of the PEERS intervention produce many of the benefits observed in full program implementation (Zheng et al., 2021). No attempt will be made in this study to alter the content or PEERS protocol for the determined section of the intervention without the explicit guidance of a PEERS trainer.

Research Questions

This study seeks to understand further the social validity of VR for delivering SE interventions to adolescents and the efficacy of these interventions by answering the following research questions:

1. **Is there a difference in the effectiveness of a VR based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEERS) for middle school students?**

    1a. Is there a difference in the social communication knowledge of a virtual reality based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEERS) for middle school students?

    1b. Is there a difference in the social communication skill application of a VR based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEER) for middle school students?

Hypothesis: Based on previous research on the effectiveness of VR in delivering systematic instruction (Krokos et al., 2019, Miller & Bugnariu, 2016), no significant difference in knowledge acquisition is expected between the two interventions (PEERS and VOISS). Both interventions employ evidence-based practices within their program (i.e., social narratives, video modeling) for improving social skill competence. Therefore, both are predicted to make significant gains in knowledge acquisition. However, the difference in skill application scores reported pre and post intervention are predicted to be higher for students utilizing VOISS than those utilizing PEERS because VR allows the user to be immersed within an environment in which they can manipulate the scene in front of them and obtain natural consequences and re-teaching for incorrect choices. Video modeling does not provide the same standardized response within a real-life environment in real time. It is predicted that this immediate feedback and practice within a variety of settings within the virtual school will improve generalization of skills at a faster pace than video modeling.

2. Is there a difference in the ratings of social validity measures (acceptability, feasibility, and appropriateness) of a VR based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEERS) for middle school students?

2a. Is there a difference in the pre and post acceptability ratings of a VR based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEERS) for middle school students?

2b. Is there a difference in middle school student ratings of feasibility of a virtual reality based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEERS)?

2c. Is there a difference in middle school student ratings of appropriateness of a VR based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEERS)?

Hypothesis: Previous research shows interventions delivered through VR may have increased social validity because they are provided without a great deal of teacher preparation and professional development, which allows educators to provide tailored real-world interventions in a controlled environment and students to better personalize their experience while still receiving standardized content (Charlop-Christy & Daneshvar, 2003; Glantz et al., 2003). Prior studies of the social validity of video modeling also show highly favorable responses to this intervention by student participants (King et al., 2014). Research reveals students with and at risk for social-behavioral difficulties have greater social validity toward interventions when the intervention takes up little classroom time (i.e., around 30 minutes a session) and provides a way for students to covertly self-regulate the intervention in a manner that does not draw unwanted attention (Felver, et al., 2017). PEERS and VOISS both allow for these options. Therefore, it is predicted that the social validity perceptions (i.e., acceptability, feasibility, and appropriateness) of students will remain high for both PEERS and VOISS and that only a slight increase may be shown in the VOISS intervention over PEERS in acceptability due to the novelty of a VR program delivering this form of instruction.

Parameters of the Study

The purpose of this study is to determine middle school students' perceived acceptability, feasibility, appropriateness, and effectiveness of a VR-delivered SE intervention (VOISS) versus a SE intervention delivered through video modeling (PEERS). The study also seeks to determine whether there are changes in knowledge base and teacher ratings of the targeted social

communication skills of a VR-delivered SE intervention (VOISS) versus a SE intervention delivered through video modeling (PEERS) for middle school students.

This study's objective is not to understand if VOISS or any VR delivered SE intervention can be termed an evidence-based practice. There are intervention practices within VOISS, and other VR delivered SE programs that include elements of the EBPs for students with ASD, such as video modeling and social narratives. However, there are no known studies reporting that these practices with a VR program are completed in a manner that would be considered evidence-based. There are also aspects of other evidence-based practices in both VOISS and PEERS (i.e., visual supports; structured practice). However, these aspects remain within most interventions incorporating video modeling and social narratives, so we did not go in depth about their role within either intervention as they are used in these interventions to support the primary EBP listed in each intervention.

Traditionally, an adult presents social narratives by reading a story to a student. Today, technology has increased the delivery options for such narratives, making narratives available to students independent of adults. Providing this EBP through technology decreases the support needed from teachers, support staff, and paraprofessionals (Boswell et al., 2013). Software programs, applications, simulations, augmented reality, and virtual environments are now available to present students' social narratives.

This study seeks to understand aspects of social validity (i.e., acceptability, feasibility, appropriateness, and effectiveness) of a VR intervention that presents social scenarios that have similarities to both video modeling and social narratives. However, this study does not consider whether social narratives or video modeling within the VR intervention (VOISS) are consistent with the indicators of these EBPs. This study does not seek to determine if all VR SE

interventions increase student SE competencies, as this would require a more considerable number of VR programs created for this purpose. Choosing to focus on middle school students does not provide enough information to determine the implications of this research for those younger than ten and older than fifteen.

Chapter 2: Literature Review

Today's Technology Trends

Various forms of immersive learning are currently being used to assist students in feeling like they are experiencing and interacting with a real physical environment at all levels of immersion when that environment or static materials are not otherwise accessible (Radianti et al., 2020). Augmented reality (AR), virtual reality (VR), mixed reality (MR), and extended reality (XR) provide realistic, immersive instruction that might improve social competence and skills for individuals with ASD. AR, VR, MR, and XR are all relatively novel but increasingly available forms of technology. AR enhances the real world by overlaying digital content on real-world elements and often provides the user with a feeling, through technology, of something tangible being placed in one's environment. AR contains both an aspect of technology and the physical world and with modern technology may include text, audio, video, QR codes, links, and interactive 3D models.

VR provides a digital simulation of an environment, often three dimensional, where a person physically interacts with technology and is immersed in such a manner that the senses perceive a "real world." VR may involve a head-mounted display (HMD) such as an Oculus Rift or HTC Vive. VR may involve older technology such as 3D glasses inside a CAVE, which is a virtual environment (VE) with three to six projectors directed on the walls, floor, and ceiling of a small room. MR combines technologies into a continuous scale of VR and AR, which allows the user to interact with and manipulate physical and virtual elements. XR is an umbrella term referring to all real-and-virtual combined environments and the areas incorporated among them generated by wearables. XR takes massive amounts of detailed and personal data (i.e., a person's emotions, likes, interests) and synthesizes this information to make a virtual experience even

more indistinguishable from an authentic experience. XR is essentially MR that is further connected, intelligent, and immersive.

AR, VR, MR, and XR were developed to allow users to have experiences that may otherwise not be available (i.e., visiting a different country). Students may benefit from these forms of immersive technology because they provide opportunities for practice in an environment that mimics an authentic situation where the skill would be applied. Currently, of the four immersive technologies, only AR and VR are being used to provide SEL to students.

Previous Reviews of the Literature

Recent research reviews have identified evidence supporting the use of VR and AR to instruct students with ASD. Researchers have examined the effects of innovative technologies to deliver instruction, but often focused on the student's ability to use and navigate the technology (i.e., usability studies). In one literature review (Kurilovas, 2016), which focused on MR environments, researchers were primarily interested in the quality and personification within the learning environments and found improved student motivation and satisfaction but did not investigate the effectiveness of the technology in teaching or learning. A systematic review using MR by implementing both AR and VR for instruction (Sheik-Ali et al., 2019) solely considered the technology in terms of surgical education in the medical field. Even with the limited evidence base, research reveals that AR and VR are currently used in general education classrooms (Garzón & Acevedo, 2019), and XR is predicted to be mainstreamed in schools and businesses within the next five years (Scribani, 2019).

VR and AR for Instruction

Recent research reviews have identified evidence supporting the use of AR and VR to instruct students. This research has not been specific to adolescents. Instead, it has included a

variety of students in the K-12 age range with various ability levels. Mikropoulos and Natsis (2011) examined VR's use in specific content areas (e.g., mathematics) and found VR helpful in improving students' higher-order thinking skills. Merchant and colleagues (2014) focused on the differences in aspects of three forms of desktop-based VR. Findings indicated that game-based learning environments were most effective, but there was no statistical significance between the three groups in student learning, student outcomes, or generalization of targeted skills. Researchers determined that gaming aspects were more suited for acquiring new knowledge, whereas simulations were more effective for feedback. However, the same intervention was not provided within the game like intervention as the simulation, making it difficult to compare results.

Gleason (2017) found virtual technology, due to its interactivity, to be a valuable tool for practitioners to improve teaching and learning in both the school and home settings but stated the need for further investigation as to whether the technology is readily accessible and can cause improvement in a targeted skill. Schmidt and Schmidt (2008) reported virtual environments support the generalization of skills and knowledge between contexts and requested more research be conducted to understand the adoption of VR within schools. Radu's meta-analysis (2014) found AR in educational settings improved math and science content recall, long-term memory retention, collaboration, and motivation for both below average and average students. However, they also reported high achieving students did not similarly benefit from AR. AR has yet to be used consistently to deliver SE interventions to adolescent students.

VR for Students with High Incidence Disabilities

Technology is a crucial component in teaching students with disabilities outside the classroom to facilitate their learning and acquisition of SSs (Roberts-Yates & Silvera-Tawil,

2019). Bellani et al. (2011) reviewed studies that applied virtual technology to teach a variety of skills (i.e., reading, math, adaptive skills, communication) to students with ASD and found the technology a promising line of research. The two studies included in Bellani's research which addressed social skills reported positive treatment effects in moderate to high virtual immersion (Miller & Bugnariu, 2016; Reed et al., 2011). However, the review focused primarily on tolerance of VR equipment rather than specific social skill acquisition, only included two studies involving students with disabilities, and did not implement the same intervention in the low and high virtual immersions.

Carreon and colleagues (2020) sought to understand the impact of VR on students with disabilities and found a majority (80%) of studies used non-immersive VR. Their results reveal VR to be promising but reinforced the need to understand what elements of the technology (e.g., student's sense of presence, the varying virtual environments, implementation time) lead to positive outcomes. Cheng & Chen (2010) reported immersive technologies to provide increased opportunities for practice with reduced social pressure for students with ASD but did not have interview data to show what caused the increase in willingness to engage in practice time within the technology. Rising (2017) added that this practice increased students' motivation to learn without a substantial increase in resources and time from teachers and parents but did not state whether the technology was easily accessible and a preferred form of intervention delivery.

VR for Social Skill Acquisition

VR has been utilized in studies to improve the acquisition of social skills for adults and students of varying ability levels. Vasquez and colleagues (2015) completed a review of 19 unique studies that targeted social skill development using virtual environments for K–12 students with ASD. The review included a broad definition of virtual learning environments

(VLE), including a continuum that allowed for VR applications, 3D emotion systems, animated television series, and several other technologies loosely affiliated with either VLEs or VR. Their review reinforced the changing nature of virtual technology tools and how the hardware and software have the potential to alter and impact student outcomes. The researchers found that simulations may be a more effective method for student engagement and social skill improvement than non-simulated environments. Still, the interventions utilized within the technologies were not uniform and much of the data on improvements was lacking.

Howard and Gutworth (2020) meta-analyzed VR training programs to teach social skills such as awareness of social space, body language, and verbal tone to students of varying ages and abilities. They analyzed studies with participants from school age through adulthood from general and specialized populations (e.g., participants with aphasia, anxiety, high incidence disabilities). Howard and Gutworth found VR training to be more effective than comparison programs (e.g., social narratives, social skill curricula, buddy programs) by almost three-fourths of a standard deviation. However, contrary to their expectations, studies with individuals with disabilities produced smaller effects than those from general populations. These results caused Howard and Gutworth to urge the field to further investigate targeted skill acquisition within VR for those with varying ability levels.

All the above studies have provided relevant information about the ability to use virtual and augmented technology for teaching purposes. However, researchers have reported gaps in the literature (Bellani et al., 2011; Merchant et al., 2014; Miller & Bugnariu, 2016; Sansosti et al., 2015). Each of the above reviews considered an aspect of a virtual technology intervention (i.e., usability, feasibility). However, researchers have yet to explore these studies considering whether the social skills chosen are important and applicable and whether the technology

methods are motivating and acceptable. This information is needed to determine whether the SS intervention is useful and will be maintained(Callahan et al., 2017; Kennedy, 2002). Extant literature has yet to explore these studies taking into consideration the treatment agents, targeted social skill goals and teaching intervention used within the environment. Therefore, a systematic review was necessary to explore and understand both the acceptability and usefulness of virtual technologies as well as the ability of the intervention within to promote social skill acquisition for students with ASD.

Social Validity (SV)

There are no established criteria for determining what constitutes social validity. However, there are methods for determining whether enough information is present to verify aspects of social validity (Callahan et al., 2017). Reichow and colleagues (2011), when determining quality indicators of evidence-based practices (EBPs) for students with ASD, identified SV as extremely important. For an intervention to be socially valid, the study should contain four of the following seven indicators: (a) socially important dependent variables, (b) time- and cost-effective interventions, (c) comparisons between individuals with and without disabilities, (d) clinically significant behavioral change, (e) satisfaction with intervention results by consumers, (f) independent variable manipulation by people the participant typically interacts with, and (g) take place in natural contexts (Reichow et al., 2011). Due to this study needing to validate both the technology and the intervention within the technology we split these into nine categories and 17 indicators. The nine categories include:

1. social relevance of technology dependent variables (i.e., participants have positive feelings toward the technology)

2. social relevance of intervention dependent variables (i.e., participants have positive feelings toward the intervention)

3. accessible (i.e., readily available, time- and cost-effective)

4. ease of use

5. satisfaction with the results by stakeholders (i.e., technology was reported useful by teachers, parents, and/or clinicians)

6. a behavioral change that is large enough for practical value (i.e., participant's increase in knowledge or skill as a result of the intervention)

7. continued skill success reported after the intervention

8. skills are generalized into a natural context (i.e., home, school, community) and

9. skills are maintained over time.

The extent to which an intervention is considered socially valid significantly influences whether the intervention is adopted and implemented by students, educators, and parents (Kern & Manz, 2004). Therefore, we took the social validity indicators in the above nine categories and broke down two categories to establish 17 total indicators which influence intervention use: 10. number of sessions, 11. session time, 12. time span, 13. application outside technology, 14. norm-referenced, 15. pre and post comparison, 16. multiple measures of performance, and 17. fidelity and reliability.

Systematic Review

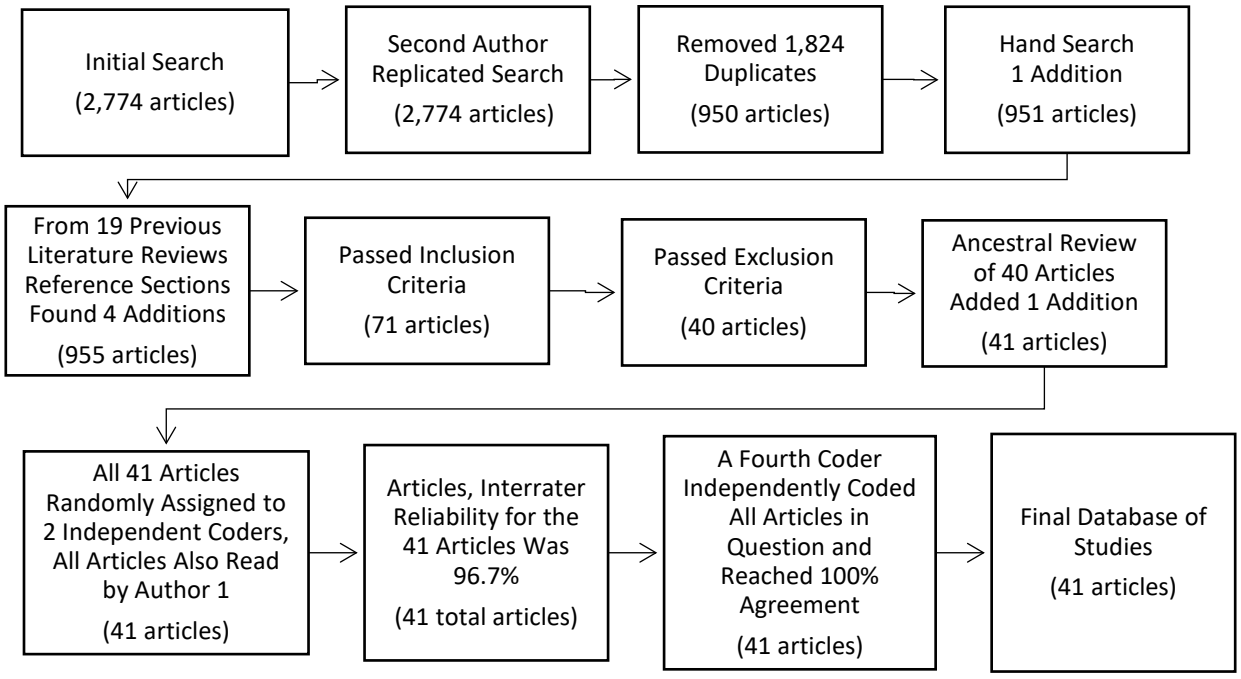
Search Procedures

A systematic search for studies which utilized immersive technology to teach SSs to school age students with ASD was conducted across four databases for twenty years, from 2000 to 2020, using PRISMA-P protocol and traditional approaches to identify all relevant sources

(Cronin et al., 2008; Gersten et al., 2005; Kepes et al., 2014). The four databases selected for analysis included the Education Resources Information Center (ERIC), PsycINFO, ScienceDirect, and Web of Science. These databases were chosen because they are the most extensive databases containing articles published on education and technology. The following search terms were used: "autis*," and "social," and "student," and "generaliz*" and either "reality" or "virtual" to encompass all the following: autism, autistic, ASD, generalize, generalization, virtual environment, virtual learning, virtual reality, immersive virtual, augmented reality, mixed reality, and extended reality. The search was conducted in March of 2020 and was filtered by language (English) and limited to peer-reviewed published articles. This search returned 2,774 articles (see Figure 1) and involved four researchers, referred to as "first, second, third and fourth author/researcher" in-turn, in the summary below.

Figure 1

Search and Coding Procedures



A search protocol was given to the second author who independently replicated the search and yielded 2,774 articles. After removing duplicate articles, the results were exported and combined into a single database. The search returned 950 articles for screening. A comprehensive hand search of five journals, chosen for their extensive publishing of technology in special education (*Journal of Special Education Technology and Computers and Education*) and autism research (*Journal of Autism and Developmental Disorders, Autism Research, and Focus on Autism and Other Developmental Disabilities*), resulted in one additional article. An examination of 19 literature review references produced four additional articles, resulting in 955 articles for screening.

The authors screened the title and abstracts and excluded articles that did not utilize a research design or target a social skill intervention utilizing virtual technology for school-age children with ASD. Screening resulted in the elimination of 884 articles and the inclusion of 71 articles. Articles were included if they used VR, AR, or MR as the independent variable; had one school aged student with a diagnosis of ASD; and were empirically based using single subject, qualitative, quantitative, or mixed methods. Articles were excluded that examined elements of virtual or reality (e.g., usability) without focus on the application of the technology for teaching or learning and were not subject to peer review.

After applying the inclusion and exclusion criteria to the 71 articles, 40 articles remained. An ancestral review was conducted using references from the 40 articles and resulted in one additional article. Three reviewers independently reviewed all 41 articles and came to 100% inclusion agreement.

Coding Procedures

The first author coded all 41 articles. References for articles were entered into a database and randomly assigned to two additional researchers for coding. A fourth researcher was trained to code any disagreements. Training of coders involved reviewing the coding criteria, coding three articles, discussing coding and disagreements, and providing feedback until 100% agreement was achieved. The coding form included primary and secondary quality indicators by type of experimental design (Reichow et al., 2011) and the quality indicators of systematic reviews in behavioral disorders (Maggin et al., 2017).

Categories were coded as "unclear" when the authors did not provide sufficient details to determine the variable. The 17 indicators of social validity were coded both for their presence in the study and whether the response from participants was negative, positive, or had mixed results. These measures included technology's ease of use, the usefulness of the intervention, participant's views toward the intervention, as well as cost and availability of the technology. Maintenance was coded by agent reporting and length.

The specific social skill was coded as well as whether a single, multiple, or social and other skills (i.e., academic, motor coordination) were implemented. Relationship skills included verbal and non-verbal communication and social engagement. Executive functioning involved the ability to focus on a task, create a plan of action, complete multiple tasks at one time, or any combination of the three. Emotion recognition involves naming a given emotion when shown an image. Studies were coded in the social awareness category if the dependent variable involved understanding the causes of events or behaviors and perspective-taking. Studies were coded in cooperation when the dependent variable included working with others to complete a task (Shih et al., 2015). The use of direct instruction and observational learning within the technology

delivered intervention was coded. Direct instruction was defined as the explicit teaching of each step necessary to learn the targeted skill (Plavnick & Hume, 2014). Observational learning (OL) was defined as learning that occurs from seeing others' behavior and the implications for that behavior (Catania, 1998; Plavnick & Hume, 2014). Each type of technology and whether outside measures (i.e., prompting) were present within the intervention were coded.

Interrater reliability was calculated using the Cochrane Review model (Higgins & Green, 2011) in which 52 items of the 126 were considered for each article, resulting in 2,184 total items coded for reliability purposes. Interrater reliability was calculated by determining the percentage of agreement. The raters divided total agreements by agreement plus disagreements multiplied by 100 for each response on the coding form to calculate the agreement rate. Interrater reliability for the 41 articles was calculated at 96.7%. Discrepancies were resolved by a fourth, trained researcher who independently coded all articles in which the coders disagreed. The information was conveyed to coders who reached 100% consensus of the 41 articles.

Results

The 41 studies included 524 males and 87 females who ranged in age from two to twenty years old. The treatment agent and setting were reported in 34 studies (19 occurred in schools, 10 in a clinic, and five in multiple environments) with researchers implementing the technology in 21 studies, teachers in 16, clinicians in nine, and parents in three. Thirty studies were conducted to improve multiple social skills, seven taught a single social skill, and the remaining four did not state the targeted skill. The social skills taught through technology included emotion recognition, relationship skills, social awareness, cooperation, and executive functioning.

Social Validity Measures Reported

Appendix A provides the 17 indicators of social validity and whether the specific social validity information was reported. Appendix B shows whether the nine categories were positive or negative (i.e., useful/not useful) by the type of technology used to present the intervention. Eighteen studies (44%) provided social validity measures related to the feelings toward technology and 15 (37%) of the 41 studies reported the feelings of the intervention within the technology.

Goals, Importance & Justification. All 41 studies stated multiple goals for the study, at least one of which was for the participants to learn a social skill. All studies stated the importance of teaching social skills to students with ASD and reported a parent or teacher documented social skill deficit in the student. Two studies (7%) included the technology's cost or availability to parents and teachers. One study (Yuan et al., 2018) stated the CAVE was not cost-effective or available outside the clinic. Participants in this study became limited to those who had the time and transportation to and from the clinic containing the CAVE technology. Researchers in another study (Stichter et al., 2014) declared the VR iSocial cost-effective and accessible to parents and teachers to implement.

Procedures. All 41 studies stated the specific technology used to implement social skills. Five studies (12%) used AR, 26 (63%) used NI VR, 10 (24%) used immersive VR, and MR was not used in any study. Researchers in 17 studies (41%) conveyed the ease of use of technology reported by the participants as well as the treatment agents (i.e., teacher). Participants and treatment agents in 11 studies (65%) stated the technology was easy to use. Authors of two studies (12%) said the technology initially was difficult to use but became comfortable with time. Four studies (24%) showed mixed reports regarding ease of use. Participants whose IQ

scores were higher than 70 reported the technology accessible while those with IQ scores lower than 70 reported the technology was difficult to use. AR and NI VR were the primary technologies used in studies where participants stated the technology was easy to use. Researchers using immersive environments in only one study (Adjorlu et al., 2017) indicated technology ease of use. Other immersive VR implementers reported the technology ease was feasible only after learning to use the technology (Lorenzo et al., 2013; Lorenzo et al., 2016).

Eighteen studies (45%) included the participant and treatment agents' attitudes and views toward the technology, with 13 studies showing a positive attitude (72%), two studies (11%) showing a negative attitude, and three studies (17%) showing a mix of positive and negative reactions. For example, Tsiopela and Jimoyiannis (2014) used a non-immersive virtual computer game to teach primarily pre-vocational skill speed, the accuracy of vocational skills (e.g., organizing, sorting), and self-confidence. Parents and teachers within the study said the technology made a positive impact on student confidence, communication, social awareness, and relationship skills, as well as speed and accuracy of pre-vocational skills. This finding suggests students may observe and practice technology skills outside of the technology's instructional objective. The two studies that reported a negative outlook (Lorenzo et al., 2013; Lorenzo et al., 2016) were also the two studies reporting the technology was not initially easy to use. The researchers reporting mixed attitudes were due to some participants not liking to wear the 3D glasses (Cai et al., 2013) and one participant with more severe impairments not wanting to interact with the virtual avatar (Mantziou et al., 2015).

Fifteen studies (37%) stated whether participants liked the intervention within the technology. Researchers in 14 of the 15 studies (93%) reported participants finding the intervention exciting and rewarding. The remaining study (7%) reported participants having

mixed feelings toward the intervention (i.e., not enjoying at all or having varying enjoyment levels throughout the intervention).

Participants and treatment agents in 35 studies (85%) stated whether the intervention presented through the technology was useful, with those in 34 of the 35 studies (97%) finding it useful and one finding mixed results (3%). Five studies (15%) in which participants and agents reported the intervention useful did not significantly improve the targeted skill. For example, parents' reports of social competence in Stichter et al. (2014) deemed the technology useful despite no significant change in the children's scores on emotion recognition after the intervention.

The included authors used various measurement approaches to determine intervention success. Researchers used norm-referenced assessments to identify students for the intervention in 16 studies (39%). Norm-referenced measures were primarily used to assess IQ and a specific social skill deficit (i.e., emotion recognition from facial expressions). Of the 15 studies (37%) that reported a control group, eight (53%) consisted of typically developing peers, and 12 studies (80%) had a control group with matched abilities in either social skill competence, full IQ, performance IQ, or verbal IQ. Eighteen studies (44%) implemented pre- and post-assessments. Norm-referenced assessments measured progress pre- and post-intervention in only nine studies (22%). The studies' primary measures of improvement were observation by treatment agent (N= 33, 85%) and rating scales with interviews (N=29, 74%). Fifteen studies (37%) utilized researcher-developed assessments to determine intervention success.

The intervention duration also varied considerably between studies. The number of sessions the participants received varied from one session on one day (Cai et al., 2013) to 80 sessions over four months (Modugumudi et al., 2013). The average number of sessions across

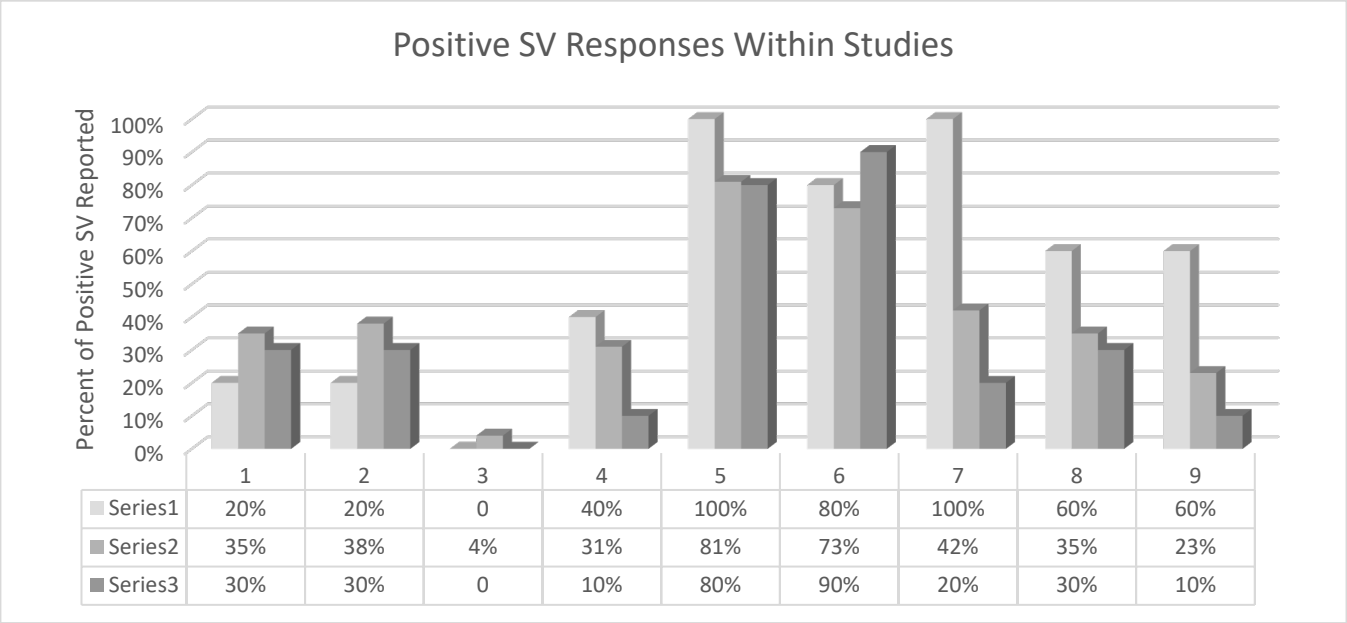
studies was 14 sessions. Thirty-four (83%) studies reported the intervention period and the number of sessions, and 31 studies (76%) reported session time. Session times varied from 10 minutes (Alcorn et al., 2018) to 150 minutes (Parsons et al., 2004). Most of the intervention sessions were within 20-40 minutes (N=15, 48%). Appendix C shows additional characteristics of each study.

Outcomes. The magnitude of the effect was not mentioned in any of the 41 studies. The intervention's significance was determined in 35 studies (85%) by the effectiveness in teaching the targeted skill and in six studies (15%) by whether the participants were able to use the technology to complete the social task. The intervention caused statistical improvement in 15 of the 41 studies (37%). The intervention was considered effective in 26 studies (63%), not effective in 4 studies (10%), and 11 studies (27%) reported mixed results. The studies reporting mixed results did so because either the technology accurately taught one skill but not the targeted skill or the technology improved targeted skills but did not reach statistical significance. Intervention effectiveness was listed in all five social skill areas: relationship skills (N=13, 50%), emotion recognition (N=9, 35%), social awareness (N= 6, 23%), cooperation (N=3, 12%), and executive functioning (N=3, 12%).

Researchers in 35 studies (85%) reported whether participants increased in knowledge, skills, or experience from the technology intervention, with 32 studies (91%) stating an increase in knowledge, skills, or experience, and three (9%) stating no increase in knowledge, skills, or experience. Figure 2 shows both reporting of statistical and significant effects of the targeted social skill as well as whether the minimum requirements to determine study validity and reliability by design type were included (Campbell & Stanley, 2015; Ledford & Gast, 2014).

Figure 2

Literature Review Social Validity Responses by Immersive Technology



	1	2	3	4	5	6	7	8	9
Series1	20%	20%	0	40%	100%	80%	100%	60%	60%
Series2	35%	38%	4%	31%	81%	73%	42%	35%	23%
Series3	30%	30%	0	10%	80%	90%	20%	30%	10%

The included studies differed in the method used within the technology to teach the targeted social skill. Three studies (7%) taught social skills through direct instruction (DI). Seventeen studies (41%) taught social skills through observational learning (OL). A little over half of the studies (51%) utilized DI and OL within the technology to teach the targeted skill. OL alone effectively taught relationship skills and cooperation but not emotion recognition, executive functioning, and social awareness. Over half of the studies reporting significant improvements (65%) utilized a combination of direct instruction and observational learning, with six studies (23%) using only observational learning and three (12%) using only direct instruction.

Researchers in 20 studies (49%) reported generalization of the social skill outside of the technology environment. Of these, 19 studies (95%) stated the generalization environment (i.e., school, home, and community) and the person reporting the generalization (i.e., parent, teacher, student). Fifteen studies (79%) reported students could generalize skills learned within the

technology into real-world environments. Four studies (20%) reported some students were able to generalize, and some were not, and one (5%) stated there was no generalization. The maintenance of the social skill was reported by 13 studies (32%) with 10 studies (77%) reporting maintenance, two (15%) showing maintenance for a few but not all participants and one study (8%) reporting no maintenance (Mitchell et al., 2007). The maintenance reported in studies varied from 10 days to 720 days. Of the 13 studies (32%) reporting generalization and maintenance, 12 said the skill was both maintained and generalized.

Discussion

RQ1 Studies Reporting Social Validity Measures

This review examines the social validity of utilizing virtual technologies to teach social skills to school-age children with ASD. Three decades of documentation show social validity is a critical component of social skill interventions (Carter & Wheeler, 2019; Hansen et al., 1989). However, current research has yet to provide adequate information within studies to determine whether AR, VR, or MR are socially valid social skill acquisition modalities. No researcher reported information for all nine categories of social validity, revealing some studies either did not measure social validity within the study or did not report measuring these indicators. Of the nine categories of social validity, studies identified anywhere from zero to eight categories. The SV indicators reported by researchers ranged from two to 14 of the 17 indicators. Only two studies reported whether the technology was accessible and affordable, an essential aspect of social validity. Participants in one NI VR study reported it was accessible and affordable, while another study utilizing immersive VR, reported it was not accessible or affordable.

It is important to note researchers who reported a higher number of SV indicators also tended to report significant improvements in social skills. The session information and measures

used varied between studies, but most studies reported the technology easy to use and the intervention useful. Even though no studies reported all SV indicators, 85% of researchers reported on the usefulness of the technology and whether the intervention within the technology improved social skills. Of studies reporting SV indicators, 87% conveyed motivation toward the intervention and 72% reported a positive student attitude toward the technology.

Social validity measures are necessary to determine if the skill selected for intervention improves the participant's functioning of daily life requirements and activities. The technology was aligned to the student's specific social skill needs in 15 of the 41 studies (37%). Most studies utilized technology with an already programmed script for teaching specific skills and then sought students with social skill deficits, assuming the technology would be beneficial. One study (Adjorlu et al., 2017), reporting higher levels of SV, utilized teachers in the intervention creation. The teachers chose the virtual setting, helped in the intervention design, and provided direct instruction to students through a headset during the three scenarios. This study showed higher implementation fidelity than other studies implemented by teachers and may, in part, be due to the teachers' ability to design and utilize the technology for specific students.

Educational technology needs differ significantly across communities, educational settings, and socioeconomic backgrounds (Miller & Bugnariu, 2016). Yet, cultural validity was not mentioned in any study, despite the studies spanning 11 countries. The expected norms and behaviors of culture are embedded within any social skill acquisition. For example, Self et al. (2007) considered fire and tornado drill safety a social skill because researchers felt these skills benefit students' daily wellbeing. A separate researcher may consider these adaptive skills rather than social and may find they are not necessary for social acceptance in everyday life. Providing

information on cultural validity in future studies would help determine the perceived usefulness of the technology delivered intervention for the desired population.

Findings indicated there are many socially valid reasons for using AR and VR as a method of social skill instruction for students with ASD. Among studies reporting usefulness, the central element reported useful was the technology rather than the social skill or the intervention within the technology. It would be helpful to understand how useful the skill taught within the technology is for the participant and those who interact daily with the participant. It would also be helpful to know if participants felt the intervention methods within the technology were adequate for acquiring a targeted skill. Knowledge of whether the social skills chosen in studies were selected because they were easier to program or measure or whether they addressed a primary skill deficit would help determine the actual usefulness of the intervention. Increasing SV measures within studies would provide a better understanding of the benefit of using virtual and augmented technology versus other instruction methods. Many SV measures were primarily based on verbal reports from students, parents, and teachers. Having a norm-referenced measure to determine skill acquisition, generalization, and maintenance would provide a greater understanding of the technologies' successful implementation.

The high levels of student motivation toward the intervention, positive attitudes toward the technology, and perceived usefulness of the intervention suggest AR and VR may be socially valid instructional methods. Increasing the role of parents, educators, and students as both skill selectors and treatment agents within the technology has the potential to increase social validity. Additionally, providing accurate measures of student progress in skill development has the potential for improving the statistical significance of AR and VR delivered interventions.

RQ2 Social Validity Reported: Goals, Justification, Procedures, and Outcomes

Researchers must obtain information from participants about their attitudes toward the intervention and the intervention delivery to determine social validity. The authors of every study reported a justification for the need to teach social skills to students with ASD. However, only 15 studies (37%) discussed with participants and treatment agents their feelings toward the intervention. Eighteen studies (45%) determined whether participants or treatment agents had positive or negative attitudes about using the technology. Research shows a participant's attitude is vital, as this plays a significant role in the intervention's continued use upon study completion (Carter & Wheeler, 2019).

Procedures used within each intervention were not always reported. The primary reporting was on whether students learned through OL or DI. In 41% of studies, students with ASD were not given any DI on the skills, even though researchers stated the skill was "taught" to students. DI in systematically teaching a social skill in a purposeful manner (Plavnick & Hume, 2014) was the primary instructional component in only three studies (7%). Individuals with ASD tend to require one-to-one delivered DI to learn a new skill (Stahmer, 2007). DI can be given through AR and VR, but it is currently under-utilized in interventions delivered virtually. OL was the primary means of teaching in 38 studies (93%). However, research shows students with ASD do not readily learn prosocial behaviors through OL (Plavnick & Hume, 2014). When assessing whether AR and VR are effective means of instruction, future researchers must also consider if the delivery within these interventions provides an adequate education.

Another critical measure of social validity is the acceptability of an intervention. There was a reported correlation in ease of use and the participant's attitude toward the technology (Lorenzo et al., 2013; Lorenzo et al., 2016). As VR use became more natural, participants'

attitudes improved. Contradictory to Howard and Gutworth's findings (2020) and in support of Miller and Bugnariu's conclusions (2016), higher levels of immersion were more conducive to successfully delivering social skill interventions for students with ASD. Even though treatment agents and participants found immersive VR more challenging to use initially, the immersive VR showed greater ease of use as time went on and greater significant improvements compared to NI VR or AR. The technology's acceptance by participants was only discussed in the studies using HMDs. Since virtual technology in schools is primarily implemented through screen-based devices, it would help to understand what aspects of these technologies may hinder learning.

We found evidence contrary to Miller and Bugnariu (2016) who reported the closer the VR match to the real-world, the better the outcomes. Environments too closely resembling the student's actual school caused more off-task behavior and less effective results, as students were distracted when anything did not perfectly match their current physical environment (Adjorlu et al., 2017). All 20 studies reporting generalization included settings where participants reported feeling like they were in a real room talking to real people without the environment matching their classrooms. This aspect of resembling reality may be more effective than resembling specific locations, which may distract students.

Most researchers in the 13 studies reporting generalization and maintenance stated the skills were generalized and maintained. For example, Cheng and colleagues (2010), utilizing NI VR, found a significant improvement in all three students' performance on the Empathy Rating Scale (ERS). Through discussions with teachers and observations, they were able to identify students who had increased empathy apart from the VE. For two of the three students, empathy was maintained for 60 days. In another display of generalization, Chen and colleagues (2016) utilized a tablet and a storybook with embedded AR markers. They found students were able to

learn six core emotions and facial expressions and apply this knowledge in their home and community.

Mixed generalization results were reported in a few studies where some students generalized skills, and some did not, or some skills were generalized but others were not. Although researchers stated reasons for the participant differences, no researcher systematically studied the variance in maintenance and generalization. For example, Adjorlu and colleagues (2017) found only two of five students were able to generalize skills of cooperation and sharing into the classroom following VR intervention. Still, they did not complete follow up testing to determine why skills were not generalized for the three remaining students. Stichter et al. (2014) utilizing NI VR reported improvements in all areas that generalized to the school, home, and community except executive functioning, but did not propose a reason.

Twelve studies (80%) reported students could maintain skills learned in the AR and VR environments once intervention was complete. Lorenzo and colleagues (2016), comparing VR and NI VR for students with ASD, found greater presence of appropriate emotional behaviors in immersive VR. Through observation, questionnaires, interviews, and rating scales, researchers determined that students using immersive VR maintained improvements in self-control, empathy, and emotion recognition for two years.

Interestingly, all studies reporting maintenance had over nine SV indicators, signifying a social skill may more likely be maintained when parents, teachers, and participants find the technology enjoyable, easy to use, and valuable. We also discovered studies conducted in schools in which the intervention periods (i.e., months instead of days) were extended resulted in higher levels of social skill generalization and maintenance. This finding suggests a need for further research into whether interventions implemented in schools improved students'

maintenance and generalization over those in clinics or homes. The increased generalization in schools may also be due to the teacher having a better understanding of the intervention and therefore, being better able to apply aspects of the VR intervention into daily classroom routines.

Thirty-two (91%) studies reporting improvement in knowledge, skills, or experience stated improvement was due to the AR and VR delivered intervention and the interventions effectively taught a targeted social skill in 26 studies. Researchers in 10% of studies showed no significant improvement, and in 27% of studies showed mixed results. Despite AR and VR not consistently reaching statistical significance, there is social validity evidence supporting the use for social skill instruction. Further research is needed to determine if these technologies are an effective method for social skill instruction for students with ASD. When authors provided detailed study descriptions to determine intervention success (i.e., reliable measures, clear variables), AR and VR were found useful.

Limitations

This paper utilized only peer-reviewed studies from 2000 to 2020 from specific databases. Thus, while we believe we were thorough in our identification of studies, the quick-paced, evolving nature of technology and the growing outlets publishing on virtual technologies leads to the possibilities of missing some current literature. Our focus on school-age students does not provide enough information to determine the implications of this research for early childhood and adults with ASD.

While we controlled for ambiguous definitions through agreement from multiple coders, social skill categories, OL, and DI may be defined and evaluated differently by different researchers. Effect sizes were also not calculated for these studies. Although not required to determine the evidence base of a strategy (Cook et al., 2014), calculating standardized effect

sizes would provide comparisons across studies. Finally, we did not exclude studies with low or no validity and reliability measures due to insufficient evidence on the reason the study excluded this information (i.e., word count limitations or insufficient rigor).

Implications for Researchers, Programmers, and Practitioners

The SV measures revealed participants had a positive attitude toward using all forms of technology when they felt the technology was easy to use. Based on the literature, if educators allow students to become comfortable with immersive VR before the intervention, more significant learning of skills may be present. NI environments often take little pre-training but may not have the same impact as immersive technologies. For example, Lorenzo et al. (2016) found students in NI VR obtained higher frequencies of adequate behaviors in the initial sessions than those in immersive. However, with training and practice, the immersive environment showed greater ease of use over time and greater overall improvements related to students' emotional behaviors and compliance. Therefore, investing time to ensure student comfort before implementing the intervention has a positive impact. Time spent training on technology use also assisted in improving attitudes from participants and treatment agents, which suggests ease of use may impact feelings about the intervention.

Practitioners may have better results in interventions if they determine targeted intervention elements before implementing virtual technology. These elements include whether the social skill deficit is skill-based or performance-based and whether the intervention within the technology is best suited for the student's specific deficit. Interventions using OL were effective when teaching relationship skills and cooperation but were ineffective when teaching other social skills. Future researchers may need to clarify how to ensure interventions within VEs provide instruction necessary for the specific skill deficit.

Determining the aspects of technology that may hinder students with ASD may provide more productive learning spaces. Sensory needs and thresholds for participants should be considered both in selecting the equipment as well as the VE. Environments may be too distracting for sensory-seeking individuals (Adjorlu et al., 2017). For example, Ke and Im (2013) found when the ability to fly and voice chat were enabled, off-task behavior occurred from all students. As soon as these non-essential functions were disabled, students participated appropriately. Students who are sensory avoiders may require VR without wearables or haptic controllers (Cai et al., 2013). Practitioners, programmers, and technologists may want to consider developing and utilizing technology in which distracting features as well as specific handheld device requirements can be disabled for better individualization.

Human developmental factors should be included to determine an acceptable age to switch to immersive environments, to not interfere with cognitive and physical development in young children. This would assist educators in determining which VE is best suited for the developing brain. It would appear beginning with NI VR or AR for young students and moving toward immersion as the student ages is advantageous.

Studies that provided higher levels of SV indicators were more likely to report generalization and maintenance. This finding could be due to these specific researchers' increased thoroughness in documenting attitudes, motivations, usefulness, generalization, and maintenance. However, it could also be because studies with higher SV measures considered essential social aspects that allowed continued use of the technology. Attitudes toward specific technologies often correlate with the degree to which students and educators are willing to use technology (Dabholkar & Bagozzi, 2002). There is need for further research on the factors

influencing social skill acquisition and generalization, paying particular attention to treatment agent attitudes and participant motivation.

One study (Didehbani et al., 2016) mentioned that once the program began rewarding appropriate social interactions, teachers no longer needed to provide physical rewards. Playing in the environment with interactive objects became rewarding. This knowledge is helpful to practitioners because having an intervention as a reward may decrease the need for external reinforcers. This knowledge is also beneficial to researchers and programmers as there was not a need for additional reinforcement measures (i.e., badges, unlocking additional rooms) within the technology. The technology was motivating, which may allow researchers to focus more on the intervention delivered within the technology and less on providing game-like features.

A cost-benefit analysis comparing AR and VR to existing techniques delivered through technology as well as human delivered interventions would provide researchers with a better justification for investing in virtual technology. Justifying technology as the instruction mode over other instructional methods is needed before educators invest time and resources into implementing these mediums. Understanding the developmental factors, intervention specifics, and stakeholder input will not only improve SV but will further highlight the potential of virtual technologies.

Chapter 3: Methods

The neural and hormonal changes at the onset of puberty offer a second opportunity for development in all SE domains (Blakemore & Mills, 2014; Crone & Dahl, 2012). Yet, finding quality SE programs to assist adolescents in dealing with social skill struggles can be difficult (Sawchuk, 2021). There are currently several evidence supported social skill programs for adolescents (e.g., PEERS, Zheng et al. 2021; SENSE Theatre, Corbett et al. 2014; SOSTA, Freitag et al. 2016; Second Step, Moy & Hazen, 2018; START, Vernon et al. 2016). However, recent reviews and meta-analyses revealed varying degrees of program effectiveness for improving SE knowledge and skill demonstration (Cappadocia & Weiss 2011; Corcoran et al., 2018; Gates et al. 2017; McMahon et al. 2013; Wolstencroft et al. 2018). SEL interventions for adolescents are not as effective those targeting earlier ages and rarely do middle school students report these programs to be motivating or effective (Heckman & Kautz, 2012; Yeager, 2017).

Investigating both the effectiveness and social validity of a VR delivered intervention versus another evidence-based intervention utilizing technology may illuminate potential barriers (e.g., perceived ease of use, motivation, direct versus indirect instruction) to the intervention's use and effectiveness. Such information may be useful in supporting current SE practices within middle schools as well as in shaping future SE interventions to improve the social validity of these interventions for this population. Therefore, the following research questions were developed to gather valid and reliable data that may assist educators and curriculum developers in making decisions on adopting virtual technologies:

1. Is there a difference in the effectiveness of a VR based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEERS) for middle school students?

1a. Is there a difference in the social communication knowledge of a VR based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEERS) for middle school students?

1b. Is there a difference in the social communication skill application of a VR based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEER) for middle school students?

2. Is there a difference in the ratings of social validity measures (acceptability, feasibility, and appropriateness) of a VR based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEERS) for middle school students?

2a. Is there a difference in the pre and post acceptability ratings of a VR based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEERS) for middle school students?

2b. Is there a difference in middle school student ratings of feasibility of a VR based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEERS)?

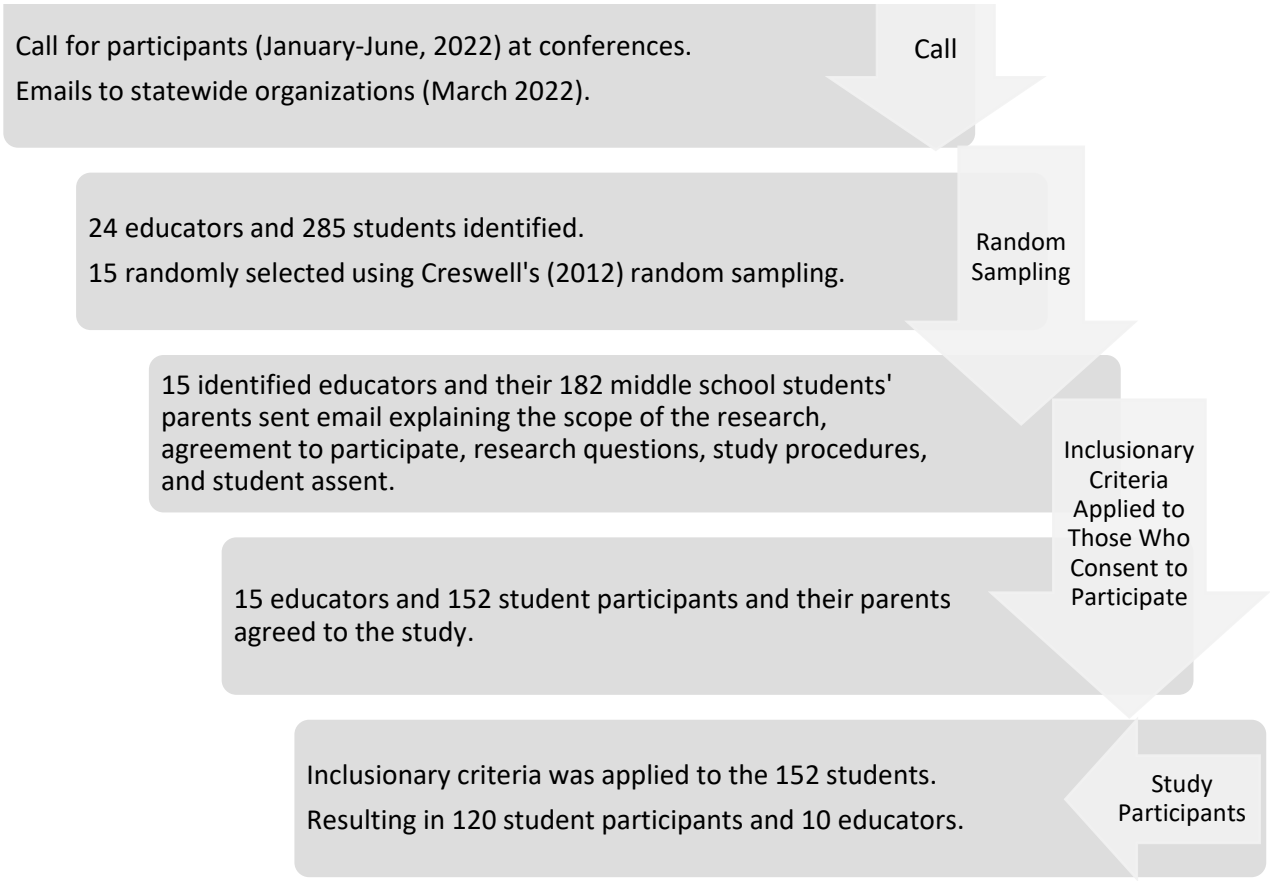
2c. Is there a difference in middle school student ratings of appropriateness of a VR based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEERS)?

Participants

Approval was received by the University of Kansas Office of Research Institutional Review Board (IRB) prior to all research activity (see Appendix E). The study was pre-registered in the Center for Open Science. Figure 3 provides the recruitment selection process.

Figure 3

Participant Selection Process



Participants for this study included middle school students and their primary educator. A call went out for participants at the 2022 Council for Exceptional Children National Conference, the Assistive Technology Industry Association National Conference, the Autism Across the Lifespan Regional Conference, the American Education Research Association International Conference, the Midwest Symposium for Leadership in Behavior Disorders Conference, the SEL Exchange Virtual Summit, and the Arizona Evidence for Success Disability Conference. Emails were also sent in March, 2022 to statewide organizations which provide services to those with social communication delays. If interest was expressed, the study requirements and process were

provided with a recruitment letter (see Appendix D) and time was allotted for answering educator, parent, and student questions both face to face and virtually. Twenty-four educators' 285 middle school students were identified. A culturally responsive research approach was taken to provide a pool where minority and marginalized voices representing diverse cultures were kept constant (Oluo, 2019) prior to applying random sampling (Creswell, 2012). This process was selected to obtain participants in different U.S. states (NM, KS, NC, VA), schools spanning urban, suburban, and rural districts, and in attempts to remove the over representation of one voice and culture within research over another. Random sampling using this approach resulted in fifteen educators and 182 middle school students. Educators and students' parents were sent (emailed to the teacher; emailed and a paper copy to the parent) the consent and assent forms for educators, participants, and their guardians (see Appendix E) explaining the scope of the research, agreement to participate, research questions, and study procedures. All fifteen educators and 152 students' parents agreed to the study.

Inclusionary criteria was applied to 152 students, resulting in 120 student participants ages 10 to 13 years (M= 11) and 10 educators. Student participants' inclusionary criteria consisted of: 1. being of middle school age (i.e., age 10 to 15); 2. being identified by a qualified educator or practitioner familiar with the adolescent to be in need of a pragmatic or expressive language social skill intervention determined by a valid and reliable assessment measure (e.g. Clinical Assessment of Pragmatics, Test of Pragmatic Language); 3. being able to complete rating scales on their perceptions; 4. being willing to participate for the duration of the study and follow up; 5. being able to participate in a technology-based intervention; 6. being educated in pragmatic communication by an educator willing to oversee technology use; 7. having an educator willing to complete rating scales; and 8. having the communication abilities to

participate in the VOISS and PEERS interventions (i.e., English-speaking with a minimum third grade reading level). A participant's diagnosis, if any, was not a pre-requisite for participation, though it was documented. Instead, students with and without disabilities were recruited to ensure the main qualifier for participation is a deficit in the targeted skill as determined by a qualified school professional (e.g., speech and language pathologist, special education teacher, occupational therapist, school psychologist). Table 1 provides a summary of student participant demographic information.

Table 1

Student Demographic Information

Race and Ethnicity	***n***	**%**	**Student Age**	***N***	**%**
African American	7	4.8	10 years old	48	33.1
American Indian/Alaska Native	6	4.1	11 years old	51	35.2
Asian	11	7.6	12 years old	14	9.7
Hispanic/Latino	12	8.3	13 years old	7	4.8
More Than One Race (African American & Latino)	1	0.7			
White	85	58.6			
Gender	***n***	**%**		***N***	**%**
Female	54	37.2	Male	66	45.5

The study included classrooms in private, public, and charter schools (see Table 2). All ten educators reported adequate access to technology and broadband internet in their classrooms. All student and educator participants reported extensive (i.e., three or more years) experience utilizing the technology delivering the intervention (i.e., Chromebook, iPad) in their classrooms. Educators time spent teaching ranges from 3 years to over 25 years. The same was true for number of years providing instruction in developing social-emotional competencies (see Table 5).

Table 2

Educators' School Demographic Information

Location	n	%	State	*N*	%	Type of School	*N*	%
Rural	3	30	KS	2	20	Public	5	50
			NM	1	10	Charter	1	10
suburban	4	40	VA	4	40	Private	4	40
urban	3	30	NC	3	30			

All student participants included in the study were identified as "in need of a pragmatic language intervention" by their school's identification process and receiving intervention instruction in this area. Thirty-eight percent of student participants were on formalized plans for their social, emotional, communication, or behavioral needs. Thirty-seven percent of student participants had a diagnosed disability. Participants' mean pragmatic language delays fell in the moderate low (below average) range, as measured by the Clinical Evaluation of Language Fundamentals-5 Pragmatic Profile (CELF-5 PP) ratings by educators (M=76.2, SD= 34.1) and students (M=74.5, SD= 28.59), indicating "deficiencies in reciprocal social behavior that are clinically significant and lead to substantial interference with everyday social interactions" (Constantino, 2012). Table 3 provides the disability diagnoses for participants and Table 4 provides an overview of participant scores at baseline.

Table 3

Participant Diagnosis & School Plan

Diagnosed Disability			***N***	**%**
Attention Deficit Hyperactivity Disorder (ADHD)			7	5.8
Autism			15	12.4
Autism Level 1	*n=10*	*8.3%*		
Autism Level 2	*n = 4*	*3.3%*		
Autism Level 3	*n= 1*	*0.8%*		
Dual Diagnosis			24	19.9
ADHD & Learning Disability			*n=7*	*5.8%*
ADHD, Anxiety Disorder & Learning Disability (LD)			*n=1*	*0.8%*

ADHD, Autism L1 & Learning Disability (LD)	*n=10*	*8.3%*
ADHD, Autism L1, Depression & OCD (Obsessive–Compulsive Disorder)	*n=4*	*3.3%*
Behavior Disorder, LD & Sensory Processing Disability	*n=2*	*1.7%*
Intellectual Disability	3	2.5
Learning Disability	8	6.7
No Known Diagnosis	63	52.5

Student Plan Type	***N***	**%**
504	1	0.8
IEP	25	20.8
IEP with Accompanying Behavior Plan	3	2.5
IEP with Accompanying Social Skills Plan	5	4.1
Social Skills Plan/Pull Out Social Intervention	17	14.2
Student Improvement Team Plan	7	5.8
No Formal Plan	62	51.7

Table 4

Student Baseline Pragmatic Communication Knowledge and Application Scores

CELF-5 PP Teacher Ratings [a]	**Min**	**Max**	**Range**	**Mean**	**SD**	**% Mastery**
Total Pragmatic Communication	58	200	142	154.11	35.79	77%
Receptive Communication	12	48	36	39.21	9.09	82%
Expressive Communication	42	152	110	114.90	27.71	76%

CELF-5 PP Student Ratings [a]	**Min**	**Max**	**Range**	**Mean**	**SD**	**% Mastery**
Total Pragmatic Communication	74	200	126	149.73	28.59	75%
Receptive Communication	12	48	36	35.79	8.46	75%
Expressive Communication	62	152	90	113.94	23.57	75%

Student's Communication Knowledge [b]	**Min**	**Max**	**Range**	**Mean**	**SD**	**% Mastery**
Social Communication Knowledge	3	36	33	20.47	8.75	51%

[a]As measured by the Clinical Evaluation of Language Fundamentals-5 Observational Rating Scale Teacher and Student Ratings (CELF-5) Pragmatic Profile

[b]Communication Knowledge is a 40 Question Multiple Choice Test of Social Communication Skills Identified Within Both Interventions

Adult participants included six classroom teachers, three special education resource room teachers and one counselor. All demographic information was obtained from the educator and included the educator's role (e.g., special educator, related service provider, general educator, counselor), training related to SE interventions (yes or no), prior experience providing SE

instruction (number of years), and teaching experience (number of years). The educators' ages ranged from 35 to 70 years old (M= 53). Their years in education ranged from 4 to 43 years (M= 20) with a range of 3 to 35 years teaching SE competencies (M= 18). All ten educators reported having used both video modeling and social narratives in the past, though none had used any of the VOISS or PEERS interventions with students. Educator characteristics can be found in Table 5.

Table 5

Educator Demographic Information

Race and Ethnicity	***N***	**%**	**Educator Age**	***N***	**%**
African American	1	10	25-44 years old	4	40
American Indian or Alaska Native	2	20	45-64 years old	5	50
Asian	1	10	65+ years old	1	10
Hispanic or Latino	1	10	**Gender**	***N***	**%**
%White	5	50	Female	6	60
			Male	4	40
Years teaching in classrooms	***N***	**%**	**Years teaching SE**	***N***	**%**
3-4 years	1	10	3-4 years	1	10
5-10 years	1	10	5-10 years	2	20
11-15 years	1	10	11-15 years	2	20
20-25 years	3	30	20-25 years	2	20
25 years or more	4	40	25 years or more	3	30

Participants assigned to both groups received intervention in the same room, at the same time of day, from the same technology device, with the same educator, excluding unforeseen absences from school. All field trips and school events scheduled that may cause participation loss were controlled by randomly assigning students within the same school who received instruction from the same educator. No other therapies or expressive communication interventions were provided by the study team or primary educators (general education teacher and special education teacher) during the study. Parents were asked to report whether their child participated in any outside interventions (e.g., social skill groups, speech-language therapy,

applied behavior analysis) during the study. No outside interventions were reported for any participant by their educators or parents.

Control Group

A control group consisting of no intervention was not used within this study for the following reasons:

1. It would be unethical to deprive students in need of an expressive communication intervention access to that intervention during instructional hours when an educator is readily available.

2. It would be difficult to ensure students within a control group did not receive any instruction in expressive communication skills during the intervention period, which would be necessary for true control.

3. Comparing a VR delivered intervention to no intervention does not provide accurate evidence to answer the study research questions and may result in inflated effect results.

4. Comparing a VR delivered intervention to no intervention does not assist in determining whether a VR delivered social skill intervention is effective, socially valid, or comparable to another research backed intervention delivered through technology.

Utilizing each classroom's current SE program as a control was rejected due to numerous programs reported in use, many of which were being created by educators or districts with limited research base. Using the educator created interventions in classrooms within the study with other classrooms utilizing valid and reliable interventions (e.g., Second Step) may alter results due to the additional outside variables (i.e., prior training on the program, effectiveness of one program versus another increasing one classroom's outcomes over another.) While unable to control every variable, authors tried to account for as many variables as possible.

The study also utilized the portions of the VOISS and PEERS program which require less than a few sessions of training prior to use. There are other sections of both interventions (i.e., VOISS Advisor lessons, PEERS didactic lessons) which were not implemented. The entire PEERS and VOISS curricula were not implemented because of time constraints and the additional training beyond two days that would be necessary to ensure implementation fidelity on the part of the teacher. The section chosen to be implemented involved two areas of each intervention that required training which could be adequately completed in two 30-to-45-minute training sessions. The control received the evidence-based intervention (video modeling) for teaching the same skills within a research-based program's (PEERS') social communication domain. All educators in the study had some prior knowledge of implementing video modeling, role plays, and social narratives. Both interventions were administered through the same readily available technology (i.e., Chromebook or iPad) used daily by the student in the classroom. This was done to control the technology device displaying the intervention and the student's familiarity with this device.

Setting and Materials

To ensure maximization of learners' time and to comply with school COVID protocol regulations, all sessions occurred over Zoom in a room with a table, a computer connected to Zoom, and a Chromebook or an iPad. A physical presence was made available upon request, but no physical presence was requested. All participants had their educator in the room during all stages of the study. Throughout this study, the word "educator" refers to the adult (e.g., teacher, counselor) who typically provides the student's SE instruction. This study began in October, 2022 and ended in March, 2023 with the intervention phase all occurring within October 2022 through January 2023.

The intervention occurred during the student's normally scheduled SE skill instructional time. Educators and students spent two to three sessions (90 minutes total) within a two-week time span being trained in using and navigating both the technology and the intervention within the technology (i.e., VOISS, PEERS). The first author, with twenty years of experience in special education and SE instruction, implemented all training as well as the pre and post assessment questions over Zoom. All assessment questions were responded to using Qualtrics immediately following the intervention for knowledge questions and a week following the intervention for application ratings. The intervention session length per day was dependent on the typical class intervention schedule for that school and ranged from 20 to 60 total minutes per day and one to four sessions per week. Each matched peer received the same scheduled intervention day, time, and amount unless absent from school. If absent from school, the participants made up the time the day they arrived back at school in the same classroom environment and with the same educator as their matched peer. The varying intervention lengths occurred because the intervention was intended to be delivered at the educator's normal SE instructional time to ensure students were not pulled from any academic instruction or extracurricular events. Every participant received an estimated 300 minutes of intervention within a one to four month time span. Two coders observed randomly selected sessions to ensure coding for a minimum of 34% of sessions for reliability purposes.

Interventions

Virtual reality Opportunities to Integrate Social Skills (VOISS) was selected due to its ability to be deployed on the same device as a research-based intervention (i.e., Chromebook, iPad) and its fidelity and reliability data supporting the program's 180 SE competencies for middle school students. VOISS was developed by experts in the special education and the social

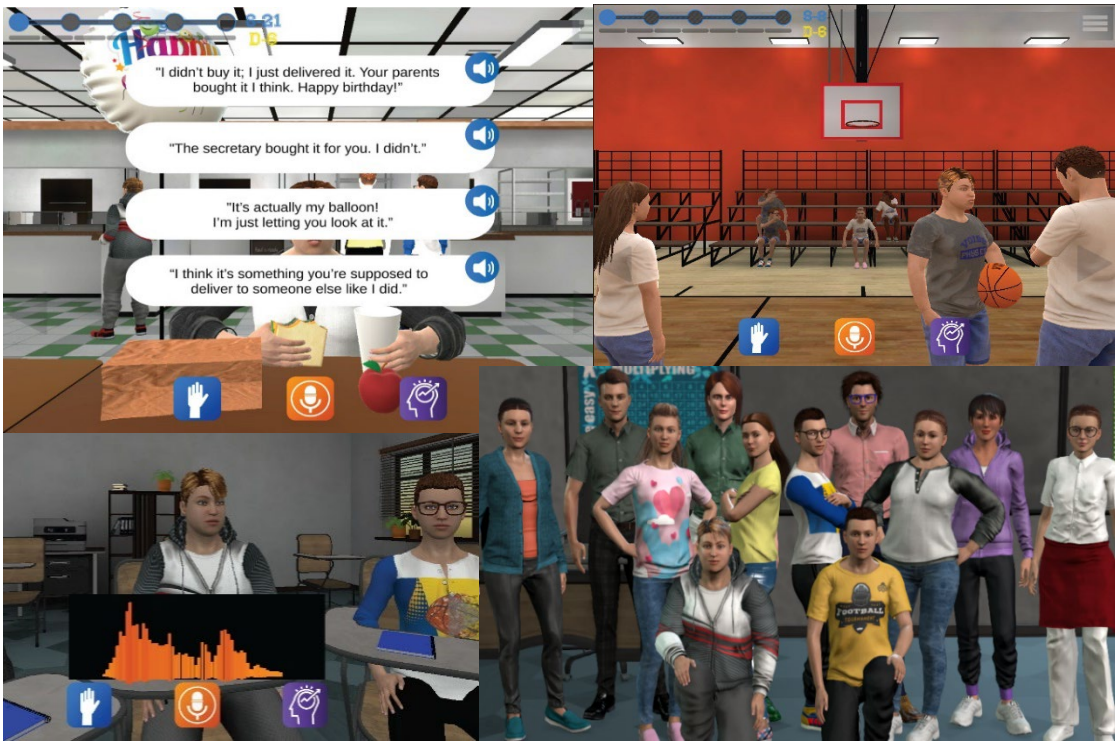
and emotional instructional field. In VOISS, participants are presented with social skill scenarios in which they interact with same age peer avatars and adults observing and taking part in problem-solving through authentic social situations. VOISS scenarios take place in numerous school environments including: (a) classrooms, (b) playground, (c) bus, (d) hallway, (e) cafeteria, (f) gymnasium, (g) library, (h) office, (i) field trips, and (j) neighborhood streets. A student is provided with both direct social skill instruction with assessment and natural consequences as well as reteaching and observational learning. Participants are presented with social situations where they must either select a correct multiple-choice response, orally respond to a request, or move based on directives provided. For example, a participant may be presented with a friend who wants to exclude another student from joining their game. The participant must then interact and determine how to respond and react in the specific situation. The program provides direct instruction on the upcoming skill, choice selection on what the participant could do, natural consequences of that choice, and then feedback and suggestions to help the participant navigate the social situation.

Participants navigate the scenarios by touching a screen or mouse or using an HMD hand controller. Each scenario varies in length and contains a variety of multiple-choice, oral, and directive participation. In the event of a wrong selection or response, a natural consequence is provided, and the narrator will explain why the response was unexpected. The participant will receive reteaching and can select a new response. A progress monitoring (PM) tool within VOISS records the correct and incorrect responses, time spent in the scenario, and the movements and actions made (i.e., clicks to touch something, picking up items) throughout the VR environment. Figure 4 provides screenshots from the VOISS program.

All scenarios and skills within VOISS were developed by experts in the special education field and checked by experts in SE skill acquisition for fidelity and reliability. Further, the scenarios were written by teachers in the field of special education across the United States. The scenarios were then checked for reliability and fidelity by professors from various institutions of special education across the country in the field of special education.

Figure 4

Screen Shots of the VOISS Intervention



The social competencies within VOISS were analyzed by four separate SE experts who determined the domains which provided instruction in pragmatic communication. According to the experts, the domains which contained the largest number of irreversible discrete skills were labeled "Social Communication" in the control intervention (PEERS) and "Expressive Communication" in VOISS. See Table 6 for a list of all domains and the number of skills within

each domain considered by these experts. Irreversible discrete skills were required for each scenario to determine pre and post scores, as the skills could not build upon one another. The scenario order was randomized per session with two scenarios in each session.

Table 6

The 10 Social-Emotional Domains in VOISS and Example Skills

VOISS Domains	# Of Skills	# Of Scenarios	Example Skill
1. Self-Awareness & Advocacy	25	28	Communicates preferences
2. Self-Regulation	17	23	Understands no means no
3. Critical Thinking & Problem-Solving	21	39	Knows where to seek assistance
4. Executive & Organizational	15	21	Follows daily schedule
5. Receptive Communication	10	23	Understands space boundaries
6. Expressive Communication	24	26	Listens without interrupting
7. Relationship	13	29	Asks to join in
8. Social Comprehension	18	26	Manages peer pressure
9. School, Home & Community	24	25	Manages transitions between activities
10. Self-Care & Safety	17	30	Identifies risky situations

*The Expressive Communication Domain with 26 scenarios teaching 22 skills was selected for use in the intervention.

The Program for the Education and Enrichment of Relational Skills (PEERS) was selected due to its development by experts in the special education and social and emotional instructional field and the fidelity and reliability data supporting its social skill competencies and video modeling strategies. PEERS was also selected due to its worldwide recognition for providing evidence-based social skill interventions to adolescents with autism spectrum disorder (ASD), attention deficit/hyperactivity disorder (ADHD), anxiety, depression, and other SE problems. PEERS has been used in 125 countries and was first developed at UCLA by their

clinic director Dr. Elizabeth Laugeson. Not all the PEERS' curriculum has been validated as utilizing evidence-based practices. However, the PEERS videos have been validated, are accessible via two of the same platforms as VOISS (i.e., the Chromebook and iPad), and most are available for free in their online web-based Role Play section. Those that are not available for free were obtained from the PEERS trainer with the curriculum guide.

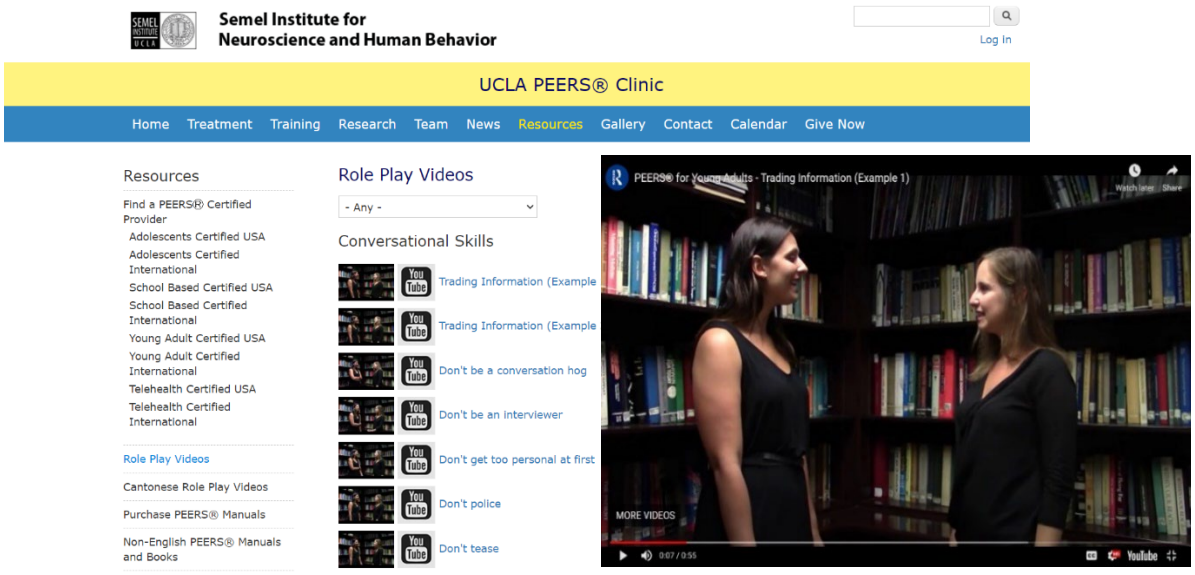
In PEERS, participants are presented with social skill scenarios in which they watch adolescents and adults take part in problem-solving through authentic social situations and then do a brief imitation of the behavior or task. This portion of the PEERS intervention utilizes primarily video modeling (VM), where students watch videos of others modeling the desired skill and then imitate that action. Although the section of the videos online is titled "Role Play Videos," only the video modeling portion was utilized. It was determined that although the Role Play portion did not follow a fidelity checklist with acceptable procedures to be considered the EBP of a role play, the video modeling portion of the lessons did follow the correct procedures for the EBP video modeling. The Role Play portion of the curriculum is often utilized within the adolescent PEERS curriculum in a video modeling capacity whereas in the adult PEERS curriculum they are only used as role play examples.

The PEERS videos include scenarios which take place in numerous environments including: (a) classroom, (b) friends' home, (c) library, (e) office, (f) hallway, and (g) neighborhood. A student can see within the video both good and bad examples with natural consequences for each. Participants are then provided with an opportunity to imitate the task seen in the video in a situation they can recall or a guided one in the curriculum. This process can be guided by questions presented at the end of the video. PEERS videos were also selected due to the video teaching the same skill listed in VOISS scenarios, to ensure the instruction provided

by each is for the same listed skill to be measured. The implementation guide used in recording fidelity to the video modeling portion of PEERS and the social scenario portion of VOISS can be found in Appendix I. Within the PEERS intervention, prior to watching the video models, the teacher and student come together, utilizing an assessment of choice (e.g., CELF ratings, time on task, Bellini Scale), to determine an important skill to develop. The student then watches the video model on these skills and chooses the skill of greatest priority to create one video clip (less than 7 minutes) using either self-modeling, point-of-view modeling, or video prompting. After the targeted skill is determined, the videos within the social communication domain are watched and skills practiced. After completion of watching the videos on the checklist, imitating, and discussing the video set, the student designs and completes their own video to watch. Figure 5 contains screenshots from the PEERS portion of the program, which, when online, can be found on the PEERS website under "PEERS Role Play Videos" and on YouTube under "PEERS Video Modeling Videos."

Figure 5

Screen Shots of PEERS Intervention Videos



The Social Emotional Skills that have compatible matches in VOISS and PEERS include those within VOISS Expressive Communication (EC) domain and the section of the PEERS Social Communication (SC) domain which primarily deals with conversational skills. Expressive Communication is defined as skills which allow an individual to convey ideas, wants, needs and other complex thoughts through the oral, written, or gesture sensory system (Wilson et al., 2019). Social Communication (pragmatic communication) is defined as the use of language in relation to context and includes elements of both expressive and receptive communication (Mandy et al., 2017).

The 24 EC skills and 26 scenario scripts in VOISS were sent to four specialists in expressive and receptive communication (i.e., speech language pathologist [SLP], professionals in special education who provide social skill instruction) for analysis to determine if any of the skills built on one another and what skills may be more vulnerable to pretest effects, history, and maturation. Of the 26 scenarios it was determined that 24 did not have skills which built on one another or had these skills within the same scenario. Within those 24 scenarios were 22 specific social communication skills necessary for student success (Magiati et al., 2014; Wong et al., 2015). The selected social communication skills were all considered by the SLPs and special education teachers to include both elements of social communication skills (receptive and expressive communication) even though the domain name was expressive communication (e.g., conversational turn-taking, varying speech to match context or convey intent, reading body language, understanding what body gestures communicate greetings or exits).

These 22 skills and 24 scenarios were then sent back to the four specialists in social communication to determine which skills aligned and taught the same skill as PEERS. It was determined that 20 skills within VOISS and PEERS taught the same skill. These were the 20

skills and their accompanying VOISS scenarios and PEERs videos which were used during the intervention section of the study. These are also the 20 skills assessed in two different manners in the Social Communication Knowledge Questions. The CELF-Pragmatic profile assesses these skills along with additional skills within each domain that are observed within both interventions but not explicitly taught.

Table 7 and Table 8 provide a list of the skills within each of the scenario and videos as well as the corresponding questions in the Social Communication Knowledge Questions and the CELF-5 PP. Tables 7 and 8 also list the location of the VR intervention within the program and what avatars are interacting during those scenarios within the VR intervention. All PEERS Videos consist of real people, although a bit older than our targeted population, and all videos occur within an alcove bookshelf area resembling a library or group work setting seen in Figure 5. Each scenario and video with question responding takes no more than 7 minutes to complete. To ensure the targeted session time of interacting with the scenario and video of 10 to 15 minutes, two VOISS scenarios and two to four PEERS Videos were included within every session. The order of scenarios and videos were randomly assigned to participant's classrooms through SPSS's randomization function. Each classroom had the same order to assist the educator working with the PEERS group.

Table 7

Crosswalk of Skills Taught in VOISS and Corresponding CELF-5 PP Rated Items

VOISS Scenarios (CELF # and VOISS Scenario #)	Example Presented and Sample Question	Location	Avatars and People Involved
Displays Manners-Compliments & Offers to Help (CELF 23, Scenario 1 and 2)	You notice that you like the way your friend helped you learn to play the card game. What could you say to let them know?	Lunchroom	Peers

Uses Appropriate Voice Level and Tone (CELF 43 & 46, Scenario 1 and 2)	The teacher comes around and asks you individually while others are working, “Have you found all of your definitions?” You have an opportunity to respond. What voice level and tone should you use?	Classroom	Peers and Teacher
Starts a Conversation (CELF 2, Scenario 3 and 4)	You want to open a conversation with a topic that is relevant to both you and the people you’re talking to. What could you say to this group?	Classroom	Peers
Conversation Skills (CELF 4, Scenario 3 and 4)	A friend just sat down next to me and said hi. Other friends are talking about a game. You are asked a question about the game. How would you respond?	Basketball Game in Gym	Peers
Modifying Language to Topic, Trading Information in Unstructured Activity (CELF 10 & 15, Scenario 5 and 6)	Another student says, “I’m excited for lunch today. I heard there’s pizza today! Do you like pizza?” How should you respond?	Lunchroom	Peers
Turns in Work, Asks for Change from Others or Help from Others (CELF 22 & 31, Scenario 5 and 6)	The teacher comes around and asks you individually while others are working, “Have you found all of your definitions?” You have an opportunity to respond. What voice level and tone should you use?	Classroom	Peers and Teacher
Listens Without Interrupting, Interrupting Strategies (CELF 18, Scenario 7 and 8)	Another student says, “I’m excited for lunch today. I heard there’s pizza today!" Then asks your friend, "Do you like pizza?” How should you respond?	Gym	Peers
Turn-Taking, Exiting When and When Not Accepted (CELF 3, Scenario 7 and 8)	You are playing basketball, but no one has passed the ball to you yet. What could you do so you can take a turn?	Gym	Peers
Greets Others (CELF 40, Scenario 9 and 10)	Another student is waiting in line to go into class. They smile and wave at you. How would you respond?	Hallway	Peers and Teacher
Responds to Greetings Shares Contact Info (CELF 1, 9 and 10)	You’re walking in the hallway looking for Classroom #170 and your teacher smiles and says hi. What could you do?	Hallway	Peers and Teacher
Introduces New Topic, Get Togethers (CELF 5, Scenario 11 and 12)	You want to change the conversation to a game that is relevant to both you and the people you’re talking to. What is a good way to introduce a new topic into the conversation?	Gym	Peers
Accepts Change (Scenario 11 and 12)	Students are talking about pets together. One of them changes the subject to the math test before you get the chance to participate. How should you respond?	Classroom	Peers
Responds to Introduction or Disagreement (CELF 16 & 26; Scenario 13 and 14)	The student next to you is discussing the research they are doing for their project with you. You want to be able to share what you are researching too. What could you do?	School Library and Media Center	Peers and Teachers

Responds to Questions or Clarification (CELF 9; Scenario 13 and 14)	You move down the lunch line and another Lunch Personnel says, "Do you want French fries or mashed potatoes?" How should you respond?	Cafeteria	Cafeteria Workers and Peers
Ends Conversation (CELF 2, 13, & 42; Scenario 15 and 16)	You are finishing a conversation with your friends outside of the classroom. How should you exit the conversation and go into class?	Hallway	Peers
Making relevant Contributions to Conversation (CELF 7; Scenario 15 and 16)	You're in line getting your food in the cafeteria. The cafeteria worker asks what you would like. How could you respond?	Lunchroom	Cafeteria Workers and Peers
Situational Topic Maintenance (CELF 6; Scenario 17 and 18)	You are speaking with your friend's mom while waiting for your friend to come back from the bathroom. She asks you, "What is your favorite class?" How should you respond?	Office	Administrator and Teacher
Interacting Avoiding Repetitive/Redundant (CELF 8; Scenario 17 and 18)	You are speaking to your teacher and principal about an event coming up that you have volunteered to help with. Your principal changes the topic and asks you, "How has recruiting judges been going?" How should you respond?	Office	Administrator, Teacher, and Peers
Asks a Question, Interacting in Structured Group Activities (CELF 9 & 14; Scenario 19 and 20)	Your teammate was missing when the gym teacher explained the game. The game starts in a few moments, and he asks you what he missed. What would be a good summary of the main points needed to understand the game?	Gym	Peers and Teacher
Digital Citizen Responses (CELF 41; Scenario 19 and 20)	You are asked to share confidential information online. How could you respond?	Library	Peers
Other Expressive Communication Skills (Scenarios 21-26)	Used for training purposes and include no teaching of any measured skills, selected for training purposes by four experts in EC skills.	ALL	ALL

Table 8

Crosswalk of PEERS and the SCKQ

PEERS Video Skills (46 skills, 15 sec to 2 min each)	**Validated Questions to Determine Skill Increase (40 Actual Question # From Assessment Next to Question)**

1. Handling teasing (sounding board) 2. Handling teasing (having an attitude) 3. Spread the rumor about yourself (bad example, good example)	10. When you see your friend Amy in the lunchroom, you sit down next to her. She says, "I saw the way you threw the ball today in gym, did you forget to lift weights this Summer? You threw it like my 6-year-old sister." You know you need practice to get better at throwing, and you notice your friend's tone of voice doesn't mean just teasing, how could you respond? 15. Your iPad is broken, and you have to advocate for yourself. What could you do?
4. Accepting rejection (bad example and good example) 5. Turning someone down (bad and good example)	9. You are standing on the sideline in the gym and would like to have a turn in the game but when you ask your friend who is playing if you could join in your friend who is holding the ball says, "No, the teams are full and we are practicing for a scrimmage tonight so we need to play with the right number as we would in a game." How do you respond? 18. You aren't feeling well so you decide to go see the school nurse. Your stomach hurts. She asks, "How can I help you?" What is the best response?
6. Giving compliments good and bad example)	11. You go to the office where the secretary is sitting at the front desk with flowers. She says to you, "I need your help. It's Amy Rodriguez' birthday and her parents sent her flowers. You have lunch with Amy would you mind dropping these off to her before you get in line for lunch?" The bell rings, how should you respond? 25. You find classroom 180 and see a line forming outside the door. Students are talking to one another. What could you do?
7. Use good volume control (good and bad examples)	14. Wallace, another student bumps into you in the hallway and causes you to drop your iPad. It cracks on the ground. How should you react? 27. You are splitting up responsibilities for a group activity in class. The teacher says the groups are getting too loud. How do you ask to do the slide show portion?
8. Starting an individual conversation (good and bad example)	5. You want to open a conversation with a topic that is relevant to both you and the people you're talking to. Which of these options is the best way to start a conversation in a classroom? 6. You want to start talking to someone you don't know but saw at the game this weekend. They are standing near you. What would be something you could say to start a conversation?
9. Don't be a conversation hog 10. Don't tease 11. Don't be argumentative	39. You are enjoying a conversation about your favorite foods. A friend changes the topic to a class you don't take. What could you say? 13. You go to sit with Amy. She has her lunch and flowers out. She says to you, "Thank you so much for the flowers! It was so, so kind of you to buy them for me! I love them!" How should you respond?
12. Trading Information (Example 1 and 2)	21. Another student says to you "How are you?" Which is the best response? 22. You are speaking to your teacher and principal about an event coming up that you have volunteered to help with. Your principal says,

	"Thanks for helping with this. How has recruiting judges been going?" How should you respond?
13. Talking to a mutual friend 14. Don't get too personal at first 15. Don't police 16. Don't brag	17. You are speaking with your friend's mom while waiting for your friend to come back from the bathroom. She asks you, "What is your favorite class?" How should you respond? 34. Your teacher finishes talking and is now asking you a question, but you weren't listening and don't know the answer. What could you do?
17. Entering a group conversation (good and bad example) 18. Exiting when fully accepted (good and bad example)	26. You are working on an assignment in a group. Your group leader says, "I think we should be writing this down in case we need to report back to the class," then looks at you and says, "Will you record it for us?" You don't want to write. What is the best way to respond? 32. Another student says, "I'm excited for lunch today. I heard there's pizza today!" Then asks your friend, "Do you like pizza?" How should you respond?
19. Exiting when never accepted (good and bad example) 20. Exiting when initially accepted and then excluded (good and bad example)	9. You are standing on the sideline in the gym and would like to have a turn in the game but when you ask your friend who is playing if you could join in your friend who is holding the ball says, "No, the teams are full, and we are practicing for a scrimmage tonight so we need to play with the right number as we would in a game." How do you respond? 30. You are playing basketball, but no one has passed the ball to you yet. What could you do so you can take a turn?
21. Use good body boundaries (good and bad examples) 22. Use good eye contact (good and bad examples)	33. You need to get your books and a student is standing in front of your locker. How should you proceed? 36. Another student is drinking from the water fountain. They have been drinking water for a long time and don't seem to notice you behind them. You would like to get some water before your next class. You know the person who gets in line behind you and that person says hi. What could you do?
23. Exchanging contact information (good and bad example) 24. Responding to greeting	23. Robert walks by you in the hallway and makes eye contact, with a slight head lift in greeting. What could you do? 24. You are walking down the hall, looking for classroom #170. Your class begins in 1 minute. As you are walking you make eye contact with your art teacher in room 180. Your teacher smiles and nods a silent greeting or acknowledgement of your presence. What could you do?
25. Beginning a get-together (good and bad example) 26. Ending a get-together (good and bad example)	28. The other students in your group project are talking about something you don't care about. What is the best way to deal with this? 29. You are getting together at a friend's house. They just gave you a tour of their home and you finished the tour and are outside in the backyard where goal posts are set up. Since the tour is over, your friend stopped talking and the conversation has gone quiet. What could you do?

27. Accepting rejection (good and bad example)	38. Students are talking about pets together and this is your favorite topic. Dallas walks up and changes the subject to the math test before you get the chance to participate. Dallas says, “That test was awful, wasn’t it?” How should you respond? 19. You’re talking with friends, but it’s time to get to class. One of your friends says, “Well, good chatting with you, guys! See you around.” How should you respond?
28. Responding to a disagreement (start through keep cool, listen, repeat, explain, say sorry, solve the problem)	37. A student in the hallway stops you and says to you, “Why are you walking here? This is my hallway!” How can you respond to them in the best way? 31. Another student asks if you know how to answer a question on the worksheet. You don’t know the answer either. The student gets upset that you haven't responded. How should you proceed?
29. Trading Information 30. Don’t be a conversation hog	22. Another student is waiting in line to go into class. They smile and say “Hey, how was your weekend?” How would you respond? 4. You are doing research on a library computer for science class. Another student sits at the computer next to you and says, “Hey! Are you working on the science project too?” What is the best response?
31. Ending phone calls (good and bad example) 32. Ending conversation in person	20. You are finishing a conversation with your friends outside of the classroom. How should you exit the conversation and go into class? 2. You finish getting your food and the check-out personnel says, “Enjoy your lunch and have a great rest of your day!” What is the best way to respond?
33. Don’t be an interviewer 34. Entering a group conversation (good and bad example)	3. You walk into the library and hear two students talking to each other one says, “I love our English assignment because Science Fiction is the best.” The student calls out to you and asks, “Hey, what do you have to work on in Study Hall?” What is the best way to respond? 1. You are in the beginning of the lunch line and the Lunch Personnel says “Hi! Hope you are hungry today!” How should you respond?
35. Bringing up a disagreement (start through end of wait, keep cool, ask to speak privately, explain, listen, repeat, tell them what you need, solve the problem) 36. Maintains topic	12. Amy wasn’t in the cafeteria, so you set the flowers down and got in line for lunch. When you see Amy, you get out of line to bring her flowers. You are starving, so you get back in line where you were. Another student says, “Hey! This is unbelievable; you don’t get to cut me!” What is the best way to respond? 8. You are sitting with friends. They are discussing their favorite pizza toppings. What could you say?
37. Multiple speakers and topics 38. Don’t be a coach 39. Entering a group conversation	7. A friend just sat down next to me and said hi. Other friends are talking about a game. What could I say? 15. Your iPad is broken, and you have to advocate for yourself. What could you do?

40. Suggest a change if bored 41. Giving a courtesy laugh (good example) 42. Pay attention to your humor feedback (laughing with) 43. Group activities	35. Your teacher has been talking for a long time and you're starting to get bored. What could you do? 27. You are splitting up responsibilities for a group activity in class. How do you ask to do the slide show portion?
44. Beginning and ending phone calls (good and bad example) 45. Leaving voicemail (good and bad example) 46. Online communication (good and bad example)	40. Which of the following would be a good way to end a voicemail? 28. The other students in your group project are talking about something online you don't care about. What is the best way to deal with this?

Technology Delivering the Intervention

VOISS and PEERS were delivered through the same iPad or Chromebook through which the student participant typically received their instruction. There were 102 students who utilized a Chromebook and 18 who utilized an iPad. Their assigned matches were also using the same device in the same classroom. On these devices, the students hear and see all visuals and sounds from the iPad or Chromebook's speakers and can move and respond while tapping on buttons on the iPad screen or Chromebook mouse. It was decided to use the device the students currently use most frequently in their classroom in attempts to decrease the amount of time needed to familiarize the student with the technology device, to decrease the possibility of gains or losses being caused by the novelty of the device, and to ensure students who had accessibility needs were able to utilize their everyday instructional device.

Measures

Social Communication Knowledge Questions (SCKQ; RQ 1)

Prior to study initiation, the first author, in collaboration with two experts in the field, clearly defined and operationalized the expressive and receptive communication skills within social (pragmatic) communication that were taught in both the PEERS and VOISS identified domains for intervention. The author and experts then generated questions and correct responses

for each of the skill areas in a session by adapting a pool of validated VOISS assessment questions for each targeted skill as well as PEERS questions for each targeted video. The adaptation occurred by: (a) identifying and defining each EC/SC skill to be measured, (b) selecting a four option multiple-choice measurement format already familiar to participants in which only 1 answer is correct, (c) re-writing the VOISS and PEERS assessment questions for the targeted skill, (d) submitting the items for expert review on the item's content and measurement appropriateness to two external evaluators, (e) obtaining approval from two experts separately on each item's content, and (f) administering the new tool, along with the VOISS and PEERS measurement questions to a pilot group of middle school students to ensure high item correlation and reliability (α=.92). This process assisted in solidifying the 40 knowledge questions assessed measured the intended construct (i.e., social communication).

The SCKQ questions were validated through 1. the pilot of middle school stakeholders (face validity); 2. the crosswalk of each skill assessed within the assessment with social communication intervention objectives in VOISS and PEERS identified with 95% inter-rater agreement by three separate coders (see Appendix K; sampling validity) 3. the experts examining the items and determining with 100% agreement that each question measured the skill it intended to measure and that the question did not measure other variables (content validity); 4. the measure accurately provided information that allowed educators to improve the instruction of the pilot middle school student participants' pragmatic communication (formative validity) and 5. administering the new tool and correlating results with the VOISS and PEERS measurement questions to a pilot group of middle school students (criterion validity).

Correct responding data was collected by both presenting the question and all multiple-choice options both visually and verbally to the student and requiring the student to record a

response after all four options were read. A correct expressive communication response entailed the participant saying or clicking on the correct answer to the social skill question the first time the question is presented. An incorrect response will be listed if the participant does not say or click on the correct answer to the social skill question the first time the question is presented. See Appendix F for the list of questions presented. The number of correct responses will be recorded, and the percentage of correct responding will be calculated by totaling the number of correct responses divided by the total number of possible correct responses and multiplying the quotient by 100. These pre and post questions will measure content knowledge on the targeted skill before and after intervention.

The Clinical Evaluation of Language Fundamentals-5 Pragmatic Profile (RQ 1)

Expressive communication (EC) is defined as skills which allow an individual to convey ideas, wants, needs and other complex thoughts through the oral, written, or gesture sensory system (Wilson et al., 2019). Many standardized language assessments evaluate structural language and typically do not assess the pragmatic and discourse deficits. Four separate standardized measures appropriate for students in middle school which evaluate both structural language as well as pragmatic and discourse deficits were considered to determine social communication (SC) skill level prior to intervention: (a) the Comprehensive Receptive & Expressive Vocabulary Test (CREVT; Wallace and Hammill), (b) Expressive Vocabulary Test, 2nd edition (EVT; Williams, 2007), (c) the Clinical Assessment of Pragmatics (CAPs; Lavi Institute), and (d) the Clinical Evaluation of Language Fundamentals-5 Pragmatic Profile (CELF-5 PP; Wiig et al., 2013).

The Clinical Evaluation of Language Fundamentals-5 Pragmatic Profile (CELF-5 PP; Wiig et al., 2013) was chosen as the pre and post intervention standardized measure because of

its ability to identify strengths and weaknesses as a basis for intervention recommendations in expressive, receptive, and pragmatic communication. The CELF-5 PP was the only measure meeting our qualifying criteria. These criteria included: 1. being supported by valid and reliable research; 2. having evidence of the applicability of the measure for students of varying groups (i.e., ethnicity, disability); 3. implemented over time with middle school students; 4. evaluated in four or more publications in peer-reviewed journals; 5. well established norms; 6. encompassed student and teacher perceptions of progress (Wiig et al., 2013). The CELF-5 PP is an individually administered, norm-referenced instrument used to plan intervention recommendations, classroom adaptations and accommodations, and to assist in the diagnosis of language disorders in students five through 21 years old. The CELF-5 is composed of several tests (e.g., Sentence Comprehension, Word Structure, Pragmatic Profile). Each test can be administered as an independent test (Wiig et al., 2013). The Pragmatic Profile was chosen from the battery due to its ability to accurately measure application of each of our targeted skills in the selected intervention domains (i.e., Expressive Communication, Social Communication).

The CELF-5 PP is a widely used normed standardized test with sensitivity and specificity above .9. Test-retest reliability scores for index and composite scores ranged from .83 to .90. The CELF-5 PP also shows concurrent validity with the Oral and Written Language Scales-2nd Edition (OWLS-2; Carrow-Woolfolk, 1995), Comprehensive Assessment of Spoken Language (CASL; Carrow-Woolfolk,1999), the Test of Language Development-Intermediate 4th Edition (TOLD-I:4; Hammill & Newcomer, 2008) and the Test for Expressive Language (TEXL; Carrow-Woolfolk & Allen, 2014). The student along with their educator completed the CELF-5 PP in Appendix F. The profile consists of a 50-question survey which ranks pragmatic skills as Never or Almost Never (1), Sometimes (2), Often (3), and Always or Almost Always (4). Skills

rated as never or almost never and sometimes are of the most concern for a knowledge and application deficit. The skills rated as often indicate that the targeted pragmatic skill may be learned but is still emerging in its application. Skills rated as always are indicative of appropriate knowledge and use of the targeted pragmatic skill.

The CELF-5 PP was given the day before training for the intervention begins (which is approximately 1 to 2 weeks prior to the intervention start) and approximately 1 to 2 instructional weeks after the intervention ends. The delay in giving the profile right after the intervention was to allow time for the last skills taught to be generalized and observed. The profile was collected the day it was given.

Social Validity

Individual surveys containing rating scales were selected as the instrument for social validity data collection rather than focus groups or interviews because they allow students to share their views about the intervention without the influence of outside voices, which research shows causes less biased responses than responses given when in a group of peers or directly to a researcher (Creswell, 2002). Rating scales were chosen over other instruments because subjective measurements are more appropriate to assess social acceptance, feasibility, and appropriateness (Kazdin, 1977; Wolf, 1978). Surveys were also selected because they produce information about beliefs and attitudes, which are otherwise difficult to measure using observational techniques (McIntyre, 1999). Creswell (2002) states the major disadvantage of surveys are that they report what people think not what they do, may have low response rates, and do not provide participants flexibility in question responding. These disadvantages do not apply to this research because educators’ and students' beliefs, not their actions, are being

analyzed. Also, responses are required for study participation and there is a comment area within the CIRP for students to provide any additional thoughts.

There are a number of empirically validated scales for measuring social validity, such as the Treatment Evaluation Inventory (TEI; Kazdin 1980), Intervention Rating Profile-20 (IRP-20; Witt & Marstens 1983); Children's Intervention Rating Profile (CIRP; Witt & Elliott 1985); Behavior Intervention Rating Scale (BIRS; Von Brock & Elliott 1987); Treatment Acceptability Rating Form—Revised (TARF-R; Reimers et al. 1992); and the Abbreviated Acceptability Rating Profile (AARP; Tarnowski & Simonian 1992). These rating scales are primarily developed as a questionnaire with a Likert-type scale completed by either the parent or teacher. An adaptation of the Intervention Rating Profile (Adapted IRP; Lane et al., 2015), similar to the IRP-15 (a brief version of the IRP; Martens et al., 1985), was first chosen over other acceptability rating forms, because the IRP is commonly used in educational settings, assesses acceptability of interventions, determines risks, and allows for a measure on acceptability of length of treatment as well as effects on the educator and fellow students.

The targeted questions in this study are on students' feelings of social validity rather than educators' feelings. This caused the Children's Intervention Rating Profile (CIRP; Witt & Elliott, 1985) to be considered. It was noted that this measure was created for the acceptability of an intervention. Interventions for adolescence are reported to be ineffective unless they consider whether the skills, environment, and instruction are appropriate and acceptable (Berg et al., 2017; Jennings & Greenberg, 2009). An appropriateness measure was determined to be needed in addition to acceptance. Finally, interventions that are not feasible are not likely to be maintained (Proctor et al., 2011). This is particularly true when considering interventions delivered through technology (Lorenzo et al., 2016). Therefore, a feasibility measure was also

included. This led to selecting three areas of needed measurements: (a) acceptability, (b) appropriateness, and (c) feasibility in the measures outlined below.

Adapted Children's Intervention Rating Profile (RQ 2)

The adapted Children's Intervention Rating Profile (Germer et al., 2011; Lane et al., 2015) was chosen as the student measure of acceptability because it was written at a 3rd grade reading level to allow for students to complete the intervention ratings. The adapted CIRP was modified slightly from the CIRP (Witt & Elliott, 1985) to maintain the readability, validity, and reliability level of the CIRP while modifying vocabulary to better fit current school age raters. The underlying construct of acceptability measured within the adapted CIRP was well-defined and supported by a comprehensive theoretical framework and prior research. The definition of acceptability to be measured is how well an intervention will be received or is received by a target person or population and the extent to which the intervention meets the needs of the target population and context (Briesch et al., 2013; Lane et al., 2015; Martens et al., 1985).

The CIRP was additionally modified by authors of the study based on research behind visuals. This change included the addition of pictures accompanying the ratings to thumbs up and thumbs down, rather than just the original numbers or happy and sad face, to gain a more accurate picture of agreement and disagreement rather than if the question made the student happy or sad. Also, a word was placed with every number as students with disabilities in the age group in past assessments required additional vocabulary to understand the difference between an agree 6 and an agree 5. Students completed the measure at time 1 (the session prior to the start of the intervention) and time 2 (the session immediately after the end of the intervention). The measure contained 7 questions on a 5-point Likert scale (1=Strongly Disagree, 5=Strongly Agree) and was created to assist in determining whether an intervention should be selected for use within a

classroom. Total scores range from seven to 42 with scores of 24.5 or higher considered acceptable (Turco & Elliot, 1986). Higher total scores indicate greater levels of intervention acceptability.

Adapted Intervention Appropriateness Measure (RQ 2)

After considering multiple feasibility and appropriateness surveys, the Intervention Appropriateness Measure (IAM) and Feasibility of Intervention Measure (FIM) were selected due to their ability to accurately assess appropriateness and feasibility within the targeted population as well as the survey length necessary for a thorough understanding while considering time and attention span of the target population. The IAM and FIM contain response selection on a Likert scale which ranges from completely disagree (i.e., score 1) to completely agree (i.e., score 5) in which higher scores indicate a greater sense of appropriateness or feasibility toward the intervention (Weiner et al., 2017). The scales have a Flesch reading ease score of 95.15 which is a grade five reading level. There are no specialized skills or training needed to administer, score, or analyze the IAM or FIM (Weiner et al., 2017). The combined measures take less than five minutes to complete. The IAM and FIM received the highest validity and reliability ratings of all student rating scales with a 5th grade reading level or below according to the Implementation Outcome Repository. They were the chosen methods of middle school student evaluation measures by *Program Fit Measures,* a California Evidence-Based Clearinghouse for Child Welfare.

Appropriateness is the perceived fit, relevance, or alignment of an intervention or practice in a specific context for a specific issue with the expectation or current role (Weiner et al., 2017). Appropriateness is a necessary measure to attain whether stakeholders' feelings about the intervention align with their expectations and current needs (Proctor et al., 2011).

Appropriateness is a similar construct to acceptability but remains distinct in that it can ascertain resistance in implementing or partaking in an intervention by stakeholders. For example, an intervention may be suitable or appropriate for a particular need, but the intervention's features may make the intervention unacceptable to the rater (e.g., too much deviation from the original intervention method intent; Proctor et al., 2011). The Intervention Appropriateness Measure (IAM) is a four-item scale with excellent internal consistency and strong psychometric properties. Cut-off scores for interpretation of FIM results are not yet available; however, higher scores indicate greater feasibility. Still, this survey was selected for use as an accurate measure of acceptability with the highest scored scale of the three social validity scales developed by Weiner and colleagues (2017) with a Cronbach's alpha of 0.91.

The Feasibility of Intervention Measure (RQ2)

Feasibility is the extent to which an intervention or practice can be or has been successfully implemented within a given context (Weiner et al., 2017). Feasibility is connected to the construct of appropriateness but varies conceptually (Weiner et al. 2017). For example, an intervention may be appropriate (i.e., relevant in a classroom) but at the same time not feasible because the classroom setting may not allow for access to the time necessary to complete the intervention (Proctor et al., 2011). Feasibility assists in measuring both the practical component of the intervention implementation (i.e., how easily the intervention can be implemented) in each context in which it will be delivered by the student and those assisting the student. The Feasibility of Intervention Measure (FIM) is a four-item scale with good internal consistency and reliability with a Cronbach's alpha score of 0.89 (Weiner et al., 2017). Cut-off scores for interpretation of FIM results are not yet available; however, higher scores indicate greater feasibility.

Survey Implementation Reasoning

Acceptability is believed to be a dynamic concept which can change within a short period of time. For this reason, acceptability ratings may vary before and after intervention implementation. As a result, the student acceptability measures will be given at time one and time two (i.e., pre- and post-intervention). However, appropriateness and feasibility are most effectively tested retrospectively to allow raters to have experiences to draw on to form their opinions (Proctor et al., 2011). Therefore, IAM and FIM will only be given at time two. See Appendix F for a full list of the items on each of the rating scales.

Written surveys can be subject to coverage error and item nonresponse, where some questions can be inadvertently or intentionally skipped (Salant & Dillman, 1994). To resolve the possibility of coverage error, the questions of the survey were electronically randomized by classroom to help limit biased context results and ensure that if people quit partway through the survey, the data collected would not be substantially affected. Randomization also limited the possibility of the order influencing the participants' responses.

The surveys were distributed to all matched participants within the same time frame to ensure the surveys do not reflect seasonal or temporal differences. Data was analyzed immediately following collection. Qualtrics (Provo, UT) was chosen for the survey platform because of its accessibility, data security, and randomization features. Experts were consulted to ensure appropriate language and response options as well as to assess whether the surveys measured the target construct (Browne & Keeley, 1998; Fowler, 1995).

Procedures

The experimental design consisted of 90 minutes of technology training broken into 2 or 3 sessions, pretests scales and surveys, two practice scenarios, the intervention phase with pre

and post SCKQ questions posed, and posttest scales and surveys. Each student and educator were given a checklist with each day of the study procedures listed as well as every scenario and video for that day. There was a box for the student and educator to mark off as they completed each task. The educator was also trained on and given a fidelity implementation checklist, to assist the educator with implementing the intervention procedures in a manner in which the educator was trained. An example student checklist can be found in Appendix G and fidelity implementation for PEERS Video Modeling and VOISS Social Scenarios as well as the training and assessment phases can be found in Appendix I.

Training

Participants were trained in accessing the intervention and using features of the technology on the iPad and Chromebook utilizing a "teach, model, and do" with guided feedback approach. Training included scenarios and videos displayed on the same technology device (iPad or Chromebook) as the skill matched peer. The steps used in the training are explained below. The training took place via Zoom based on the desire of the participants and schools during continued COVID protocols. Participants and educators also received visuals with written reminders able to be read aloud in Google Classroom on mouse click, in case they forgot a step or needed a reminder on how to navigate the technology.

VOISS Intervention. Participants will have an iPad or Chromebook with the VOISS application loaded in front of them. Participants will first be shown how to open the device, locate the app, log in, and tap on the domain listed on their check-off sheet. The researcher will then demonstrate how to control the volume, click on tools, make multiple-choice selections, and navigate using a finger tap. The researcher will demonstrate how to access the microphone button and speak into the device for oral responding. The participant will then be given the

opportunity to complete the scenario while the researcher observes and provides feedback. Upon completing the first practice scenario, the participant will be instructed to complete the second practice scenario independently. Practice scenarios will continue until the participant is able to independently navigate the scenario. Training will be complete when the researcher observes the participant independently accessing, interacting, and successfully completing VOISS scenarios via the iPad or Chromebook. The following day, the researcher will watch as the student participant instructs the educator participant using the same process above with guided feedback as necessary from the researcher to ensure training knowledge was retained and internalized and to ensure familiarity with the intervention and technology by both the student and the educator.

PEERS Intervention. Participants will have an iPad or Chromebook with the PEERS videos for the day's session loaded in front of them. Participants will first be shown how to open the device, get on the internet, locate the website, and tap on the video listed on their check-off sheet. The researcher will then demonstrate how to control the volume, click to start, and stop the video and get back to the main screen should the webpage accidentally close. The researcher will demonstrate how to imitate the video skill after watching and discuss these imitations using the PEERS question prompts. The participant will then be given the opportunity to watch the video and practice imitating, while the researcher observes and provides feedback. Upon completing the first practice video, the participant will be instructed to complete the second practice video independently.

Practice videos will continue until the participant is able to independently navigate the website videos and imitate the video. Participants will then be shown how to utilize their device to record their own video on the teacher and student identified skill. Training will be complete when the researcher observes the participant independently accessing, interacting, and

successfully completing the selected video both watching, imitating, and starting their own recording via the iPad or Chromebook. The following day, the researcher will watch as the student participant instructs the educator participant in using the same process above with guided feedback as necessary from the researcher to ensure training knowledge was retained and internalized and to ensure familiarity with the intervention and technology by both the student and the educator.

Pretest

Before beginning the intervention stage, students completed an Adapted Children's Intervention Rating Profile (CIRP) along with SCKQ. The student, along with their educator, also completed a 50-question rating scale of participants' pragmatic communication skills (Appendix F: CELF-5 PP; Wiig et al., 2013). These tests were presented to students through Qualtrics on their preferred device (Chromebook, iPad). The tests were read aloud to the student by the same person and in the same classroom with their matched peers. For the SCKQ, the student was unable to answer the questions until all four question response options were provided.

Intervention

During the intervention, the participants entered the room where the iPad/Chromebook was set up on their desk with either the VOISS application or PEERS Videos preloaded on the device beside a student checklist. The primary researcher was present on Zoom as well as a second researcher who was either present or watched a recording of the session, for reliability and fidelity purposes, on a minimum of 35% of sessions. The students sat at their desks accompanied by the educator who was always in the room. Participants were instructed as to where they were on their checklist and which session to begin. The determination of

scenarios/videos order was predetermined by computerized randomization and written on each student's checklist. Each scenario/video varied in complexity and completion depended on participant usage. Although the VOISS intervention was not administered through a head mounted display or other fully immersive manner, it was determined to still follow protocol for interventions delivered through VR, which recommended participants spend a maximum of 15 minutes at a time in a session with no more than 60 minutes a day completing scenarios/videos. Procedural checklists can be found in Appendix G-I.

The VOISS intervention has checks for understanding throughout the scenario as well as re-teaching. The PEERS intervention has checks for understanding in the imitation and discussion after each set of videos. Some videos are as short as 15 seconds. The set of videos is between 2 and 5 minutes. To ensure adherence to the implementation guide, imitation and discussion were read directly from the PEERS curriculum by educators to students, typically taking around 10 minutes to complete after the group of videos. The educator was only instructed to clear up misinterpretations of video content but not to add additional content to the instruction. Due to copyright limitations, the PEERS end of video imitation guide, question prompts, and clarifications guide are not included in the Appendixes but are available through PEERS for adolescence certified training at https://www.semel.ucla.edu/peers. Videos and sample questions are also available on this website.

Posttest

The five post assessments (CELF-5 PP, SCKQ, IAM, FIM, and CIRP) were presented to students through Qualtrics on their preferred device (Chromebook, iPad). Educators completed post assessments (CELF-5 PP) for matched pairs on the same day.

Experimental Design and Data Analysis

A randomized control trial (RCT) design was utilized to evaluate the feasibility, acceptability, appropriateness, and preliminary efficacy of a social communication intervention utilizing the expressive communication domain in the VR intervention VOISS. Participants were randomized in pairs matched on the following six criteria, with priority taken to each of the proceeding levels (see Appendix J for breakdown of matching process and variance between groups): 1. the teacher typically providing their social instruction (students receiving instruction in the school day from the same educators), 2. teacher ratings of communication skill application (CELF-5 PP), 3. student ratings of communication skill application (CELF-5 PP), and 4. student answers to 40 multiple choices social communication knowledge questions (Social Communication Knowledge Questions).

A power analysis suggested 30 total participants (15 within each group) would be enough to provide a medium effect size of .50 (d=.5) and would obtain statistical power at the level of .70. Olejnik (1984) describes acceptable levels of statistical power ranging between .70 and .90, where an increase in statistical power would require an increase in the sample size needed. Even with a small effect size of .20 (d=.2) usability with 30 total participants would obtain statistical power at the level of .60. The central limit theorem theorizes that 30 participants are sufficient to approximate a normal distribution and allow researchers to predict characteristics of a larger population with characteristics of the representative sample (Islam, 2018).

When there are several variables tested within a study, Olejnik (1984) reports a need for a larger sample size for greater accuracy. It was determined that the minimum number of participants in each group would be 30 (total n=60) and that a sample twice that size would produce greater accuracy of results in representing the diverse population the interventions list as

"targeted" for the intervention's use (i.e., middle school students with ASD, ADHD, anxiety, depression, and other SE problems).

Students were paired who have similar scores in the CELF-5 Pragmatic Profile and Social Communication Knowledge Question scores. From those paired students, each was randomly assigned by SPSS to either VOISS or PEERS for the intervention period. The participants paired are of similar demographics and taught similar curriculum outside of the intervention sessions. Student demographic information was obtained from the educator prior to randomization and included gender, age, experience with the technology being used to deliver the intervention, any diagnosis, and any current school plan or program (e.g., individualized education program, behavioral intervention plan, student improvement plan).

Paired participants were then entered into the Statistical Package for Social Sciences (SPSS) for one of the pair to be randomly assigned a number one (the control condition using PEERS) or a two (the training condition using VOISS). These two groups were then analyzed in SPSS to ensure there was no statistical variance between the two pairs' communication knowledge scores and application rating. After all students were paired, an additional assessment of each group's traits (i.e., diagnosed disability, chronological age, race, gender, and type of educational plan) were considered to ensure groups were not disproportional. Priority was given to age and gender because of prior literature reporting differences in acceptability and outcomes for these two groups. Having no variance in all variables for a population of 120 students was not possible, but this allowed for a good measure of accuracy in pairing similar students.

Participants completed all the pretest measures one to five days prior to the intervention and all the posttest measures one to five days following the intervention. Pre- and post-measures were collected at the same time of the day and in the same setting for each participant. Training

began the week of September 26-30 and ended the following week. The intervention began in October, 2022 and ended in January, 2023. February and March, 2023 were used to assist educators in interpreting results and maintaining the intervention, but no assessment or intervention occurred during this time.

The primary dependent quantitative measures involved the comparison of post intervention communication application ratings (CELF-5 PP) by the teacher and student, the number of correct social communication skill responses (Social Communication Knowledge Questions) for each of the 20 communication skills taught in the intervention, and the student participant's acceptability, feasibility, and appropriateness ratings of the intervention (FIM, IAM, CIRP). All statistical analyses were performed using SPSS Software. Descriptive statistics for all pretest and posttest scores were calculated.

A five-pronged approach to data analysis was implemented. First, effect size estimates for each intervention condition were calculated using the partial eta squared effect (Gray & Kinnear, 2012) from ANOVA Repeated Measure and Cohen's *d* (1988) from the independent samples *t* test. Partial eta square effect sizes are categorized as small (.01), medium (.06) and large (.14 or higher). Cohen's *d* effect sizes are categorized as small (0.2), medium (0.5) and large (0.8 or higher). Second, a 2-by-2 mixed-design analysis of variance (ANOVA) was performed to evaluate whether there were significant effects. Next, an independent samples *t* test was performed on the IAM and FIM (i.e., measures with post ratings only) using Levene's test for equality of variance prior to calculating effect sizes for each intervention condition. Finally, statistical significance ($p < .05$) was calculated for all measured variables using Wilks' Lambda.

Reliability Measurements

The reliability for the assessments given and the interventions selected to teach and

measure the selected variables can be found above. The reliability of correct matching of students within classrooms to obtain adequate comparison groups can be found in Appendix J. There was not a need to establish the reliability of the teaching portion of the scenarios of the VOISS intervention Expressive Communication Domain, as mentioned above the scenarios have been found reliable and valid through multiple measures and were provided to students through technology, ensuring the responses to student questions within scenarios remains the same for every participant. The same is said for the PEERS videos within the PEERS intervention except for the student imitation time, the educators' answers to student questions and the student created video. To ensure, as far as possible, the consistency of educators' responses to producing the same results across students after watching the PEERS video and in the creation of the student's video a reliability check on the PEERS training of educators of the PEERS intervention implementation was needed.

Training educators on adequate educator responding to PEERS videos and assessing adequacy of the student created video model was established through inter-rater agreement. Prior to reliability data collection, a PEERS certified trainer and the first author observed two teacher question response and video modeling preparation and implementation sessions (30 min each) on a video recording. The PEERS trainer provided the first author with the educator prompts and clarification guide as well as a list of operational definitions, and verbally explained what the video models provided for the student and what the educator would then provide. After watching the two videos, the first author provided the trainer with the implementation guidelines and checklists modified from the PEERS program and video modeling best practices. The implementation guidelines as well as a checklist were provided for both interventions. This was done to ensure a checklist was available that listed out exact steps for the session (session

checklist) as well as the full intervention use (implementation guide), which explained the full process of the intervention within the classroom.

The certified trainer validated the modified implementation guide for PEERS to ensure it aligned with their curricula practices and watched the first author present the materials and PEERS training that would later be provided to educators. The implementation guide's listed activities (i.e., which skill will be chosen for their video modeling creation, whether specific props and setting locations are needed, whether the teacher reviewed student video correctly prior to student watching the video) were part of the implementation score for the observed PEERS training session. Then, independently the first author and PEERS trainer scored the recorded training and calculated inter-observer agreement (IOA). IOA data was collected through direct observational recording of agreements and disagreements: (agreements/ [agreements + disagreements] x 100 = percent of agreement; Price et al., 2015). Agreement on the session was defined as at least 90% agreement on the identified procedural steps in the training. Cohen's kappa (κ) was calculated to determine the level of agreement between the coders while controlling for agreement due to chance. The training IOA indicated "substantial agreement" ($\kappa = 0.79$, $p < .005$) with an agreement of 93% that all core pieces necessary to accurately teach the PEERS intervention were present in the training. The steps presented in this training video were recorded and used as the training checklist for the PEERS training.

Reliability of content for the created student video model was obtained by one graduate student and the first author independently, via videoconferencing software, reviewing 30% of the randomly selected student created PEERS videos to ensure each of the core steps within the PEERS curriculum for the chosen skill were visible in the video. This was done to determine how reliable the last video watched was at teaching content. The student participant, by this point

in the study, had already watched a video model of all the same 20 core skills instructed within the VOISS scenarios. This check was just to ensure the last video had adequate reliability to try to control the skill being taught again through a student video influencing the intervention. The obtained agreements data was collected using point-by-point agreement ([agreements/total number possible] × 100; Ledford et al., 2018) where each step of the skill is a point of agreement only if it is marked by the observer as observed within the video.

Fidelity Measurements

Three sessions were randomly selected to be observed for procedural fidelity during the training, pre-assessing, intervention, and post-assessing sessions across participants and conditions. Two independent graduate students were trained using an example video, which was 40 minutes long and depicted a sample from each phase of the study, as well as the checklists in Appendix I. The first author provided the observers with a list of operational definitions for dependent variables and verbally explained each variable within the video session for the training, intervention, and assessment portions of the video. Together, the two observers and the first author jointly scored the video. The two observers were then given another sample video with the same sequence of phases. Separately, the two observers scored this video. Observers documented whether students and educators followed the implementation guidelines and checklists and whether the researcher implemented the training and assessment sessions with fidelity to the protocol. After reaching 100% agreement on the sample videos, each observer was then independently assigned nine sessions at random (32% one from each phase).

The total twenty-seven sessions randomly selected for procedural fidelity included sessions that occurred during the training, pre-assessing, intervention, and post-assessing phases. Inter-observer agreement (IOA) was taken across participants and conditions using point-by-

point agreement ([agreements/total number possible] × 100; Ledford et al., 2018). Each of the two independent graduate students viewed either a live or recorded randomly assigned session and completed the checklist to measure adherence to the checklists. These sessions occurred in various classrooms with a variety of educators. The presence or absence of critical components (e.g., accuracy in following training script, utilizing necessary steps of implementation guide) was measured across all conditions to account for the occurrence and nonoccurrence of behaviors. The direct observational recording system included a script and a checklist that addressed preparation of technology, structure of implementation, facilitation of intervention, provisions of feedback, and an intervention implementation endorsement rating. The observer assessed whether the implementer (a) presented the correct materials (VOISS or PEERS on the Chromebook/iPad), (b) ensured the participant accessed the right scenario/video, (c) the accuracy of reading questions, response options, and procedural script to participants across all conditions, (d) whether the participant remained within those scenarios/videos until completed, (e) whether participants completed the session checklist as listed, and (f) whether the implementer followed implementation guide procedures accurately.

The confidence level in study outcomes increases when internal validity strategies, such as checklists and training, are incorporated into the study design (Horner et al., 2006). Therefore, careful attention was given to maintaining the integrity of each training, assessment, and session delivery across treatment groups and sessions. Research-backed protocols for intervention implementation were used to ensure the PEERS and VOISS interventions were performed with all necessary components. The necessity of following the strict protocols was conveyed to all implementers and reinforced throughout the study. All study periods (i.e., training, intervention, assessment) for matched pairs occurred at the same time of day, in the same location, and with

the same educator in as many sessions as were within our control (e.g., not within our control would be a student missing a day of school). Since contextual factors (e.g., location, time of day, educator in the room) may influence a participant's performance, it was important to ensure these measures were taken to the greatest extent possible. Table 5 provides the study implementation timeline. Study procedures, dates at which intervention started and ended and intervention session times remained the same for matched pairs but varied in some classrooms, due to the amount of allotted time the educator had with the students (e.g., 30 minute sessions versus 45 minute sessions), and the individual classroom needs (e.g., students with more severe disabilities needing an increased amount of intervention days to watch and create video models and complete the scenarios.)

Appendix G provides an example of one of the student participant's checklists for study sessions. An example was provided rather than all checklists as checklists were slightly different to accommodate for randomization of scenarios and videos but maintained the same pace and structure. Appendix H and I provide the intervention procedural checklists and implementation guides for PEERS video modeling and VOISS social narratives. Prior to selecting PEERS, a discussion was had with a PEERS trainer on the Video Modeling and Role Play videos to determine what fidelity measures were taken to ensure necessary components to video modeling were present within the program. The PEERS trainer reviewed the modifications to their validated Implementation Checklist for Video Modeling. It was determined that the entire intervention implementation guide for the EBP be provided rather than just the ones pertaining to the sessions to assist educators in becoming familiar with the whole process, start to finish, when the study ended. For the VOISS intervention, the implementation checklist for the program was provided by the program developers and used in the same manner.

Table 9

Research Timeline

	May 15-28	Aug 18-30	Sept 17-21	Oct 2-23	Oct 24-28	Oct 24-Nov 1	Nov 1-20	Nov 21-30	Dec 1-30	Jan 1-21	Feb 1-Mar 21	Jan 15-May 28
Recruit pool of participants	X											
Seek IRB approval from KU		X										
Select participants and send out introductory emails			X									
Send and explain study process, procedures, consent, and assent to participants				X								
VOISS and PEERS student and implementer training					X							
Administer pre- rating scales and EC questions						X						
VOISS and PEERS intervention							X					
Administer post rating scales and survey								X				
Analysis of data by each coder									X			
Group analysis of data										X		
Share results with participant/stakeholders and answer any remaining questions											X	
Complete preliminary findings disseminated plan and send out to a peer-reviewed publication												X

Chapter 4: Results

A randomized control trial (RCT) with pretest and posttest measures was employed to investigate the feasibility, acceptability, appropriateness, and preliminary efficacy of a social communication VR intervention (VOISS) for middle school students. Matched pairs within ten participating classrooms were assigned to treatment (VOISS) and control (PEERS) conditions. All 120 student participants and 10 educators remained in the study throughout and participated in all aspects of the study, except for one student participant in the PEERS group. This student would not participate in creating a video. Instead, she watched other students create the video on her targeted skill. Social communication was assessed using teacher and student pre and post intervention pragmatic skill application ratings (CELF-5 PP) and student pre and post social communication knowledge question responses (SCKQ). Statistical analyses were conducted to determine the statistical strength of the intervention; if there were differences in pretest and posttest scores between treatment and control conditions; and each intervention's social validity ratings in the areas of acceptability, feasibility, and appropriateness. Descriptive statistics were derived for all the dependent variables for both pretest and posttest apart from the IAM and FIM, which are constructs that can only be adequately measured post intervention. See Tables 10-13 for the calculations. The group means and standard deviations were calculated for student and educator pretest and posttest ratings on the CELF-5 PP's Receptive Communication, Expressive Communication, and Composite Pragmatic Communication as well as for the CIRP.

Independent samples *t* tests were run on the newest version of Statistical Package for the Social Sciences (SPSS) using pretest scores for the SCKQ and the CELF-5 PP ratings of educators and students prior to the start of the intervention for group 1 (PEERS) and group 2 (VOISS). Although there were large standard deviations of the entire participant population,

there were no significant differences (p>.05) between groups prior to the start of the intervention (see Appendix J). There was extensive time spent matching participants within classrooms prior to randomly assigning participants to groups. There is always the potential for participants to perform better post-intervention, due to communication interactions outside the intervention and learning history (i.e., a testing confound). This was controlled for as much as possible using matched peers within the same classroom who were receiving instruction from similar educators throughout their school day as well as by scheduling all intervention sessions during their only scheduled time each week for receiving social communication interventions. All parents stated prior to the start of the intervention that their child was not attending outside social skill or language development classes during the intervention timeline. All one-hundred twenty students completed all assessments as did all 10 educators.

Reliability of Content in Student Created Video

Reliability of VOISS and PEERS intervention content can be found above under interventions. The reliability of the final video content in the PEERS intervention was obtained by one graduate student and the first author who independently, via videoconferencing software, coded 10 randomly selected (32%) student videos. Specifically, the researcher and graduate student watched the video and indicated either the presence or absence of the skill step from the curriculum.

Self-modeling was used by all participants in the 31 student created videos. Students in classrooms with peers with similar priorities often created their video together, resulting in fewer videos than the number of participants in the PEERS intervention group. Only one student did not participate in creating the final video, though she watched her class peers with the same selected skill create their self-video. No educator selected more than one priority skill to be

created in a video. Video lengths ranged from 51 seconds to 4 minutes and 28 seconds. The obtained agreements data was collected using point-by-point agreement ([agreements/total number possible] × 100; Ledford et al., 2018). The total number of points was the exact number of steps listed in the PEERS Curriculum for the identified skill. There was 100% agreement between raters that all skill steps were present in the student video.

Procedural Fidelity

An implementation and procedural checklist was developed to measure teachers' adherence to delivering the PEERS and VOISS interventions (see Appendix H and I). The procedural checklist ensured the educator was adhering to each step necessary to complete the intervention (see Example in Appendix H). The evidence-based practice of social narratives and video modeling have checklists created for their use at the Ohio Center for Autism and Low Incidence (LaCava, 2008). The first author modified these checklists and sent them to two practitioners who regularly implement the VOISS and PEERS interventions to ensure correct alignment to these programs. This implementation checklist was provided with the procedural checklist to all educators in the study to measure each educator's adherence to the intervention conditions (see Appendix I). The implementation checklist was used to ensure educators understood all steps of continuing to complete the intervention once the study ended. Fidelity checklists for the researcher delivered training and assessment phases are in Appendix I. The educator was present in the room during both phases with the students.

The numbers assigned to each point of agreement were as follows: a 2 (implemented), 1 (partially implemented), 0 (did not implement), or NA (not applicable for this situation/stage of training) for each task and step observed within the identified phase as well as for every item within that day's session checklist. Cohen's kappa (κ) was calculated to determine the level of

agreement between the coders while controlling for agreement due to chance. A total of 32 to 35% of sessions (i.e., 32% of sessions in the intervention phase and 35% of sessions in the training and assessment phase) were randomly selected for IOA between the three coders. The IOA indicated "substantial agreement" in all three video session phases. The assessment phase agreement ($\kappa = 0.82$, $p < .005$) ranged from 96-98% agreement between coders. The training implementation phase agreement ($\kappa = 0.81$, $p < .005$) ranged from 95-98% agreement between coders, and the intervention implementation phase agreement ($\kappa = 0.68$, $p < .005$) ranged from 87-96% agreement between coders.

Descriptive Statistics

All 120 participants were administered the SCKQ to test knowledge of social communication skills and both subtests of the CELF-5 PP to assess receptive and expressive communication social skills. The scores obtained from these assessments were analyzed in SPSS to compare the effectiveness of the interventions on knowledge acquisition and application for middle school students with identified social communication delays. Descriptive and inferential statistics were used to compare pre-post scores. The independent variable was which group the participants were assigned. The dependent variables were the total knowledge score of the Social Communication Knowledge Test as well as each of the subscale receptive and expressive communication scores and the composite score of the CELF-5 PP. See Table 10 for descriptive statistics for the knowledge assessment for all participants and Table 11 for descriptive statistics for the CELF-5 PP and Table 12 for a break down by each intervention group.

Table 10

Descriptive Statistics for Pre and Post Social Communication (SC) Knowledge Responses

SC Knowledge Totals	Min	Max	Range	Mean	SD	% Mastery*
PEERS Pre SC Knowledge	3	36	33	21.67	8.85	54%

PEERS Post SC Knowledge	9	39	30	26.90	8.08	67%
VOISS Pre SC Knowledge	4	34	30	19.27	8.55	48%
VOISS Post SC Knowledge	10	40	30	32.85	5.94	82%
Total Pre SC Knowledge	3	36	33	20.47	8.75	51%
Total Post SC Knowledge	9	40	31	29.87	7.67	75%

Mastery is the mean percent of Social Communication Knowledge Questions accurately answered

Table 11

Descriptive Statistics for Pre and Post CELF-5 Pragmatic Profile Ratings

CELF-5 Pragmatic Profile Subscales [a]	**Min**	**Max**	**Range**	**Mean**	**SD**	**% Mastery***
Pre Teacher-Receptive Communication	12	48	36	39.21	9.09	82%
Post Teacher Receptive Communication	17	48	31	40.55	7.89	85%
Pre Student Receptive Communication	12	48	36	35.79	8.46	75%
Post Student Receptive Communication	19	48	29	38.62	7.52	80%
Pre Teacher-Expressive Communication	42	152	110	114.90	27.71	76%
Post Teacher Expressive Communication	60	152	92	132.07	21.20	87%
Pre Student Expressive Communication	62	152	90	113.94	23.57	75%
Post Student Expressive Communication	62	152	90	125.23	20.00	82%

CELF-5 Pragmatic Profile Composite[a]	**Min**	**Max**	**Range**	**Mean**	**SD**	**% Mastery***
Pre Teacher-Composite Communication	58	200	142	154.11	35.79	77%
Post Teacher Composite Communication	77	200	123	172.62	27.80	86%
Pre Student Composite Communication	74	200	126	149.73	28.59	75%
Post Student Composite Communication	86	200	114	163.86	25.88	82%

*% Mastery is the mean percent of SCKQ accurately answered out of the 40 multiple choice questions

[a]As measured by the Clinical Evaluation of Language Fundamentals-5 Observational Rating Scale Teacher and Student Ratings (CELF-5) Pragmatic Profile

A 2-by-2 mixed-design analysis of variance (ANOVA), which compares changes over time according to group membership, was performed to evaluate whether there were significant effects. The ANOVA was conducted to determine if there was a significant interaction over time between intervention groups on pre and post total knowledge scores of the Social

Communication Knowledge Test as well as on each of the subscale scores (receptive and expressive communication) and the composite score of the CELF-5 Pragmatic Profile. Finally, statistical significance ($p < .05$) was calculated for all measured variables using Wilks' Lambda. Effect size estimates for each intervention condition were calculated using the partial eta squared effect (Gray & Kinnear, 2012) from ANOVA Repeated Measure. Partial eta square effect sizes are categorized as small (.01), medium (.06) and large (.14 or higher).

Social Communication Knowledge Questions

The SCKQ was administered to participants to assess student knowledge of social receptive and expressive communication. The scores were analyzed to compare the effectiveness of PEERS and VOISS on the acquisition of social communication knowledge for middle school students with deficits in pragmatic communication. Descriptive and inferential statistics were used to compare the total scores.

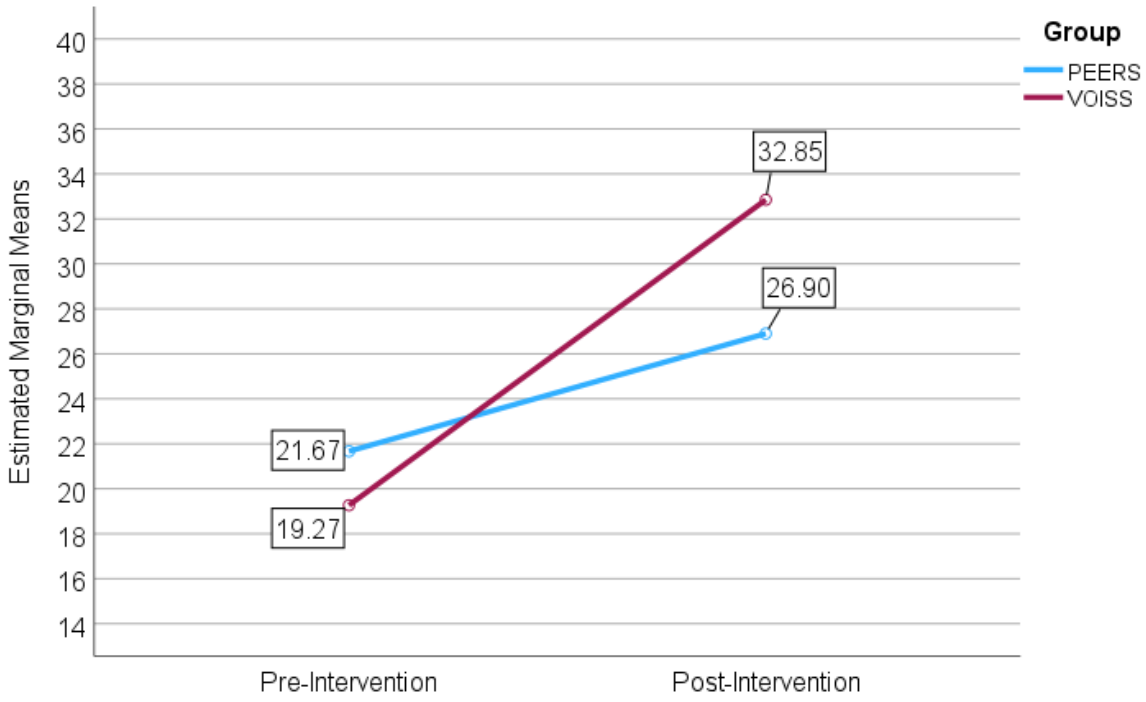
Pre and post intervention data utilizing the Social Communication Knowledge Test (SCKT) were used to answer the following question: Is there a difference in the social communication knowledge of a VR based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEERS) for middle school students? Based on previous research on the effectiveness of VR in delivering systematic instruction (Krokos et al., 2019; Miller & Bugnariu, 2016), it was predicted that both groups would significantly improve their acquisition of social skills knowledge following the completion of the intervention. A repeated measures analysis of variance (ANOVA) was conducted to test for significant change across time using Wilks' Lambda. The independent variable was the intervention the participants were assigned.

The repeated measures analysis of variance of the dependent variable, social

communication knowledge test, for both groups pre to posttest found a significant interaction ($F[1, 118] = 235.9$, $p < .001$) with a very large effect size (partial eta squared of 0.67). The ANOVA of the dependent variable, social communication knowledge test, also found a significant interaction ($F[1, 118] = 46.45$, $p < .001$) with a large effect size (partial eta squared of 0.28; see Figure 6). The social communication knowledge means improved pre to post intervention by 9.4 points for an increase of 24%. There was a significant difference in the increased knowledge between the two interventions with the highest mean improvements of 13.58 (34% increase) for the students using the VOISS intervention ($F[1, 59] = 162.29$, $p < .001$) with a large effect size (partial eta squared of 0.27) over the increased mean of 5.23 (13% increase) for students using the PEERS intervention ($F[1, 59] = 75.23$, $p < .001$) with a large effect size (partial eta squared of 0.56).

Figure 6

Social Communication Knowledge Change from Pretest to Posttest



Social Communication Application Ratings

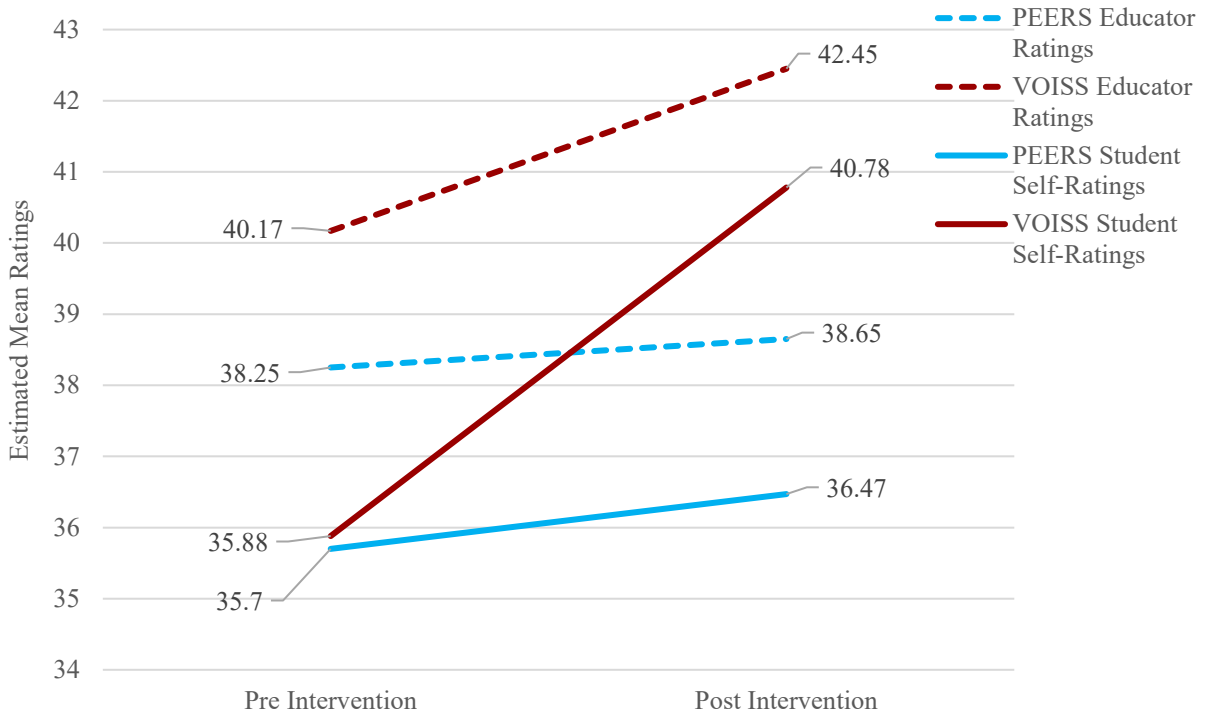
Pretest and posttest CELF-5 Pragmatic Profile (CELF-5 PP) data was used to answer the following question: Is there a difference in the social communication skill application of a VR based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEERS) for middle school students? Six repeated analyses of variance (ANOVAs) were conducted in SPSS to test for significant change across time. The independent variable was the group the participant was assigned, and the dependent variables were the two subscale scores and the total score ratings from both the educator and the student. It was predicted that both groups would improve their knowledge application following the completion of the intervention. It was also predicted that the difference in skill application ratings pre and post intervention would be higher for students utilizing VOISS than those utilizing PEERS. This prediction was accurate for the student CELF-5 PP ratings but not all educator ratings, as explained below.

The Receptive Communication Subtest is a subtest of the CELF-5 PP that assesses the understanding of an individual about what is being communicated to them through non-verbal external stimuli (Wiig et al., 2013). The repeated measures analysis of variance with educator ratings of receptive communication as the dependent variable did not find a significant interaction ($F[1, 118] = 2.12$, $p = .15$, $\eta^2 = .02$). However, when considering both intervention groups combined together pre to post, the interventions worked significantly ($F[1, 118] = 4.3$, $p = .04$) with a small effect size (partial eta squared of .04). When isolating the interventions, the PEERS intervention did not have a significant interaction pre to post in educator ratings of receptive communication ($F[1,59] = .17$, $p = .69$, $\eta^2 = .003$). However, the VOISS intervention did have a significant interaction pre to post in educator ratings of receptive communication ($F[1,59] = .89$, $p = .009$) with a medium effect size (partial eta squared of .11).

The repeated measures analysis of variance with student ratings of receptive communication, however, found a significant interaction with a medium effect size (F[1, 118] = 12.16, $p < .001$; $\eta 2 = 0.09$) and as a whole (F[1, 118] = 22.86, $p < .001$) with a large effect size (partial eta squared of .16). When isolating the interventions, those receiving the VOISS intervention (F[1,59] = 25.90, $p < .001$, $\eta 2 = .31$) increased their receptive communication self-ratings significantly with a large effect size over those receiving the PEERS intervention (F[1,59] = 1.23, $p = .27$, $\eta 2 = .02$) who did not have a significant increase in student self-reporting of receptive communication. Figure 7 provides a visual comparison of intervention groups and participant ratings.

Figure 7

CELF-5 PP Receptive Communication Rating Change from Pretest to Posttest



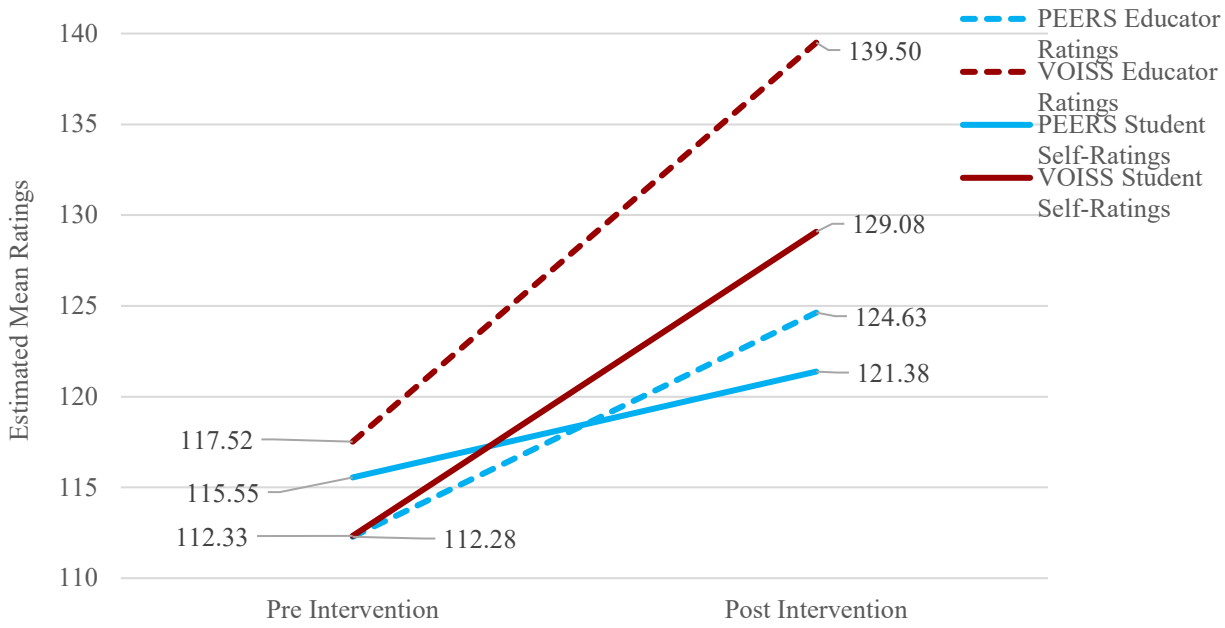
The Expressive Communication Subtest is a subtest of the CELF-5 PP that assesses an individual's ability to convey ideas, wants, needs, and other complex thoughts through the oral,

written, or sensory gesture system (Wiig et al., 2013). The repeated measures analysis of variance with educator ratings of expressive communication as the dependent variable found a significant interaction (F[1, 118] = 7.34, p =.008) with a very large effect size (partial eta squared of 0.06). The main effect was also significant (F[1, 118] = 93.17, p < .001) with a very large effect size (partial eta squared of 0.44). This indicates that the educators' ratings of the participants in both groups showed an increase in expressive communication after receiving the intervention with a significant increase in VOISS over PEERS. When isolating the interventions, educators' ratings of those receiving the VOISS intervention (F[1,59] = 63.69, p < .001) increased significantly with a very large effect size ($\eta 2$ = .52). Educators' ratings of those receiving the PEERS intervention also increased significantly (F[1,59] = 30.12, p < .001) with a very large effect size ($\eta 2$ = .34).

The repeated measures analysis of variance with student ratings of expressive communication pre and post assessment of participants in VOISS versus those in PEERS also found a significant interaction with a medium effect size (F[1, 118] = 12.52, p < .001; partial eta squared of 0.1) and the interaction pre to post of the participants when combined as a whole was significant (F[1, 118] = 53.57, p < .001) with a large effect size (partial eta squared of .31). When isolating the interventions, those receiving the VOISS intervention (F[1,59] = 51.83 , p < .001) increased their receptive communication self-ratings significantly with a very large effect size ($\eta 2$ = .47). Those receiving the PEERS intervention increased their expressive communication self-ratings significantly (F[1,59] = 8.29, p = .006) with a medium effect size ($\eta 2$ = .12). Figure 8 provides a visual comparison of groups.

Figure 8

CELF-5 PP Expressive Communication Rating Change from Pretest to Posttest



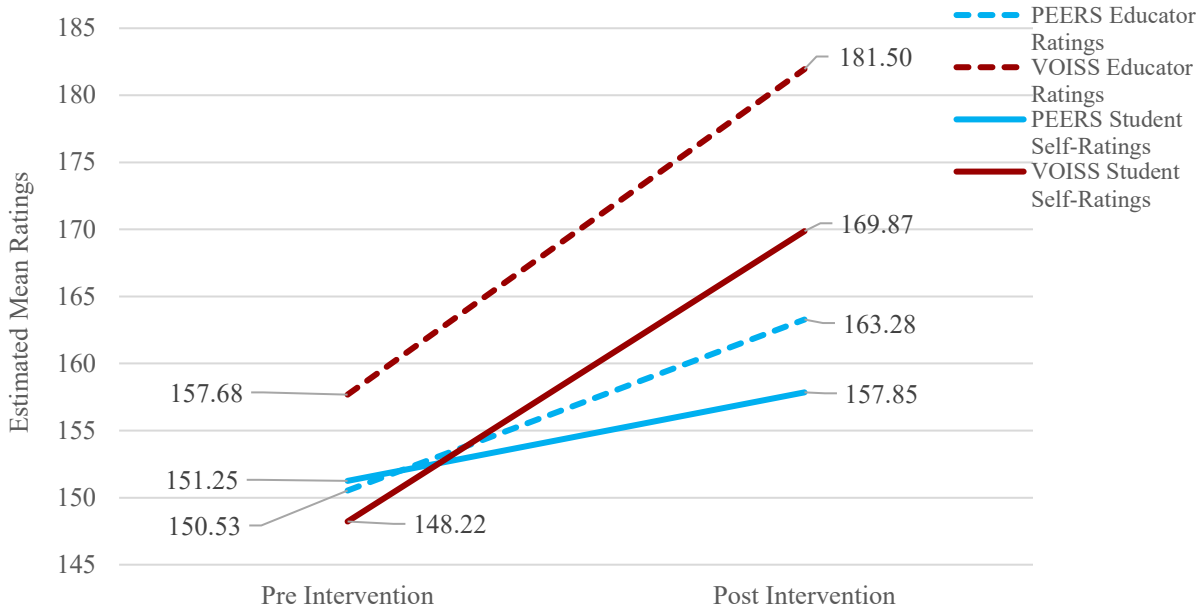
The Total Pragmatic Performance refers to the use of language in relation to context and includes elements of both expressive and receptive communication (Wiig et al., 2013). The repeated measures analysis of variance with the total pragmatic performance teacher ratings as the dependent variable found a significant interaction for the intervention groups ($F[1, 118] = 7.14$, $p = .009$) with a small effect size (partial eta squared of 0.057). The main effect of growth by all participants as a whole was significant ($F[1, 118] = 73.75$, $p < .001$) with a very large effect size (partial eta squared of 0.39). This indicates that the educators' ratings of the participants in both intervention groups showed an increase in both expressive and receptive communication after receiving the intervention regardless of which intervention was received. When isolating the interventions, educators' composite ratings of those receiving the VOISS intervention ($F[1,59] = 53.99$, $p < .001$) increased significantly with a very large effect size ($\eta 2 = .48$). Educators' composite ratings of those receiving the PEERS intervention also increased

significantly (F[1,59] = 21.19, p < .001) with a very large effect size ($\eta 2$ = .26).

The repeated measures analysis of variance with student ratings of the pragmatic profile as the dependent variable found a significant interaction and a large effect size for intervention groups (F[1, 118] = 18.74, p < .001; partial eta squared of 0.14) and as a whole (F[1, 118] = 66.03, p < .001; partial eta squared of .36). When isolating the interventions, those receiving the VOISS intervention (F[1,59] = 69.91 , p < .001) increased their composite communication self-ratings significantly with a very large effect size ($\eta 2$ = .54). Those receiving the PEERS intervention increased their composite self-ratings significantly (F[1,59] = 8.09, p = .006) with a medium effect size ($\eta 2$ = .12). Figure 9 provides a visual comparison of groups.

Figure 9

CELF-5 PP Composite Pragmatic Communication Change from Pretest to Posttest



From pretest to posttest, the mean scores for students in both groups across social communication knowledge and application increased significantly. The largest gains were in the social communication knowledge-based assessment (total gain of both groups of +9.4). There was a significant difference between the two interventions with the higher gains (+13.58) being

found for students using the VOISS intervention over students using the PEERS intervention (+5.23). The application scores between the students and educators in both the expressive and receptive communication measures differed. All participants revealed a significant increase in receptive communication (educator: +1.34, student: +2.83), expressive communication (educator: +17.17, student: +11.29), and composite pragmatic communication overall (educator: +18.51, student: +14.13). The educators reported a larger change in expressive communication application and the students reported a larger gain in receptive communication. As shown in Figure 9, overall, educators reported larger gains in pragmatic communication application than students. Table 12 provides a comparison of descriptive statistics, significance, and effect sizes for all CELF-5 PP ratings for educators. Table 13 provides the descriptive statistics for self-ratings of students.

Table 12

CELF-5 PP Ratings from Educators Pretest to Posttest

TEACHER COMMUNICATION RATINGS		Pretest Receptive	**Posttest Receptive**	Pretest Expressive	**Posttest Expressive**	Pre-Pragmatic Composite	**Post-Pragmatic Composite**
Interaction Of the Groups and Effect Size		*F[1, 118]*= 2.12 *p*= .15 *η2*=.02		***F[1, 118]*= 7.34 *p*= .008 *η2*=.06**		*F[1, 118]*= 7.14 *p*= .057 *η2*=.06	
PEERS	Minimum	12.00	**17.00**	46.00	**60.00**	58.00	**77.00**
	Maximum	48.00	**48.00**	149.00	**152.00**	196.00	**200.00**
	Range	36.00	**31.00**	103.00	**90.00**	138.00	**123.00**
	Mean	38.25	**38.65**	112.28	**124.63**	150.53	**163.28**
	Std. Dev.	9.19	**8.75**	26.33	**23.85**	34.09	**31.23**
VOISS	Minimum	13.00	**19.00**	42.00	**97.00**	59.00	**122.00**
	Maximum	48.00	**48.00**	152.00	**152.00**	200.00	**200.00**
	Range	35.00	**29.00**	110.00	**55.00**	141.00	**78.00**
	Mean	40.17	**42.45**	117.52	**139.50**	157.68	**181.95**
	Std. Dev.	8.96	**6.45**	29.01	**15.01**	37.37	**20.15**
Total	Minimum	12.00	**17.00**	42.00	**60.00**	58.00	**77.00**
	Maximum	48.00	**48.00**	152.00	**152.00**	200.00	**200.00**
	Range	36.00	**31.00**	110.00	**92.00**	142.00	**123.00**
	Mean	39.21	**40.55**	114.90	**132.07**	154.11	**172.62**
	Std. Dev.	9.09	**7.89**	27.71	**21.20**	35.79	**27.80**
Interaction Of All Participants Pre-Post and Effect Size		***F[1, 118]* = 4.3 *p* =.04 *η2*=.04**		***F[1, 118]* = 93.17 *p* < .001 *η2*= 0.44**		***F[1, 118]* = 73.75 *p* < .001 *η2*= 0.39**	

Table 13

CELF-5 PP Self-Ratings of Students Pretest to Posttest

STUDENT COMMUNICATION RATINGS		Pretest Receptive	**Posttest Receptive**	Pretest Expressive	**Posttest Expressive**	Pre-Pragmatic Composite	**Post-Pragmatic Composite**
Interaction Of the Groups and Effect Size			***F[1, 118]* = 12.16** ***p* <.001** ***η2*=.09**		***F[1, 118]* = 12.52** ***p* <.001** ***η2*=.10**		***F[1, 11*= 18.74** ***p* <.001** ***η2*=.14**
PEERS	Minimum	12	**21**	62	**62**	74	**86**
	Maximum	48	**48**	152	**152**	200	**200**
	Range	36	**27**	90	**90**	126	**114**
	Mean	35.70	**36.47**	115.55	**121.38**	151.25	**157.85**
	Std. Dev.	9.02	**8.40**	24.39	**22.40**	30.70	**28.86**
VOISS	Minimum	17	**19**	62	**93**	92	**119**
	Maximum	48	**48**	152	**152**	200	**200**
	Range	31	**29**	90	**59**	108	**81**
	Mean	35.88	**40.78**	112.33	**129.08**	148.22	**169.87**
	Std. Dev.	7.93	**5.83**	22.82	**16.59**	26.48	**21.09**
Total	Minimum	12	**19**	62	**62**	74	**86**
	Maximum	48	**48**	152	**152**	200	**200**
	Range	36	**29**	90	**90**	126	**114**
	Mean	35.79	**38.62**	113.94	**125.23**	149.73	**163.86**
	Std. Dev.	8.46	**7.52**	23.57	**20.00**	29.59	**26.00**
Interaction Of All Participants Pre-Post and Effect Size			***F[1, 118]* = 22.86** ***p* < .001** ***η2*=.16**		***F[1, 118]* = 53.57** ***p* < .001** ***η2*=.31**		***F[1, 118]* = 66.03** ***p* < .001** ***η2*=.36**

Social Validity Findings

A 2-by-2 mixed-design analysis of variance (ANOVA) was performed to evaluate whether there were significant effects between pre and post CIRP. An independent samples *t* test was performed on the measures with post ratings only (i.e., IAM and FIM) using Levene's test for equality of variance prior to calculating effect sizes for each intervention condition to determine if ratings between groups were statistically significant. Finally, statistical significance ($p < .05$) was calculated for all measured variables.

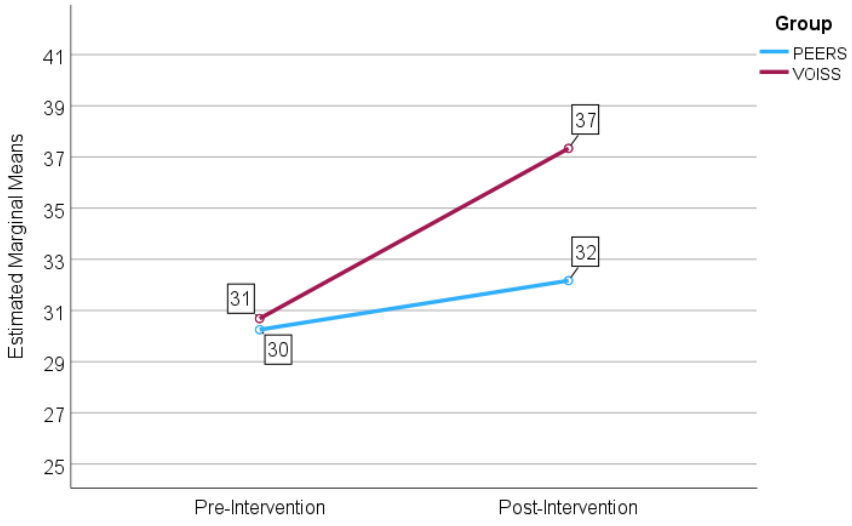
Acceptability. To evaluate whether there were significant effects between pre and post CIRP, an ANOVA was performed to answer the following question: Is there a difference in the acceptability ratings of a VR based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEERS) for middle school students? It was predicted

that acceptability of students will remain high for both PEERS and VOISS and only a slight increase may be shown in the VOISS intervention due to the novelty of VR.

As predicted, the repeated measures analysis of variance with student CIRP ratings of intervention acceptability as the dependent variable found a significant effect (F[1, 118] = 46.54, p < .001) with a large effect size (partial eta squared of 0.28). Both interventions were found highly acceptable to students pre (M= 30.47) and post intervention (M= 34.75). There was also a significant interaction when looking at each group (F[1, 118] = 14.21, p < .001) revealing that the VOISS intervention was significantly more acceptable than PEERS with a medium effect size (partial eta squared of 0.11) pre to post ratings (see Figure 10). When isolating the interventions, those receiving the VOISS intervention (F[1,59] = 40.17, p < .001) increased their ratings of intervention acceptability significantly with a very large effect size ($\eta 2$ = .41). Those receiving the PEERS intervention also increased their ratings of intervention acceptability significantly (F[1,59] = 6.14, p = .016) with a medium effect size ($\eta 2$ = .09). The prediction that both interventions would be seen acceptable by students was accurate as was the prediction that VOISS would be rated more acceptable than PEERS be students.

Figure 10

Student CIRP Ratings of Intervention Acceptability



The largest increase in ratings on the CIRP pretest to posttest was for the rating on the question "this program could help other kids too" which started with a 63% completely agree response and rose to an 85% completely agree response. Although acceptability remained high for both interventions, the mean acceptability for specific questions for the PEERS intervention saw a decrease in three questions. After the PEERS intervention, the ratings of liking being in the program, believing the program will be helpful in school performance, and believing this program is the best method for the participant went down. Table 14 provides the questions and the mean responses for each group. Within the table, in bold, is the mean difference pretest to posttest for each question by group. Table 15 provides a list of the 16 participant comments. They are listed by the individual participant's acceptability ratings from least to greatest.

Table 14

CIRP Question Response Means Pretest and Posttest with Mean Difference for Each Group

	The program we will use sounds fair. …we used was fair.			This program could help other kids too. …will help other kids, too.			I think I will like being in this program. I liked the program we used.			I think being in this program will help me do better in school. Being in this program helped me...		
PEERS	4.50	4.80	**0.30**	4.07	4.93	**0.87**	4.33	4.30	**-0.03**	4.22	3.98	**-0.23**
VOISS	4.63	5.42	**0.78**	4.27	5.52	**1.25**	4.80	5.28	**0.48**	4.67	5.05	**0.38**
Total	4.57	5.11	**0.54**	4.17	5.23	**1.06**	4.57	4.79	**0.23**	4.44	4.52	**0.08**
Reverse Score Ratings Report Here*	I think my teacher will be (was) too harsh on me. …was too harsh on me.			Being in this program may cause problems with my friends. …caused problems with my friends.			There are better ways to teach me. …were better ways to teach me.			*Total Pre*	*Total Post*	***Mean Difference***
PEERS	4.50	5.13	**0.63**	4.53	5.40	**0.87**	3.87	3.62	**-0.25**	*30.02*	*32.17*	***2.15***
VOISS	4.72	5.55	**0.83**	4.65	5.63	**0.98**	4.23	4.88	**0.65**	*31.97*	*37.33*	***5.36***
Total	4.61	5.34	**0.73**	4.59	5.52	**0.93**	4.05	4.25	**0.20**	*31.00*	*34.75*	***3.75***

*Questions in the bottom portion of the table show scores after reverse scoring. For example, "I think my teacher will be too harsh on me" increase pre to post in bold shows that they are less likely to believe their teacher will be harsh on them after intervention.

Table 15

CIRP Posttest Student Comments on the Acceptability of the Interventions

Commenter's Total Rating and Assigned Group	**The 16 Student Participants of 120 Raters Who Commented on the CIRP Posttest Listed in Order of Posttest Acceptability Rating** (9 comments are from students using VOISS and 7 from students using PEERS A 24.5 or higher is considered acceptable (Turco & Elliot, 1986)
18 PEERS	I would not like to do it again because it is too hard and frustrating. And i am sorry to say but it's kind of boring.
20 PEERS	The picture quality on videos is good and the people we watched are real relatable people but imitating what they did correctly after didn't help me understand why I am supposed to do that.
24 PEERS	Acting was okay minus screaming one some good examples, but did they really have to do it again and again we get it already. It was like class most of the time boring. We talk, share about our day, film each other doing the right action to one of our problems and watch the one who gets it right over. But what right looks like to her is sus.
31 VOISS	I liked it was easy to use and the way that the animations made the expressions so we could tell how they felt but I didn't like using headphones.
32 VOISS	I liked the situations in scenarios but not a fan of those graphics.
32 VOISS	nothing really liked characters not graphics
34 PEERS	It puts you in like real situations that happen in life. It felt weird because it was staged, and I didn't really like that.
35 VOISS	The app was fun and understandable.
36 PEERS	I liked that I learned a lot of things I did not really dislike anything
37 PEERS	I disagreed with the way Elina was very rude in the videos but although it was really great, I understood everything that they said and did (their actions). I liked the videos and how they helped me understand things better and it also was a good demonstration for what I need to do in my everyday life.
38 VOISS	I like the graphics they were super good and I like how it is teaching you how you can become a nicer person. Really, I liked everything, so I wouldn't change anything.
38 VOISS	I LOVED IT!!!!
40 VOISS	The program is very good
40 VOISS	i liked that it is real there are real people doing the video, but it could have explained about what she did right and what she did wrong
40 PEERS	I didn't like how sometimes they would do the same topic, but I liked that what they talked about sometimes happens to me too. Now I see how to respond next time.
41 VOISS	I like the animation of the people and how you were able to talk to them, but I didn't like that you weren't able to choose your own voice.

Appropriateness. Inspection of Q-Q Plots revealed that IAM scores were normally distributed for both groups and that there was homogeneity of variance as assessed by Levene's Test for Equality of Variances. Therefore, an independent samples t test was performed on the data with a 95% confidence interval (CI) for the mean difference to answer the following question Is there a difference in skill intervention (PEERS)? It was predicted that both groups would indicate high appropriateness ratings for the PEERS and VOISS interventions. It was found that

appropriateness ratings interaction was statistically significant with a large effect size (t[118] = 5.44, p < .001, d = 0.99). Middle school students' ratings of appropriateness for VOISS (M =18.22) were significantly higher than those for PEERS (M = 14.53).

The prediction that both interventions would be seen appropriate by students was not accurate. Student participants rated VOISS as completely agree on 91 to 92% of questions on acceptability with "the program seems suitable" as the highest rated question. Student participants rated PEERS as completely agree on only 66 to 81% of questions on acceptability. The areas which student participants did not find acceptable in relation to the PEERS intervention were on whether the intervention seemed "fitting" and was "a good match" to their wants and needs. Table 16 provides the means and standard deviations for each intervention group on all social validity measures administered.

Table 16

Mean Acceptability, Appropriateness, and Feasibility of the Interventions

Pretest	**Group**	**Mean**	**SD**	**Posttests**	**Group**	**Mean**	**SD**
Pre	PEERS	30.25	5.739	IAM[b]	PEERS	14.53	3.92
CIRP[a]	VOISS	30.68	5.369		VOISS	18.22	3.48
	Total	*30.47*	*5.538*		*Total*	*16.38*	*3.7*
Posttests	**Group**	**Mean**	**SD**	FIM[b]	PEERS	18.45	3.31
Post	PEERS	32.17	4.396		VOISS	18.82	2.00
CIRP[a]	VOISS	37.33	4.725		*Total*	*18.64*	*2.66*
	Total	*34.75*	*5.233*				

[a] Total scores range from 7 to 42 with scores of 24.5 or higher considered acceptable (Turco & Elliot, 1986)
[b] Total scores range from 4 to 20 with higher scores considered higher social validity (Weiner et al., 2017).

Feasibility. Inspection of Q-Q Plots revealed that FIM scores were normally distributed for both groups and there was homogeneity of variance as assessed by Levene's Test for Equality of Variances. Therefore, an independent samples t test was performed on the data with a 95% confidence interval (CI) for the mean difference to answer the following question: Is there a

difference in middle school student ratings of feasibility of a VR based social skill intervention (VOISS) versus an evidence-based video modeling social skill intervention (PEERS)? It was predicted that the feasibility of students toward both interventions would be high. Higher scores on the FIM indicate greater feasibility. It was found that both interventions were highly feasible, with a mean score between 18 and 19 out of 20 for both intervention groups. One intervention was not statistically different than the other intervention in ratings of feasibility (t[118] = 0.73, p = 0.465, d =0.13). Both interventions received between 91 to 98% "completely agree" responses to feasibility questions. See Table 17 for questions and mean responses. The VOISS intervention had the highest ratings on the question "the program seems easy to use" at 98% of participants giving this question a 5 rating of "completely agree." There were no neutral or negative ratings on "the program seems easy to use" and "the program seems possible" for the VOISS intervention.

Table 17

Mean Responses to Intervention Feasibility and Appropriateness Questions

IAM	The program seems fitting.		The program seems suitable.		The program seems applicable.		The program seems like a good match.	
VOISS	∑:273 ***M*: 5**	**91% ca** 5% cd	∑:275 ***M*:5**	**92% ca** 3% cd	∑:273 ***M*: 5**	**91% ca** 7% cd	∑:272 ***M*: 5**	**91% ca** 7% cd
PEERS	209 ***M*:2**	**69% ca** 3% cd	222 ***M*:4**	**74% ca** 3% cd	244 ***M*:4**	**81% ca** 0 cd	197 ***M*:2**	**66% ca** 5% cd

FIM	The program seems implementable.		The program seems possible.		The program seems doable.		The program seems easy to use.	
VOISS	∑:273 ***M*: 5**	**91% ca** 3% cd	∑:288 ***M*: 5**	**96% ca** 0 cd	∑:273 ***M*: 5**	**91% ca** 5% cd	∑:295 ***M*: 5**	**98% ca** 0 cd
PEERS	∑:272 ***M*:5**	**91% ca** 5% cd	∑:282 ***M*:5**	**94% ca** 5% cd	∑:274 ***M*:5**	**91% ca** 5% cd	∑:279 ***M*:5**	**93% ca** 5% cd

∑60: Raw score out of 300 possible points; % sa: Percent of students rating a 5 "completely agree" on this question % sd: Percent of students rating a 1 "completely disagree" on this question; *M*: Closest mean rating

Chapter 5: Discussion

This study examined the social validity as well as the efficacy of a VR intervention on social communication knowledge acquisition and application. Eight separate systematic literature reviews of VR research over the past twenty-five years (Bellani et al. 2011; Carreon et al., 2022; Howard & Gutworth, 2020; Merchant et al., 2014; Miller & Bugnariu, 2016; Mosher & Carreon 2021; Mosher et al. 2022; Sansosti et al., 2015) have called out researchers, due to the lack of a single study with five essential characteristics. These missing characteristics are: (a) an experimental design, (b) a sample size of more than 64 students, (c) a control group receiving a comparative research-backed intervention, (d) one specific VR intervention used within the study, and (e) a valid and reliable measure of growth in the intervention's targeted skill. Many studies on VR interventions have small sample sizes (i.e., 2 participants; Mantziou et al., 2015), utilize self-report measures without validity or reliability evidence (Marshall et al., 2016), and do not include an equivalent control group (Howard & Gutworth, 2020). While some studies show that VR interventions are effective for social skill development (Sullivan, et al., 2016; Yuan & Ip, 2018), Howard and Gutworth (2020) were unable to find a single study that proposed a specific VR program that is effective in improving students' social or communication skills. These facts make it difficult to make judgements regarding the efficacy of VR interventions to develop pragmatic skills. This study implemented all five essential characteristics in an attempt to correct the disparity in VR research on interventions for improving adolescents' social communication.

Results of the present investigation suggest that a VR delivered intervention (VOISS) has the potential to provide effective social communication instruction to middle school students. The overall findings are consistent with previous research (Chen et al., 2022; Lozano-Álvarez et

al., 2023), revealing VR interventions can accurately instruct students with and without disabilities. Results indicated the video modeling intervention (PEERS) and VR scenario intervention (VOISS) made statistically significant growth pretest to posttest in social communication knowledge and application with effect sizes ranging from .04 through .44 in all dependent measures. VOISS was statistically greater than PEERS in all dependent measures except the Educator CELF Receptive Communication and Composite Pragmatic Profile.

Social validity data indicated high ratings of acceptability, appropriateness, and feasibility for the VR intervention among middle school students. This finding is consistent with previous research revealing high social validity of VR interventions presented through iPads and Chromebooks with adolescent students (Carreon et al., 2023). Interestingly, the acceptability and feasibility of PEERS was also high. This is in line with research, which reveals students with and at-risk for social-behavioral difficulties have greater acceptance of interventions when the intervention takes up little classroom time (i.e., less than 30-min a session), is presented through technology (Wong et al., 2020), and does not draw unwanted attention (Felver, et al., 2017). The acceptability and appropriateness of the VOISS intervention was significantly higher than PEERS, a program known for being enjoyed and valued by adolescents (Gilmore et al., 2023). PEERS was not found appropriate by a number of adolescents, although it was found acceptable. This finding should be explored further through mixed methods research to understand the reasons for the high levels of feasibility, appropriateness, and acceptability for students receiving the VOISS intervention.

Efficacy of a VR Intervention for Social Communication Knowledge Acquisition

The accurate prediction that both interventions would cause a statistical increase in social communication knowledge was based on previous research on the effectiveness of VR in

delivering systematic instruction (Krokos et al., 2019, Miller & Bugnariu, 2016) as well as the knowledge that aspects of the EBPs video modeling (UCLA PEERS Clinic, 2020) and social narratives (Project VOISS, 2021) are contained within the programs. The finding that VOISS produced a statistically greater effect than PEERS was surprising, since studies report the PEERS intervention as having medium to large advantageous effects in improving adolescents' social skill acquisition (Zheng et al., 2021). From pretest to posttest, the mean SC knowledge scores for students in both groups increased significantly. The largest gains (+13.58) were found for students using the VOISS intervention over students using PEERS (+5.23). The finding that VOISS was statistically higher is promising for VR intervention development and should be studied further.

Group comparisons in past research show that immersive VR technology (i.e., HMD) is just as effective at skill development as non-immersive (i.e., Chromebook or iPad) technology (Carreon, 2023). Since the influence of the technology device (i.e., HMD versus an iPad) in a VR intervention has been studied and found insignificant, it would be advantageous to understand other aspects of the VR intervention contributing to VOISS participants' substantial gains. For example, the VOISS intervention provided direct instruction within the social scenario in a pertinent simulated school location. The program provided multiple choice response options, with a few choices being acceptable but one choice being ideal for the situation. If the incorrect choice was made, there was a natural consequence, reteaching, and the student was directed back to the original question. In comparison, the PEERS intervention provided a visual (i.e., video) of students completing the correct response to an action and another video with the incorrect response and consequence. Then, there was time for questions, a step-by-step recap, and the opportunity for the student to imitate the skill within a pertinent real-life setting. In PEERS,

direct instruction was only provided by the curriculum in a task analysis format if the imitation made by the student was deemed incorrect by the curriculum guide. PEERS provided open ended questioning to prompt conversation among students. The student used this observed and discussed knowledge to create a video of themselves completing correctly a skill the student previously was unable to master. This study calls for further investigation into VR interventions for students with social communication deficits, particularly the components that differed from the PEERS and VOISS interventions:

1. the method of instruction within each intervention (i.e., procedures, checks for understanding, prompting);
2. the time spent within each form of instruction (i.e., amount of intervention spent in observational learning vs direct instruction);
3. the example situations provided (i.e., relevancy of situations depicted, complexity of scenes depicted);
4. the types of questioning (i.e., one optimal response or constructing knowledge to come to a response);
5. the forms of feedback (i.e., verbal, token, natural consequence);
6. the visualizations (i.e., real people engaged in conversation, avatars walking up to greet students); and
7. the interactions (i.e., physical contact with the environment where skill is performed, peer models prompting, opportunities to move on to new environments).

This knowledge would provide helpful insight into what within VR interventions leads to improved knowledge acquisition and skill implementation for adolescents with pragmatic delays.

Efficacy of a VR Intervention for Social Communication Knowledge Application

The difference in skill application scores reported pre and post intervention were predicted to be higher for students utilizing VOISS than those utilizing PEERS, because VR allows the user to obtain immediate natural consequences after making choices. Video modeling does not provide the same natural consequence to student actions. This immediate feedback and practice within various simulated school settings was also predicted to increase skill generalization at a faster rate. This prediction was true across groups for the student self-ratings, which had a medium effect in both receptive ($\eta 2$=.09) and expressive ($\eta 2$=.10) communication and a large effect in the pragmatic composite ($\eta 2$=.14). It was also true of the expressive communication ratings of students by educators which had a medium effect ($\eta 2$=.06).

The CELF-5 Pragmatic Profile ratings between the students and educators in both the expressive and receptive communication measures differed. Compared to students, educators revealed larger gains pre to post intervention in expressive communication (educator: +17.17, student: +11.29;) and the composite pragmatic communication (educator: +18.51, student: +14.13). However, only students reported significant gains with a large effect size in receptive communication (educator: +1.34, student: +2.83). The non-significance of educators' ratings of the interaction of groups in students' receptive communication compared to the students may have occurred because the ratings were taken soon after the intervention ended. This short time may have been inadequate for educators to observe the new skill application across settings. However, skill application growth ratings by students and educators pre to post for the pragmatic composite saw substantial improvements [educators: $F(1, 118) = 73.75$, $p < .001$, $\eta 2 = 0.39$; students: $F(1, 118) = 66.03$, $p < .001$, $\eta 2 = 0.36$] with very large effect sizes. Educators also reported a larger change in expressive communication application [$F(1, 118) = 93.17$, $p < .001$,

η2= 0.44], even larger than students [$F(1, 118) = 53.57$, η2=.31]. Therefore, it is unlikely that this is solely due to lack of time to generalize skills.

The differences in student skill application ratings and educator skill application ratings could be because educators are more accurate in their observation. Students may rely on their perceived new knowledge levels in their ratings of application (i.e., claiming application though the knowledge has not yet generalized). However, if this were the case, it would not be expected that educator ratings in the expressive subtest and composite would surpass students' ratings. The finding may be more accurately related to prior research, which indicates that although receptive communication skills are often observed to be higher than expressive communication skills in typically developing students, the opposite is true for students with ASD (Fenson, et al., 1994; Kjelgaard & Tager-Flusberg, 2001). It is possible that receptive communication skills are less observable in a population that struggles with pragmatic language, such as those with ASD, than expressive communication skills. Educators may also be able to observe application of expressive communication at an earlier rate than receptive skills for this population. Exploring this finding further may influence the way receptive and expressive communication are assessed within populations with pragmatic language delays.

Social Validity of a VR Intervention to Improve Social Communication Skills

Social validity is a critical component of social communication interventions (Carter & Wheeler, 2019; Hansen et al., 1989). Study findings agree with Halabi and colleagues (2017), who found VR interventions not only improve skill performance for students with pragmatic delays, they also have greater acceptability than other instructional methods. As predicted, acceptability ratings for both interventions were significantly high ($F[1, 118] = 46.54$, $p < .001$) with a large effect size (partial eta squared of 0.28) for students pre ($M= 30.47$) and post

intervention (M= 34.75). The prediction that the VOISS intervention would have slightly higher acceptability by middle school students was also accurate. VOISS was significantly more acceptable than PEERS (F[1, 118] = 14.21, p < .001) with a medium effect size pretest to posttest.

The largest increase in acceptability ratings for both interventions was on the question of agreement as to whether this program could help other kids, which started with a 63% "complete agreement rating" and rose to 85% rating "complete agreement" to the question. This suggests that students were recognizing benefits after the interventions they had not expected before the interventions. Although acceptability remained high for both interventions, the mean acceptability for three questions for the PEERS intervention saw a decrease (i.e., liking being in the program, believing the program will be helpful in school performance, and believing the program is the best method for the participant). This may indicate that students felt less favorably about aspects of the PEERS intervention, particularly related to the interventions' helpfulness and fit, than they did prior. The term "fit" within the acceptability scale is also similar to terms used in the appropriateness scale, which found the PEERS intervention ratings substantially lower than VOISS. In future research, it would be helpful to understand if this pattern of decrease remains with the addition aspects of the PEERS intervention (i.e., role play).

Appropriateness ratings of the VOISS intervention in comparison to the PEERS intervention was statistically significant with a large effect size. The mean appropriateness rating for VOISS was 18.22 out of 20. For PEERS the mean was 14.53 out of 20. The areas with low ratings in the PEERS intervention involved whether the intervention seemed "fitting" and like a "good match." Since both interventions teach the same skills and are delivered through the same preferred device to randomly matched peers, this finding suggests an aspect of the intervention

(e.g., representation of cultures, method of breaking down skills, response options), rather than the skills themselves or the delivery device, may be the cause. The appropriateness ratings by student participants on individual questions for PEERS was only 66 to 81% in complete agreement compared to the VOISS appropriateness complete agreement ratings in the 91 to 92% range. This finding should be investigated further, particularly considering the comments discussed in the acceptability ratings. This finding also raises the question as to whether an intervention can be considered acceptable by middle school students (e.g., convenience, ease of use, meets needs) but not appropriate (e.g., fitting, a good match, best option).

Both interventions were reported as highly feasible, with a mean score between 18 and 19 out of 20. One intervention was not statistically different than the other in feasibility, as both interventions received between 91 to 98% "completely agree" responses to all feasibility questions. Although there were a couple of students who rated some aspects of PEERS as neutral or not feasible, there were no neutral or negative ratings for the VOISS intervention on "the program seems easy to use" and "the program seems possible." This reveals that both interventions have high ratings for ease of use. Future research should consider if intervention feasibility for students may be higher when the technology delivering the intervention is familiar to students. This knowledge would be impactful for curriculum developers, as understanding what improves the successful implementation of an intervention within a given context is vital for intervention implementation and maintenance (Weiner et al., 2017).

Prior research shows video modeling to be a highly favorable intervention for students (King et al., 2014). Yet, VOISS was rated as significantly more acceptable and appropriate than PEERS. Some researchers attribute greater acceptance of VR instructional programs over other interventions to be due to the pressure-free practice environment within VR, reducing the stress

for students (Pizzoli et al., 2019), while others attribute high acceptability to the "real-life" feeling within VR (Halabi et al., 2017). It would be advantageous to know what within interventions improves acceptability for students who need assistance building SE competencies.

Although not a part of the original questions presented for examination, the comments section at the end of participants' CIRP surveys suggest the content of the intervention and how it is presented may be just as important as the element of realness and reduced stress. Two comments, coming from students who rated the highest acceptability and applicability, one from each intervention group, provided information on the benefit found in the manner in which the instruction was given. A student in the VOISS group commented, "The program was funny, had realistic situations and reactions. I liked understanding why I was supposed to respond a certain way." The student using PEERS commented, "I didn't like how sometimes they would do the same topic, but I liked that what they talked about sometimes happens to me too. Now I see how to respond next time." The same phenomenon was discovered in the comments from those with lower acceptability and appropriateness ratings. All three of the 120 students who did not find the intervention acceptable (scored lower than 24.5 CIRP) and had lower ratings on intervention appropriateness (scores of 6, 10, and 15 out of 20) were receiving the PEERS intervention. One student stated, "I would not like to do it again because it is too hard and frustrating. And I am sorry to say but it's kind of boring." Another stated, "The picture quality on videos is good and the people we watched are real relatable people but imitating what they did correctly after didn't help me understand why I am supposed to do that." A third participant added, "Acting was okay minus screaming one, some good examples, but did they really have to do it again and again, we get it already. It was like class most of the time boring. We talk, share about our day, film each other doing the right action to one of our problems and watch the one who gets it right over. But

what right looks like to her is sus."

After asking a follow-up question on one comment, it was discovered "sus" refers to suspect interpretations of something, and the participant felt that sometimes the correct action in the eyes of a teacher is not the correct action to maintain friends for a student. The comments suggest there may be benefits in examining, in future research, the aspects within interventions (e.g., repetition, response options, relevancy of scene) separately, to examine what causes one intervention to be more acceptable than another. The student responses found in Table 15, warrant investigation of the usefulness and relevancy of skills taught to students in the classroom when applied to their communities and cultures.

Limitations

This study implemented many of Botchwey and colleagues' (2020) recommendations for increasing retention of culturally diverse youth in research (i.e., targeting areas with culturally responsive outreach plans, building relationships with community members from diverse populations, including diverse members as participants and research consults). Still, several aspects should be considered when applying these results to diverse populations. With regards to the study design, all participants were recruited via conference presentations and targeted emails to organizations. Participants were given a flyer with study information and chose to volunteer for the study. Although three regional conferences serving rural populations were targeted, there are still many educators in rural communities who do not attend conferences. There are also many organizations that address pragmatic language concerns that may not have been considered in the email outreach. Despite Creswell's (2012) random sampling procedure being applied to obtain the maximum number of participants representing diverse groups, the participating schools were from only four states (NM, KS, NC, VA). Two educators came from rural public

schools in KS, one from a rural charter school in NM, four from a private suburban school in VA, and the remaining three educators were from an urban public school in NC. Additional research is needed to better understand how these findings may translate into other populations (i.e., young adults) and content areas (i.e., reading, job skills) and would allow a greater extension of research findings to larger populations.

A second limitation was limited time, which influenced the ability to apply the interventions in their entirety, the time classrooms had available for intervention which varied by teacher, and the time students had available to move from knowledge acquisition to knowledge implementation. Everyone received approximately 300 minutes of the intervention, which was the mean amount of time it took participants to complete the VOISS and PEERS intervention targeted skill sections. What varied was the length between sessions, as some educators saw these students four times a week for 45 minutes, while others only saw them once a week for an hour. This caused the duration of the study to be between 10 days and four months, depending on how often schools scheduled SE intervention time within their tiered scheduling. This was controlled as much as possible by requiring all matched peers to be within the same classroom. Still, the confines of completing the study within 16 weeks meant that neither intervention was able to be delivered in its entirety. Although an educator was available to ensure imitation to the video models in PEERS was accurate after the videos, the PEERS program in its entirety involves a great deal more parent interaction. The VOISS intervention has nine additional domains that were not utilized in the study, as well as a companion website of videos and lessons to assist educators in generalizing skills into their classrooms. Due to time constraints and school schedules, neither intervention was completed in its entirety and the length between each intervention session varied. Therefore, results about the efficacy of these programs needs to be

considered in light of these limitations.

A third limitation is that, although most of the PEERS intervention was delivered through the same student familiar classroom device (iPad or Chromebook), there were more aspects of the PEERS intervention than the VOISS intervention that required interaction with an educator and time outside of a device. For example, the VOISS questions and responses were provided within the device. However, though the PEERS questions were provided within the device, the answers were generated to the participant's teacher and peers. Students in PEERS had to gather materials needed to complete their imitations of videos and for the creation of their video model. This time outside the device ranged from student to student with a minimum time spent outside the device being 30 minutes and the maximum being 96 minutes. The time outside the device for some students required little educator interaction (i.e., 4 prompts within 300 intervention minutes). For other students, it required a great deal of interaction (i.e., 42 prompts within 300 minutes of intervention). Although there was some prompting for students with more severe disabilities to remain engaged in VOISS (22 prompts within 300 minutes of intervention), these prompts were related to refocusing on the technology or assisting with difficulties within the technology (e.g., frozen screen), rather than prompting on knowledge understanding. Additional prompts did not substantially influence treatment fidelity, according to observer ratings, but may have influenced students' feelings about the intervention or educators' attitudes while assisting students.

An additional limitation is that the ambiguity of terms within current social skill and SE interventions may lead to misinterpretation of the scope of study findings. Policymakers, researchers, curriculum developers, and practitioners have yet to agree on SE skill terms, what domains skills fall under, and whether skills are discrete and teachable (McKown, 2017).

Although this study tried to control for ambiguity of terms with precise, validated definitions, terms may influence application of study results. For example, the same skills labeled within the PEERS intervention as "Social Communication" were found within the VOISS "Expressive Communication" domain. In the CELF-5 Pragmatic Profile, the same targeted skills were located under both "Expressive Communication" and "Receptive Communication." The non-significance of application gains by educators of student's receptive communication may have been influenced by the fact that the VOISS "Receptive Communication" domain was not implemented within this study. Although most of the skills within the CELF Pragmatic Profile are taught, practiced, or observed within the VOISS and PEERS intervention sections in the study, not every CELF skill is directly taught within the two interventions. The primary skills missing within the interventions were within the "Receptive Communication" subtest of the CELF Pragmatic Profile, which may have led to the non-significant finding being observed in only that subtest by educators.

A final limitation is the limited standardized measurements used throughout this study. Although the study's inclusionary criteria required participants were previously identified with a pragmatic or expressive language social skill delay by a qualified practitioner using a valid and reliable assessment, no pre intervention standardized measure was required for study participation. Adding a standardized measure of knowledge and an observational measure (e.g., Test of Pragmatic Language, Second Edition, Clinical Assessment of Pragmatics) pre and post intervention to the standardized rating scales and knowledge test would provide a better understanding of participants' skill knowledge and application throughout the study. The primary assessments used in the study were surveys, whose reports may be influenced by expectancy biases (McMahon et al., 2013). An independent evaluation of social skill application, such as that

provided by a teacher and parent not involved in the study, may assist in providing a more well-rounded understanding of skill application post intervention. Due to the comments provided within the CIRP, it would also be beneficial to add qualitative measures such as interviews and focus groups to understand, in greater depth, the thoughts and feelings behind the selected social validity responses.

Implications for Research and Practice

The Global Market for Educational Technology and Smart Classrooms predicted the 118 billion dollars spent in the US in 2022 on educational technology will rise to 392 billion annually by 2030 (Global Industry Analysts, 2022). Schools are spending funds on the newest educational technology devices at an unprecedented pace without an understanding that improvements in technologies are not often necessary for improvements in student outcomes (Card, 2017; Preece et al., 2015). In fact, this study's intervention was delivered through Chromebooks and iPads that, in some classrooms, were almost a decade old. This study supports data on the effectiveness of non-immersive VR interventions (Carreon et al., 2023; Howard & Gutworth, 2020) by demonstrating that a non-immersive VR intervention presented through a classroom's current technology was a highly acceptable intervention which produced statistical gains. Participant CIRP responses suggest the intervention within the technology may be as, if not more, important than the technology delivering the intervention. Overall, researchers and educational technology developers should be mindful of whether investigating in the instructional processes within the technology is more advantageous than investing in cutting edge technology devices.

Study outcomes suggest an aspect of the VOISS intervention itself, rather than the technology presenting the intervention, may be responsible for knowledge and application growth. This conclusion is suspected because both interventions for matched peers were

delivered through the same technology device and utilized either real (i.e., human actors in PEERS) or life-like (i.e., VR avatars in VOISS) instructors in visual environments that resembled parts of a real school. Yet, the PEERS intervention was missing reasoning as to why the skill should be performed in a specific manner, which often came with the VOISS direct instruction. Researchers report that students with ASD need direct social skill instruction and do not typically learn pragmatic skills through watching the reactions of others (Plavnick & Hume, 2014). PEERS and VOISS both included elements of direct instruction and observational learning. However, VOISS provided the "why" within the direct instruction for each action. PEERS provided the same direct instruction only if the correct student imitation response was not shown after the video and discussion. The direct instruction and the reasoning behind each skill's implementation in VOISS may have influenced student outcomes. If so, this would support Howard and Gutworth's (2020) finding that social communication interventions which provide imitation, examples, or practice space alone may not be effective. It would be beneficial to know the influence of the time spent in direct instruction versus observational learning in other interventions for adolescents with pragmatic language deficits.

Comments by students on the CIRP, as well as the significantly lower acceptability and appropriateness ratings of PEERS compared to VOISS, suggest having knowledge of why a skill should be performed in a certain manner and in a specific place may be just as important as providing examples of what the skill looks like and a practice environment. Social communication skill application is often performed in combination with multiple other social skills and is contextually dependent (Ke, et al., 2018). The complexity of this dynamic task increases the challenge of understanding why and when to translate social skill knowledge to performance, particularly for students with pragmatic delays. Future research of interventions

that contain the “why” and “where” behind pragmatic skills may assist educators in choosing interventions that have higher levels of efficacy and social validity.

Beneficial educational technology interventions are often not used, due to poor design, lack of systematic instruction, and an insufficient understanding of how educators plan to use them (Vincent-Lancrin, 2022). Although there are numerous VR interventions for training in academic, physical, and medical skills, VR interventions for improving SE skills that are systematically designed with validated content are still in the developmental stages (Howard, 2018; Jensen & Konradsen, 2018). This study provides support on the need to involve educators in the creation and validation of VR interventions. Programmers with technical expertise are often responsible for developing VR intervention. Yet, an understanding of intervention design features critical for creating an impact in producing therapeutic effects is necessary for those involved in intervention creation. Quality interventions often require knowledge of EBPs to be effective (Belini & Akuilian, 2007). Therefore, multidisciplinary research teams of educators, programmers, and researchers developing and modifying VR interventions together may provide the most effective interventions for students.

Another important discovery in this study that warrants investigation by future researchers is the measurement tools used to determine whether classroom interventions for adolescents should be adopted. Often, the primary student measurement tool to determine if an intervention should be adopted is a measure of intervention acceptability (Common et al., 2018). It is less common that educators add additional ratings of feasibility and appropriateness. However, this study found that, though feasibility and acceptability were adequate for the PEERS intervention, appropriateness was not. Overall, students did not term acceptability to hold the same meaning as appropriateness, as shown by the differing scores in these two areas by

the same rater on the same day about the same intervention in this study. Although appropriateness may entail aspects of acceptability, as shown in the two questions within the IAM appropriateness scale that are like those found in the CIRP scale (i.e., "the program seems suitable" and "the program seems applicable"), appropriateness measures a crucial understanding of whether adolescents feel the intervention best fits their needs. PEERS had lower ratings of "completely agree" on the intervention's perceived "fit" and "match." Many adolescents report SE programs to be "unmotivating," "irrelevant," and "out of date" (Heckman & Kautz, 2012; Yeager, 2017). Meta-analyses reveal varying degrees of effectiveness of social skill programs for adolescents, which may be due to a feeling of "mismatch" by students (Corcoran et al., 2018; Gates et al., 2017; Wolstencroft et al., 2018). These terms of "irrelevant" or "not fitting" are terms more often associated with an intervention's appropriateness rather than acceptability (Weiner et al., 2017). It would be helpful in future studies to look at interventions being seen as "acceptable," which contain research-based methods but are not making significant growth to determine if these interventions are rated appropriate by their user.

Another key area for future research involves fidelity of implementation, which remained high for all educators throughout the study ($\kappa = 0.68$, $p < .005$). Implementation fidelity is impacted by an educator's lack of time, lack of resources, lack of training, and feelings of stress (Robertson et al., 2020). These challenges result in persistently low implementation fidelity among educators (Suhrheinrich et al., 2020). In fact, implementation of EBPs by educators is often considered inadequate for achieving positive effects (Zhang et al., 2022) particularly when implementing interventions for students with ASD (Stahmer et al., 2015). Although inter-observer agreement found both interventions were implemented with fidelity during the intervention phase, the VOISS intervention was implemented with near 100% fidelity.

Interventions implemented through technology have been associated with higher levels of systematic delivery, increased flexibility in scheduling, reduced costs, and improved access to EBPs for families and teachers, which are crucial considerations given the multitude of barriers to providing EBP interventions (Johnson & Hastings, 2002). This is an important feature to consider for teachers, who implement social skill interventions, and for the peer models. Peer models may deviate from procedures, whereas programmed avatars express the same facial expressions, say the same cues, and perform the same behaviors throughout sessions (Miller & Bugnariu, 2016). This standardization may assist students in more clearly identifying social cues in the intervention stage, so that these can then be generalized to more nuanced expressions. Due to its ability to provide increased standardization of procedures (Miller & Bugnariu, 2016), VR may play a substantial role in improving intervention implementation fidelity.

Finally, this study points to the need for future researchers to determine the cultural fit of an intervention prior to the intervention's implementation. The expected norms and behaviors of cultures are embedded within social skill acquisition. However, the educators' expected norms may not be an appropriate fit to the student's cultural norms. For example, evidence shows positive outcomes when using social narratives and video modeling to develop social communication (Wong et al., 2015). However, identifying appropriate responses can be subjective and thus challenging, especially when educators create these without guides and examples that fit the student's needs. Both the PEERS and VOISS interventions provide these examples for the student, so all that is required is that the teacher follow the implementation guide rather than create content. Having this validated content within an intervention improves consistency, no matter the educator implementing the program.

CIRP comments from a study participant revealed the created content of his educator, as

well as videos within PEERS, contained "suspect" content that was not a correct fit for him to keep and maintain relationships. Inappropriate instruction in skills was also discovered in the PEERS curriculum during the matching process. These skills were not used in this study and were not found within VOISS. For example, PEERS has listed good and bad eye contact as a curriculum skill and have video models to teach students to maintain eye contact with a speaker. For those within the Navajo tribe, this would be offensive instruction, as making eye contact is seen as disrespectful and impolite (National Park Service, 2018). There are additional populations (i.e., adolescents and adults with a diagnosis of ASD), where instruction in making and receiving direct eye contact is extremely uncomfortable and anxiety producing (Trevisan et al., 2017). It is imperative that interventions ensure intercultural sensitivity so that inappropriate skills are not inadvertently taught and reinforced. Sharing this knowledge with educators who are creating their own classroom content is essential to confirming the content does not provide unintended harm to students.

Conclusion

The United Nations issued a warning that mental health and relationship development, particularly among adolescents, is a health crisis we cannot ignore (Kelland, 2020). Social communication competencies are necessary for students to both acquire and maintain relationships and improved mental health (Alzahrani et al., 2019; Mahoney et al., 2018). Adolescents often prefer technology-based interaction to address areas of social communication weakness over face-to-face (Sweeney et al, 2019). Although VR-based social skill interventions have been known for their high motivation for the adolescent and young adult population (Finkelstein et al., 2010), the un-matched interventions, non-standardized measures, and lack of relative comparisons made results from VR intervention studies difficult to verify (Howard &

Gutworth, 2020). This study's preliminary data aligns with prior research showing potential for VR interventions to significantly improve social communication knowledge and application for middle school students (Ke & Moon, 2020; Yuan & Ip, 2018; Parsons, 2015).

This study expands upon previous research (Lozano-Álvarez et al., 2023) to support the finding that VR interventions for social communication are acceptable, appropriate, and feasible for middle school students. After approximately 300 minutes of a VR intervention (i.e., VOISS), 60 participants showed medium to large advantageous effects in social communication knowledge and application. A social communication VR intervention has the potential to minimally impact teacher time (i.e., less than 10% of the educator's allotted time was spent assisting in VOISS implementation) and require little implementor training (i.e., less than 90 minutes allotted time for each study intervention). Yet, this intervention may achieve significant social communication knowledge acquisition and application gains for students. Furthermore, this study indicates that these gains can be accomplished with the devices teachers currently have within their classrooms and do not require educator's prior knowledge or training to implement the systematic delivery of content to students. Results of this study suggest a need for replication and extension with more diverse populations, increased standardized measures, and increased intervention time. Overall, results are promising. VR interventions have potential for providing students with access to effective and socially valid social communication content.

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Appendix A: Number of Social Validity Indicators Reported by Study

Studies Reporting Information on the Seventeen Indicators of Social Validity

Author	*Year*	Attitude Toward Tech	Feelings on Intervention	Cost/Availability	Tech Easy to Use	Technology Useful	Increased Knowledge/Skill	Success of Training	Generalization Reported	Maintenance Reported	Number of Sessions	Session Time	Time-Span	Applied Outside of Tech	Norm Referenced Given	Pre & Post Given	Multiple Measures	Fidelity/Reliability	**Percent of Social Validity Indicators Reported**	***Number of Social Validity Indicators Reported***
Adjorlu et al.	2018	1	1	0	1	1	1	1	1	0	1	1	1	1	0	0	0	0	**59%**	**11**
Alcorn et al.	2011	1	1	0	0	1	1	0	0	0	1	1	1	0	0	0	1	0	**41%**	**8**
Bekele et al.	2014	0	0	0	0	1	0	0	0	0	1	1	1	0	1	1	0	0	**29%**	**6**
Bernardini et al.	2014	0	0	0	1	1	1	1	1	0	0	1	1	1	1	1	1	0	**65%**	**11**
Cai et al.	2013	1	1	0	1	0	1	0	0	0	1	0	1	0	1	0	0	1	**41%**	**8**
Chen et al.	2015	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	1	0	**53%**	**10**
Chen et al.	2016	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	**82%**	**15**
Cheng et al.	2010	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	**82%**	**15**
Cheng et al	2015	0	0	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	**59%**	**11**
Cheng & Jun Ye	2009	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	**65%**	**12**
Didehbani et al.	2016	0	0	0	1	1	1	0	0	0	1	1	1	0	1	1	1	0	**47%**	**9**
Grynszpan et al.	2008	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	0	**24%**	**5**
Halabi et al.	2017	1	1	0	0	1	1	0	0	0	1	1	1	0	0	0	1	0	**41%**	**8**
Herrera et al.	2008	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	**71%**	**13**
Ip et al.	2016	0	0	0	0	1	1	0	0	0	1	1	1	0	1	1	0	0	**35%**	**7**
Ip et al.	2018	0	0	0	0	0	1	0	0	0	1	1	1	0	1	1	1	0	**35%**	**7**
Jarrold et al.	2013	0	0	0	0	1	0	0	0	0	1	1	0	0	1	0	1	1	**29%**	**6**
Ke & Im	2013	0	0	0	0	1	1	0	0	0	1	1	1	0	1	0	1	0	**35%**	**7**
Ke & Lee	2015	0	0	0	0	1	1	0	0	0	1	1	1	0	0	0	1	1	**35%**	**7**
Kim et al.	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	**12%**	**2**
Lan et al.	2018	1	1	0	1	1	1	1	1	0	0	0	1	1	0		0	0	**53%**	**9**
Lee et al.	2018	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	**65%**	**12**
Lorenzo et al.	2019	0	0	0	0	1	1	1	0	0	1	0	1	0	0	1	1	0	**41%**	**8**
Lorenzo et al.	2016	1	0	0	1	1	1	0	1	1	0	1	1	1	0		0	0	**53%**	**9**
Lorenzo et al.	2013	1	0	0	1	1	1	0	1	0	1	0	1	1	0	0	1	1	**53%**	**10**
Mantziou et al.	2015	1	1	0	1	1	1	1	1	0	1	0	0	1	1	0	0	0	**53%**	**10**
Mitchell et al.	2007	0	0	0	0	0	0	0	1	1	1	0	1	0	0	1	0	0	**18%**	**4**
Modugum-udi et al.	2013	0	0	0	0	1	1	0	0	0	1	1	1	0	0	1	0	0	**29%**	**6**
Moore et al.	2005	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	**18%**	**3**
Parsons	2015	1	1	0	1	1	1	0	0	0	1	1	1	0	1	0	1	0	**53%**	**10**
Parsons et al.	2006	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	0	**71%**	**13**
Parsons et al.	2004		0	0	1	0	1	0	0	0	1	1	0	0	1	1	1	0	**35%**	**7**
Saadatzi et al.	2018	1	1	0	0	1	1	1	1	1	1	0	1	1	0	1	1	0	**65%**	**12**
Schmidt et al.	2011	0	0	0	0	1	0	0	1	0	1	1	1	1	0	0	0	1	**35%**	**7**
Self et al.	2007	0	0	0	0	1	1	1	1	1	1	1	1	1	0	1	1	0	**59%**	**11**
Stichter et al.	2014	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	**82%**	**15**
Taryadi & Kurniawan	2018	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	**18%**	**3**
Tsiopela & Jimoyiannis	2014	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	**65%**	**12**
Wang et al.	2016	1	1	0	1	1	1	0	0	0	1	0	1	0	0	0	1	0	**41%**	**8**
Wang et al.	2018	1	0	0	0	1	1	0	0	0	1	1	1	0	0	0	0	0	**29%**	**6**
Yuan & Ip	2018	1	1	1	0	1	1	1	1	0	0	1	0	1	1	1	1	0	**71%**	**12**
% of Studies Reporting		45%	37%	5%	41%	85%	85%	46%	49%	32%	83%	73%	83%	49%	39%	46%	68%	27%		
Total Reporting of 41 Studies		**18**	**15**	**2**	**17**	**35**	**35**	**19**	**20**	**13**	**34**	**30**	**34**	**20**	**16**	**18**	**28**	**11**		

Appendix B: The Positive, Negative and Mixed SV Indicators by Technology Device

Total Responses in all Immersive Technologies in 41 Studies

	Participants Reported Positive Feelings about the Technology	Participants Reported Positive Feelings about the Intervention	The Technology was Easily Accessible (Available, Low Cost)	Participants Stated the Technology was Easy to Use	Teachers, Parents, or Clinicians Reported Technology Was Useful	Participants Increased in Knowledge or Skill due to the Intervention	Multiple Observers Reported Success After the Training	Social Skill Learned Was Generalized into other Settings	Social Skill Learned Was Maintained After Intervention	Positive Social Validity Measures Reported in Study
Reporting Positive SV	***13***	***14***	***1***	***11***	***34***	***32***	***18***	***15***	***10***	**148**
Reporting Mixed Results	***3***	***1***	***0***	***4***	***1***	***0***	***0***	***4***	***2***	**15**
Reporting Negative SV	***2***	***0***	***1***	***2***	***0***	***3***	***1***	***1***	***1***	**11**

Studies Utilizing Augmented Reality

Author	Year	Participants Reported Positive Feelings about the Technology	Participants Reported Positive Feelings about the Intervention	The Technology was Easily Accessible (Available, Low Cost)	Participants Stated the Technology was Easy to Use	Teachers, Parents, or Clinicians Reported Technology Was Useful	Participants Increased in Knowledge or Skill due to the Intervention	Multiple Observers Reported Success After the Training	Social Skill Learned Was Generalized into other Settings	Social Skill Learned Was Maintained After Intervention	Positive Social Validity Measures Reported in Study
Chen et al.	2015	N/R	N/R	N/R	N/R	Yes	yes	Yes	Yes	yes	**5**
Chen et al.	2016	Yes	Yes	N/R	yes	Yes	yes	Yes	Yes	yes	**8**
Lee et al.	2018	N/R	N/R	N/R	yes	Yes	yes	Yes	Yes	yes	**6**
Lorenzo et al.	2019	N/R	N/R	N/R	N/R	Yes	no	Yes	N/R	N/R	**2**
Taryadi & Kurniawan	2018	N/R	N/R	N/R	N/R	Yes	yes	Yes	N/R	N/R	**3**
Reporting Positive SV		***20%***	***20%***	***0***	***40%***	***100%***	***80%***	***100%***	***60%***	***60%***	**24**
Reporting Mixed Results		***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	**0**
Reporting Negative SV		***0***	***0***	***0***	***0***	***0***	***20%***	***0***	***0***	***0***	**1**

Studies Utilizing Non-Immersive Virtual reality

Author	Year	Participants Reported Positive Feelings about the Technology	Participants Reported Positive Feelings about the Intervention	The Technology was Easily Accessible (Available, Low Cost)	Participants Stated the Technology was Easy to Use	Teachers, Parents, or Clinicians Reported Technology Was Useful	Participants Increased in Knowledge or Skill due to the Intervention	Multiple Observers Reported Success After the Training	Social Skill Learned Was Generalized into other Settings	Social Skill Learned Was Maintained After Intervention	Positive Social Validity Measures Reported in Study
Alcorn et al.	2011	Yes	yes	N/R	N/R	Yes	yes	N/R	N/R	N/R	**4**
Bekele et al.	2014	N/R	N/R	N/R	N/R	Yes	N/R	N/R	N/R	N/R	**1**
Bernardini et al.	2014	N/R	N/R	N/R	yes	Yes	no	Yes	Yes	N/R	**4**
Cheng et al.	2010	Yes	yes	N/R	yes	Yes	yes	Yes	Yes	mixed	**7**
Cheng & Jun Ye	2009	N/R	N/R	N/R	N/R	Yes	yes	yes	Yes	yes	**5**
Didehbani et al.	2016	N/R	N/R	N/R	yes	Yes	yes	N/R	N/R	N/R	**3**
Grynszpan et al.	2008	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	**0**
Herrera et al.	2008	N/R	N/R	N/R	N/R	Yes	yes	yes	Mixed	yes	**4**
Ke & Im	2013	N/R	N/R	N/R	N/R	yes	yes	N/R	N/R	N/R	**2**
Ke & Lee	2015	N/R	N/R	N/R	N/R	yes	yes	N/R	N/R	N/R	**2**
Kim et al.	2015	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	**0**
Lan et al.	2018	Yes	yes	N/R	yes	yes	yes	yes	Yes	N/R	**7**
Mantziou et al.	2015	Mixed	yes	N/R	mixed	mixed	yes	yes	Yes	N/R	**4**
Mitchell et al.	2007	N/R	N/R	N/R	N/R	N/R	N/R	N/R	No	no	**0**
Modugum-udi et al.	2013	N/R	N/R	N/R	N/R	yes	yes	N/R	N/R	N/R	**2**
Moore et al.	2005	N/R	N/R	N/R	N/R	yes	yes	N/R	N/R	N/R	**2**
Parsons	2015	Mixed	yes	N/R	mixed	yes	yes	N/R	N/R	N/R	**3**
Parsons et al.	2006	Yes	yes	N/R	yes	yes	yes	yes	Yes	yes	**8**
Parsons et al.	2004		N/R	N/R	mixed	N/R	no	N/R	N/R	N/R	**0**
Saadatzi et al.	2018	Yes	yes	N/R	N/R	yes	yes	yes	Yes	yes	**7**
Schmidt et al.	2011	N/R	N/R	N/R	N/R	yes	N/R	N/R	Yes	N/R	**2**
Self et al.	2007	N/R	N/R	N/R	N/R	yes	yes	yes	Mixed	yes	**4**
Stichter et al.	2014	Yes	yes	Yes	yes	yes	yes	yes	Mixed	N/R	**7**
Tsiopela & Jimoyiannis	2014	Yes	yes	N/R	yes	yes	yes	yes	Yes	yes	**8**
Wang et al.	2016	Yes	yes	N/R	yes	yes	yes	N/R	N/R	N/R	**5**
Wang et al.	2018	Yes	N/R	N/R	N/R	yes	yes	N/R	N/R	N/R	**3**
Reporting Positive SV		***35%***	***38%***	***4%***	***31%***	***81%***	***73%***	***42%***	***35%***	***23%***	**94**

Reporting Mixed Results	*8%*	*0*	*0*	*12%*	*4%*	*0*	*0*	*12%*	*4%*	**10**
Reporting Negative SV	*0*	*0*	*0*	*0*	*0*	*8%*	*0*	*4%*	*4%*	**4**

Studies Utilizing Immersive Virtual reality

Author	Year	Participants Reported Positive Feelings about the Technology	Participants Reported Positive Feelings about the Intervention	The Technology was Easily Accessible (Available, Low Cost)	Participants Stated the Technology was Easy to Use	Teachers, Parents, or Clinicians Reported Technology Was Useful	Participants Increased in Knowledge or Skill due to the Intervention	Multiple Observers Reported Success After the Training	Social Skill Learned Was Generalized into other Settings	Social Skill Learned Was Maintained After Intervention	Positive Social Validity Measures Reported in Study
Adjorlu et al.	2017	Yes	Yes	N/R	yes	yes	yes	no	Mixed	N/R	**5**
Cai et al.	2013	Mixed	mixed	N/R	mixed	N/R	yes	N/R	N/R	N/R	**1**
Cheng et al	2015	N/R	N/R	N/R	N/R	yes	yes	yes	N/R	yes	**4**
Halabi et al.	2017	Yes	Yes	N/R	N/R	yes	yes	N/R	N/R	N/R	**4**
Ip et al.	2016	N/R	N/R	N/R	N/R	yes	yes	N/R	N/R	N/R	**2**
Ip et al.	2018	N/R	N/R	N/R	N/R	N/R	yes	N/R	N/R	N/R	**1**
Jarrold et al.	2013	N/R	N/R	N/R	N/R	yes	N/R	N/R	N/R	N/R	**1**
Lorenzo et al.	2016	no	N/R	N/R	No	yes	yes	N/R	Yes	mixed	**3**
Lorenzo et al.	2013	no	N/R	N/R	No	yes	Yes	N/R	Yes	N/R	**3**
Yuan & Ip	2018	yes	Yes	No	N/R	yes	Yes	yes	Yes	N/R	**6**
Reporting Positive SV		*30%*	*30%*	*0*	*10%*	*80%*	*90%*	*20%*	*30%*	*10%*	**30**
Reporting Mixed Results		*10%*	*10%*	*0*	*10%*	*0*	*0*	*0*	*10%*	*10%*	**5**
Reporting Negative SV		*20%*	*0*	*10%*	*20%*	*0*	*0*	*10%*	*0*	*0*	**6**

Appendix C: Immersive Technology Study Characteristics

For all studies and to see this chart at 100% go to:
https://www.researchgate.net/publication/351238561_Immersive_Technology_to_Teach_Social_Skills_to_Students_with_Autism_Spectrum_Disorder_a_Literature_Review

Study characteristics by findings by technology type 1. augmented reality, 2. immersive virtual reality, and 3. non-immersive virtual reality

Reference	Statistical Improvement	Reported Improvement	Validity & *Reliability*	Dependent Variable	Treatment Agent	Instructional Method	Results and Outcomes	Generalization	Maintenance
Chen et al. (2015)	Yes	Yes	Yes *Yes*	Observed Recognition & Response Naming of Emotions	Clinician	Direct Instruction & Observational Learning	AR caused a statistical difference in the ability to identify the 6 core emotions for all participants. The AR improved the appropriate recognition and response naming of emotions. In addition, the mean difference in performance level between the baseline and follow-up phases was significant ($p < .05$).	Yes	Yes 2 Weeks
Chen et al. (2016)	Yes	Yes	Yes *Yes*	Researcher Developed Assessment, Parent Interviews, Questionnaires	Clinician	Direct Instruction & Observational Learning	Results showed the intervention effectively attracted and maintained the attention of children with ASD to nonverbal social cues and helped them better understand facial expressions and emotions of the storybook characters. Students identified six core emotions significantly better.	Yes	Yes 4 Weeks
Lee et al. (2018)	Yes	Yes	Yes *Yes*	Baker's (2001) Social Story TM SST Test	Clinician	Direct Instruction & Observational Learning	AR significantly increased students' ability to recognize and understand relationships and appropriate responses to actions. The three-phase test data suggest that the AR with concept map intervention was moderately effective in teaching the target greeting responses to children with ASD.	Yes	Yes 28 Days
Lorenzo et al. (2019)	No	Mixed	No *Yes*	Autistic Spectrum Inventory & Questionnaire	Clinician	Observational Learning	The results do not show statically significant differences between the group with the therapist and the group with the AR App. Slight improvements appear in some items (i.e., flexibility, imitation, focus, and motivation).	N/R	N/R
Taryadi & Kurniawan (2018)	Yes	Mixed	No *Yes*	Observation	Teacher & Researcher	Direct Instruction	There was a significant improvement in communication ability after AR in all but 1 student. The increase achieved an average of 76% of the communication skills of children before treatment. The average ability level in communication before and after treatment was 47% and during the treatment was 65%.	N/R	N/R
Adjorlu et al. (2018)	No	Mixed	Yes *No*	Teacher Questionnaire, Interviews, & Observation	Teacher	Direct Instruction & Observational Learning	Improvements in turn taking, sharing, & understanding of an event with proper response. Virtual classroom that was designed similar to the real classroom was distracting. All enjoyed VR & found it easy to use. There was a total of 18 positive comments and eight negative comments on VR.	Mixed	N/R
Cai et al. (2013)	No	Mixed	No *No*	TONI-3, Parent GARS, & Observation	Clinician	Observational Learning	Nonverbal communication was inconclusive. Three participants were able to learn with minimal supervision. Three participants were able to learn but required prompting. Five participants were overwhelmed by the VR & needed mediation. Four participants were unable to use the VR.	N/R	N/R
Cheng et al (2015)	Yes	Yes	Yes *Yes*	Social Events Card Scale and Social Behaviors Scale	Researcher, Observer, & Teacher	Direct Instruction & Observational Learning	Participants improved in theory of mind & socially appropriate behavior. This improvement continued through maintenance. The VR system was shown to have the ability to present an effective learning environment for the promotion of social understanding.	N/R	Yes 20 Days
Halabi et al. (2017)	Yes	Yes	No *No*	Satisfaction of Immersion, Interview, & Impact Questionnaire	Researcher	Direct Instruction & Observational Learning	Researchers reported all systems effective for improving the communication skills of students with autism. Impact of technology on all the participants was positive. Most participants reported learning to introduce themselves when speaking to a new friend for the first time. Satisfaction for CAVE was 82-85%, for HMD was 78-82%, & for the Desktop was 57-60%.	N/R	N/R
Ip et al. (2016)	Mixed	Yes	No *No*	FT, ET, PEP-3, SAT, ABAS-II, SCAS-P, SCAC-C, & CCC-2	Unclear	Direct Instruction & Observational Learning	VR enhanced social and emotional skills. Noted improvement in self-regulation, emotional expression, and social-emotional reciprocity. There was a significant difference in the PEP-3 scores, Eyes Test, social reciprocity, and affective expression test. There was no significant difference in the Faces Test.	N/R	N/R
Ip et al. (2018)	Mixed	Yes	No *No*	FT, ET, ABAS-II, PEP-3, RPM, & CAST	Unclear	Observational Learning	Significant improvements in the project's primary measures (children's emotion expression & regulation & social-emotional reciprocity) but not in the secondary measures (emotional recognition).	N/R	N/R
Jarrold et al. (2013)	Mixed	Yes	Yes *Yes*	Social Orientation, Average Duration of Looks, & Fixation Length	Researcher	Observational Learning	Statistical improvements in social orientation, duration of looks, and fixation length. Students with ASD displayed atypical social orienting in conditions requiring them to speak while attending to avatar peers but typical social attention in condition that did not require dual tasks. These differences in attention were more pronounced with social stimuli vs. nonsocial stimuli.	N/R	N/R
Lorenzo et al. (2016)	Yes	Yes	No *No*	Frequency of Behaviors, Questionnaire, & Interviews	Teacher & Researcher	Direct Instruction & Observational Learning	This study showed a greater presence of appropriate emotional behaviors in immersive VR than the comparison desktop non-immersive VR. The immersive VR group also showed greater transfer of the acquired skills into a school environment than the non-immersive group.	Yes	Yes for 2 Years
Lorenzo et al. (2013)	Yes	Yes	Yes *Yes*	Researcher Protocol TEVISA & PIAV, Observation, & Interviews	Teacher & Researcher	Direct Instruction & Observational Learning	The visual strategies & structured and repetitive support tasks within IVE improved the acquisition of executive functioning and social skills for students. Both primary and secondary students carried out the social tasks with acceptable results, especially in less structured VR environments (ie. Playground). Both groups were able to transfer skills possibly due to teacher involvement & student motivation.	Yes	N/R
Yuan & Ip (2018)	Yes	Yes	No *No*	PEP-3 Subtests of Affective Expressions & Social Reciprocity, In Class Observation, & Communication Logs	Clinician & Researcher	Direct Instruction & Observational Learning	Students improved in affective expressions & social reciprocity, & scored higher on emotion expression, regulation, social interaction & adaptation. Statistically significant interaction between group and time on affective expressions & social reciprocity. Initially students did not want to wear goggles. Parents expressed children more proactive in greeting and communicating with neighbors & relatives, as well as being more flexible in seat & food preferences. Teachers reported students making new friends & engaging in conversations.	Yes	N/R

Reference	Statistical Improvement	Reported Improvement	Validity & Reliability	Dependent Variable	Treatment Agent	Instructional Method	Results and Outcomes	Generalization	Maintenance
Alcorn et al. (2011)	Mixed	Yes	No *No*	Observational Video Reaction Time	Researcher	Direct Instruction & Observational Learning	Children were able to successfully follow a virtual character's gaze and gesture cues. There was the perception by some students that the VR character was a true human being. There was a significant interaction of mutual gaze and pointing $p<.01$ ($F=1$, 30), with a strong effect size (Cohen's $f= 0.477$).	N/R	N/R
Bekele et al. (2014)	No	Mixed	No *No*	Expressions, Response Latency, & Confidence Ratings	Unclear	Observational Learning	Similar accuracy of facial recognition in both groups. Students with ASD showed lower confidence in their responses & substantial variation in gaze patterns. No perceptual discrimination deficits in either.	N/R	N/R
Bernardini et al. (2014)	Mixed	Yes	Yes *Yes*	Classroom Observation	Researcher	Direct Instruction & Observational Learning	Slight increase in responses between pre & posttest. Probability of responding to bids for interaction increased. 8 children increased their number of initiations to avatar, 7 produced the same number, & 4 decreased. Students found program useful, easy to use, & enjoyable.	Yes	N/R
Cheng et al. (2010)	No	Yes	Yes *No*	Empathy Rating Scale (ERS)	Researcher & Teacher	Direct Instruction & Observational Learning	The Collaborative Virtual Learning Environment system markedly improved participant performance on the ERS after the intervention and on students' ability to generalize this understanding to use empathy in their daily lives.	Yes	Mixed (2 for 60 Days)
Cheng & Jun Ye (2009)	No	Yes	Yes *Yes*	Oral Exam Scores for Social Competence	Researcher & Teacher	Observational Learning	Collaborative Virtual Learning Environment showed significant positive effects on improving participants' understanding of social competence and participants' parents reported high satisfaction. Two participants enjoyed the Collaborative Virtual Learning Environment. One was not interested in using it but gained. No statistical information was provided.	Yes	Yes 10 Days
Didehbani et al. (2016)	Mixed	Yes	No *Yes*	NEPSY-II, Triangles (Social Attribution Task)	Clinician	Direct Instruction & Observational Learning	Improved social attribution, emotion recognition, and executive functioning of analogical reasoning in all measured skills in both students with ASD and the combined ASD & ADHD group. Both subgroups were equally engaged. Not all skills reached statistical improvement.	N/R	N/R
Grynszpan et al. (2008)	Yes	Mixed	No *No*	VE Training Games within Scenarios	Researcher	Observational Learning	Students with ASD, displayed poorer performance on rich interfaces. Their learning in emotion recognition improved & transfer occurred only with non-VR, not VR. Typically developing peers made improvements after both rich (VR avatar) and simple (cartoon character) interventions.	N/R	N/R
Herrera et al. (2008)	No	Yes	Yes *Yes*	TOPP Structured & Unstructured Test of Pretend Play (ToPP), Interview, Functional Play: SPT	Researcher, Teacher, & Clinician	Observational Learning	Significant advances in performance after treatment for both children in functional, symbolic, & imagination understanding. For one child acquired skills were generalized to the external environment. In the ToPP test, memory effect occurred with the first participant in just one of the items, resulting in 1 false point in his final score. Results still suggest significant increase not statistical in scores in both participants.	Mixed	Yes 7 Weeks
Ke & Im (2013)	No	Yes	No *No*	Social Skill Questions & Interviews	Parents, Researcher, & Teacher	Direct Instruction & Observational Learning	All participants showed improved responding and interacting skills throughout intervention sessions. Most participants showed improved interactions (i.e. initiation, greeting, and conversation ending) after Second-Life intervention.	N/R	N/R
Ke & Lee (2015)	Yes	Yes	Yes *Yes*	Qualitative time-series and micro-behavior analyses.	Facilitators & a Peer	Direct Instruction & Observational Learning	Participating children demonstrated a sustained level of engagement in the collaborative design task and fulfilled the targeted design goal. The flexibility, identity, and norm construction of the two children with HFA were all higher than 75%. The communication flexibility was 56%.	N/R	N/R
Kim et al. (2015)	Mixed	Mixed	Yes *Yes*	WASI, Test for symptom-atology, cognition and emotion	Unclear	Observational Learning	Students with HFA showed significantly less tendency to use the joystick to move toward a virtual avatar expressing a positive emotion, than typically developing students. Students with HFA avoided avatars expressing negative emotions at the same rate as the control group.	N/R	N/R
Lan et al. (2018)	No	Yes	No *No*	Observation & Post-Study Interviews	Teacher & Researcher	Direct Instruction of Vocab & Observational of Social	Parents and students reported increased vocabulary knowledge, improved motivation, and increased communication and concentration. Interview of students and parents revealed the student with ASD reported liking the VR and found it easy to use. All 4 students reported similar findings of enjoying the technology and improving communication.	Yes	N/R
Mantzioou et al. (2015)	No	Yes	No *No*	Facial Emotion Recognition (FER) & Observation	Teacher	Observational Learning	The ICT teaching was not significantly different than the conventional methods in terms of preference and acceptance by students. Better acceptance from the student with high functioning autism in ICT than face to face. The child with low functioning autism did not interact at all with ICT & preferred face to face interaction.	Yes	N/R

For the additional studies and to see this chart at 100% size go to:
https://www.researchgate.net/publication/351238561_Immersive_Technology_to_Teach_Social_Skills_to_Students_with_Autism_Spectrum_Disorder_a_Literature_Review

Appendix D: Recruitment Letter

KU DEPARTMENT OF SPECIAL EDUCATION
The University of Kansas

My name is Maggie Mosher, and I am a doctoral student at the University of Kansas in the department of special education. I am writing to invite you to participate in a research study where students will utilize an iPad or Chromebook to access an intervention which supports expressive communication social skill knowledge acquisition. Your students will be eligible in this study if they are: 1. age 10 to 15 or in middle school; 2. have a delay in expressive communication identified by a qualified professional through the Clinical Assessment of Pragmatics (CAPs; Lavi Institute); 3. have a need for a social-emotional skill intervention as identified by a parent, educator, or practitioner familiar with the adolescent; and 4. are English-speaking with a minimum third grade reading level.

Participants in this study will have approximately a week-long intervention. If consent is given, participants will be given rating scales with less than 20 questions and they and their teacher will be given the Clinical Evaluation of Language Fundamentals-5 (CELF-5) Pragmatic Profile 50 questions (Wiig et al., 2013) pre and post intervention. If consent is given the participants will be provided access to either the VOISS VR intervention or the PEERS Video Modeling intervention. During the intervention, participants will utilize the VOISS application or PEERS Website. This application and website will provide the child with 20 scenarios or videos. These scenarios and videos will depict real-world expressive communication situations. During the scenarios, participants will be presented with multiple-choice questions and written or oral response options. These responses will be sent to the researcher. This will take approximately 45 minutes per day. Finally, the student and educator will complete the CELF-5 Pragmatic Profile post intervention. The student participant will also complete rating scales on the technology, intervention, and their thoughts about the intervention.

We believe that information from the study may be helpful in providing students with an enhanced way to receive social-emotional skill instruction. As our society moves increasingly towards the use of virtual reality tools, this study will help to create a better understanding of the potential benefits of virtual learning. This study will also benefit your child by enhancing social-emotional skills instruction for the classroom. Additionally, this study will allow students to be more independent in their acquisition of social-emotional skills.

We do not perceive any risks associated with this study with the exception of possible eye strain from the technology. If this occurs at any time, the intervention may be stopped.

Please remember, this is completely voluntary. You can choose to be in the study or not. If you would like to participate, have any student recommendations, or have any questions about the study, please email me at mosherku@ku.edu.

Sincerely,
Maggie Mosher
Principal Investigator
The University of Kansas Department of Special Education
Lawrence, KS 66045
816-824-5864

Appendix E: Consent and Assent Documents

KU DEPARTMENT OF SPECIAL EDUCATION
The University of Kansas

Informed Research Consent Statement for Educators

Project Title: Virtual Reality for Social-Emotional Intervention: Student Outcomes & Preferences

Introduction

The Department of Special Education at the University of Kansas supports the practice of protection for human subjects participating in research. The following information is provided for you to decide whether you wish to participate in the present study. You may refuse to sign this form and not participate in this study. You should be aware that once you agree, you are still free to withdraw from participation at any time. If you withdraw from this study, it will not affect your relationship within the schools, the services it may provide to you, or the University of Kansas.

Purpose of the Study

This study is a cooperative venture with the University of Kansas. The purpose of this study is to investigate the underlying social validity factors (e.g., acceptability, feasibility, appropriateness, effectiveness) of a virtual reality SE intervention and a video modeling SE intervention delivering instruction on expressive communication skills to middle school students.

KEY INFORMATION

- This project is studying a technology delivered social skill intervention and how it can enhance participant's learning.
- Your participation in this research project is completely voluntary.
- Your participation will take 7 days and approximately 45 minutes a day.
- Your student will be asked to do the following:
    - Complete a pre and post intervention rating scale (with 7 to 15 questions) to gather information about thoughts on technology and social-emotional skills.
    - Answer 40 multiple choice social skill questions.
    - Use a program for 7 days (2 practice sessions and 10 learning sessions) to learn and practice social skills.
- You and your student will be asked to do the following:
    - Complete a pre and post skill rating scale (with 50 questions) called the Clinical Evaluation of Language Fundamentals-5 (CELF-5) Pragmatic Profile (Wiig et al., 2013). These will help us see how your student performs in social-emotional skills before and after the sessions.
- You will be asked to do the following:
    - Complete training which involves 2 practice sessions (2 scenarios, 2 videos) and assist by using a fidelity checklist on the 10 learning sessions (20 scenarios) on the remaining 5 days while students learn and practice social skills.

- There are no perceived risks that are greater than day-to-day activities. If you or your student experiences any discomfort, they or you can let us know and we will stop at any time.
- The scenarios will benefit participants by enhancing their social-emotional skill knowledge and educators by enhancing their understanding of their student's preferences and feelings.
- Your alternative to participating in this research study is not to participate.

Procedures

If you give consent, you and your student will do the following: (*Note:* All times are estimates determined by how long it took a middle school student to complete the task. It may require more or less time depending on the participant.)

Participants will be randomly assigned by a computer program to one condition (evidence-based social skill instructional method or technology delivered social skills program) for the period required to complete the targeted skills (estimated by educators to be one week). When the week is over, students will be switched to the other condition. This will ensure every student is provided with the same content. At each session, your student will be instructed on the program to use an evidence-based social skill instructional method (e.g., PEERs video modeling) or a technology delivered social skills program (e.g., virtual reality delivered VOISS). The device displaying the program (e.g., Chromebook, iPad) will be the same regardless of the program. During the session, the program will provide your student with 2 scenarios per session and questions to answer about these situations. They will participate in 10 of these sessions (20 scenarios) in the intervention and 2 of the sessions (4 scenarios) in the training. These scenarios will depict real world expressive communication situations. Before and after the sessions, your student will be presented with multiple choice questions to determine content knowledge on these skills. The student may provide written, or an oral response based on the student's preference or ability level. This will take approximately one class period (45 minutes) with a total of 2 training and survey days and 5 program days with post surveys on the final days.

The researcher will provide a 40-question multiple-choice knowledge test, the CELF-5 Pragmatic Profile, and the Children's Intervention Rating Profile. This takes an estimated 15 to 20 minutes to complete and is listed in the procedures below.

After participating in the assigned condition (estimated to be one week later), participants will take the researcher provided Adapted Version of the Children's Intervention Rating Profile, Intervention Appropriateness Measure and Feasibility of Intervention Measure [15 Questions for an estimated 10 minutes].

Student Procedure

Day 1 ***45 minutes***

- ☐ SCKQ kill Based Test (40 Questions) *12 minutes*
- ☐ CELF-5 Pragmatic Profile (50 Question Rating) *15 minutes*
- ☐ Training on Device Features (iPad or Chromebook) 5 *minutes*
- ☐ Adapted Version of the Children's Intervention Rating Profile Intervention (7 Question

Rating) *7 minutes*

☐ Questions 6 *minutes*

Day 2 ***45 minutes***

☐ Training on VOISS *15 minutes*

☐ Training on PEERS Website Features *10 minutes*

☐ Training on PEERS Video Modeling *15 minutes*

☐ Questions 5 *minutes*

Day 3 ***45 minutes***

☐ Student teaches educator each intervention (PEERS *10 min*, VOISS *10 min*) *20 minutes*

☐ Session 1: Randomly Assigned 2 Scenarios *10 minutes*

☐ *Break 5 minutes*

☐ Session 2: Randomly Assigned 2 Scenarios *10 minutes*

Day 4 ***40 minutes***

☐ Session 3: Randomly Assigned 2 Scenarios *10 minutes*

☐ *Break 5 minutes*

☐ Session 4: Randomly Assigned 2 Scenarios *10 minutes*

☐ *Break 5 minutes*

☐ Session 5: Randomly Assigned 2 Scenarios *10 minutes*

Day 5 ***40 minutes***

☐ Session 6: Randomly Assigned 2 Scenarios *10 minutes*

☐ *Break 5 minutes*

☐ Session 7: Randomly Assigned 2 Scenarios *10 minutes*

☐ *Break 5 minutes*

☐ Session 8: Randomly Assigned 2 Scenarios *10 minutes*

Day 6 ***40 minutes***

☐ Session 9: Randomly Assigned 2 Scenarios *10 minutes*

☐ *Break 5 minutes*

☐ Session 10: Randomly Assigned 2 Scenarios *10 minutes*

☐ Skill Based Test (40 Questions) *15 minutes*

Day 7 ***40 minutes***

☐ CELF-5 Pragmatic Profile (50 Question Rating) *15 minutes*

☐ Adapted Version of the Children's Intervention Rating Profile (CIRP), Intervention Appropriateness Measure (IAM), and Feasibility of Intervention Measure (FIM) (15 Question Rating) *10 minutes*

☐ Time for Student Questions *15 minutes*

<u>Educator Procedure (time varies depending on the number of student participants)</u>

Day 1 ***depends on the number of students.***

☐ CELF-5 Pragmatic Profile (50 Question Rating) *depends on number of students*

☐ Run Through Tasks *12 minutes*

☐ Training on Device Features (iPad or Chromebook) *5 minutes*

☐ Questions *6 minutes*

Day 2 ***45 minutes***

☐ Training on VOISS *15 minutes*

☐ Training on PEERS Website Features *10 minutes*

☐ Training on PEERS Video Modeling *15 minutes*

☐ Questions *5 minutes*

Day 3 ***25-45 minutes***

☐ Student teaches educator each intervention (PEERS *10 min*, VOISS *10 min*) *20 minutes*

☐ Mark Implementation Checklist *1 minute per student*

☐ Ensure Student Gets on Correct Intervention # Listed on Checklist *1 minute first session, 1 minute second session per student*

☐ Work with PEERS Group Using Curriculum Guide on Video Modeling Imitations with Prompting as Needed *5-10 minute after watch videos for that session*

Day 4 ***25-45 minutes***

☐ Mark Implementation Checklist *1 minute per student*

☐ Ensure Student Gets on Correct Intervention # Listed on Checklist *1 minute first session, 1 minute second session per student*

☐ Work with PEERS Group Using Curriculum Guide on Video Modeling Imitations with Prompting as Needed *5-10 minute after watch videos for that session*

Day 5 ***25-45 minutes***

☐ Mark Implementation Checklist *1 minute per student*

☐ Ensure Student Gets on Correct Intervention # Listed on Checklist *1 minute first session, 1 minute second session per student*

☐ Work with PEERS Group Using Curriculum Guide on Video Modeling Imitations with Prompting as Needed *5-10 minute after watch videos for that session*

Day 6 ***depends on the number of students.***

☐ Mark Implementation Checklist *1 minute per student*

☐ Ensure Student Gets on Correct Intervention # Listed on Checklist *1 minute first session, 1 minute second session per student*

☐ Work with PEERS Group Using Curriculum Guide on Video Modeling Imitations with Prompting as Needed *5-10 minute after watch videos for that session*

☐ CELF-5 Pragmatic Profile (50 Question Rating) *depends on number of students*

Day 7 ***if have more students continue to fill out CELF-5 for those students.***

☐ CELF-5 Pragmatic Profile (50 Question Rating) *depends on number of students*

☐ Answer any questions you may have *15 minutes*

<u>COVID-19 Procedures</u>

The University of Kansas recognizes that the COVID-19 pandemic has changed the level of risk to you regarding your participation in this research. The university is following Centers for Disease Control & Prevention (CDC), state, and institutional guidelines and best practices and is requiring additional precautions and procedures for this project in light of this.

Please be advised that although the researchers will take precautions to maintain your health and safety, the nature of COVID-19 prevents the researchers from guaranteeing protection from the virus. To assist with your feelings of safety, you will have the option to participate in all sessions over Zoom or in person. The researchers would like to remind you to follow the CDC's recommended guidelines for protecting yourself and others from exposure to the virus. If you are at risk for contracting COVID-19, or if you do not feel comfortable participating due to the risk of COVID-19, you are encouraged to either not participate or participate over Zoom.

Risks and Participant Confidentiality

Breach of confidentiality is a risk. However, data will be stored on a password protected computer and locked in an office at the University of Kansas.

Your student's name will not be associated in any publication or presentation with the information collected about your student or with the research findings from this study. No identifying information will be collected. All research data will be maintained confidentially by a unique numerical code in password-protected databases. All data will be de-identified to ensure anonymity. All subject records and materials will be kept in locked file cabinets in a secure office. Only the personnel of this project will have access to the data. Records will be stored for a period of seven (7) years as dictated by federal funding requirements. A copy of the records disclosed can be provided to you upon request. Your identifiable information may be removed from the data, and the deidentified data will be used or distributed for future research without additional consent from you. Your identifiable information will not be shared unless (a) it is required by law or university policy, or (b) you give written permission.

Benefits

As our society moves increasingly towards the use of new forms of technology for instruction, this study will help to create a better understanding of the use of these technologies to deliver social skill interventions. This study will also benefit your child by enhancing social skills instruction for the classroom. Additionally, this study will allow your child to be more independent in their acquisition of social skills.

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You will not be paid to participate in this study.

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Canceling This Consent and Authorization

You may withdraw your consent to participate in this study at any time. You also have the right to cancel your permission to use and disclose further information collected about yourself, in writing, at any time, by sending your written request to: Maggie Mosher, Department of Special Education, JR Pearson Hall, University of Kansas, 1122 W. Campus Road, Lawrence, KS 66045 or emailing mosherku@ku.edu.

If you cancel permission to use your information, the researchers will stop collecting additional information about you. However, the research team may use and disclose information that was gathered before they received your cancellation, as described above.

Questions About Participation
Questions about procedures should be directed to the researchers listed at the end of this consent form.

Participant Certification:
I have read this Consent and Authorization form. I have had the opportunity to ask, and I have received answers to, any questions I had regarding the study. I understand that if I have any additional questions about my rights as a research participant, I may call (785) 864-7429 or (785) 864-7385, write the Human Research Protection Program (HRPP), University of Kansas, 2385 Irving Hill Road, Lawrence, Kansas 66045-7568, or email irb@ku.edu.

I agree to take part in this study as a research participant. By signature, I affirm that I am at least 18 years old and that I have received a copy of this Consent and Authorization form.

_____
Type/Print Your (Educator's) Name

_____ _____
Educator's Signature Date

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KU DEPARTMENT OF SPECIAL EDUCATION
The University of Kansas

Informed Research Consent Statement for Parents

Project Title: Virtual reality for Social-Emotional Intervention: Student Outcomes and Preferences

Introduction

The Department of Special Education at the University of Kansas supports the practice of protection for human subjects participating in research. The following information is provided for you to decide whether you wish for your child to participate in the present study. You may refuse to sign this form and not participate in this study. You should be aware that once you agree, you are still free to withdraw your child from participation at any time. If you withdraw your child from this study, it will not affect your relationship within the schools, the services it may provide to you, or the University of Kansas.

Purpose of the Study

This study is a cooperative venture with the University of Kansas. The purpose of this study is to investigate the underlying social validity factors (e.g., acceptability, feasibility, appropriateness, effectiveness) of a virtual reality SE intervention and a video modeling SE intervention delivering instruction on expressive communication skills to middle school students.

KEY INFORMATION

- This project is studying a technology delivered social skill intervention and how it can enhance participant's learning.
- Your child's participation in this research project is completely voluntary.
- Your child's participation will take 7 days and approximately 45 minutes a day.
- Your child will be asked to do the following:
    - Complete a pre and post rating scale (with 7 to 15 questions) to gather information about thoughts on technology and social-emotional skills.
    - Answer 40 multiple choice social skill questions.
    - Use a program for 7 days (2 practice sessions and 10 learning sessions) to learn and practice social skills.
- Your child and their educator will be asked to do the following:
    - Complete a pre and post rating scale (with 50 questions) called the Clinical Evaluation of Language Fundamentals-5 (CELF-5) Pragmatic Profile (Wiig et al., 2013). These will help us see how your child performs in social-emotional skills before and after the sessions.

- There are no perceived risks that are greater than day-to-day activities. If your child experiences any discomfort, they or their educator can let us know and we will stop at any time.
- The scenarios will benefit your child by enhancing their social-emotional skill knowledge. You will have the opportunity to share feedback in an interview if desired.
- Your alternative to participating in this research study is not to participate.

Procedures

If you give consent, you and your child will do the following: (*Note:* All times are estimates determined by how long it took a middle school student to complete the task. It may require more or less time depending on the participant.)

Your child will be randomly assigned by a computer program to one condition (evidence-based social skill instructional method or technology delivered social skills program) for the period required to complete the targeted skills (estimated by educators to be 5 days). When the week is over, students will be switched to the other condition. This will ensure every student is provided with the same content. At each session, your child will be instructed on the program to use an evidence-based social skill instructional method (e.g., PEERs video modeling) or a technology delivered social skills program (e.g., virtual reality delivered VOISS). The device displaying the program (e.g., Chromebook, iPad) will be the same regardless of the program. During the session, the program will provide your child with 2 scenarios per session and questions to answer about these situations. They will participate in 10 of these sessions (20 scenarios) in the intervention and 2 of the sessions (4 scenarios) in the training. These scenarios will depict real world expressive communication situations. Before and after the sessions, your child will be presented with multiple choice questions to determine content knowledge on these skills. Your child may provide written, or an oral response based on your child's preference or ability level. This will take approximately one class period (45 minutes) with a total of 2 training and survey days and 5 program days with post surveys on the final days.

The researcher will provide a 40-question multiple-choice knowledge test, the CELF-5 Pragmatic Profile, and the Children's Intervention Rating Profile. This takes an estimated 20 to 30 minutes to complete and is listed in the procedures below. After participating in the assigned condition (estimated to be one week later), your child will re-take the researcher provided Expressive Communication Multiple Choice Questions, and the Adapted Version of the Children's Intervention Rating Profile. Your child will also take the Intervention Appropriateness Measure and Feasibility of Intervention Measure [15 Questions for an estimated 10 minutes].

Student Procedure

Day 1 ***45 minutes***

☐ SCKQ kill Based Test (40 Questions) *12 minutes*

- ☐ CELF-5 Pragmatic Profile (50 Question Rating) *15 minutes*
- ☐ Training on Device Features (iPad or Chromebook) 5 *minutes*
- ☐ Adapted Version of the Children's Intervention Rating Profile Intervention (7 Question Rating) *7 minutes*
- ☐ Questions 6 *minutes*

Day 2 ***45 minutes***

- ☐ Training on VOISS *15 minutes*
- ☐ Training on PEERS Website Features *10 minutes*
- ☐ Training on PEERS Video Modeling *15 minutes*
- ☐ Questions 5 *minutes*

Day 3 ***45 minutes***

- ☐ Student teaches educator each intervention (PEERS *10 min*, VOISS *10 min*) *20 minutes*
- ☐ Session 1: Randomly Assigned 2 Scenarios *10 minutes*
- ☐ *Break 5 minutes*
- ☐ Session 2: Randomly Assigned 2 Scenarios *10 minutes*

Day 4 ***40 minutes***

- ☐ Session 3: Randomly Assigned 2 Scenarios *10 minutes*
- ☐ *Break 5 minutes*
- ☐ Session 4: Randomly Assigned 2 Scenarios *10 minutes*
- ☐ *Break 5 minutes*
- ☐ Session 5: Randomly Assigned 2 Scenarios *10 minutes*

Day 5 ***40 minutes***

- ☐ Session 6: Randomly Assigned 2 Scenarios *10 minutes*
- ☐ *Break 5 minutes*
- ☐ Session 7: Randomly Assigned 2 Scenarios *10 minutes*
- ☐ *Break 5 minutes*

☐ Session 8: Randomly Assigned 2 Scenarios *10 minutes*

Day 6 ***40 minutes***

☐ Session 9: Randomly Assigned 2 Scenarios *10 minutes*

☐ *Break 5 minutes*

☐ Session 10: Randomly Assigned 2 Scenarios *10 minutes*

☐ Skill Based Test (40 Questions) *15 minutes*

Day 7 ***40 minutes***

☐ CELF-5 Pragmatic Profile (50 Question Rating) *15 minutes*

☐ Adapted Version of the Children's Intervention Rating Profile (CIRP) Intervention Appropriateness Measure (IAM) Feasibility of Intervention Measure (FIM) (15 Question Rating) *10 minutes*

☐ Time for Student Questions *15 minutes*

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office. Only the personnel of this project will have access to the data. Records will be stored for a period of seven (7) years as dictated by federal funding requirements. A copy of the records disclosed can be provided to you upon request. Your identifiable information may be removed from the data, and the deidentified data will be used or distributed for future research without additional consent from you. Your identifiable information will not be shared unless (a) it is required by law or university policy, or (b) you give written permission.

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I agree to take part in this study and to allow my child to take part as a research participant. By signature, I affirm that I am at least 18 years old and that I have received a copy of this Consent and Authorization form.

_____

Type/Print Your Child's Name

_____

Type/Print Your (Parent/Guardian) Name

_____ _____

Parent/Guardian's Signature Date

Researcher Contact Information:
Maggie Mosher (Principal Investigator)
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Student Assent

Project Title: Virtual reality for Social-Emotional Intervention: Student Outcomes and Preferences

My name is Maggie Mosher. I am interested in learning about how you feel when using programs through different kinds of technology and whether you think the technology helped you learn and communicate with others. If you would like, you can be in my study.

If you decide you want to be in my study, you will fill out a few short surveys about your feelings when using technology before and after the study, a survey about your feeling of being present within technology, and a survey about how you feel you perform specific skills. Before the study you will also answer 40 multiple choice questions. I will present you with either a screen based virtual reality program or video modeling videos on either an iPad or Chromebook and ask you questions about it. We will meet to do this for seven days total about 45 minutes a day. You and your teacher will have two sessions of training on 2 separate days prior to these 5 days of the program, to make sure you feel comfortable with the technology, game, myself, and my fellow researcher. After the 10 sessions, I will re-ask you those 40 multiple choice questions and you will re-take the rating scales. This will all occur with me over Zoom or in your classroom and your teacher will be nearby.

There are no perceived risks to answering the questions that are greater than day-to-day activities. You may have some eye discomfort from looking at a technology screen. If you do, you can let us know and we can stop at any time.

Other people will not know if you are in my study. I will put things I learn about you together with things I learn about other students using technology, so no one can tell what things came from you. When I tell other people about my research, I will not use your name, so no one can tell who I am talking about.

Your parents or guardian have to say it’s OK for you to be in the study. After they decide, you get to choose if you want to do it too. If you don’t want to be in the study, no one will be mad at you. If you want to be in the study now and change your mind later, that’s OK. You can stop at any time.

If you don't feel like answering any questions, you don't have to. You can stop using the technology, speaking with me, or answering questions anytime and that will be all right.

I will be happy to answer any questions you may have now or anytime when we are talking together. Do you want to take part in this study? If yes, verbally tell your parents and they will sign to consent.

Appendix F: Measures

Clinical Evaluation of Language Fundamentals-5 (CELF-5) Pragmatic Profile

(Wiig et al., 2013)

Note: The parent/educator version is listed below. The student version is the same form in first person with visual prompts and the ability for the form to be read aloud.

Verbal Communication Pragmatic Skill Questions	Never/ Almost Never (1) Sometimes (2) Often (3) Always/Almost Always (4)
Rituals and Conversation Skills: The student demonstrates culturally appropriate use of language when…	
1. Making/responding to greetings to/from others	1 2 3 4
2. Beginning/ending conversations (face to face, phone, etc.)	1 2 3 4
3. Observing turn-taking rules in the classroom or in social interactions	1 2 3 4
4. Maintaining eye contact/gaze	1 2 3 4
5. Introducing appropriate topics of conversation	1 2 3 4
6. Maintaining topics using typical responses (nods, responds with "hmm…," etc.)	1 2 3 4
7. Making relevant contributions to a topic during conversation/discussion	1 2 3 4
8. Avoiding use of repetitive/redundant information	1 2 3 4
9. Asking for/responding to requests for clarification during conversations	1 2 3 4
10. Adjusting/modifying language based on the communication situation (communication partner[s], topic, place)	1 2 3 4
11. Telling/understanding jokes/stories that are related to the situation	1 2 3 4
12. Showing sense of humor during communication situations	1 2 3 4
13. Joining or leaving an ongoing communicative interaction	1 2 3 4
14. Participating/interacting in structured group activities	1 2 3 4
15. Participating/interacting in unstructured group activities	1 2 3 4
16. Responding to introductions and introducing others	1 2 3 4

17. Using strategies for getting attention	1 2 3 4
18. Using strategies for responding to interruptions and interrupting others	1 2 3 4
The student asks for, gives, and responds to information: The student demonstrates culturally appropriate use of a language when…	
19. Giving/asking for directions	1 2 3 4
20. Giving/asking for the time of events	1 2 3 4
21. Giving/asking for reasons and causes for actions/conditions/choices	1 2 3 4
22. Asking for help from others	1 2 3 4
23. Offering to help others	1 2 3 4
24. Giving/responding to advice or suggestions	1 2 3 4
25. Asking others for permission when required	1 2 3 4
26. Agreeing and disagreeing	1 2 3 4
27. Asking for clarification if he/she is confused or if the situation is unclear	1 2 3 4
28. Accepting/rejecting invitations	1 2 3 4
29. Starting/responding to verbal and nonverbal negotiations	1 2 3 4
30. Reminding others/responding to reminders	1 2 3 4
31. Asking others to change their actions/states (e.g., please move, stop tapping)	1 2 3 4
32. Apologizing/accepting apologies	1 2 3 4
33. Responding when asked to change his/her actions (by accepting/rejecting)	1 2 3 4
34. Responding to teasing, anger, failure, disappointment	1 2 3 4
35. Offering/responding to expressions of affection, appreciation	1 2 3 4
36. Knowing how someone is feeling based on nonverbal cues	1 2 3 4
37. Reading the social situation correctly and behaving/responding to it	1 2 3 4
38. Understanding posted and implied group/school rules	1 2 3 4
Non-Verbal Communication Skill Questions	Never or Almost Never (1) Sometimes (2) Often (3) Always or Almost

The student reads and interprets the following nonverbal messages accurately…	
39. Facial cues/expressions	1 2 3 4
40. Making/responding to greetings to/from others	1 2 3 4
41. Making/responding to farewells to/from others	1 2 3 4
42. Beginning/ending conversations	1 2 3 4
43. Tone of voice	1 2 3 4
The student demonstrates culturally appropriate use of the following nonverbal support…	
44. Facial cues/expressions	1 2 3 4
45. Body language/gestures	1 2 3 4
46. Voice intonation (pitch, inflection, tone, or cadence)	1 2 3 4
47. Expresses messages by using gestures or facial expressions	1 2 3 4
48. Uses gestures and/or facial expressions according to the situation	1 2 3 4
49. Adjusts body distance (sits/stands) according to the situation	1 2 3 4
50. Presents matching gestures/facial expressions with verbal messages	1 2 3 4

This test has a mean of 10 and a standard deviation of 3.

Score of 10: performance of the typical student of a given age

Scores 8-12: average range

Scores 7 and below: below average to very low social communication abilities relative to same age peers

Pragmatics Profile Item Analysis

Communication	Item
Using Rituals	1, 2, **3**, 16, **40**, **41**, **42**
Following Conversational Rules	**3**, 4, 5, 6, 7, 8, 9, 10, 13, **17**, **18**, 27, **38**
Understanding Humor/Jokes	11, 12, **37**
Participation	14, 15, **17**, **18**, 22, 23
Giving/Asking for Information	19, 20, 21, **38**
Understanding/Expressing Complex Intentions	24, 25, 26, 28, 29, 30, 31, 32, 33
Awareness/Use of Prosodic Cues	43, 46
Sharing/Responding to reactions	34, 35, 36, **37**
Reading/Using Body Language	39, **40**, **41**, **42**, 44, 45, 47, 48, 49, 50

Note. Bold items appear in more than one category.

Social Communication Knowledge Questions (SCKQ)

The following questions were randomized by Qualtrics and each answer response within the question was also randomized. Participants were unable to click the correct answer until all answer options were read. The student could not continue to the next question until answering.

1. You move down the line and another Lunch Personnel says, “Do you want French fries or mashed potatoes?” How should you respond?
    a) No.
    b) Keep walking with your head down without responding.
    c) Did you know that the origin of French fries is disputed? Some people think they were invented in Belgium and others say France. In France, they are called ‘les frites.’ Mashed potatoes have a similar background. I will take the French fries today please. Thanks.
    d) I’ll take the French fries today please. Thanks.

2. You are in the beginning of the lunch line and the Lunch Personnel says “Hi! Hope you are hungry today!” How should you respond?
    a) Yeah.
    b) You keep walking with your head down.
    c) Hi! I am super hungry today even though I had a huge breakfast of two eggs, three pieces of bacon, and one piece of toast with butter on it. And I ate a granola bar between classes in the hallway.
    d) Hi! Yes, I am hungry today.

3. You finish getting your food and the check-out personnel says, “Enjoy your lunch and have a great rest of your day!” What is the best way to respond?
    a) I doubt it will be an enjoyable day.
    b) Walk away without looking at the lunch personnel.
    c) Look at the lunch personnel and smile.
    d) Look at the lunch personnel, smile, and say, “Thanks! You have a great day too!”

4. You walk into the library and hear two students talking to each other one says, “I love our English assignment because Science Fiction is the best.” The student calls out to you and asks, “Hey, what do you have to work on in Study Hall?” What is the best way to respond?
    a) Walk up to the student nose to nose and say, “Hey, I finished my exam, so I was going to start our essay. What about you? I love that book by the way.”

b) Walk up to the student and respond, “I finished my exam, so I was going to work on the essay. What about you? Are you planning to read it? I love science fiction by the way.”
c) Walk up to the student nose to nose and say, “Hey, I finished my exam, so I was going to start our essay. What about you? I love that book by the way.”
d) Walk up to the student and say, “I love *Star Wars*! Luke’s my favorite character. Who is yours?”

5. You are doing research on a library computer for science class. Another student sits at the computer next to you and says, “Hey! Are you working on the science project too?” What is the best response?

a) Hey! Yeah, I’m just doing research on it now. I chose to make my topic marine biology. What about you?
b) Lean in and say, “Yes, I am.”
c) Science is dumb.
d) Ignore the student because you are supposed to be doing research not talking.

6. You want to open a conversation with a topic that is relevant to both you and the people you’re talking to. Which of these options is the best way to start a conversation in a classroom?

a) The latest version of my favorite video game came out this weekend.
b) How was your weekend?
c) I dreamed that we didn’t have school today. I can’t believe I still got here on time!
d) Don’t say anything.

7. You want to start talking to someone you don’t know but saw at the game this weekend. They are standing near you, what would be something you could say to start a conversation?

a) You over there, come over here.
b) Hi, I noticed you were at the game last week. Do you like basketball?
c) Say nothing and hope they start talking.
d) Walk by and say you hate school and hope they stop you asking more questions.

8. Students are talking about a soccer game at a birthday celebration. Which of the following options is the best way to continue the conversation?

a) Have any of you been on a soccer team before?
b) Why didn’t anyone ask me how my weekend was?

c) Your grandpa had a birthday this week, didn't he?
d) Anyone want to see a picture of me on my birthday?

9. A friend just sat down next to me and said hi. Other friends are talking about a game. What is the best response option?

a) Did you know that carnivorous dinosaurs were the only ones that had feathers?
b) My sister plays basketball and I've gone to her games. I went to the boys' basketball game last week. They won! Did you watch it?
c) Just listen and don't say anything.
d) This conversation is boring so I'm going to talk with my friend about something I enjoy.

10. You are sitting with friends. They are discussing their favorite pizza toppings. What is the best response option?

a) Does anyone know the origins of pizza? They go back really far. Do you like history? It is my favorite subject.
b) My mom got me new sneakers, they're cool right?
c) My favorite topping is pepperoni. Have you ever tried pizza with pineapple?
d) Your favorite toppings are gross. I don't like them.

11. You go to the office where the secretary is sitting at the front desk with flowers. She says to you, "I need your help. It's Amy Rodriguez' birthday and her parents sent her flowers. You have lunch with Amy would you mind dropping these off to her before you get in line for lunch?" The bell rings, how should you respond?

a) Did you know that flowers cause allergies? Some of my favorite flowers can make my mom sneeze. Do flowers make Amy sneeze?
b) Sure, I can help. I'll take the flowers to Amy. That was the changing period bell, so I better start heading to lunch. Have a good rest of your day.
c) Sure, I can help but not today as I have lunch. I'll check back tomorrow. Have a great day.
d) That was the lunch bell. I don't need to say anything, but I better leave as if I don't head to the cafeteria now, I may end up at the end of the line for lunch.

12. Amy wasn't in the cafeteria, so you set the flowers down and got in line for lunch. When you see Amy, you get out of line to bring her flowers. You are starving so you get back in line where you were, another student says, "Hey! This is unbelievable; you don't get to cut me!" What is the best way to respond?

a) Tell the unobservant student in a calm voice, “I was standing here before. You’re the one being rude. I’m hungry and I’m not waiting in the back again.”
b) Explain the situation simply in a calm voice, “I just stepped out of line to deliver Amy flowers. I’m sorry if you thought I left the line for good. Is it okay if I have my place back in line back?”
c) Go to the end of the line it’s not worth a fight.
d) Explain the situation simply in a calm voice, “I was here first and only left for a second. I’m sorry if you thought I left the line for good, but I didn’t.”

13. You go to sit with Amy. She has her lunch and flowers out. She says to you, “Thank you so much for the flowers! It was so, so kind of you to buy them for me! I love them!” How should you respond?

a) Oh, I didn’t buy them. I just delivered them. Your parents bought them. They are nice though. Happy birthday.
b) The secretary bought those for you. I just delivered them.
c) Happy birthday. Oh, I didn’t buy them. I just delivered them. The school bought them.
d) I think the flowers are something you’re supposed to deliver to someone else like I did.

14. Wallace, another student bumps into you in the hallway and causes you to drop your iPad. It cracks on the ground. How should you react?

a) I can’t believe my iPad is broken! I’m going to punch that kid!
b) I can’t believe my iPad is cracked. I’m going to find an adult so I can let someone know what just happened.
c) This isn’t my problem! Wallace broke the iPad. I’m not going to worry about it.
d) I can’t believe this! No one is ever going to give me an iPad again! I need to pretend nothing happened, so I don’t get into trouble.

15. Your iPad is broken, and you have to advocate for yourself. What is the best response option?

a) Find your teacher and say, “Excuse me, but someone bumped into me, and I accidentally dropped my iPad. Can you help me?”
b) Find the nearest teacher and say, “Help me. My iPad’s broken and I have to get to class.”
c) Find the nearest teacher and say, “Wallace broke my iPad. Can you help me?”
d) Find a school administrator and wait at the door. When the administrator is ready say, “Excuse me, Wallace dropped my iPad. Can you help me fix it?”

16. You are speaking to your teacher and principal about an event coming up that you have volunteered to help with. Your principal says, “Thanks for helping with this. How has recruiting judges been going?” How should you respond?

    a) I really like the science projects I have seen so far. They are interesting. Thanks for having the science fair.
    b) I haven’t found as many judges as I wanted. I’m still going to ask a few more teachers and parents. Would you be available to judge? I really like the science projects I have seen so far, and I think you would enjoy them.
    c) I need more judges, so I hope it is okay, but I signed you up to judge this Tuesday. I’m still going to ask a few more teachers and parents and then we will be all set. I appreciate you thanking me.
    d) Um, I really don’t want to talk about it right now.

17. You are speaking with your friend’s mom while waiting for your friend to come back from the bathroom. She asks you, “What is your favorite class?” How should you respond?

    a) I like videogames more than class.
    b) I’m just waiting for my friend.
    c) I like Science class the most. I learned something really cool about turtles last week!
    d) Science.

18. You aren’t feeling well so you decide to go see the school nurse. Your stomach hurts. She asks, “How can I help you?” What is the best response?

    a) My stomach hurts so my teacher told me to ask you for help.
    b) Call my parents.
    c) My stomach hurts so my teacher told me to leave so I don’t get sick.
    d) My stomach hurts so I came to see if you had something that may help.

19. You’re talking with friends, but it’s time to get to class. One of your friends says, “Well, good chatting with you, guys! See you around.” How should you respond?

    a) Did I ever tell you guys the story about what happened in 5th period last Friday?
    b) I’ve got to run to history class. See you around.
    c) That was the bell, so I guess we better stop talking or at least get out of the hallway, so we don’t get in trouble.
    d) Leave without saying anything as some information is private.

20. You are finishing a conversation with your friends outside of the classroom. How should you exit the conversation and go into class?

    a) Just walk away and say nothing, you don't need to tell them why you are no longer listening to them.
    b) Start walking to class so they know what you are doing and yell back "I need to go guys. We'll talk later."
    c) Grab your books and say, "I have to get to class but let's pick up this conversation after if you are around."
    d) Say "Okay, bye." And wait for them to walk away before you go to class.

21. Another student says to you "How are you?" Which is the best response?

    a) I'm good, how about you?
    b) I don't want to talk to you.
    c) English class is so stupid!
    d) Politely ask how you are back.

22. Another student is waiting in line to go into class. They smile and say "Hey, how was your weekend?" How would you respond?

    a) Don't talk to me.
    b) Hello.
    c) It was great! I played soccer. How was yours?
    d) I don't know, fine, I guess.

23. Robert walks by you in the hallway and makes eye contact, with a slight head lift in greeting. What is the best response option?

    a) Look at Robert and return head nod.
    b) Look at Robert then look away.
    c) Follow Robert so he can see you in the eyes and then say hello politely.
    d) Stop Robert to politely ask what a head lift means.

24. You continue walking, looking for classroom #170 as your class begins in 1 minute and as you are walking you make eye contact with your art teacher in room #180. Your teacher smiles and makes eye contact. What is the best response option?

    a) Smile back at the teacher and continue on.
    b) Frown at the teacher and continue on.

c) Look down and continue on.
d) Stop and start talking to the teacher since the teacher initiated a conversation with a smile.

25. You find classroom #170 and see a line forming outside the door. Students are talking to one another. What is the best response option?
    a) Stay on the other side of the hall because you have too much to do to get into trouble for talking.
    b) Stand in the front of the line because you want to be first in the room and join in the conversation.
    c) Stand in the back of the line because you don't want to cut and join in the conversation.
    d) Open the door and walk into the classroom as the teacher needs to know everyone is waiting outside.

26. You are working on an assignment in a group. Your group leader says, "I think we should be writing this down in case we need to report back to the class," then looks at you and says, "Will you record it for us?" You don't want to write, what is the best way to respond?
    a) I think we can all remember what we say. We don't need to write it down. That's a waste of time.
    b) I'd rather not write. Would it be okay if we just tried to remember what everyone said or would someone else like to write?
    c) You're always telling us what to do. I don't think a real group leader should act like that.
    d) Why are we bothering to write? We have good memories. We should just discuss it. Right guys?

27. You are splitting up responsibilities for a group activity in class. How do you ask to do the slide show portion?
    a) I will do the slide show portion on my own as I don't like to work with anyone.
    b) Don't say anything and just do whatever the other students don't want to.
    c) I would like to do the slide show portion, is that okay with everyone?
    d) If I don't get to do the slide show portion, then I really don't want to participate.

28. The other students in your group project are talking about something you don't care about. What is the best way to deal with this?

a) Just wait patiently and politely to a topic ending point and change the conversation to a new topic.
b) Ask your teacher for a new group.
c) Interrupt them and start talking about something new.
d) Just wait patiently and politely to a topic ending point and then leave the table.

29. You are standing on the sideline and would like to have a turn in the game what would you do:

a) I should ask my friend if I can play.
b) I should take my friend's ball. He wasn't any good at shooting anyway.
c) I should stand here and wait until someone invites me.
d) I should take the ball and run to the other court because I don't want to play with them.

30. You are playing basketball, but no one has passed the ball to you yet. What is the best response option so you can take a turn?

a) Yell at the players for not passing the ball saying it is your turn.
b) Go get another ball and continue playing on the same court.
c) Sit down on the bench and wait for someone to offer assistance.
d) Signify to your teammates that you are ready to be passed to, reminding them you would like a turn.

31. Another student says, "Can you believe how much homework we had last night?!" How should you respond?

a) There was a lot of homework. Did you get yours done?
b) My favorite video game is Minecraft.
c) Why are you sitting here? I wanted to sit alone!
d) I don't want to talk to you.

32. Another student asks if you know how to answer a question on the worksheet. You don't know the answer either, how should you proceed?

a) Say, "I'm not sure how to answer that question either, maybe we should ask the teacher."
b) Say, "You do your work and I'll do mine."
c) Change the subject to something you do know.
d) Say, "No."

33. Another student says, “I’m excited for lunch today. I heard there’s pizza today! Do you like pizza?” How should you respond?

    a) I am not excited for lunch.
    b) I’m excited too. I love pizza. What’s your favorite topping?
    c) Last night I played video games.
    d) I’m excited too!

34. Your teacher has been talking for a long time and you’re starting to get bored. What is the best response option?

    a) Look out the window and stop listening so you don’t get mad.
    b) Continue to listen attentively trusting it may get better.
    c) Interrupt your teacher to let them know you’re bored.
    d) Have a side conversation with a friend so you don’t fall asleep and get in trouble.

35. Your teacher finishes talking and is now asking you a question, but you weren’t listening and don’t know the answer. What is the best response option?

    a) Stay silent and wait for the teacher to move on. If the teacher doesn’t answer something about the subject, you were on before you stopped listening.
    b) Tell the teacher the question doesn’t make sense. Then answer to the best of your knowledge.
    c) Tell your teacher not to ask you any more questions.
    d) Ask the teacher to repeat the question and answer to the best of your knowledge.

36. You need to get your books and a student is standing in front of your locker. How should you proceed?

    a) Look them eye to eye and say, “Hey! I need to get into my locker!”
    b) Stand in front of the students looking down at the floor until they move. The student will get the point by your presence, no need to say anything.
    c) Politely say, “Could I get past you? I need to get a book from my locker.”
    d) Politely approach, reach behind the student and open the locker you don’t need to say anything the student will get the point.

37. Another student is drinking from the water fountain. They have been drinking water for a long time and you would like to get some water before your next class. What is the best response option?

    a) Move them out of the way and get water.

b) Politely stare at the floor and wait your turn even if it means you are late for class you can always tell the teacher what happened later.
c) Politely state in a calm tone, “Could I grab some water? I’m in a hurry to get to class before the bell?”
d) Politely tap their shoulder and in a calm tone say, “There are other people in line to get water and you are taking too long. Please hurry up.”

38. A student in the hallway stops you and says to you, “Why are you walking here? This is my hallway!” How can you respond to them in the best way?

a) Say, “This is not your hallway. Get out of my way. The hallway belongs to the school.”
b) Shove the student aside and continue on.
c) Politely keep walking where you need to, don’t engage. Next time, see if there is a friend you can walk with or strategize something that may jokingly de-escalate the situation.
d) Explain exactly where you are going and why. Then, politely ask permission to proceed. Next time, see if there is a friend you can walk with or strategize something that may jokingly de-escalate the situation.

39. Students talk about pets together and this is your favorite topic. Dallas walks up and changes the subject to the math test before you get the chance to participate. Dallas says, “That test was awful, wasn’t it?” How should you respond?

a) Tell Dallas how you feel saying “You interrupted us. We were talking about something else. No one cares about the test.”
b) Say, “Yeah. I stayed up late studying for that test! On a more cheerful topic, we’ve been talking about our pets and the crazy things they do. My dog is always running to the door every time he hears an ice cream truck go by. Do you have pets, Dallas?”
c) Ignore Dallas and continue saying, “My dog is always running to the door every time he hears an ice cream truck go by. Do you have pets, Dallas?”
d) Switch to Dallas’ topic so no one gets mad and say, “How are you guys planning to study for the science test on Friday?”

40. You are enjoying a conversation about your favorite foods. A friend changes the topic to a class you don’t take. What is the best response option?

a) I’m not in that class so this topic is irrelevant to me.
b) I’m not in that class but going back to what we were discussing earlier I really like pizza.
c) I don’t think this conversation is fair.
d) I like pizza.

Adapted Version of the Children's Intervention Rating Profile (CIRP)

Adapted based on expert opinion and feedback from pilot middle schoolers, the Ci3T website at https://www.ci3t.org/ (Lane, 2012) and Witt, J.C. & Elliott, S.N. (1985). Acceptability of classroom intervention strategies. In Kratochwill, T.R. (Ed.), *Advances in School Psychology*, Vol. 4, 251 – 288. Mahwah, NJ: Erlbaum.

Student ID: _____

	CIRP Pretest	 **Strongly Disagree 1**	 **Disagree 2**	 **Slightly Disagree 3**	 **Slightly Agree 4**	 **Agree 5**	 **Strongly Agree 6**
1	The program we will use sounds fair.						
2	I think my teacher will be too harsh on me.						
3	Being in this program may cause problems with my friends.						
4	There are better ways to teach me these skills.						
5	This program will help other kids, too.						
6	I think I will like being in this program.						
7	I think being in this program will help me do better in school.						

Comments:_____

_____

_____

_____

_____

Student ID: _____

	CIRP Posttest	 **Strongly Disagree 1**	 **Disagree 2**	 **Slightly Disagree 3**	 **Slightly Agree 4**	 **Agree 5**	 **Strongly Agree 6**
1	The program we used was fair.						
2	I think my teacher was too harsh on me.						
3	Being in this program caused problems with my friends.						
4	There were better ways to teach me.						
5	I liked the program we used.						
6	The program could help other kids too.						
7	Being in this program helped me do better in school.						

Comments:_____

_____

_____

_____

_____

Intervention Appropriateness Measure (IAM)

These two measures are given post sessions with the intervention name the student received in the parentheses.

GENERAL INSTRUCTIONS: These measures could be used independently or together. The IAM items could be modified to specify a referent organization, situation, or population (e.g., my clients). Please check and report the psychometric properties with each use or modification. (INSERT INTERVENTION) will list the program the computer selects for that participant (i.e., VOISS or PEERS).

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
1. (INSERT INTERVENTION) seems fitting.	①	②	③	④	⑤
2. (INSERT INTERVENTION) seems suitable.	①	②	③	④	⑤
3. (INSERT INTERVENTION) seems applicable.	①	②	③	④	⑤
4. (INSERT INTERVENTION) seems like a good match.	①	②	③	④	⑤

Feasibility of Intervention Measure (FIM)

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
1. (INSERT INTERVENTION) seems implementable.	①	②	③	④	⑤
2. (INSERT INTERVENTION) seems possible.	①	②	③	④	⑤
3. (INSERT INTERVENTION) seems doable.	①	②	③	④	⑤
4. (INSERT INTERVENTION) seems easy to use.	①	②	③	④	⑤

Appendix G: Example of a Student Checklist

Note: Every student will receive their 2 scenarios in the order directed by an online randomization generator: https://miniwebtool.com/random-name-picker/ or SPSS in which each scenario name is listed, and the 3-step randomization is selected. After the scenarios have been randomized for students, they and their educator will each receive a copy of a checklist like the one below with the order of their scenarios and questions in the exact order generated by the randomization tool. This is an example as depending on if they were assigned VOISS or PEERS these changes as well as which scenarios or videos they were assigned.

Example When Educator Only Had 30 Minute Classes with Student

Student ID _____

Day 1

☐ CELF-5 Pragmatic Profile (50 Question Rating)

Day 2

☐ Answer SCKQ (40 Questions)

☐ Questions

Day 3

☐ Adapted Version of the Children's Intervention Rating Profile Intervention (7 Question Rating)

☐ Training on Device Features

☐ Training on VOISS and PEERS Features

Day 4

☐ Student Trains Teacher to Show Knowledge

☐ Training on VOISS App and PEERS Website

Day 5

☐ Scenario 3 (Uses Appropriate Voice Levels>Starting a conversation)

☐ Break

☐ Scenario 4 (Uses Appropriate Voice Levels>Conversation at lunch table)

Day 6

☐ Scenario 21 (Provides a main idea…>Balloon delivery)

☐ Break

☐ Scenario 22 (Problem solving a broken device)

Day 7

☐ Scenario 15 (Greets and responds to greetings>Talking with adults)

☐ Break

☐ Scenario 16 (Greets and responds to greetings>Ending a conversation)

Day 8

- ☐ Scenario 5 (Uses Appropriate Voice Levels>Turn in work)
- ☐ Break
- ☐ Scenario 6 (Uses Appropriate Voice Levels>Asking teacher A for help)

Day 9

- ☐ Scenario 9 (Greets and responds to greetings>Greeting others)
- ☐ Break
- ☐ Scenario 10 (Greets and responds to greetings>walking through the hallway…)

Day 10

- ☐ Scenario 7 (Listens without interruption>Collaborative Activity in the classroom)
- ☐ Break
- ☐ Scenario 8 (Listens without interruption>Shooting baskets in gym)

Day 11

- ☐ Scenario 19 (Asks a question about a topic>Library project)
- ☐ Break
- ☐ Scenario 20 (…>Being a good digital citizen)

Day 12

- ☐ Scenario 14 (Greets and responds to greetings>Teacher calls on student in the classroom)
- ☐ Break
- ☐ Scenario 13 (Greets and responds to greetings>Greetings and conversation hallway)

Day 13

- ☐ Scenario 11 (Greets and responds to greetings>Conversations with peers' classroom)
- ☐ Break
- ☐ Scenario 12 (Greets and responds to greetings>Changing topics in conversation)

Day 14

- ☐ Scenario 17 (Asks a question about a topic>Interacting with cafeteria personnel…)
- ☐ Break
- ☐ Scenario 18 (Asks a question about a topic>Working on homework in library)

Day 15

- ☐ SCKQ (40 Questions)
- ☐ Adapted Version of the Children's Intervention Rating Profile Intervention Appropriateness Measure (IAM) Feasibility of Intervention Measure (FIM) (15 Questions Rating

1 Week Later (Day 22)

- ☐ CELF-5 Pragmatic Profile (50 Question Rating)

Appendix H: Procedural Checklists for Session

VOISS Procedural Checklist

Example When Educator Had 60 Minute Classes with Student

Student Procedure

Day 1 ***52-60 minutes***

☐ SCKQ (40 Questions) *15-25 minutes*

☐ Adapted Version of the Children's Intervention Rating Profile Intervention (7 Question Rating) *7 minutes*

☐ Student Procedure Checklist Training on Use *20 minutes*

Day 2 ***45 minutes***

☐ CELF-5 Pragmatic Profile (50 Question Rating) *15-25 minutes*

☐ Training on Device Features VOISS Scenario 25 (Providing key details) *10 minutes*

☐ Training on PEERS Website Features 37 (Providing key details) *10 minutes*

Day 3 ***54 minutes***

☐ Training on VOISS *20 minutes*

☐ Questions *7 minutes*

☐ Training on PEERS *20 minutes*

☐ Questions *7 minutes*

Day 4 ***54 minutes***

☐ Student and teacher show what learned and train each other while researcher comments on implementation fidelity on VOISS *20 minutes*

☐ Questions *7 minutes*

☐ Student and teacher show what learned and train each other while researcher comments on implementation fidelity on PEERS *20 minutes*

☐ Questions *7 minutes*

Day 5 ***40 minutes***

☐ Additional Questions or Practice *15 minutes*

☐ Session 1: Randomly Assigned 2 Scenarios *10 minutes*

☐ *Break 5 minutes*

☐ Session 2: Randomly Assigned 2 Scenarios *10 minutes*

Day 6 ***40 minutes***

☐ Session 3: Randomly Assigned 2 Scenarios *10 minutes*

☐ *Break 5 minutes*

☐ Session 4: Randomly Assigned 2 Scenarios *10 minutes*

☐ *Break 5 minutes*

☐ Session 5: Randomly Assigned 2 Scenarios *10 minutes*

Day 7 ***40 minutes***

☐ Session 6: Randomly Assigned 2 Scenarios *10 minutes*

☐ *Break 5 minutes*

☐ Session 7: Randomly Assigned 2 Scenarios *10 minutes*

☐ *Break 5 minutes*

☐ Session 8: Randomly Assigned 2 Scenarios *10 minutes*

Day 8 ***25 minutes VOISS 30 minutes other school tasks not related to pragmatics.***

☐ Session 9: Randomly Assigned 2 Scenarios *10 minutes*

☐ *Break 5 minutes*

☐ Session 10: Randomly Assigned 2 Scenarios *10 minutes*

☐ Student Moves on to Questions for Class as PEERS Group requires a bit more time to complete than VOISS Group same skills 30 *minutes*

Day 9 ***30 minutes***

☐ SCKQ (40 Questions) *15 minutes*

☐ Adapted Version of the Children's Intervention Rating Profile Intervention Appropriateness Measure (IAM) Feasibility of Intervention Measure (FIM) (15 Question Rating) *15 minutes*

1 Week Later (Day 16)

☐ CELF-5 Pragmatic Profile (50 Question Rating) *15 minutes*

☐ Time for Student Questions *15 minutes*

Educator Procedure (time varies depending on the number of student participants)

Day 1 ***depends on the number of students.***

☐ CELF-5 Pragmatic Profile (50 Question Rating) *depends on number of students*

☐ Run Through Tasks *12 minutes*

☐ Training on Device Features (iPad or Chromebook) *7 minutes*

☐ SCKQ (40 Questions) *15-25 minutes*

☐ Student Procedure Checklist Training on Use *20 minutes*

Day 2 ***45 minutes***

☐ CELF-5 Pragmatic Profile (50 Question Rating) *15-25 minutes*

☐ Training on Device Features VOISS Scenario 25 (Providing key details) *10 minutes*

☐ Training on PEERS Website Features 37 (Providing key details) *10 minutes*

Day 3 ***54 minutes***

☐ Training on VOISS *20 minutes*

☐ Questions *7 minutes*

☐ Training on PEERS *20 minutes*

☐ Questions *7 minutes*

Day 4 ***54 minutes***

☐ Student and teacher show what learned and train each other while researcher comments on implementation fidelity on VOISS *20 minutes*

☐ Questions *7 minutes*

☐ Student and teacher show what learned and train each other while researcher comments on implementation fidelity on PEERS *20 minutes*

☐ Questions *7 minutes*

Day 5 ***27-55 minutes depending on number of students and aides in the room.***

☐ Complete Tasks on Implementation Checklist and Mark as Complete 5-*10 minutes*

☐ Ensure Student Gets on Correct Intervention # Listed on Educator Checklist and Mark Off on Your Checklist Student Name *1 minute first session, 1 minute second session*

☐ Work with PEERS Group Using Curriculum Guide on Video Modeling Imitations with Prompting as Needed *5-10 minute after watch videos for that session*

Day 6 *27-55 minutes depending on number of students and aides in room.*

☐ Complete Tasks on Implementation Checklist and Mark as Complete 5-*10 minutes*

☐ Ensure Student Gets on Correct Intervention # Listed on Educator Checklist and Mark Off on Your Checklist Student Name *1 minute first session, 1 minute second session*

☐ Work with PEERS Group Using Curriculum Guide on Video Modeling Imitations with Prompting as Needed *5-10 minute after watch videos for that session*

Day 7 *27-55 minutes depending on number of students and aides in room.*

☐ Complete Tasks on Implementation Checklist and Mark as Complete 5-*10 minutes*

☐ Ensure Student Gets on Correct Intervention # Listed on Educator Checklist and Mark Off on Your Checklist Student Name *1 minute first session, 1 minute second session*

☐ Work with PEERS Group Using Curriculum Guide on Video Modeling Imitations with Prompting as Needed *5-10 minute after watch videos for that session*

Day 8 *depends on the number of students.*

☐ Complete Tasks on Implementation Checklist and Mark as Complete 5-*10 minutes*

☐ Ensure Student Gets on Correct Intervention # Listed on Educator Checklist and Mark Off on Your Checklist Student Name *1 minute first session, 1 minute second session*

☐ Student Moves on to Questions for Class as PEERS Group requires a bit more time to complete than VOISS Group same skills so may need to help them transition to this 10 *minute.*

☐ Work with PEERS Group Using Curriculum Guide on Video Modeling Imitations with Prompting as Needed *5-10 minute after watch videos for that session*

Day 9 *30 minutes*

☐ SCKQ (40 Questions) *15 minutes*

☐ Adapted Version of the Children's Intervention Rating Profile Intervention Appropriateness Measure (IAM) Feasibility of Intervention Measure (FIM) (15

Question Rating) *15 minutes*

1 Week Later (Day 16) *depends on the number of students.*

☐ CELF-5 Pragmatic Profile (50 Question Rating) *the number of minutes it takes to complete the CELF for all students in both groups in the same two-day time span*

☐ Time for Student Questions *15 minutes*

PEERS Procedural Checklist

Example When Educator Had 60 Minute Classes with Student

Student Procedure

Day 1 *52-60 minutes*

☐ SCKQ (40 Questions) *15-25 minutes*

☐ Adapted Version of the Children's Intervention Rating Profile Intervention (7 Question Rating) *7 minutes*

☐ Student Procedure Checklist Training on Use *20 minutes*

Day 2 *45 minutes*

☐ CELF-5 Pragmatic Profile (50 Question Rating) *15-25 minutes*

☐ Training on Device Features (iPad or Chromebook) *10 minutes*

☐ Training on PEERS Website Features (iPad or Chromebook) *10 minutes*

Day 3 *54 minutes*

☐ Training on VOISS *20 minutes*

☐ Questions *7 minutes*

☐ Training on PEERS *20 minutes*

☐ Questions *7 minutes*

Day 4 *54 minutes*

☐ Student and teacher show what learned and train each other while researcher comments on implementation fidelity on VOISS *20 minutes*

☐ Questions *7 minutes*

☐ Student and teacher show what learned and train each other while researcher comments on implementation fidelity on PEERS *20 minutes*

☐ Questions *7 minutes*

Day 5 ***50 minutes***

☐ Additional Questions or Practice *15 minutes*

☐ Session 1: Randomly Assigned Videos *5 minutes*

☐ Planning out materials needed for own video modeling 15 *minutes*

☐ Session 2: Randomly Assigned Videos *5 minutes*

☐ Work with PEERS Group Using Curriculum Guide on Video Modeling Imitations with Prompting as Needed *5-10 minute after watch videos for that session*

Day 6 ***50 minutes***

☐ Session 3: Randomly Assigned Videos *5 minutes*

☐ Planning device to record on student has used in the past successfully *10 minutes*

☐ Session 4: Randomly Assigned Videos *10 minutes*

☐ Planning props and setting *10 minutes*

☐ Session 5: Randomly Assigned Videos *5 minutes*

☐ Work with PEERS Group Using Curriculum Guide on Video Modeling Imitations with Prompting as Needed *5-10 minute after watch videos for that session*

Day 7 ***50 minutes***

☐ Session 6: Randomly Assigned Videos *5 minutes*

☐ Planning script for videos *10 minutes*

☐ Session 7: Randomly Assigned Videos *10 minutes*

☐ Planning script for videos *10 minutes*

☐ Session 8: Randomly Assigned Videos *5 minutes*

☐ Work with PEERS Group Using Curriculum Guide on Video Modeling Imitations with Prompting as Needed *5-10 minute after watch videos for that session*

Day 8 ***55 minutes***

☐ Recording Videos *30 minutes*

☐ Watching and Discussing the Student Recorded Videos *15 minutes*

☐ Discussing their question answers from PEERS videos *10 minutes*

Day 9 ***50 minutes***

☐ SCKQ (40 Questions) *15 minutes*

☐ Adapted Version of the Children's Intervention Rating Profile Intervention Appropriateness Measure (IAM) Feasibility of Intervention Measure (FIM) (15 Question Rating) *15 minutes*

☐ Discussing their question answers from VOISS and PEERS *20 minutes*

Day 16 (1 week later) 30 ***minutes***

☐ CELF-5 Pragmatic Profile (50 Question Rating) *15 minutes*

☐ Time for Student Questions *15 minutes*

Educator Procedure (time varies depending on the number of student participants)

Day 1 ***depends on the number of students.***

☐ Run Through Tasks *12 minutes*

☐ Training on Device Features (iPad or Chromebook) *7 minutes*

☐ Determine the learner's pre-knowledge and establish a baseline (e.g., 40 Questions & Observation) Skill Based Test (40 Questions) *15-25 minutes*

☐ Student Procedure Checklist Training on Use *20 minutes*

Day 2 ***45 minutes***

☐ Collect baseline data to identify the steps of the task that the learner can complete without assistance. CELF-5 Pragmatic Profile (50 Question Rating) *15-25 minutes*

☐ Training on Device Features VOISS Scenario 25 (Providing key details) *10 minutes*

☐ Training on PEERS Website Features 37 (Providing key details) *10 minutes*

Day 3 ***54 minutes***

☐ Training on VOISS *20 minutes*

☐ Questions *7 minutes*

☐ Training on PEERS *20 minutes*

☐ Questions *7 minutes*

Day 4 ***54 minutes***

☐ Student and teacher show what learned and train each other while researcher comments on implementation fidelity on VOISS *20 minutes*

☐ Questions *7 minutes*

☐ Student and teacher show what learned and train each other while researcher comments on implementation fidelity on PEERS *20 minutes*

☐ Questions *7 minutes*

Day 5 ***17-55 minutes depending on number of students and aides in room.***

☐ Complete Tasks on Implementation Checklist and Mark as Complete 5-*10 minutes*

☐ Ensure Student Gets on Correct Intervention # Listed on Educator Checklist and Mark Off on Your Checklist Student Name *1 minute first session, 1 minute second session*

☐ Work with PEERS Group Using Curriculum Guide on Video Modeling Imitations with Prompting as Needed *5-10 minute after watch videos for that session*

Day 6 ***17-55 minutes depending on number of students and aides in room.***

☐ Complete Tasks on Implementation Checklist and Mark as Complete 5-*10 minutes*

☐ Ensure Student Gets on Correct Intervention # Listed on Educator Checklist and Mark Off on Your Checklist Student Name *1 minute first session, 1 minute second session*

☐ Work with PEERS Group Using Curriculum Guide on Video Modeling Imitations with Prompting as Needed *5-10 minute after watch videos for that session*

Day 7 ***17-55 minutes depending on number of students and aides in room.***

☐ Complete Tasks on Implementation Checklist and Mark as Complete 5-*10 minutes*

☐ Ensure Student Gets on Correct Intervention # Listed on Educator Checklist and Mark Off on Your Checklist Student Name *1 minute first session, 1 minute second session*

Day 8 ***depends on the number of students.***

☐ Complete Tasks on Implementation Checklist and Mark as Complete 5-*10 minutes*

☐ Ensure Student Gets on Correct Intervention # Listed on Educator Checklist and Mark Off on Your Checklist Student Name *1 minute first session, 1 minute second session*

☐ Work with PEERS Group Using Curriculum Guide on Video Modeling Imitations with Prompting as Needed *5-10 minute after watch videos for that session*

☐ Student Moves on to Questions for Class as PEERS Group requires a bit more time to complete than VOISS Group same skills so may need to help them transition to this 10 *minute.*

Day 9 ***50 minutes***

☐ SCKQ (40 Questions) *15 minutes*

☐ Adapted Version of the Children's Intervention Rating Profile Intervention Appropriateness Measure (IAM) Feasibility of Intervention Measure (FIM) (15 Question Rating) *15 minutes*

☐ Discussing their question answers from VOISS and PEERS *20 minutes*

1 Week Later (Day 16) ***depends on the number of students.***

☐ CELF-5 Pragmatic Profile (50 Question Rating) *the number of minutes it takes to complete the CELF for all students in both groups in the same two-day time span*

☐ Time for Student Questions *15 minutes*

Appendix I: Fidelity Checklists

Training Phase Fidelity Checklist

Observer_____ **Date**_____

Circle One Used in Training

Student Device: Chromebook iPad **Session Trained On:** PEERS VOISS BOTH

1. Were the students seated with their assigned device?	☐ Yes ☐ No
2. Did the researcher instruct the participant on powering off and on the device?	☐ Yes ☐ No
3. Did the researcher instruct the participants on how to navigate through the VOISS user interface or the PEERS website and curriculum?	☐ Yes ☐ No
4. Did the researcher explain what the three main buttons accomplish in VOISS or the progression of videos in PEERS?	☐ Yes ☐ No
5. Did the researcher model the sample scenario in VOISS or video and imitation in PEERS?	☐ Yes ☐ No
6. Did the researcher model how to select answers to the delayed questions in VOISS or the curriculum questions in PEERS?	☐ Yes ☐ No
7. Did the researcher instruct the participant to complete the sample scenario in VOISS or videos in PEERS independently?	☐ Yes ☐ No
8. Was the student able to complete the sample scenario independently in VOISS or the video and imitation in PEERS?	☐ Yes ☐ No
9. Was the student able to accurately teach the educator how to complete the sample scenario in VOISS or the video and imitation in PEERS?	☐ Yes ☐ No
10. Was the educator accurately able to practice assisting with limitations in PEERS group and checking checklist and break time for VOISS group?	☐ Yes ☐ No

([agreements/total number possible] × 100; Ledford et al., 2018).

Total Fidelity This Session: **Number of yes**= _____/10 x100= _____**% agreement**

Intervention Phase Fidelity Checklists

During training, this implementation guide as well as checklist for both groups are provided to the educator. The educator is trained on which tasks are not within this study ON THE Implementation Guide during training and they cross of and ignore those sections during the study as that has been completed. The guide includes all sections to ensure after the study fidelity is continued to all aspects of the intervention. The entire implementation guide is provided because in a prior single case design study educators found having the entire EBP process was helpful as a reminder of what was completed prior to intervention phase start and what will continue after intervention phase finishes within their classrooms. All steps are needed to accurately make decisions regarding intervention's social validity.

The person performing the fidelity check only used the section labeled for that specific time of the study- assessment, training, or intervention. They listed at the top which one they were recording by marking it in the correct column: PTP- Pretest Phase, T- Training Phase. I-Intervention Phase, AIA-After Intervention Assessment, and O-Other which had to be explained in the boxes below. These are the only sections used all other sections are not used in the fidelity checklist although they are all checked with the teacher prior to study start to ensure the steps listed have occurred prior to Day 1 and that these steps will continue so that the skills can be generalized further after study completion. Support was provided (though not documented for study purposes) after the study was completed and all data collected and analyzed for 3 additional weeks to assist with continued questions while implementing all remaining pieces of the implementation guide and to assist with explaining data and how to use data to continue to make informed instructional decisions.

Implementation Checklist for PEERS Video Modeling

Instructions*:* Record a 2 (implemented), 1 (partially implemented), 0 (did not implement), or NA (not applicable) next to each step observed to indicate to what extent the step was implemented/addressed during your observation. Use the last page of the checklist to record comments and record if the teacher or another student aided in any way that was not listed on this list.

Educator (s) Observed: _____ Observer: _____

	Observation	PTP	T	I	AIA	O
	Date					
	Observer's Initials					
Planning & Assessing Phase (Steps 1-5)						

Identified prior to study start not used in fidelity check move on to stage of study Step 1: Targeting a Behavior for Teaching	2 = implemented; 1 = partially implemented; 0 = did not implement; NA = not applicable				
1. Identify a target behavior that is important to be taught.					
2. Define and describe the target behavior so that it is observable and measurable.					
Completed prior to study not used in fidelity check move into stage of study Step 2: Preparation	2 = implemented; 1 = partially implemented; 0 = did not implement; NA = not applicable				
1. Acquire a video recording device (e.g., handheld video camera, digital camera, computer technology).					
2. Identify how the video will be played back (e.g., DVD, VCR, computer).					
3. Become familiar with the equipment and comfortable using it.					
4. Write a script or task analysis detailing exactly what needs to be said and/or done on the video.					

Assessment Phase of Study First 1-4 Days and the 1-4 Days After Intervention Phase is Complete: Step 3. Collecting Data	2 = implemented; 1 = partially implemented; 0 = did not implement; NA = not applicable				
1. Determine the learner's knowledge (e.g., 40 Questions & Observation).					
2. Collect data to identify the skills or steps of a task that the learner can complete without assistance. (e.g., CELF-5 & Observation)					
Training Phase of Study First 2-6 Days: Step 4. Making the Video or Identifying Key Elements Needed within PEERS Videos	2 = implemented; 1 = partially implemented; 0 = did not implement; NA = not applicable				

1. Identify the kind of video appropriate for the student created learner video (e.g., video modeling, self-modeling, point-of-view modeling, video prompting), based on the learner's skill level and preferences, as well as the target behavior.					
2. Prepare the model (with basic video modeling) or the learner (with self-modeling) for the video (during PEERS training time).					
3. Record or find a section in the intervention day's video that is satisfactory in quality and accurately reflects the steps of the skill/task analysis identified in baseline knowledge and CELF ratings.					
4. Ensure videos cover your skills for that student or edit the video and remove any errors and prompts.					
5. Ensure video questions are appropriate if using PEERS videos or complete voice-overs if student created videos, if necessary.					
Training Phase of Study First 2-6 Days: Step 5. Arranging the Environment	2 = implemented; 1 = partially implemented; 0 = did not implement; NA = not applicable				
1. Identify the environment where the 1 student video will be filmed and watched. Consider also if you could allow access to this video and that intervention day's PEERS video during that school day and if so when and how could it be used within natural routines. (Be sure to ensure it is used for the same amount of time that the VOISS matched peer re-plays scenario).					
2. Ensure that the materials gathered for the 1 video creation of the 1 skill chosen for the video created match those on the video.					

Intervention Phase (Steps 6-8)					
Intervention Phase of Study Days Starting Days 5-12 Continuing Through Completion of Checklist: Step 6. Showing the Video	2 = implemented; 1 = partially implemented; 0 = did not implement; NA = not applicable				
1. Allow the learner to watch the video(s) and provide prompts necessary to gain and/or keep attention while watching the					

PEERS video. (Similar to prompting given in VOISS just to assist with navigation and continued engagement nothing more.) A. Check to see, are the students seated with their assigned device? B. Are the students on the correct videos? C. If the educator aids in any way, is it recorded for the researcher? D. Did the student complete the items for today's session on the checklist? E. Was the student directed or reminded to stop after completing the videos to complete imitation and questions? F. Were the students reminded of when and where the videos are after their imitation and question time? G. Did the educator follow the steps and questions for the correct video in the PEERS Curriculum?					
2. Allow the learner to imitate and if successful, move on. If not successful, watch the video an appropriate number of times for success and complete the after-video questions (not less than 1 time and not more than 5 times).					
3. NOT IN THIS STUDY BUT FOR FUTURE USE: For video prompting, allow for stopping the video after each step of the task analysis so the target behavior can be performed by the learner. (PEERS videos have already allowed for stopping the video after each step of the task analysis so the target behavior can be performed by the learner, so this is an N/A on scoring rubric.)					
Intervention Phase of Study Days Starting Days 5-12 Continuing Through Completion of Checklist: Step 6. Showing the Video *Progress Monitoring (Steps 7-8)*					
Intervention Phase of Study Days Starting Days 5-12 Continuing Through Completion of Checklist: Step 7. Monitoring Progress	2 = implemented; 1 = partially implemented; 0 = did not implement; NA = not applicable				
1. Collect data on the performance of the target behavior in the 1 video students create based on kind of video needed, noting the specific steps of the task learners were able to do independently.					

2. Note how often and when the learner watches the video during that school day when it was provided using the target behavior.					
3. If after collecting data on three to five occasions, learners are not making progress, begin troubleshooting (see Step 8). If learners are making progress, instruction is continued until intervention end time.					

Intervention Phase of Study Days Starting Days 5-12 Continuing Through Completion of Checklist: Step 8. Intervention Phase of Study Days Starting Days 5-12 Continuing Through Completion of Checklist: Troubleshooting if the Learner is Not Making Progress	2 = implemented; 1 = partially implemented; 0 = did not implement; NA = not applicable				
1. Analyze the learner's progress by monitoring data to identify changes needed for the video modeling procedures.					
2. Adjust intervention tactics to help the learner make progress by asking:					
a. Is the learner watching the video enough times per week?					
b. Is the learner watching the video, but not attending to the most relevant parts?					
c. Is the learner getting enough prompting from adults and/or peers to use the target behavior?					
d. Is the learner receiving the appropriate amount and type of reinforcement for performing, or attempting to perform, the target behavior(s)?					
e. Is the video too complex? And					
f. Does another task analysis need to be completed to make sure that the PEERS video includes the correct steps and the 1 student created video is accurate?					

3. Implement the adjustments to the video modeling procedures.					

Generalization and Maintenance Phase (Steps 9 & 10)					
Intervention Phase of Study Days When Student Records Their Video: Step 9. Fading the Prompting and the Video	2 = implemented; 1 = partially implemented; 0 = did not implement; NA = not applicable				
1. Teachers/practitioners fade the use of prompting to encourage independent use and to promote maintenance.					
2. Teachers/practitioners use one or more of the following procedures when fading videos:					
a. delaying start/premature stop,					
b. error correction and					
c. scene fading.					
3. Teachers/practitioners allow the learner to continue watching the video to some extent if it is appropriate, enjoyable for the learner, and supports the behavior.					

Throughout Days of Intervention When See Student and for 1 Week Post Intervention Step 10. Generalizing Learning	2 = implemented; 1 = partially implemented; 0 = did not implement; NA = not applicable				
1. Teachers/practitioners monitor and encourage independent use with a variety of people, in different environments, and at different times.					
2. Teachers or practitioners or students, or a combination of these complete follow-up assessments of the newly learned skill to ensure maintenance (e.g., Observation, 40 Questions, CELF-5).					

Date	Observer	Comments

Implementation Checklist for VOISS Scenarios Social Narratives

Instructions*:* Record a 2 (implemented), 1 (partially implemented), 0 (did not implement), or NA (not applicable) next to each step observed to indicate to what extent the step was implemented/addressed during your observation. Use the last page of the checklist to record comments and record if the teacher or another student aided in any way that was not listed on this list.

Educator (s) Observed: _____ Observer: _____

	Observation	PTP	T	I	AIA	O
	Date					
	Observer's Initials					
Planning & Assessing Phase (Steps 1 & 2)						
Assessment Phase of Study First 1-4 Days and the 1-4 Days After Intervention Phase is Complete: Step 1. Assessing	2 = implemented; 1 = partially implemented; 0 = did not implement; NA = not applicable					
1. Uses multiple means (e.g., CELF-5, observations, student answers to knowledge questions) to identify student needs to be targeted within the program.						
2. Complete either the VOISS Inventory or CELF ratings with observational data to assist in determining needed scenarios or the next place the student should be within VOISS.						
Implemented #1 and #2 of Step 2 prior to study start move to #3 of Step 2 to start fidelity check for this phase of study. **Training phase of study #3 and #4** **Step 2. Preparation**	2 = implemented; 1 = partially implemented; 0 = did not implement; NA = not applicable					
1. Acquire a device for presenting VOISS (e.g., Chromebook, iPad, HMD). Headphones should also be acquired if other students will also be in the room working or learning.						
2. Download VOISS Part 1 and Part 2 from the App Store. If only domains 1-5 are needed only Part 1 needs to be downloaded. If only						

domains 6-10 are needed only Part 2 needs to be downloaded. Otherwise, both Part 1 and 2 should be downloaded.					
3. Allow time for the student to become familiar with the equipment (e.g., Chromebook, iPad, HMD) and practice with the equipment until comfortable using it.					
4. Allow time for the student to become familiar with the VOISS features (e.g., arrow clicks, using the toolbox, click to hear options, click to raise hand, click to speak, movement options, menu options, how to go back to selection page) and practice with VOISS until comfortable navigating the app environment.					

Intervention Phase (Step 3)					
Intervention Phase of Study Days Starting Days 5-12 Continuing Through Completion of Checklist: Step 3. Playing VOISS	2 = implemented; 1 = partially implemented; 0 = did not implement; NA = not applicable				
1. Check that the student is directed to the correct first scenario or instruct the student on which scenario to complete. The instructor can use VOISS Progress Monitoring System to keep track or print out a sheet of scenarios for students to cross out as they complete each one. A. Check to see, are the students seated with their assigned device? B. Are the students in the correct scenarios? C. If the educator aids in any way is it recorded for the researcher? D. Did the student complete the items for today's session on the checklist? E. Was the student directed or reminded to stop after completing the session for their break? F. Were the students reminded of when and where the next session is after their break?					

2. Check periodically that the student is continuing to complete scenarios and prompt if the student stops by reminding the student of the next scenario to complete.					
3. Answer student app navigation questions as they arise within the program (in a manner similar to questions asked in PEERS Video Navigation but no prompting or instruction beyond that). If any prompting is given it is recorded by the teacher for the researcher with an explanation as to need.					
Progress Monitoring (Step 4 & 5)					
(STEP 4 NOT Implemented during this study because the study is not using other aspects of Intervention other than those listed (videos and scenarios): Step 4. Monitoring Progress	2 = implemented; 1 = partially implemented; 0 = did not implement; NA = not applicable				
1. Analyze either the VOISS Progress Monitoring System data or collect data (i.e., CELF-5, Questions, Observation) on the performance of the targeted skills.					
2. If learners are not making progress, begin troubleshooting (see Step 5), assign additional scenarios, or change assigned scenarios based on data from 1 above.					
3. Observe behaviors associated with targeted skills by noting:					
a. Is there demonstrated mastery of the targeted skill outside of the VOISS app?					
b. How often the targeted behavior is exhibited correctly and independently?					
c. When the targeted behavior is exhibited and whether the learner is able to use the skill at the necessary times of the day?					
d. Where the targeted behavior is exhibited and whether the learner is able to demonstrate the targeted skills in authentic settings?					

e. With whom the targeted behavior is exhibited and whether the learner is able to use the skill with different people?					
4. If after collecting data on three to five occasions within VOISS, learners are not making progress, begin troubleshooting (see Step 5). If learners are making progress, instruction is continued until they have reached maximum proficiency.					

(STEP 5 NOT Implemented during this study because the study is not using other aspects of Intervention other than those listed (videos and scenarios): Step 5. Troubleshooting if the Learner is Not Making Progress Within VOISS	2 = implemented; 1 = partially implemented; 0 = did not implement; NA = not applicable				
1. Analyze the learner's progress by monitoring data to identify changes needed for VOISS procedures or additional tools that may help within VOISS Advisor.					
2. If VOISS data is not showing growth, adjust intervention tactics to help the learner make progress within VOISS by asking:					
a. Is the learner completing VOISS enough times per week?					
b. Is the learner on VOISS but not attending to the relevant information, playing in the environment, or clicking to just get through the task?					
c. Is the learner getting enough prompting from adults and/or peers while on VOISS?					
d. Is the learner receiving the appropriate amount and type of reinforcement to engage with the VOISS app?					
e. Is VOISS instruction too complex?					
3. If VOISS data is showing growth but there is no change in the actual targeted behavior outside of the VOISS environment, adjust intervention tactics to help the learner make progress within the necessary settings by asking:					

a. Has there been any instruction on implementing targeted skill outside of the app (e.g., have VOISS Advisor strategies, lessons, and tactics been utilized)?					
b. Is the learner receiving the appropriate amount and type of instruction on when and where to perform, or attempt to perform, the target behavior(s)?					
c. Is the learner getting enough prompting from adults and/or peers to use the target behavior?					
d. Is the learner receiving the appropriate amount and type of reinforcement for performing, or attempting to perform, the target behavior(s)?					
4. Implement the adjustments to the procedures based on the answers to the questions above (utilize Advisor if unsure how to do so).					

Generalization and Maintenance Phase (Steps 6 & 7)					
Intervention Phase of Study Days Through Week After Implementation End Only #3 Not Other Steps: Step 6. Fading Prompting or Rewarding	2 = implemented; 1 = partially implemented; 0 = did not implement; NA = not applicable				
1. Once targeted behaviors are displayed, teachers/practitioners fade the use of prompting to encourage independent use and to promote maintenance.					
2. Teachers/practitioners use one or more of the following procedures when fading:					
a. prompting use					
b. error correction and					
c. guided feedback.					

3. Teachers/practitioners allow the learner to continue playing VOISS scenarios from study if it is appropriate, enjoyable for the learner, and supports the practice of the behavior but only those scenarios (similar to PEERS videos being allowed to be rewatched as often as needed throughout intervention timeline as long as matches time matched PEER spends.)					

Assessment Phase of Study After Intervention Phase Has Ended: Step 7. Generalizing Learning	2 = implemented; 1 = partially implemented; 0 = did not implement; NA = not applicable

1. Teachers/practitioners monitor and encourage independent use with a variety of people, in different environments, and at different times.					
2. Teachers or practitioners or students or parents, or a combination of these complete follow-up assessments of the newly learned skill to ensure maintenance (e.g., Observation, 40 Questions, CELF-5).					

Date	Observer Initials	Comments

Both Checklists Have Been Adapted with Permission from Paul LaCava's Original Checklist Found In

LaCava, P. (2008). *Video modeling: An online training module.* (Kansas City: University of Kansas, Special Education Department). In Ohio Center for Autism and Low Incidence (OCALI), A*utism Internet Modules,* www.autisminternetmodules.org. Columbus, OH: OCALI.

Assessment Phase (Pre and Post) Fidelity Checklist

Observer_____ **Date**_____

Circle One Used in Training

Student Device: Chromebook iPad **Session Trained On:** PEERS VOISS BOTH

1. Were the students seated with their assigned device?	☐ Yes ☐ No
2. Did the researcher instruct the participants on powering on the device?	☐ Yes ☐ No
3. Did the researcher instruct the participants on locating the assessment link?	☐ Yes ☐ No
4. Did the researcher instruct the participants on navigating to the assessment marked on their checklist for that day and session?	☐ Yes ☐ No
5. Did the researcher model how to select answers to the questions by clicking using the practice question?	☐ Yes ☐ No
6. Did the researcher read each question and all response options aloud to the participants prior to allowing the participant to move on to the next question?	☐ Yes ☐ No
7. Did the researcher redirect any questions asked about the assessment questions or any question asked not related to navigation on the assessment to a different time?	☐ Yes ☐ No
8. Did the researcher use a neutral voice not varying tone or inflection so as not to suggest a specific answer choice?	☐ Yes ☐ No
9. Did the researcher instruct the participants to complete the question independently if noticing any attempts for assistance? (If no attempts for assistance by participants were made mark yes here).	☐ Yes ☐ No
10. Were the participants able to complete the assessment clicking of their answers independently with accuracy and close out of the assessment?	☐ Yes ☐ No

([agreements / total number possible] × 100; Ledford et al., 2018).

Total Fidelity This Session: **Number of yes**= _____/10 x100= _____**% agreement**

Appendix J: Process and Criteria for Validity of Student Pair Matches

After completing the initial 40 question knowledge assessment and CELF-5 Pragmatic Profile rating scale, participants were randomized in pairs matched on the following four criteria with priority taken to each of the proceeding levels. Matches were made separately by two blind coders. A third blind coder reviewed any discrepancies, and all three coders had a discussion on any remaining matches until 100% agreement was reached. The criteria the coders used for matching as well as the reasoning for each criteria order follows:

1. The teacher typically providing their communication intervention is the same for each student in the pair. If yes, continue to criteria two.

   This was a priority to control, as much as possible, for several reasons. First, to try to control for outside instruction a student could have been receiving that may influence communication abilities. Second, to ensure students would receive instruction from the same technology device (i.e., Chromebook, iPad) the students were comfortable using in their classrooms. And, finally, to ensure the intervention occurred for the matched pair at the same time of day and in the same room. Once this was a yes, the coder moved on to the next criteria.

2. The teacher ratings of communication skill performance on the CELF-5 Pragmatic Profile have similar (i.e., within 10 points of each other) skills listed as “never performed” (rating of 1) and “knows skill but doesn't perform” (rating of 3). Once yes, continue to the next criteria.

   This was a priority to understand what skills the student readily performs throughout the school day and what skills the student had adequate knowledge of but does not readily perform. The reason for focusing on 1 and 3 responses was to determine if the participant had knowledge of how to perform the communication skill but was not applying this knowledge (score 3) or did not have the necessary knowledge to attempt performing a skill (score 1) because these require different interventions depending on whether there is a skill knowledge deficit or skill performance deficit. The 10-point difference was determined based on past social skill groupings in schools by SLPs. Once this was a yes, the coder moved on to the next criteria.

3. The student ratings of communication skill performance on the CELF-5 Pragmatic Profile have similar (i.e., within 15 points of each other) skills listed as “never performed” (rating of 1) and “knows skill but doesn't perform” (rating of 3). Once yes, continue to the next criteria.

   The teacher CELF-5 Pragmatic Profile ratings were a priority over the student CELF-5 Pragmatic Profile ratings because research reveals that teachers and parents’ ratings of SE skills tend to be more accurate than student self-ratings (Gresham et al., 2010; Mudarra et

al., 2022). Parent ratings were not considered due to prior consistency in the teacher ratings between participant's two primary teachers' pre-intervention and research revealing a high level of agreement between teachers and parents in social skills related to communication and engagement (Mudarra et al., 2022). Teacher ratings and student ratings were the primary means rather than parent ratings due to the large discrepancies between study schools of parent involvement, which had the potential for influencing obtaining results from all participants. Research reveals significant inter-rater Pearson r correlations between teacher–parent social communication skills compared to teacher–student and parent–student ratings (Gresham & Elliott, 1990; Gresham et al., 2018 & 2020; Mudarra, et al., 2022). Student ratings were included with teacher ratings because research reveals these ratings both holds varying though important and valid information (McMahon & Solomon, 2015). Student ratings may also be significantly influenced by the student's gender differences (Elliott & Álvarez-González, 2020; Mudarra, et al., 2022). This research forms the basis for why an extra 5 points difference was allowed in the ratings variance of student's pretest when evaluating these scores for peer match placement than the teacher scores. Once this was a yes, the coder moved on to the final criteria.

4. The student communication total skill knowledge pretest is within 2 SD (16 points) of the other.

   The knowledge levels pre-intervention being close should have been reflected in the CELF-5 Pragmatic Profile ratings above, but we added this assessment as a criterion to account for any inaccurate ratings above and ensure students in the same match did not have significantly different knowledge levels prior to intervention delivery.

After matches were made by the above four criteria, students were randomized by SPSS into groups. SPSS was then used to ensure there was no variance between the paired groups. Groups were then analyzed for statistical variance in the above four areas and in disability and chronological age. Disability and chronological age for each group were considered based on prior research Howard & Gutworth, 2020; Vasquez et al., 2015) revealing these variables may influence intervention acceptability and effectiveness for interventions delivered through VR. Significance did not reach greater than .05 in either group. Groups were then visually compared to try as much as possible to diversify race, gender, and type of educational plan for each group. Below are the SPSS charts for the items analyzed to determine variance between groups.

No Statistical Variance Between Groups: Social Communication Scores Pre-Intervention

Group Statistics for Pretest Student Communication Scores

	N	Mean	Std. Deviation	Std. Error Mean

Teacher CELF-5 Pragmatic Profile Pretest	60	150.53	34.085	4.400
	60	157.68	37.368	4.824
Student CELF-5 Pragmatic Profile Pretest	60	151.25	30.703	3.964
	60	148.22	26.483	3.419
Student SCKQ Pretest	60	21.67	8.846	1.142
	60	19.27	8.549	1.104

Tests of Homogeneity of Variances for Communication

Equal Variance Assumed: EVA Equal Variance Not Assumed: NEA		Levene's Test for Equality of Variances		*t*-test for Equality of Means							
		F	Sig.	T	*df*	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						One-Sided p	Two-Sided p			Lower	Upper
Teacher CELF-5 Pragmatic Profile Pretest	EVA	0.24	0.63	-1.10	118	0.14	0.28	-7.15	6.53	-20.08	5.78
	NEA			-1.10	117.02	0.14	0.28	-7.15	6.53	-20.08	5.78
Student CELF-5 Pragmatic Profile Pretest	EVA	1.52	0.22	0.58	118	0.28	0.56	3.03	5.24	-7.33	13.4
	NEA			0.58	115.51	0.28	0.56	3.03	5.24	-7.34	13.4
SCKQ Pretest	EVA	0.147	0.702	1.51	118	0.07	0.13	2.40	1.59	-0.75	5.55
	NEVA			1.51	117.86	0.07	0.13	2.40	1.59	-0.75	5.55

No Statistical Variance Between Groups: Disability and Age Demographics

Group Statistics for Disability Diagnosis

Student	Group	N	Mean	Std. Deviation	Std. Error Mean
Diagnosis	1	60.000	11.300	4.931	0.637

	2			60.000	10.417		4.934		0.637	

Tests of Homogeneity of Variances for Disability

Diagnosis	Levene's Test for Equality of Variances		t-test for Equality of Means							
Equal Variance Assumed: EVA	*F*	Sig.	*t*	*df*	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
Equal Variance Not Assumed: NEA					One-Sided *p*	Two-Sided *p*			Lower	Upper
EVA	0.039	0.843	0.981	118.000	0.164	0.329	0.883	0.901	-0.900	2.667
NEA			0.981	118.000	0.164	0.329	0.883	0.901	-0.900	2.667

Group Statistics for Age

Student		N	Mean	Std. Deviation	Std. Error Mean
Age	1	60	1.68	0.854	0.110
	2	60	1.98	0.833	0.108

Tests of Homogeneity of Variances for Age

Equal Variance Assumed: EVA		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	*t*	*df*	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval	
Equal Variance Not Assumed: NEA						One-Sided p	Two-Sided p			Lower	Upper
Age	EVA	0.88	0.35	-1.95	118	0.03	0.05	-0.30	0.15	-0.61	0.01
	NEA			-1.95	117.93	0.03	0.05	-0.30	0.15	-0.61	0.01

Appendix K: Validity Crosswalk of Intervention Skill Matches and SCKQ

VOISS Scenario Skills (36 skills at 1 to 5 min a scenario)	**PEERS Video Skills** (46 skills at 15 sec to 2 min a video)	**Validated Questions to Determine Skill Increase** (40 Actual Question Numbers from the 40 SCKQ multiple choice questions)
1. Responding to Teasing 2. Responding to High Emotion Situations	1. Handling teasing (sounding board) 2. Handling teasing (having an attitude) 3. Spread the rumor about yourself (bad example, good example)	10. When you see your friend Amy in the lunchroom, you sit down next to her. She says, "I saw the way you threw the ball today in gym, did you forget to lift weights this Summer? You threw it like my 6-year-old sister." You know you need practice to get better at throwing, and you notice your friend's tone of voice doesn't mean just teasing, how could you respond? 15. Your iPad is broken, and you have to advocate for yourself. What is the best response option?
3. Accepting/Rejecting Invitations, Requests, and Offers for Help (responding when others do so and doing so yourself)	4. Accepting rejection (bad example and good example) 5. Turning someone down (bad and good example)	9. You are standing on the sideline in the gym and would like to have a turn in the game but when you ask your friend who is playing if you could join in your friend who is holding the ball says, "No, the teams are full and we are practicing for a scrimmage tonight so we need to play with the right number as we would in a game." How do you respond? 18. You aren't feeling well so you decide to go see the school nurse. Your stomach hurts. She asks, "How can I help you?" What is the best response?

4. Displaying manners- Compliments & Offers to Help	6. Giving compliments good and bad example)	11. You go to the office where the secretary is sitting at the front desk with flowers. She says to you, "I need your help. It's Amy Rodriguez' birthday and her parents sent her flowers. You have lunch with Amy would you mind dropping these off to her before you get in line for lunch?" The bell rings, how should you respond? 25. You find classroom 180 and see a line forming outside the door. Students are talking to one another. What is the best response option?
5. Uses Appropriate Voice Level and Tone	7. Use good volume control (good and bad examples)	14. Wallace, another student bumps into you in the hallway and causes you to drop your iPad. It cracks on the ground. How should you react? 27. You are splitting up responsibilities for a group activity in class. The teacher says the groups are getting too loud. How do you ask to do the slide show portion?
6. Starts a Conversation	8. Starting an individual conversation (good and bad example)	5. You want to open a conversation with a topic that is relevant to both you and the people you're talking to. Which of these options is the best way to start a conversation in a classroom? 6. You want to start talking to someone you don't know but saw at the game this weekend. They are standing near you, what would be something you could say to start a conversation?
7. Conversation Skills of not arguing 8. Don't tease. 9. Don't hog the conversation	9. Don't be a conversation hog 10. Don't tease 11. Don't be argumentative	39. You are enjoying a conversation about your favorite foods. A friend changes the topic to a class you don't take. What is the best response option?

		13. You go to sit with Amy. She has her lunch and flowers out. She says to you, “Thank you so much for the flowers! It was so, so kind of you to buy them for me! I love them!” How should you respond?
10. Modifying Language to Topic 11. Trading Information in Unstructured Activity	12. Trading Information (Example 1 and 2)	21. Another student says to you “How are you?” Which is the best response? 22. You are speaking to your teacher and principal about an event coming up that you have volunteered to help with. Your principal says, “Thanks for helping with this. How has recruiting judges been going?” How should you respond?
12. Turning in Work 13. Asking for Change from Others and Help from Others	13. Talking to a mutual friend 14. Don’t get too personal at first 15. Don’t police 16. Don’t brag	17. You are speaking with your friend’s mom while waiting for your friend to come back from the bathroom. She asks you, “What is your favorite class?” How should you respond? 34. Your teacher finishes talking and is now asking you a question, but you weren’t listening and don’t know the answer. What is the best response option?
14. Listens Without Interrupting Leaving Conversation 15. Interrupting Strategies When Entering Group Conversation	17. Entering a group conversation (good and bad example) 18. Exiting when fully accepted (good and bad example)	26. You are working on an assignment in a group. Your group leader says, “I think we should be writing this down in case we need to report back to the class,” then looks at you and says, “Will you record it for us?” You don’t want to write, what is the best way to respond? 32. Another student says, “I’m excited for lunch today. I heard there’s pizza today!" Then asks your friend, "Do you like pizza?” How should you respond?

16. Turn-Taking When Accepted 17. Exiting When and When Not Accepted	19. Exiting when never accepted (good and bad example) 20. Exiting when initially accepted and then excluded (good and bad example)	9. You are standing on the sideline in the gym and would like to have a turn in the game but when you ask your friend who is playing if you could join in your friend who is holding the ball says, "No, the teams are full, and we are practicing for a scrimmage tonight so we need to play with the right number as we would in a game." How do you respond? 30. You are playing basketball, but no one has passed the ball to you yet. What is the best response option so you can take a turn?
18. Body Boundaries in Greetings 19. Gathering attention in greetings	21. Use good body boundaries (good and bad examples) 22. Use good eye contact (good and bad examples)	33. You need to get your books and a student is standing in front of your locker. How should you proceed? 36. Another student is drinking from the water fountain. They have been drinking water for a long time and don't seem to notice you behind them. You would like to get some water before your next class. You know the person who gets in line behind you and that person says hi. What is the best response option?
20. Responds to Greeting 21. Shares Contact Info	23. Exchanging contact information (good and bad example) 24. Responding to greeting	23. Robert walks by you in the hallway and makes eye contact, with a slight head lift in greeting. What is the best response option? 24. You are walking down the hall, looking for classroom #170. Your class begins in 1 minute. As you are walking you make eye contact with your art teacher in room 180. Your teacher smiles and nods a silent greeting or acknowledgement of your presence. What is the best response option?

22. Introduces New Topic 23. Get Togethers	25. Beginning a get-together (good and bad example) 26. Ending a get-together (good and bad example)	28. The other students in your group project are talking about something you don't care about. What is the best way to deal with this? 29. You are getting together at a friend's house. They just gave you a tour of their home and you finished the tour and are outside in the backyard where goal posts are set up. Since the tour is over, your friend stopped talking and the conversation has gone quietly. What is the best response option?
24. Accepts Rejection	27. Accepting rejection (good and bad example)	38. Students are talking about pets together and this is your favorite topic. Dallas walks up and changes the subject to the math test before you get the chance to participate. Dallas says, "That test was awful, wasn't it?" How should you respond? 19. You're talking with friends, but it's time to get to class. One of your friends says, "Well, good chatting with you, guys! See you around." How should you respond?
25. Responds to Introduction or Disagreement	28. Responding to a disagreement (start through keep cool, listen, repeat, explain, say sorry, solve the problem)	37. A student in the hallway stops you and says to you, "Why are you walking here? This is my hallway!" How can you respond to them in the best way? 31. Another student asks if you know how to answer a question on the worksheet. You don't know the answer either. The student gets upset that you haven't responded. How should you proceed?
26. Responds to Questions or Clarification	29. Trading Information 30. Don't be a conversation hog	22. Another student is waiting in line to go into class. They smile and say

		"Hey, how was your weekend?" How would you respond? 4. You are doing research on a library computer for science class. Another student sits at the computer next to you and says, "Hey! Are you working on the science project too?" What is the best response?
27. Ends Conversation	31. Ending phone calls (good and bad example) 32. Ending conversation in person	20. You are finishing a conversation with your friends outside of the classroom. How should you exit the conversation and go into class? 2. You finish getting your food and the check-out personnel says, "Enjoy your lunch and have a great rest of your day!" What is the best way to respond?
28. Making Relevant Contributions to Group Conversation	33. Don't be an interviewer 34. Entering a group conversation (good and bad example)	3. You walk into the library and hear two students talking to each other one says, "I love our English assignment because Science Fiction is the best." The student calls out to you and asks, "Hey, what do you have to work on in Study Hall?" What is the best way to respond? 1. You are in the beginning of the lunch line and the Lunch Personnel says "Hi! Hope you are hungry today!" How should you respond?
29. Bringing up disagreement 30. Maintaining topic	35. Bringing up a disagreement (start through end of wait, keep cool, ask to speak privately, explain, listen, repeat, tell them what you need, solve the problem) 36. Maintains topic	12. Amy wasn't in the cafeteria, so you set the flowers down and got in line for lunch. When you see Amy, you get out of line to bring her flowers. You are starving so you get back in line where you were, another student says, "Hey! This is unbelievable; you don't get to cut me!" What is the best way to respond?

		8. You are sitting with friends. They are discussing their favorite pizza toppings. What is the best response option?
31. Interacting 32. Avoiding Refereeing Repetitive/Redundant	37. Multiple speakers and topics 38. Don't be a coach 39. Entering a group conversation	7. A friend just sat down next to me and said hi. Other friends are talking about a game. What is the best response option? 15. Your iPad is broken, and you have to advocate for yourself. What is the best response option?
33. Asks a Question 34. Interacting in Structured Group Activities	40. Suggest a change if bored 41. Giving a courtesy laugh (good example) 42. Pay attention to your humor feedback (laughing with) 43. Group activities	35. Your teacher has been talking for a long time and you're starting to get bored. What is the best response option? 27. You are splitting up responsibilities for a group activity in class. How do you ask to do the slide show portion?
35. Digital Citizenship Online Communication 36. Phone Conversations	44. Beginning and ending phone calls (good and bad example) 45. Leaving voicemail (good and bad example) 46. Online communication (good and bad example)	40. Which of the following would be a good way to end a voicemail? 28. The other students in your group project are talking about something online you don't care about. What is the best way to deal with this?