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An Investigation of the Efficacy of Speech and Language Interventions with Students with ASD Using Telepractice

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**AN INVESTIGATION OF THE EFFICACY OF SPEECH AND LANGUAGE
INTERVENTIONS WITH STUDENTS WITH ASD USING TELEPRACTICE**

A Dissertation Presented

by

MICHELLE K. BOISVERT

Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2012

Department of Communication Disorders

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DEDICATION

To my husband, Stuart, daughter, Alivia and son Nickolas whose love, patience, flexibility and encouragement have given me the strength and enthusiasm to follow my dreams. I will be forever grateful to them.

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ABSTRACT

AN INVESTIGATION OF THE EFFICACY OF SPEECH AND LANGUAGE INTERVENTIONS WITH STUDENTS WITH ASD USING TELEPRACTICE

MAY 2012

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There is a national shortage of school-based Speech Language Pathologists (SLP). Schools located in rural and geographically remote areas are often impacted by the shortage, and as a result students with an autism spectrum disorder may not receive services that are mandated by their Individual Education Plan. This study examined the use of telepractice as a method of delivery of speech and language services to individuals with autism spectrum disorders in rural areas. A quasi-experimental, single-subject, time-series design was employed. The treatment conditions were manipulated. A counter-balancing methodology was used to control for order effects in this study. Inter-observer agreement on student progress and outcomes were determined by two other master-level clinicians. Progress was measured using pre/post intervention assessments and intervention data. A statistical analysis and comparison of the two service delivery methods (telepractice and traditional on-site) was conducted using the Improved Rate Difference and a Tau-U method. Group comparison was conducted using the Pearson's Correlation . A non-directional critical value for all parametric and non-parametric analysis was set at $\alpha = .05$. If the null hypothesis was rejected, then there was a statistical difference between the progress students made when receiving telepractice as compared to on-site services. If the null hypothesis was not rejected, there was not a statistical difference between the progress students made when receiving telepractice as compared to on-site services.

Comparison at the group level resulted in a finding on non-significance between the two conditions. Findings at the individual level resulted in three out of the six participants demonstrating a finding on non-statistical difference between the on-site and telepractice conditions. For the remaining three participants a statistical difference was noted. When comparing the means of the outcome data between the two conditions, two participants responded more favorably to telepractice intervention, while the other responded better to on-site intervention. Overall, these findings suggest that a telepractice service delivery method is an effective and valid way to provide interventions to students with ASD.

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CHAPTER 1

PROVIDING SERVICES TO STUDENTS WITH ASD THROUGH TELEPRACTICE

Introduction

Autism Spectrum Disorder (ASD) is a group of complex developmental brain disorders that impair an individual's ability to process and integrate ordinary information (ASHA, 2008). This group of developmental disorders includes Autism, Pervasive Developmental Disorder – Not Otherwise Specified (PDD-NOS), Asperger Syndrome, Rett Syndrome and Childhood Disintegrative Disorder (Autism Speaks, 2011). ASD affects the way an individual perceives the world and makes social interaction and communication difficult. Individuals with ASD exhibit difficulties in social interaction, communication and repetitive behaviors, however, the severity of symptoms are different for each individual diagnosed with ASD (Centers for Disease Control and Prevention, 2010).

It is now estimated that between 1 in 110 children in the United States are diagnosed with an ASD (Centers for Disease Control and Prevention, 2010). Government statistics suggest the prevalence rate of autism is increasing 10-17 percent annually (Autism Speaks, 2011). As the rate of ASD diagnoses increases, so does the need for highly qualified personnel. As members of the special education workforce, school-based Speech Language Pathologists (SLPs) are required to provide services to students with ASD. The demand for highly qualified personnel creates problematic issues as there is a chronic shortage of SLPs in many regions nationwide (American Association of Employment in Education, 2008). The shortage is most pronounced in

rural and geographically isolated areas (World Health Organization, 2007; Belfer & Saxena, 2006; Graeff-Martins, Flament, Fayyad, Tyano, Jensen & Rohde, 2007; Brownell, Haager, Bishop, Klingner, Menon, Penfield & Dingle 2007). Due to the shortage of specialists, students with ASD are often evaluated and treated by less qualified or uncertified personnel (e.g., assistants or aides), particularly in rural communities where access to specialists is most limited (World Health Organization, 2007). The fidelity of treatment and student outcomes is compromised when interventions are implemented and delivered by professionals with insufficient training (National Research Council, 2001; Graeff-Martins et al., 2007; Scheuermann, Webber, Boutot, & Goodwin, 2003). Furthermore, the personnel shortage is not a short lived problem. Current analytical trends suggest that the recruitment and training of future specialists will not meet the demand for additional specialists in these areas (Woltmann et al., 2009).

One service delivery method that is rapidly gaining nationwide interest for the provision of therapeutic services in response to the chronic shortage of SLPs is telepractice. Telepractice is an emerging area of service delivery in speech-language pathology that is likely to become an integral part of mainstream practice in the future (Theodoros, 2011). Telepractice involves the application of technologies (e.g., computer-based videoconferencing software and the Internet), which enables specialists to deliver services in real-time over a geographical distance (Dudding, 2009). The shortage of on-site personnel creates the need for telepractice to emerge as a valid form of service delivery for speech and language services. Recent improvements to high-speed Internet and video conferencing systems facilitates this method of service delivery by enabling

rural public schools to connect to professionals regardless of their geographical locale. The use of telepractice is an appropriate model of service delivery for SLPs (ASHA, 2010) and offers the potential to extend clinical services to remote and under-privileged school districts. Often, in these school districts, it is not always logistically or fiscally possible to routinely travel the distances it would require to link trained specialists to children with ASD who require their services.

In the sections that follow, a brief summary of evidence-based interventions for individuals with ASD with respect to the proposed study will be presented. The evidence-based methods described were not delivered via telepractice and as such, it is important that future studies demonstrate the beneficial effects of these interventions using a telepractice service delivery model. In addition, a review of the literature regarding the use of telepractice for the provision of service delivery to individuals with ASD will be presented. The focus of the literature review considers the current state of published research regarding the effects of telepractice to serve the needs of individuals with ASD.

Telepractice as an Evidence-Based Service Delivery Method for Students with ASD

Evidenced Based Practice for ASD

The Individuals with Disabilities Act of 2004 and the No Child Left Behind Act of 2001 mandate that highly qualified school-based professionals adopt scientifically based research to balance out educational and behavioral disparities among students diagnosed with an ASD. Research has shown that intervention using evidence-based

practices and the acquisition of functional communicative abilities is effective in improving long-term outcomes for children with ASD (National Research Council, 2001; Ogletree, Oren & Fisher, 2007; Rogers & Vismara, 2008). Evidence-based therapy is defined as “the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients by integrating individual clinical expertise with the best available external clinical evidence from systematic research (ASHA, 2004).” Professionals in the field of speech and language pathology have been increasingly aware of the importance of evidence-based therapy. Speech and language pathologists (SLPs) are responsible for understanding the efficacy of the treatments they provide and how to isolate the active factors that lead to the desired changes in their treatments sessions (Ratner, 2006). SLPs who work with individuals diagnosed with ASD must comprehend and be knowledgeable of the research outcomes behind each method of intervention that they use with individuals on the spectrum. The treatment employed must show a positive difference in the target behavior and data must be collected to support the use of the intervention for each individual.

In 2009, the National Autism Center (NAC) completed a comprehensive, multi-year effort to identify the level of research support for interventions with individuals with ASD (National Autism Center, 2009). Through this study the NAC determined that there are 11 "established treatments" that have sufficient evidence to be considered effective and therefore evidence-based (NAC, 2009). Of the 11 established interventions, Behavioral Package Treatments and Naturalistic Teaching Strategies were identified as being evidenced-based (NAC, 2009; ASHA, 2006).

Behavioral Package Treatments are a common approach for addressing communication impairments in individuals with ASD. Behavioral treatments, including discrete trial training procedures, have been demonstrated to be effective in teaching a variety of important skills for children with ASD such as communication skills, interpersonal skills and academic skills (NAC, 2009). Interventions that implement a behavioral approach typically consist of structured drills to teach the target skill and are paired with positive and/or negative reinforcement. During trials, instructions are given once by the therapist, actions are judged as correct or incorrect and are consequently reinforced. However, a major limitation of using a strictly behavioral approach for language acquisition is the lack of spontaneity and generalization (ASHA, 2006). Researchers reported that behavioral approaches are an important instructional method, but in order to generalize the skill across other settings this method must be presented in combination with other interventions (Smith, 2001).

Naturalistic Teaching Strategies (NTS) uses learning opportunities to target and modify key behaviors. NTS aims to increase a child's motivation to learn, monitor of his/her own behavior, and initiate communication with others. It has been shown to be effective with generalizing target skills and behaviors including communication and interpersonal skills (NAC, 2009). Strategies that are associated with NTS include providing a choice for activities, reinforcing attempts and teaching students with ASD to respond to multiple cues and materials. The amount of evidence to support NTS for communication in children with ASD is broad and widespread (Goldstein, 2002; NAC, 2009). Clinicians that incorporate techniques and strategies associated with NTS facilitate the likelihood the individuals with ASD will carryover and generalize the skills

that are being targeted in therapy. Interestingly, there seems to be a movement towards a merging between behavioral and naturalistic methods to result in the most effective method of intervention (Delprato, 2001; Goldstien, 2002).

When providing services to individuals with ASD, there should be a continuous relationship between the use of evidence-based intervention, data collection and established supports (NAC, 2009). Effective strategies, such as Behavioral Package Treatments and NTS promote optimal learning and support for individuals with ASD. These approaches must have sufficient evidence to be considered "effective" and the evidence behind these approaches have been established through peer-reviewed research (NAC, 2009; ASHA, 2006). Using effective strategies to provide intervention with individuals with ASD is an excellent first start, however it must be paired with data collection. The use of data collection on a continuous basis helps drive decisions and solve problems within the context of the intervention. Through the use of consistent data collection, clinicians can determine the amount of progress that is demonstrated. Establishing accurate and ongoing performance levels enables the clinician to modify the environment in such a way that the desired skills or behaviors are supported as well as provide essential information to teachers and caregivers so generalization and carryover of successful strategies can take place.

As researchers continue to explore the use and impact of evidence-based interventions in combination with emerging methods of service delivery, such as telepractice, it is essential that the therapeutic services provided are consistent with established approaches. This consistency will only strengthen the validity of using

alternative methods and technology to access and deliver services to individuals with ASD.

A Review of Telepractice to Provide Services to Students with ASD

Empirical data are reported in published literature that support the use of telepractice to deliver health care services in other populations (Hilty, Luo, Morache, Marcelo & Nesbit, 2002; Monnier, Knapp & Frueh, 2002). For example, telepractice has been used to successfully connect doctors in hospitals to home-bound patients recovering from chronic heart disease (McCrossan, Morgan, Grant, Sands, Craig & Casey, 2007) and stroke (Demaerschalk & Meschia, 2009). Given this success, it is possible that telepractice may also be useful in connecting specialists in the field of ASD to individuals with ASD in need of services.

The use of telepractice in the assessment and treatment of individuals with ASD has been evaluated in numerous studies. A systematic review of this research by Boisvert et al. (2010) revealed a total of eight studies that met three inclusion/exclusion criteria set forth by the authors (Appendix A). First, the study had to contain at least one participant with an ASD diagnosis (i.e., autism, Asperger's, or PDD-NOS). Second, at least one dependent measure had to involve the individual with ASD and the results of an assessment, evaluation of changes in behavior (e.g., learning a new skill or decreasing challenging behavior), and/or the fidelity of implementation of an assessment, intervention or educational program. Finally, some form of telepractice had to be used to deliver one of the above services from a specialist or expert (e.g., researcher, psychiatrist or behavior analyst) at one location to participants with ASD at a second location.

A total of 46 participants with ASD received remedial services via telepractice in these eight studies. The sample sizes ranged from one to 29 participants. Three studies included only one participant while four studies included two to four participants. One study included 29 participants. Across the eight studies, nine (20%) of the participants were reported to be male and four (9%) were female. The gender of the remaining 33 participants (72%) was not reported. The most common diagnosis was autism ($n = 42$; 91%). The participants ranged in age from 2 to 11 years. The specialists who provided services included university-based researchers, behavioral analysts, consultants, education specialists, psychiatrists and psychologists. These specialists delivered training and supervision to teachers, therapists, and parents located in schools, homes, and rural community-based clinics.

With respect to the technologies utilized in these eight studies, six of the studies used widely available technology to implement telepractice. This included laptop computers with both internal or peripherally connected microphones and web cameras connected to the Internet via high-speed Internet connections. Video was transmitted at a rate of either 15 or 30 frames per second (fps). Skype © and iChat © videoconferencing software programs were used. Skype© and iChat© both allow video and voice calling over a variety of different mobile Internet devices and are currently available for free download. Two studies used more sophisticated and permanent telecommunications technologies, including a dedicated fiber-optic system and a six channel bonded digital network. Barretto, Wacker, Harding, Lee and Berg (2006) utilized the Iowa Communications Network (ICN). Savin, Garry, Zuccar and Novins (2005) used an integrated services network circuit.

With respect to the type of therapeutic services delivered in the eight studies reviewed, telepractice methodologies were used to deliver a variety of interventions. In four studies (Iowa Communications Network, 2010; Machalicek, O'Reilly, Chan, Rispoli, Lang, Davis, Shogren, Sorrells, Lancioni, Sigafos, Green & Langthorne 2009; Machalicek, O'Reilly, Chan., Lang, Rispoli, Davis, Shogren, Sigafos, Lancioni, Antonucci, Langthorne, Andrews & Didden, 2009; Machalicek, O'Reilly, Rispoli, Davis, Lang, Hetlinger-Franco & Chan, 2010), behavior analysts located at university-based clinics collected student data on challenging behavior and guided on-site professionals to implement functional analysis procedures. In two studies researchers trained teachers, therapists, or parents to implement multi-step behavioral interventions and functional communication training (Gibson, Pennington, Stenhoff & Hopper, 2010) and the Early Start Denver Model (Vismara, Young, Stahmer, Griffith & Rogers, 2009). In one study, psychologists and psychiatrists from an urban clinic provided consulting and evaluations to a clinic serving American Indian youth on their reservation (Savin et al., 2005). Finally, one study attempted to set up a more permanent consulting relationship between university-based specialists and a school located in a rural area for the purpose of consulting on the development of Individualized Education Plans (Rule, Salzberg, Higbee, Menlove & Smith, 2006).

The most common research design utilized to evaluate the efficacy of services delivered via telepractice was a single-subject experimental design. This approach was utilized in five studies. Vismara et al. (2009) taught ten therapists to implement the Early Start Denver Model of early intervention in a quasi-experimental group research design.

The remaining studies did not identify a research design and were considered informal pilot testing (Savin et al., 2005; Rule et al., 2006).

The empirical outcomes for seven of the eight studies are reported in this review and suggest successful implementation of telepractice to deliver the intended services. Rule et al. (2006) was the only study in which the researchers stated that “...technological and programmatic challenges were never fully overcome” (Rule et al., 2006, p. 3). However, despite the obstacles, the researchers stated that the child involved in the case study “...made significant improvement over the course of the consultation“(p. 4) with services provided via telepractice.

The limitations of the eight studies reviewed are related to the overall scope of the existing corpus of studies. Specifically, the Boisvert et al. (2010) review must be considered limited because of the sheer paucity of studies ($n = 8$) and the relatively few number of participants ($n = 46$). In terms of methodological quality, perhaps the most important limitation is that three of the eight studies lacked explicit description of any experimental design and only one study (Vismara et al., 2009) directly compared the effectiveness of services delivered via telepractice to the same services delivered on-site. Nonetheless, the studies reviewed do suggest that telepractice is a promising approach for this population and that additional research is warranted. A summary of the studies reviewed by Boisvert et al. (2010) are included in Appendix A.

Ethical and legal issues exist when delivering services via telepractice (Denton, 2003; Miller, Elliot, Long, Mazenca & Moder, 2006). First, the Health Insurance Portability and Accountability Act of 1996 (HIPAA) requires safeguards to ensure the privacy of information transmitted electronically (U.S. Department of Health and Human

Services, 2010). A second legal and ethical consideration involves the Family Education Rights Privacy Act (FERPA). FERPA guidelines apply to elementary, secondary, and adult students in public and private institutions that receive federal funds. The guidelines provide explicit regulations regarding the privacy and release of students' educational records (Toglia, 2007). Educational institutions subject to FERPA are prohibited from disclosing the educational records of students or personally identifiable information from education records, without a parent or eligible student's written consent. When initiating a telepractice program, obtaining informed consent is one way to ensure student and families' safety and privacy. The importance of obtaining informed consent when implementing a school-based telepractice program cannot be overstated. Ethical guidelines set forth by ASHA require clinicians to fully inform all stakeholders of the nature and possible effects of the services rendered and/or studied (Denton & Gladstone, 2005). Part of the process of obtaining consent is providing a detailed description on the type of technology used and services to be delivered. A description of how telepractice services differ from on-site services should be outlined in the consent form as well as the positive and negative consequences and risks that may result when delivering services via telepractice (Denton et al., 2005). Depending on the nature of the service being delivered and the professional organization or certifying agency associated with that service (e.g., American Psychological Association, American Speech Language Hearing Association, or Behavior Analyst Certification Board), additional ethical and legal considerations may be required prior to implementing telepractice.

Nonetheless, based on a comprehensive review of the literature, Boisvert et al.'s (2010) findings support telepractice as a promising service delivery model. Given the

shortage of specialists in SLP, the poor economy and the rising costs of gasoline for travel, especially to distant and remote areas, the need for further research regarding the capabilities and limitations of telepractice as a service delivery model is apparent. If current technology trends are sustained, telepractice will likely have the potential to become increasingly more efficient, effective, versatile, and, potentially, an even more viable means to address the need for improved access to treatment for individuals with communication challenges, especially those children with multiple and complex neurodevelopmental disabilities, such as ASD. Considering the potential of the use and application of telepractice, there is an urgent need for a more rigorous study to directly compare outcomes that students with ASD demonstrate through web-based methodologies as compared to traditional, on-site services.

Objectives and Aims

Research Purpose

The objective of the this study was to empirically demonstrate the effects of telepractice as a service delivery model for providing speech and language intervention services to individuals with ASD. This study compared the progress students made when receiving speech language pathology services through telepractice versus the progress they made through traditional on-site services. This study provided empirical evidence regarding the use of telepractice and its implementation as a valid and appropriate service delivery method to students with ASD.

The focus of this study was to compare the progress students made when receiving services through telepractice versus on-site methods using a multiple treatment design.

Research Question

The specific research question of this study is as follows:

Research Question: Is there is a difference in outcome data of Individual Education Plan goals and objectives between delivery of evidence-based treatment, in telepractice and on-site settings, of participants with autism, from mild to moderate?

Null Hypothesis: There is not a difference in participant progress outcomes on IEP goals and objectives between telepractice and on-site settings.

Alternative Hypothesis: There is a difference in participant progress outcomes on IEP goals and objectives between telepractice and on-site settings.

CHAPTER 2

METHODOLOGY

Research Design

The purpose of this research design is to determine if there is a difference in the progress and outcomes on IEP goals and objectives, when compared within two intervention settings, on-site and telepractice. The goals and objectives were targeted due to several reasons. First, as each student participant was enrolled in a public school, it was required from administrators that all intervention sessions target objectives identified in the IEP. Secondly, to reduce co-morbidity, only goals associated with intervention provided by the SLP were targeted. The objectives were not developed by this research team, rather were developed by the student's school-based team. IEP goals and objectives and the clinicians providing the services remained consistent throughout the study for each individual student. This comparison of modes of service delivery support a determination of whether or not telepractice equates to traditional on-site intervention services.

The study utilized a quasi-experimental, single-subject, multiple-group, time-series design (Kazdin, 2011). This approach is an appropriate design to determine the effect of the intervention method and has been proven particularly relevant for defining educational practices at the level of the individual learner (Horner, Carr, Halle, McGee, Odom & Wolery 2005). Single-subject designs typically include three to eight participants and each participant acts as his/her own control group. In this study, there were six single case studies investigated. The participants were treated one at a time and

accumulated into a final summary of treatment effect (Kazdin, 2011). This type of design is sensitive to individual participant differences and comparisons were made on the same individual at different points in time (National Center for Technology Innovation, 2011).

Although single subject research is often considered the best research design when measuring behavioral change in individuals (National Center for Technology Innovation, 2011), one limitation is how the outcomes are applied to the general population in the current study, to the population of students with ASD. The external validity of a single-subject design study is considered a limitation due to the small number of study participants. To address this threat to external validity, systematic replication of the study must take place over time (Horner et al., 2005). To support the feasibility of systematic replication, reliable and repeated measurement and a description of the baseline and treatment conditions must be clearly detailed (McMillian, 2004). The collective results of numerous single-subject studies that examine the same behavior enhance the external validity of the research.

This study consisted of two groups of student participants and was conducted in three phases. With respect to the first phase, baseline data was collected on-site for both groups of participants with the exception of one student. In the phase two, condition one, participants received either on-site services or telepractice services depending on the treatment condition that they were assigned to. In phase two, condition two, both groups alternated their mode of service delivery. The target IEP goals and objectives, setting, time of day, location, equipment, type of material, clinician and on-site helper remained

constant throughout the duration of the study. This consistency ensured reliable measurement within the treatment conditions for data collection (McMillian, 2004).

In this study, repeated measurements were performed throughout each condition in order to establish a clear pattern of student outcome on specific IEP goals and objectives over the course of the study. With respect to the baseline data (Phase 1), at least five data points were acquired prior to the initiation of the first condition and a stability of target behavior was achieved. A standardized measure was administered two times throughout the study as follows: a) during baseline; and b) at the completion of the study. During Phase 2, conditions 1 and 2, repeated assessments, in the form of probe data and treatment data, were documented during every therapy session for each participant. Table 1 provides a summary of the research design.

Table 1: Summary of the Research Design

Phases	Group 1	Group 2
Phase 1	Baseline Data (A) - <i>Standardized Assessment</i> - <i>3-5 data points for each IEP objective</i>	Baseline Data (A) - <i>Standardized Assessment</i> - <i>3-5 data points for each IEP objective</i>
Phase 2 Condition 1	On-Site Therapy (B) - <i>Probe/Therapy data collected for a minimum 20 data points over the course of ten therapy sessions for each participant</i>	Telepractice Therapy (C) - <i>Probe/Therapy data collected for a minimum 20 data points over the course of ten therapy sessions for each participant</i>
Phase 2 Condition 2	Telepractice Therapy (C) -- <i>Probe/Therapy data collected for a minimum 20 data points over the course of ten therapy sessions for each participant</i> Post-Intervention Data - <i>Standardized Assessment</i>	On-Site Therapy (B) - <i>Probe/Therapy data collected for a minimum 20 data points over the course of ten therapy sessions for each participant</i> Post-Intervention Data - <i>Standardized Assessment</i>

One treatment condition involved the delivery of speech and language services to students with ASD provided on-site at their educational setting. The other condition, at the other school, involved the delivery of speech and language services provided to student participants at their educational setting through the method of telepractice. Each mode of service delivery was evaluated in terms of the relative effects of the participants' progress and outcomes for specific treatment protocols and tasks outlined in each participant's IEP (Sancho, Sidner, Reeve & Sidener, 2010).

The treatment conditions were manipulated (ABC vs. ACB). To control for order effect, a counterbalancing technique was used (Jackson, 2006). Counterbalancing to control for order effect requires the presentation of conditions (on-site and telepractice) in all possible orders to the treatment group. To ensure symmetry and to explore whether the order of the treatments plays a role in progress, participants located at each of the two schools were chosen to start with a particular condition.

Participants

The outcomes for a total of seven student participants diagnosed with ASD were included in this study (Table 2). The students were elementary school aged (5-12 years; $M=8.5$; $SD=2.7$). Although the general age range is broad, comparisons were made for participants that are 5-6 years old ($n=3$) and 7-12 years old ($n=4$). The gender ratio of participants diagnosed with ASD in this study was in close approximation to national data. Approximately 16% of the participants were female. Nationally it is reported that

20% of all individuals diagnosed with ASD are female (Whiteley, Todd, Carr, & Shattock, 2010).

Table 2: Participant's Demographic Information

Participant	Race	Gender	Age	Diagnosis	Age of Diagnosis	Services Received on IEP
1	Caucasian	M	12	Autism	4	Speech/Language Academic Counseling Mathematics
2	Caucasian	F	5	Asperger's Syndrome	4	Speech/Language Academic Social Skills Behavioral
3	Caucasian	M	6	PDD-NOS	5	Speech/Language Academic Social Skills Physical Therapy Adaptive P.E. Language Arts Occupational Therapy
4	Caucasian	M	11	PDD-NOS	10	Speech/Language Social Skills English Language Arts Mathematics Occupational Therapy
5	Caucasian	M	8	PDD-NOS	7	Speech/Language Social Skills English Language Arts Mathematics Written Language
6	Caucasian	M	6	PDD-NOS	4	Speech/Language Social Skills Reading Mathematics Occupational Therapy Extended Year
7	Caucasian	M	10	Autism	5	Speech/Language Reading Mathematics Occupational Therapy

For participation in this study, participants met the following inclusionary criteria:

a) a formal diagnosis of ASD from a physician, neurologist, or psychologist on record; b) participation in an integrated or mainstream public school class at least 80 % of each school day; c) Individual Educational Plan (IEP) that includes communication specific goals; d) primary language is English to eliminate potential confounding variables related to language differences, e) health status is good to excellent in that participants with ASD will have no history of cardiovascular, pulmonary, or metabolic chronic diseases, or craniofacial abnormalities; f) minimal communication of 50 words (oral and/or signed) of which at least 10 are oral; and g) prospective participants meet the criteria for American Speech Language Hearing Association telepractice client candidacy.

Exclusionary criteria was as follows: a) other primary diagnoses (e.g., Down syndrome, Cerebral Palsy, etc.); b) prospective participants in an integrated or mainstream public school class less than 80% of each school day; c) other uncorrected sensory deficits (e.g., vision, hearing); d) recent history (past 6 months) of significant destruction of property or injury to self or others; e) less than 50 oral or signed words and less than 10 oral words; and f) prospective participants does not meet the American Speech Language Hearing Association telepractice client candidacy.

American Speech Hearing Association Telepractice Client Candidacy Criteria:

- Attention (e.g., ability to sit in front of a monitor and attend to the clinician)
- Auditory comprehension (e.g., ability to follow directions to operate equipment)
- Hearing ability
- Visual ability (e.g., ability to see material on a computer monitor)
- Speech intelligibility
- Physical endurance (e.g., sitting tolerance)
- Manual dexterity (e.g., ability to operate a keyboard if needed)

- Willingness of client and family/caregiver (as appropriate) to participate in telepractice
- Access to and availability of resources (e.g., telecommunications network, facilitator)

ASHA (2010) recommends that the above factors, while not exclusionary, may impact the success of the telepractice intervention and therefore hinder the ability to participate in this study. In terms of this study, participants demonstrated the appropriate behaviors required to receive SLP intervention through telepractice. It was essential that the duration of intervention between the two conditions be consistent and therefore each participant met the above client candidacy to ensure that a comparison between with two conditions occurred.

Participation in this study was strictly voluntary and participants could withdraw from this study at any time without retribution or risk to services.

Setting

Student participants were educated in two rural schools districts. At the time of this study, the schools had speech and language pathologists on staff. However, according to administrative reports, it was not unusual for the districts in this geographical area to have a history of SLP shortages. Administrators at participating schools confirmed their interest and support for this study regarding the use of technology for SLP interventions services.

The first participating school was the A. K. School, which, at the time of this study, enrolled 220 preschool and elementary school students from grades PK-6. Student enrollment by race included: Caucasian (81.8%), Asian (6.4%), Hispanic (4.1%) and African American (0.9%). The reduced/free lunch enrollment was 16.4%.

Intervention sessions occurred in the computer annex for both the on-site and telepractice conditions.

The second participating school was the N. James Elementary School, which at the time of this study, enrolled 474 preschool and elementary school students from grades PK-6 at the time of this study. Student enrollment by race included: Caucasian (94.3%), Hispanic (2.1%), Asian (0.2%), and African American (0.6%). The reduced/free lunch enrollment was 34.0%. Intervention sessions occurred in the speech language room for both the on-site and telepractice conditions.

Materials

Assessment Materials: Subtests of the Comprehensive Assessment of Spoken Language (CASL).

Probe Materials: Probe activities were chosen to directly target participant's IEP goals and objectives using a systematic and structured format. Materials included flashcards, verbal questions, short stories or pictures with associated questions. See Appendix B for sample of the probe tasks.

Therapy Materials: Therapy or intervention materials were chosen to directly target participant's IEP. Materials included books, games, flashcards, verbal questions, short stories or pictures with associated questions (Table 3).

Table 3: Materials Used for Probe and Therapy

Probe Materials	Therapy Materials
ESL Flashcards	ESL Flashcards
SuperDuper Sequencing Cards	Big Universe On-Line Books
SuperDuper Social Situation Cards	SmartBoard Games/Activities
SuperDuper Story Retell Cards	SuperDuper Software and Games
	SuperDuper Social Situation Cards
	SuperDuper Story Retell Cards
	Presence Learning Web-Based Games

Videoconferencing Software: Skype, a free desktop videoconferencing application, was used for the video and audio communication. At the time of this study, this web-based software had more than 663 million registered users and had been publicly available since 2003 (Skype Technologies S. A., 2011). Skype software is compatible with both Macintosh and Windows operating systems.

Screen Sharing Software: Two programs were used for screen sharing applications. The first, Adobe ConnectNow, is web conferencing system used for online meetings, eLearning, and webinars. The system is Flash based and is free for up to two people. The second system was Presence Learning. Presence Learning is a web-based platform that offers games and screen sharing functionality. This system is a fee-for-service system but was donated by the company for the purpose of this research study.

Data Collection: iSchoolWare, a secure, web-based data Special Education documentation system, provided a platform for data collection and sharing needs of the telepractice service delivery model. For the purpose of consistency, this system was used for both on-site and telepractice intervention sessions. This system allowed the treating clinicians to document, analyze and share all pertinent data with on-site team members.

The site was encrypted with a SSL 3.0, RC4 with 128 bit encryption (High); RSA with 2048 bit exchange.

Variables

Independent Variables

The qualitative independent variable in this study is the treatment condition. The specific treatment conditions to be studied include: a) telepractice service delivery condition; and b) on-site service delivery condition. The type of service delivery will be manipulated in this investigation to determine the effect it has on student progress.

Dependent Variables

As shown in Table 4, the dependent variables in the proposed study are student outcomes on individually specified IEP goals. Specifically the dependent variables are: a) performance on standardized assessments; b) quantitative and qualitative probe progress data for specific IEP objectives; and c) quantitative and qualitative therapy progress data on behavior.

Quantitative data will be reported in the form of raw scores, standard scores and percentile scores. Qualitative data will be reported in the form of level of assistance, behavioral observations and subjective response to intervention.

Table 4: Description of the IEP Objectives for Each Participant

Participant	IEP Dependent Variables	Description
Student 1	Appropriate social engagement within a conversational setting.	Maintaining the topic and engaging in turn-taking within a conversation.
Student 2	Appropriate response to open-ended questions.	Verbally answering "wh" and "how" questions in a complete sentence.
Student 3	Following 2-3 step directions.	Listening and repeating a 2-3 step direction, then carrying out the request.
Student 4	Producing appropriate transition words within a narrative context.	Retelling an event or narrative and using a variety of transition words to sequence the steps.
Student 5	Appropriate use of grammatical structures.	Verbally producing a sentence with the correct irregular past tense verb form.
Student 6	Correct production of target speech sounds.	Reducing a lateral lisp quality when producing the speech sound "sh."
Student 7	Appropriate use of vocabulary and concepts.	Paraphrase a vocabulary/concept definition and correctly use the word in a sentence.

At least 85% of intervention sessions were video recorded to conduct post-hoc inter- and intra-reliability measurements.

Procedures

This study included the use of four first year graduate clinicians who were enrolled in the UMASS Amherst's Masters degree program in Speech Language Pathology. Each graduate clinician worked with two student participants with the exception of one. Each graduate student clinician received two hours of training on the technology used to provide telepractice (Appendix C). Each graduate student clinician

also received weekly training on methods and procedures used for evidence-based intervention for both on-site and telepractice services, materials for treatment, and other ongoing responsibilities associated with the study. The graduate student clinicians remained the same throughout the duration of the study for all participants and conditions. The graduate student clinicians were supervised at all times by a certified and licensed SLP on-site and via telepractice for both treatment conditions.

Each mode of service delivery, on-site and telepractice, were evaluated in terms of the relative effects of student progress and outcomes for specific treatment protocols customized for each participant with ASD (Sancho et al., 2010). Each participant received intervention services individually, one at a time, per session. The specific treatment goals and objectives that were targeted in each session remained constant for each participant. Data were collected for at least one objective for each participant for the duration of the study. The pre-therapy probe and post-therapy probe outcomes per session were studied for the entire treatment period and were analyzed for treatment effects (Kazdin, 2011). In addition, the above mentioned treatment outcome data were collected on repeated occasions during every intervention session in phases two and three.

Treatment Conditions

After baseline, during Phase 2, condition 1, each group of participants received services for a total of six consecutive weeks for each treatment condition. Group 1 (participants located at A. K. Elementary) received on-site services in the schools computer annex, and Group 2 (participants located at N. James Elementary) received

telepractice services in the speech and language room located at the school. After six weeks the conditions changed for the participants. During Phase 2, condition 2, Group 1 received telepractice services and Group 2 received on-site services. For each participant, the clinician, educational setting, therapy time and therapy frequency was consistent between the two conditions.


Intervention services for each participant targeted communication goals that were identified from their IEP. The treatment goal, frequency and duration of services were not modified from the participants' IEP for the purpose of this study. Please see the following example (Figure 1) to further demonstrate a probe and treatment task.

Target IEP Goal: Participant will respond to what questions independently in 4/5 trials.

Probe Activity: Participant will be presented with five (5) pictures, one at a time, and asked a "what" question relating to the picture.

Clinician: "What are the mother and daughter doing?"
Participant: "Reading"
Clinician: "Excellent job!"
Clinician will move on to the next flashcard.

Flashcard Example



Therapy Activity: Participant will read a book with the graduate clinician and the graduate clinician will ask "what" questions.

Clinician: "What are the animals eating?"
Participant: "Trees."
Clinician: "Good, there is something sitting on the tree, what is that?"
Participant: "A bird."
Clinician may ask follow-up questions and provide further reinforcement.

Book Example

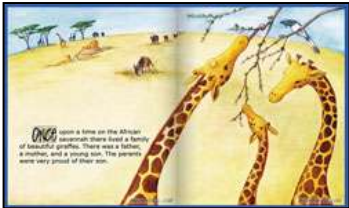


Figure 1: Example of Probe and Therapy Session

Equipment

The equipment used for the on-site and telepractice conditions included the following equipment: an e-Machine computer and speakers and an external Microsoft HD webcam with an embedded microphone. The e-Machine ran with a Microsoft Windows 7 operating system and had a 3.1GHz processor and 3GB memory. The Microsoft webcam had an auto-focus lens and captured 720p HD video with 30 fps. All intervention sessions were recorded using a Sony Handycam digital video recorder.

The materials used during each intervention session were primarily electronic and online material. Online material and activities were conducted with the Presence Learning platform, Big Universe, and various other websites that provide treatment materials. During the telepractice condition, screen sharing was utilized and conducted through Adobe ConnectNow or Presence Learning.

Intervention Models

A combination of structured trials and naturalistic interventions were incorporated into the treatment sessions. All intervention materials and activities targeted the IEP objectives on file per participant. For each participant, at least one IEP objective was targeted during the therapy session throughout the study. Built in to each session were structured trials of the target skill as well as child participant choices and task variation. Direct and natural reinforcers were used. Reinforcers included computerized images (i.e., dogs, fish, and fireworks) that appeared on the computer screen, tangible rewards provided by the on-site facilitator such as stickers as well as natural verbal reinforcements. Sessions lasted for approximately 30 minutes and were organized in

three parts (see Table 5): a) pre-intervention probe task; b) treatment consisting of unstructured activities; and c) post-intervention probe task. For the first five minutes, the graduate clinician administered a structured probe in which a target objective was systematically assessed. The following 20 minutes consisted of intervention activities, games and material that focused on the IEP objective. The final five minutes consisted of a structured probe in which the target IEP objective was assessed again. The beginning and end probe targeted the same IEP objective but utilized different stimuli to assess the skill level. The two probes were matched in terms of task difficulty. For example, Probe 1 (the beginning probe) were even numbers of a protocol and Probe 2 (the end probe) were the odd numbers. The probe stimuli were different each intervention session and varied from the therapy stimuli.

Table 5: Example Outline of a Therapeutic Session

Tasks	Activity
Probe (Five minutes)	Structured Activity (i.e., flashcards)
Treatment Session (20 minutes)	Unstructured Activity (i.e., Games, Books)
Probe (Five minutes)	Structured Activity (i.e., flashcards)

Data Collection

This study measured student progress when evidence-based and data driven interventions were delivered using on-site versus telepractice methods. Objective measures used to assess progress were subtests of the CASL, probe data and student progress data. Data were collected at baseline, throughout the study, and at the end of study. Pre/post intervention qualitative data were also collected through behavioral

observations and surveys with on-site personnel and graduate clinicians. The surveys contained questions that assessed the impression of the quality of speech language therapy. These surveys assessed study personnel's satisfaction with student's progress over the study, the ability to communicate with other personnel over the course of the study and how personnel felt telepractice compared to on-site services (see Appendix D).

According to Kazdin (2011), valid and reliable data collection methods should meet specific criteria. The criteria set forth by Kazdin include: a) tests of measurement are administered repeatedly (i.e., student probe and therapy data); b) the student objectives are operationally defined to facilitate the consistency of measurement by other observers (i.e., IEP goals and objectives); c) methods of measurement have the capacity to reflect change (i.e., increase of raw scores, standardized scores or percentile scores); d) appropriate data is used so that it reflects a dimensional scale or progress (i.e., repeated measurement of progress); e) data collection methods directly assessed the target behavior (i.e., data collected on probe and therapy tasks); and f) the target behavior should demonstrate a beneficial outcome for students (i.e., target skills that will improve communication/social interaction). This study met all of these criteria.

Subtests of the Comprehensive Assessment of Spoken Language (CASL), a standardized measure, were administered twice during the study: a) during baseline; and b) at the completion of the study. The CASL is compatible with IDEA (2004) specifications as it provides age-based norms. All methods of delivering the standardized assessment followed established protocols outlined in the assessment user guide/manual. According to the CASL manual, a period of at least six weeks is required for test-retest

administration (Carrow-Woolfolk, 1999). For this study, the participants were assessed at baseline and then reassessed approximately 15 weeks later.

Baseline data was gathered on-site prior to the implementation of the study to establish a consistent trend in each student participant's skill toward the targeted IEP goals and objectives. The data for the baseline was derived from observation, prior reports and interactions with each student participant prior to the onset of the experimental phase. At minimum, five data points for each IEP objective that was targeted during the study was collected during baseline to establish a trend in the target behavior.

Quantitative data was collected through the probe sessions by the treating student clinician. At the onset and completion of each intervention session, a probe consisting of five items/tasks was administered for a maximum of five minutes to determine student performance relating to the specific treatment objective. Raw data for each treatment objective was converted to percentages and plotted on a graph. This method of comparison was repeated for all participants over the course of all treatment sessions. Customized data collection forms were used for all probes (Appendix E). The forms identified the total trials, total correct responses and the type of prompting needed. A description of the probe was included on the form. If a student participant did not complete all five items/tasks during each probe data collection block (beginning and end of therapy session), only the amount of probes completed within the five minutes were included in the data.

Quantitative treatment session data on student progress toward IEP goals and objectives were collected for every session. These data included the student participant's

responses to the material and activities presented during the session. Correct and incorrect responses were documented as well as the type and level of prompting. Customized data sheets were used for this data collection procedure. At the end of each therapy session, qualitative descriptions of student progress were reported. Qualitative descriptions of student progress on target IEP goals and objectives were in direct relation to the therapy data collected during the sessions. Student progress toward IEP objectives was categorized as follows:

- Mastery - Student meets the established criteria as stated on their IEP and/or >80%.
- Adequate Progress - Student is reaching target objective via the probes with 50 - 79% consistency/accuracy.
- Limited Progress - Student is reaching target objective via the probes with 20 - 49% consistency/accuracy.
- No Progress - Student is reaching target objective via the probes with <20% consistency/accuracy.
(ASHA, 2010)

Qualitative measures were obtained to further assess the resulting data and to provide possible explanations in the case of a statistically significant difference between the two service delivery conditions. Qualitative measurements such as observations and surveys were used to identify the critical and salient technical features in terms of equipment and software as well as clinical approaches that are used to perform telepractice.

Observations and field notes included a description of the setting and service delivery method, the identification of the people participating in each treatment activity, the content of the interaction and a description of the quality of service delivery, any unanticipated events and potential contaminating variables that affected performance (e.g., technical issues, illness of the child participant and any adverse reaction or behavior

as a result of treatment or any other variable), and methods and systems used to ensure compliance with federal laws regarding student confidentiality (Denton, 2003).

Surveys were administered to study related personnel to determine issues concerning the quality, perception of engagement, acceptance and viability of services delivered via telepractice (Appendix D). Graduate clinicians and support personnel working with each participant were surveyed two times during the duration of this study. The two survey sessions were conducted before the first condition and at the completion of the second condition. The survey followed a consistent format. Questions targeted delivery of services using technology, perception of student participant progress and ability to communicate with on/off site staff. In addition, all stakeholders were asked to identify the strengths and challenges of telepractice and the perceived level of school-based acceptance of telepractice as a service delivery method.

Responses were organized and structured through a comparative analysis. This type of analysis enabled a comparison of the different perceptions and attitudes that the stakeholders are reporting. Surveys were in a Likert Scale format. Respondents were asked to rate questions regarding their experience on an ordinal scale of 1 (“Not Very Good”) to 4 (“Very Good”). The responses were tallied to allow a comparison within a particular survey group over the duration of the study time period. To determine if the respondent’s attitudes on the same variable over time change, a Pearson's correlation was applied. The surveys also included a section for additional comments.

With signed parent consent, a review of the student participant's file was conducted. The student's IEP and most recent progress report were reviewed. Progress reports, treatment notes and numerical data reported by the graduate clinician delivering

the services, were collected throughout the investigation to identify changes in each student participant's performance on speech and language treatment goals and objectives.

Probe and therapy data were entered on a continuous basis into a secure web-based data collection software program, iSchoolWare. Data was organized in an Excel spreadsheet prior to input into a statistical program (i.e., SPSS). Each student participant was assigned an ID number and the spreadsheet was organized so that intervention data were inputted for target goals and objectives.

Validity and Reliability Measures

The internal validity of this study was measured by conducting within-group comparisons on the effect each service delivery method had on student progress (Horner et al., 2005).

The external validity was measured by demonstrating the effect of the service delivery method across the six student participants (Horner et al., 2005).

Social validity was demonstrated by clearly describing the student's need for the speech and language services, feedback from the treating graduate clinician providing the telepractice services and the response from the on-site facilitators. In addition, the procedures used to implement intervention were judged in terms of level of acceptability and feasibility within available resources at the schools. The last survey questions asked all study-related personnel if they would recommend or choose to use this method of intervention outside the confounds of the study (Horner et al., 2005).

Reliability was assessed through inter-observer agreement on measures by independent doctoral level SLPs who viewed video recordings of participants. Percent

Progress of each participant was measured by converting the raw data per goal into percentage data. Within each therapy session for both on-site and telepractice service delivery systems, simple calculations were conducted to determine the number of correct trials compared to the total number of trials presented in each treatment session per goal.

Human Protection

This proposal was submitted for approval to the UMass Amherst School of Public Health and Health Sciences Human Subjects Review Committee (UMass SPHHS HSRC). This study was approved by the Committee UMass SPHHS HSRC on February 3, 2011. Related documents are located in Appendix F.

Statistical Analysis

Statistical analysis and comparisons of the two service delivery models and impressions of the services were performed using non-parametric analysis of variation measurements including a Pearson's correlation coefficient, Improved Rate Difference (IRD) and the Tau-U analysis. To the best extent possible, Probe 1 (i.e., the beginning probe) and Probe 2 (i.e., the end probe) were collected during each treatment session that targeted that IEP objective. The statistical analysis mentioned above will compare the means of Probe 1 and Probe 2 for treatment effects. For all statistical analyses, the level for non-directional, statistical significance was set at .05.

Visual inspection and graphical techniques compared the performance of each student participant during the different conditions (Horner et al., 2005; Kazden, 2011).

The visual description involved an interpretation of the mean level shift, variability and slope of the data during the various phases of the study.

The mean shift, variability and slope were analyzed by applying simple calculations outlined by Ottenbacher (1986). The mean shift is the percentage of mean change from Phase 1 (baseline) to Phase 2 and from Phase 2, condition 1 to Phase 2, condition 2. As seen in Table 6, the degree of mean change was computed by dividing the difference between the two phases by the mean of the preceding Phase (Ottenbacher, 1986). A positive value indicated an increase in the mean level across the two phases, while a negative value represented a decrease in the mean level across the two phases (Ottenbacher, 1986).

Table 6: Mean Shift Algorithms for Phase 1 and Phase 2

Phase	Variables	Change in Mean Shift Algorithm
Phase 1 (baseline) Mean	x	Phase 1 to Phase 2, condition 1
Phase 2, condition1 Mean	y	$\frac{y - x}{x}$
Phase 2, condition 2 Mean	z	Phase 2, condition 1 to Phase 2, condition 2
		$\frac{z - y}{y}$

The means were calculated by averaging data from Probe 1 and Probe 2 for each intervention session

The variability refers to the amount of fluctuation that occurred within and across the phases. As seen in Table 7, the measure of variability for each phase was obtained by computing the standard deviation for the data points in each phase of the design (Ottenbacher, 1986). To determine the degree of change in variability across phases, the standard deviation for Phase 1 was subtracted from the standard deviation from Phase 2.

A positive number indicated that the degree in variability had increased between the two phases while a negative value meant that the variability decreased across the phases (Ottenbacher, 1986).

Table 7: Variability Algorithms for Phase 1 and Phase 2

Phase	Variables	Change in Variability Algorithm
Phase 1 (baseline) SD	x	Phase 1 to Phase 2, condition 1 y - x
Phase 2, condition1 SD	y	Phase 2, condition 1 to Phase 2, condition 2 z - y
Phase 2, condition 2 SD	z	

The standard deviations were calculated by from data obtained through Probe 1 and Probe 2 for each intervention session

The slope is the trend that exists within the data for each phase. The slope, sometimes called "rise over run" values were computed for each phase (see Table 8). To determine the degree of change in a slope from one phase to the next, the slope for Phase 1 was subtracted from the slope for Phase 2. The largest absolute number indicated the greatest change in slope across the phases, while the smallest absolute value is associated with the smallest change in slope (Ottenbacher, 1986).

Table 8: Slope Formula and Algorithms for Phase 1 and Phase 2

Slope Formula	Phase	Variables	Change in Slope Algorithm
$M = \frac{Y_2 - Y_1}{X_2 - X_1}$	Phase 1 (baseline) slope	x	Phase 1 to Phase 2, condition 1 y - x
	Phase 2, condition 1 slope	y	
	Phase 2, condition 2 slope	z	Phase 2, condition 1 to Phase 2, condition 2 z - y

m=rise/run

The slopes were calculated by from data obtained through Probe 1 and Probe 2 for each intervention session

To determine if the outcome data noted during each condition, telepractice vs. on-site, were statistically correlated, individual means were aggregated at the group level. Although this sample size was small, testing the relationship between the variables at group level provided insightful information that will help direct future research. The means for the two treatment conditions for the various groupings were subjected to a Pearson's correlation. As seen in Figure 3, the Pearson's correlation coefficient is a measure that can be applied to single-subject research and determines the extent to which values of the two variables are "proportional" to each other (O'Neil, 2009, Parker, 2007).

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Figure 3: Pearson's Correlation Algorithm

A correlation coefficient will also identify the strength of the relationship between the variables. It is important to note that the strength of the variables is interpreted only if the correlation is statically significant. Guidelines adapted from O'Neil (2009) suggest that a correlation coefficient (r) can be interpreted as follows: a) 0.0 - 0.2 indicates a very weak relationship; b) 0.2 - 0.4 indicates a weak or low relationship; c) 0.4 - 0.7 indicates a moderate relationship; d) 0.7 - 0.9 indicates a strong, high relationship; and e) 0.9 - 1.0 indicates a very strong relationship. This analysis, which provides an r , r^2 , t -statistic and p -value, determined if documented student progress resulted in a statistically significant correlation or relationship when the treatment data between the two conditions were compared.

The Pearson's correlation was calculated using the mean of the treatment data derived from the two treatment conditions to determine effect size of the two sample groups. To determine if the variability noted during each condition, telepractice vs. on-site, was statistically significant, the total variances were subjected to the Pearson's correlation. To determine if there was a difference in the perceptions of telepractice as compared to on-site services from study related personnel, the resulting scores from the surveys were subject to the Pearson's correlation as well.

To determine if students made effective progress when receiving telepractice services, data were collected at baseline, and throughout treatment phases 2 and 3. The student baseline data were compared to student treatment data from the first condition using the Improved Rate Difference (IRD). As seen in Figure 4, the IRD is a simple calculation that has been proven effective in medical research (Parker, Vannest & Brown, 2009). The IRD can be applied to single case research to express the difference in

performance between baseline and the intervention phase (Parker, et al., 2009). To calculate the IRD, the improved rate percentage in the baseline are subtracted from the improved rate percentage in the subsequent treatment phase. Improved rates for the baseline are defined as the number of data points that tie or exceed any data point in the treatment phase and then are divided by the total number of data points in baseline phase (Parker et al., 2009). Improved rates for the treatment phase are defined as any data point which exceeds all data points in the baseline phase and then are divided by the total number of data points in the treatment phase (Parker et al., 2009). The resulting variable will indicate the percentage of improvement from the baseline phase to the subsequent treatment phase. The data used to calculate the IRD was obtained through Probe 1 and Probe 2 for each intervention session.

$$\frac{\# \text{ improved data points}}{\# \text{ total data points}} = \text{Improved Rate}$$

Figure 4: Improved Rate Difference Algorithm

To compare the two different treatment conditions, the Tau-U method or Kendall's Tau was conducted. The Tau-U is a nonparametric method for measuring the non-overlapping data between two phases. It is a “distribution free” nonparametric technique and will result in a z score and p-value. As seen in Figure 5, The Tau-U combines nonoverlap between phases with trend from within each intervention phase. Data entered for Kendall's Tau (Tau-U) was obtained through Probe 1 and Probe 2 for each intervention session. This analysis determined if documented student progress

resulted in a statistically significant non-overlap and trend between the two treatment phases (Parker, Vannest, Davis & Sauber, 2011).

$$\text{Tau - U} = \frac{(C - D)}{n/2}$$

C = Number of concordant pairs
D = Number of non-concordant pairs

Figure 5: Kendall's Tau (Tau-U) Formula

Through this analysis, a comparison was made to determine if there was a difference in participant outcomes when services were delivered in an on-site setting versus telepractice setting. If the data collected during the first condition was superior to baseline data then that was suggestive of an effective first intervention. When compared, if the two the conditions were not statistically significantly different, then it can be stated that the telepractice setting is at least equivalent to the on-site setting for the delivery of speech and language services for students with ASD.

CHAPTER 3

RESULTS

Results

The purpose of this study was to determine if there was a significant difference in student outcomes on specific IEP goals and treatment objectives when services were delivered in an on-site setting vs. a telepractice setting. In the sections that follow, the results of this investigation will be reported by individual participants and at the group level. Overall individual participant and group outcomes will include summary statistics, individual and group means, measures of variance, and a description of other non-verbal behaviors observed during tasks which may have impacted outcomes during a session. The total number of baseline, on-site and telepractice sessions and the total amount of probes are reported. It should be noted that the reported IEP goal and objective was not targeted during each intervention session. This is due to the treating clinician working on other speech and language IEP objectives not reported in this study. Only the sessions in which the target treatment probes were administered are reported in this study.

Individual Participant Results

A total of seven students diagnosed with ASD were included in this study. As previously reported, three participants were between the ages of 5-6 years and four were between the ages of 7-12 years. All participants completed this investigation over the course of approximately five months (February - June). To the best extent possible, each participant received an equal number of on-site vs. telepractice intervention sessions. Some therapy days during each condition were missed due to school activities, snow

days, vacation/holidays, and absentness, however all attempts were made to ensure that therapy provided within the two conditions were as equal as possible.

To determine individual student response to the service delivery conditions, statistical analyses were conducted for each participant. Data for the individual results for participants one through six are presented in Table 9 through 11. The results for participants one through six were summarized and plotted in Figures 6 through 11. A visual interpretation and subsequent description was conducted to describe the mean level shift, variability and trend of the participant's performance during the baseline and intervention conditions (Horner et al., 2005; Cooper, Heron & Heward, 2007, Ottenbacher, 2007).

Student 1: This participant received a total of 10 intervention sessions, first on-site followed by 11 via telepractice. For the target goal reported in this study, seven Probe 1 and Probe 2 tasks were administered for condition 1 (on-site) and seven Probe 1 and Probe 2 tasks were administered for condition 2 (telepractice). Sessions were missed due to a snow day, classroom testing, student absence and a half day.

Over the course of two baseline observations, Student 1 demonstrated difficulty engaging in conversations while maintaining a topic and partaking in turn-taking exchanges. This participant exhibited an increase in target skills following intervention that targeted social pragmatics, identifying how a conversational partner is feeling and conversational skills through social stories. As reflected in Figure 6, Student 1's appropriate use of conversational rules at baseline resulted in a mean of 52.20% (SD = 9.4).

Description of Intervention: Initially, treatment activities consisted of identifying appropriate and inappropriate social behaviors that occur within conversations and interactions. As the participant's skill level increased, this student was expected to respond to social stories and role-playing activities to solve various social problems through a dialogue. Student 1 demonstrated a mean of 82% (SD = 11.54) during the first condition, which was delivered on-site. The IRD for baseline compared to the successive phase was 66% which suggests that 66% of the data collected in the intervention phase exceeded data collected in the baseline phase.

As therapy progressed, and the conditions were alternated, the clinician working with Student 1 reported that he exhibited less dependency on cueing and prompting during intervention. Student 1 demonstrated self-monitoring and correction strategies during structured and unstructured settings. Toward the completion of this study, Student 1 mastered the skill and target objective. A mean of 94% (SD = 7.70) was observed during the telepractice condition for this participant. For this participant, the correlated relationship between the two treatment conditions were statistically significant, $z = 2.70$, $p < 0.05$ (see Table 9).

Qualitative Observations: This participant consistently introduced and maintained a topic and asked follow up questions, however, he continued to need support to appropriately end a conversation. School-based personnel reported generalization of target skills into more naturalistic settings such as in the school hallway. A high level of independence was demonstrated during the telepractice condition.

Visual Analysis: A visual analysis of the data represented in Figure 6 and Table 10 for Student 1 indicated a positive increase in his mean shift from baseline to the on-site setting, condition 1 and from condition 1 to telepractice, condition 2. This participant's variability was greater in condition 1 when compared to both the baseline and condition 2. The level of fluctuation that is demonstrated within the data is smallest in condition 2. Student 1 demonstrated a negative trend in outcome data during the baseline and condition 2. He demonstrated a positive trend in condition 1.

External Factors: Outside factors may have impacted this participant's performance on 3/18. On that day, it was reported that the student had a difficult time with peers out at recess and as such he was upset when he came to therapy. His emotional state may have impacted the outcomes during the session. On 4/4 a vast difference between the first probe and second probe is evident. On that day, it was reported by the treating clinician that this student appeared tired, had his head down on the table, yawed and engaged in a limited amount of verbal responses. Over the course of the session, Student 1 required verbal reminders to sit up but did engage in the activities presented. On 5/9 Student 1 performed better on Probe 1 as compared to Probe 2. There were no external factors reported that account for that observation. During final sessions of the study, a decrease is noted in this participant's performance. Previously, the student demonstrated mastery of the target conversational skills, and as such, in the subsequent sessions higher levels skills with complete independence were expected.

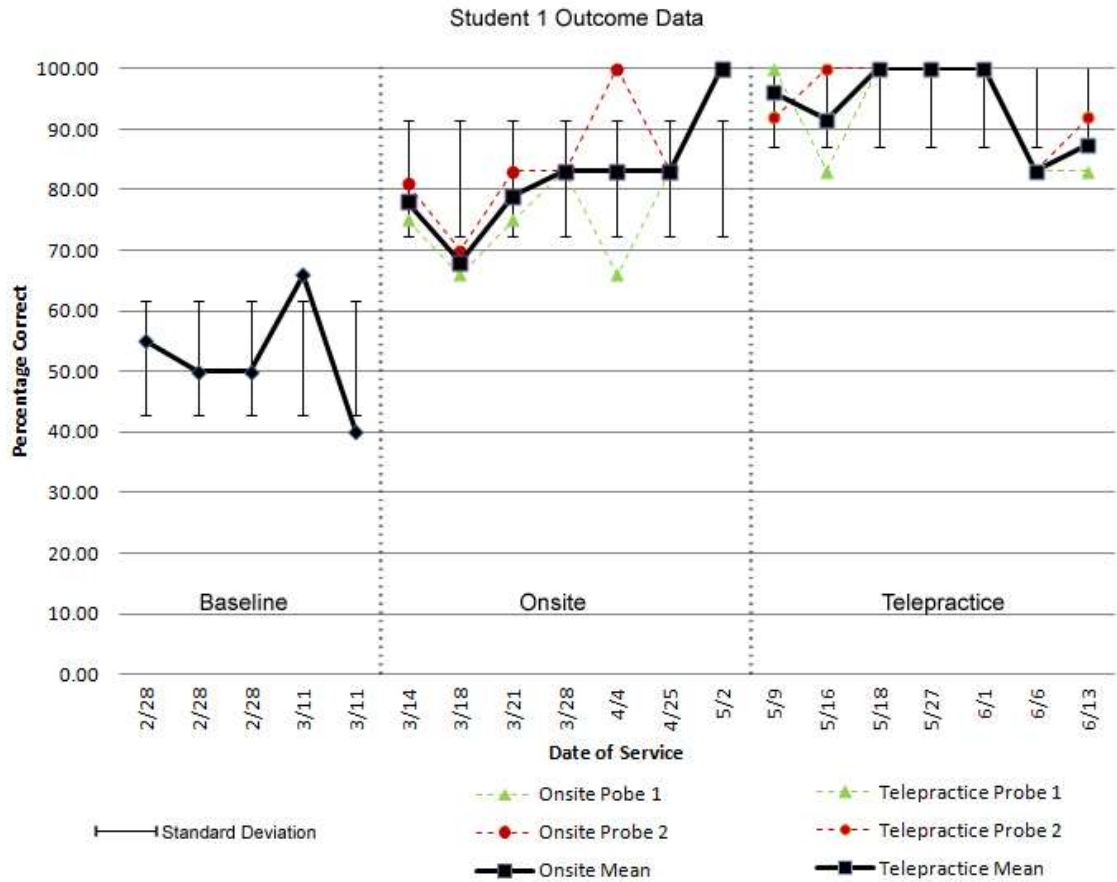


Figure 6: Student 1’s Documented Progress Across the Study

Student 2: This participant received a total of six intervention sessions on-site followed by 11 sessions via telepractice. During condition 1 (on-site), Probe 1 was administered six times and Probe 2 was administered four times. During condition 2 (telepractice), the participant was presented with the first probe on six occasions and was given the second probe on five occasions. Three times during this study, Probe 2 was not administered due to time constraints. One session was missed due to a school closing.

Student 2 joined the study one month late due to a delay in obtaining the caregiver’s signed informed consent form. As a result, the research team did not collect independent baseline data on this participant. It should be noted that this participant

received two on-site sessions from the doctoral researcher on dates 4/12 and 4/13 once the participant joined the study. As a result of the participant's late start, more telepractice sessions were conducted. To address the unequal treatment days, the data included in this study reflects the first six on-site sessions and the first six telepractice sessions only.

Prior to the start of intervention, data were obtained from the school-based SLP specialist's most current records on study-specific intervention goals and objectives obtained from their IEP. Based these reports, Student 2 demonstrated difficulty comparing and contrasting items, answering open-ended questions (i.e., "wh" and "how") and recalling details from narratives.

Description of Intervention: Intervention included looking at pictures, reading stories and narratives followed by asking the participant to answer "wh" and "how" questions. During both treatment conditions, prompting consisted of rephrasing questions or repetition of information (i.e., a sentence of the narrative read again). The first treatment condition was delivered on-site. Over that condition, Student 2 demonstrated a steady increase in target skills. This participant required a longer processing or response time when answering "wh" and "how" questions, however, her ability to recall details increased with minimal prompting as treatment continued. As seen in Figure 7, during the on-site intervention condition the documented progress on the target skill resulted in a mean of 76% (SD = 19.38). An IRD was not conducted with this participant as baseline data were not collected.

Student 2 continued to make progress when the setting alternated to telepractice and consistently demonstrated mastery for the target skills. As seen in Figure 7, the mean score for progress was 88% (SD = 10.61). Student 2's 1:1 aide reported that the participant's progress over the course of the study was above average. The treatment data obtained between the two conditions did not result in a statistically significant correlation, $z = 1.69$, $p = 0.090$ (see Table 9).

Qualitative Observations: The treating clinician reported that Student 2 actively participated in all tasks both on-site and through telepractice. Student 2 demonstrated independence with strong hand manipulation of the mouse when receiving services through telepractice. It was also reported that this participant responded better to tangible rewards (i.e., stickers) rather than computer-based rewards (i.e., butterflies flying across the screen). During telepractice sessions, tangible rewards were given to the participant by her 1:1 aide.

Visual Analysis: A visual analysis of the data represented in Figure 7 and Table 10 suggested that there was a positive shift in the mean when the aggregated outcomes from condition 1 and condition 2 were compared. A larger variability score occurred within condition 1 when compared to condition 2. A positive trend of progress outcomes existed within the data for both treatment conditions, however a greater positive change is observed in condition 1.

External Factors: During condition 1, on-site services, this participant demonstrated a high variation between the probe administered at the beginning of the session when compared to the probe administered at the end of the session. On 4/12, this

participant's first session, the participant may have been nervous and unsure what to expect. During treatment on 4/13 and 5/16 this participant demonstrated a higher performance on the second probe as compared to the first probe. There was no external factor reported by the treating clinician to account for this. On 4/25, this participant also exhibited a gap in her performance of the probes. However, there was no external factor reported by the treating clinician that may have impacted her performance. On that day, it was reported that she was engaged and actively participated in all activities. On 4/29, it was observed that toward the beginning of the session, a longer processing time (>10 seconds) was noted. On 5/18 a gap in the probes was observed. On this day, the participant again seemed engaged and actively participated in all tasks. There was no factor evident that could account for the variation.

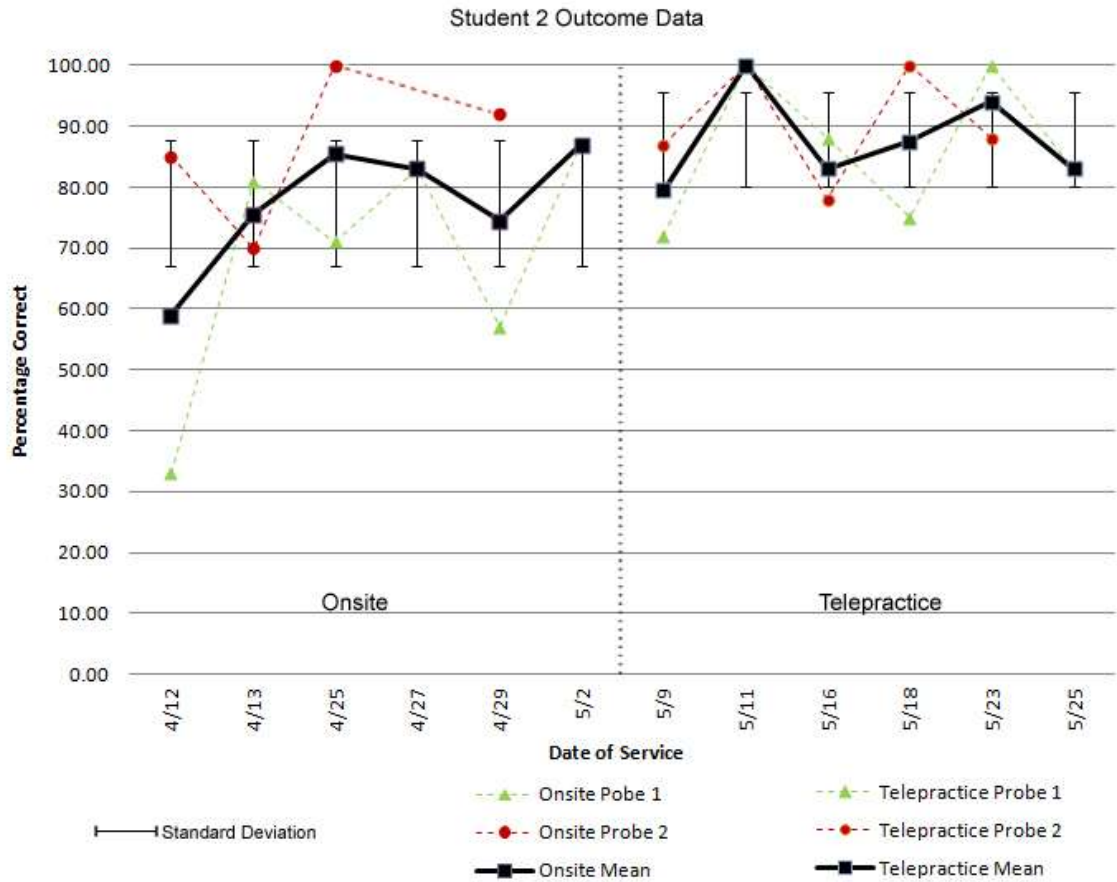


Figure 7: Student 2’s Documented Progress Across the Study

Student 3: Baseline data on this participant was collected over three sessions within two weeks. Student 3 received seven on-site intervention sessions followed by six telepractice services. Represented in Figure 8, six Probe 1s and five Probe 2s were administered in condition 1 (on-site). During condition 2 (telepractice) five probes at the beginning of treatment and four at the end of treatment were administered. As mentioned above, two probes for the target skill analyzed in this study were not given due to the time constraints.

During the baseline phase, this participant demonstrated an inconsistent level of skill on tasks that involved following directions and recalling details from a narrative.

Based on previous SLP's reports, this inconsistency in level of skill is a trend well-documented. As reflected in Figure 8, Student 3's skill level at baseline was a mean of 44% (SD = 17.30).

Description of Intervention: Intervention consisted of listening to 2-3 step directions, verbally repeating the directions and then carrying out the steps. Instructions included both physical movement (i.e., put the stuffed dog next to the book and then touch your nose) and computer-based activities (i.e., click on the green square and then click on the big ball) for both on-site and telepractice intervention services. When physical movement was expected during the telepractice condition, the participant's 1:1 aide facilitated the activity. During the on-site condition, Student 3 made progress toward the targeted objectives. His progress data during condition 1 increased to a mean of 66% (SD = 20.40). The IRD between the baseline and condition 1 was 17%, which indicated that only 17% of the on-site condition resulted in effective treatment outcomes for Student 3's skill level for following multi-step directions. This IRD was not surprising to the research team since Student 3 had been working on these skills with the SLP staff for several sessions prior to their participation in this study.

Student 3's progress remained rather consistent for condition 2, which resulted in a mean of 61% (SD = 23.40). Student 3 made adequate progress over the course of the study. As seen in Table 9, these findings yielded a non-statistical relationship between the two treatment conditions, $z = -.076$, $p = 0.939$.

Qualitative Observations: During intervention sessions, Student 3 required a considerable amount of redirection from the treating clinician and the 1:1 aide. When the

intervention sessions alternated, from on-site to telepractice, Student 3's 1:1 aide continued to provide support to help this participant attend to the treating clinician. It appeared that the computer-based activities enabled him to maintain his attention and motivation for a longer duration, which were reported to improve his performance on that particular task. This observation of prolonged attention was anecdotal and there was no qualitative data to support this. During both on-site and telepractice conditions, motor breaks were frequent and essential. These "breaks" included getting a drink of water or standing up and stretching. This participant's 1:1 aide reported that the telepractice treatment condition resulted in an improvement of the participant's generalization skills. The aide also reported that Student 3 appeared to "gain more information" through a screen presentation vs. face-to-face interactions.

Visual Analysis: A visual analysis of the data represented in Figure 8 and Table 10 suggested that Student 3 demonstrated a positive mean shift when the baseline outcomes and condition 1 outcomes were compared. A slight negative mean shift was observed when comparing outcomes from the on-site setting, condition 1 and the telepractice setting, condition 2. An increase of skill fluctuation was observed as the study progressed. Student 4 demonstrated a higher level of variation in condition 1 as compared to the baseline. He then demonstrated a higher level of variation in condition 2, telepractice, when compared to preceding condition. A positive slope is noted with both treatment conditions, however the upward slope for condition 2 is minimal.

External Factors: Student 3 demonstrated considerable variability between Probe 1 and Probe 2 on 3/7, 3/21 and on 4/11. On these days this participant preformed better during the second probe versus the first. The difference noted on 3/7 could be attributed

to the nervousness he might have felt as it was the first therapy session. There were not any external factors or influences that may have impacted his behavior reported to the treating clinician. On 4/11 another sizable gap was observed. Again, the treating clinician was not aware of any external factors that may be contributed to this variation in performance. On 5/23 Student 3 displayed a lower than expected score on both probes. Throughout the session, the participant demonstrated difficulty in attending to the tasks and required redirection from his 1:1 aide. When asked, his 1:1 aide reported that there had been a party in his classroom and that Student 3 wanted to return to the classroom. This participant demonstrated another discrepancy in his performance from Probe 1 to Probe 2 on 6/13. However, the treating clinician was not aware of any outside factor that may have impacted his performance on that day.

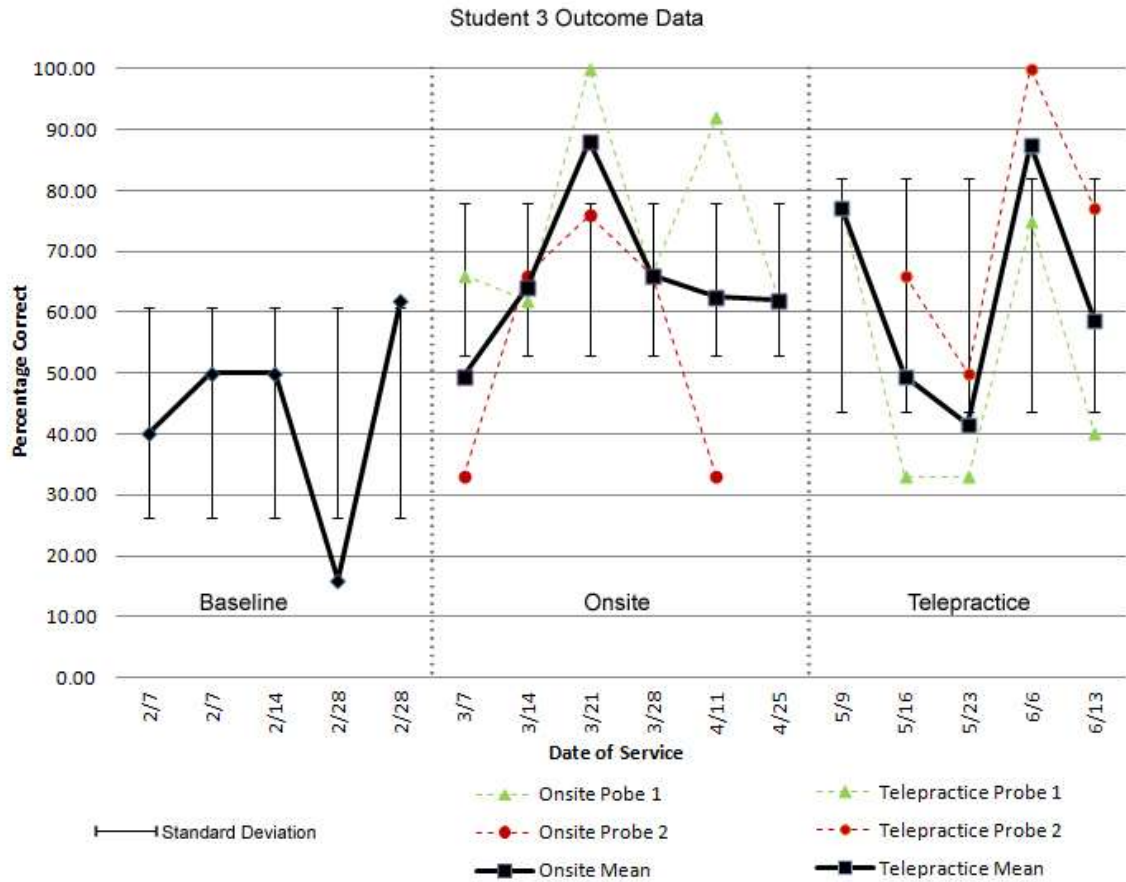


Figure 8: Student 3’s Documented Progress Across the Study

Student 4: This participant’s baseline data were collected over two sessions, followed by 13 telepractice and 14 on-site intervention sessions. Six pairs of probes were administered during condition 1 (telepractice) and condition 2 (on-site) that targeted the specific objective.

During the three baseline observations, Student 4 primarily sequenced events and steps in narratives without using transition words or he continued by using the word "then" to sequence temporal events in his expressive language. As shown in Figure 9, at baseline, Student 4's mean score for the use of transition words in a narrative context was 24% (SD = 21.96).

Description of Intervention: During the first condition delivered via telepractice, Student 4 responded well to treatment and as such, a higher level of independence was expected as the interventions in this condition progressed. When this participant engaged in sequencing tasks and stories, the variety of transition words he used increased and ranged from “first”, “then”, “next”, “after”, “last”, and “finally”. As seen in Table 9, during the telepractice condition, Student 4's mean was 91% (SD = 12.68). The IRD between the baseline and telepractice condition was 100% and which indicated that 100% of the treatment conditions resulted in a higher performance when compared to the baseline.

During the first two on-site sessions, Student 4 refused to participate in intervention tasks and rested or tilted his head down on the table. As a result, the experimental data collected during the first two sessions for both the on-site and telepractice conditions were not included in the analyses for this participant. Student 4 started to engage in the intervention services following this initial two-day period of refusing to participate in services delivered on-site. The treating clinician reported that Student 4 would “shut-down” at times, however, overall he seemed to enjoy the 1:1 attention and positive verbal reinforcement provided during the on-site intervention services.

Of note is that Student 4 was the only participant in this study that demonstrated a decrease in the mean performance during the second on-site treatment condition. This may be due to the lack of cooperation that the clinician's experienced during the on-site condition. The data for the telepractice condition suggests that Student 4 demonstrated mastery of the target skills, however, this level of success was not demonstrated for those

intervention sessions delivered on-site. Nonetheless, Student 4 made adequate progress on the use of transition words during the on-site intervention condition.

The mean for the on-site condition was 68% (SD = 21.15). This participant's outcome resulted in a significant correlation between the two conditions $z = -2.50$, $p < 0.05$ (see Table 9).

Qualitative Observations: On-site school-based personnel reported that when Student 4 received services through telepractice he was attentive and actively participated in intervention sessions with little to no redirection. However, when the intervention conditions changed from a telepractice delivery to on-site services, Student 4 exhibited difficulty adjusting to the change. The on-site staff reported that during the on-site intervention phase the number of behavioral issues increased as compared to the telepractice sessions. It was also reported that during the on-site sessions, Student 4 would state that he was "depressed" and that he "didn't like school." In contrast, during the telepractice condition, the on-site staff reported that Student 4 looked forward to "Skyping" and that this would adjust or "change his mood" when attending SLP therapy.

Visual Analysis: A visual analysis of the data represented in Figure 9 and Table 11 indicated that Student 4 demonstrated a positive mean shift when comparing the baseline outcome to the telepractice outcome. The level of performance resulted in negative shift once the services switched on an on-site setting. A reduction in the variability was noted when comparing baseline data to data collected the first condition, telepractice. An increase in the fluctuation of skill was noted when comparing the outcome data collected during condition 1, telepractice, to condition 2, on-site. An

upward trend is noted during baseline and condition 2. A downward trend is noted in condition 2.

External Factors: A gap in services occurred in early May due to school-based screenings and participant behavior. During these sessions, the participant refused services and just put his head on the desk. He reported that he had experienced a difficult time with his peers during gym class and therefore the data from that day was not included in this study. On 4/1, the participant demonstrated a better performance on Probe 2 as compared to Probe 1. On that day, the participant reported that he was "depressed." This may have been due to a two hour snow delay on that day which resulted in a different academic schedule than what the participant was accustomed to. On 5/20, although a difference in performance between Probe 1 and Probe 2 is noted, the participant arrived to therapy in a positive mood and cooperated in all activities. During the therapy session on 5/28, the participant was reluctant to engage in the activities that the treating clinician prepared. The low score demonstrated in Probe 1 may be a product of unwillingness rather than skill level. On 6/1, the participant again displayed a higher performance on Probe 2 versus Probe 1. There were no external factors reported that account for that difference.

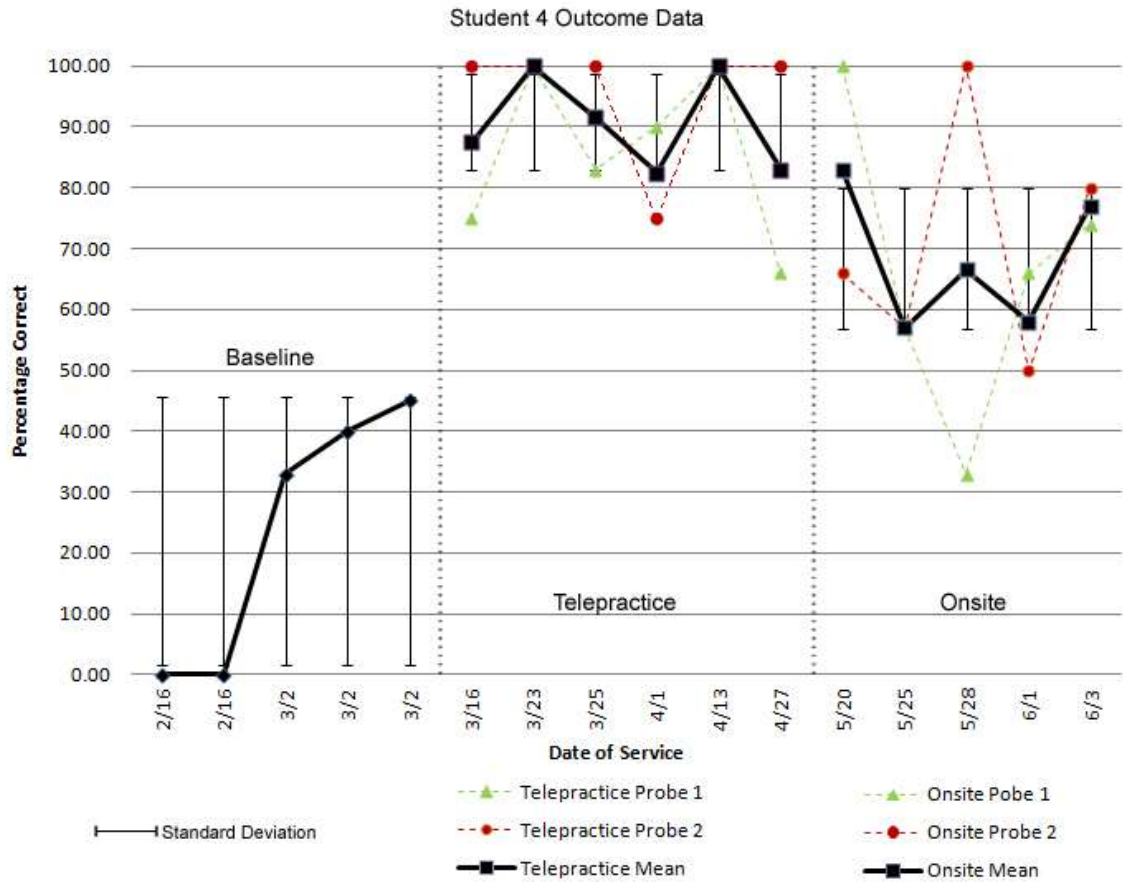


Figure 9: Student 4’s Documented Progress Across the Study

Student 5: This participant’s baseline data were obtained over two sessions and he participated in 12 telepractice sessions followed by 12 of on-site intervention sessions. During condition 1 (telepractice), probes that targeted the IEP objective were given seven times at the beginning of treatment and five times at the end of treatment. During condition 2 (on-site) five pairs of probes were administered on the same target objective. After 6/8 the IEP objective was not targeted as the participant demonstrated mastery over the course of four intervention sessions.

As seen in Figure 10, at baseline, Student 5 demonstrated a limited skill level producing grammatically correct sentences using correct irregular past tense verb forms.

Student 5's baseline mean for the production of irregular past tense verb forms at the sentence level was 10% (SD = 22.36).

Description of Intervention: During condition 1, treatment tasks were outlined to target the production of irregular past tense verb forms using visual stimuli such as pictures with action scenes and reading narratives followed by open-ended questions to solicit target behaviors spontaneously. During condition 1, this participant demonstrated progress on the target skill. This participant's mean during the telepractice session, condition 1, was 75% (SD = 13.50). The IRD between the baseline and condition 1 was 100%, which suggested that 100% of the telepractice intervention sessions were resulted in increase of performance (see Table 9).

Student 5 obtained a mean of 85% (SD = 11.95) during the on-site setting, condition 2, as shown in Figure 10 and Table 9. At the completion of the study, Student 5 demonstrated mastery of the target skill. This participant responded well to both treatment conditions and his progress did not result in a correlational difference between the two treatment settings $z = 1.40$, $p = 0.137$.

Qualitative Observations: It seemed that Student 5 enjoyed receiving intervention using the computer for both conditions. It should be noted that this perceived level of attention is based upon qualitative observations rather than quantitative data collection. During the telepractice condition, it was reported by the on-site facilitator that this participant exhibited hand-flapping behaviors and slight body rocking motions. These behaviors were also observed during the on-site condition. During the on-site condition,

Student 5's level of attention was reported to be not as high and they required more redirection by the treating clinician.

Visual Analysis: A visual analysis of the data represented in Figure 10 and Table 11 indicated that Student 5 demonstrated a positive shift in the mean scores from baseline to condition 1 and condition 1 to condition 2. Variability was noted throughout the phases with the highest level being the baseline, followed by the telepractice and then the on-site condition. During baseline, a positive slope is observed. During the condition 1, telepractice, a negative slope is noted and during the condition 2, online, a positive slope is evident.

External Factors: There were no external factors reported that may have impacted Student 5's performance over the course of the study, other than minor technical difficulties. The gap in service that occurred between 4/13 - 4/27 was a result of a school-wide vacation.

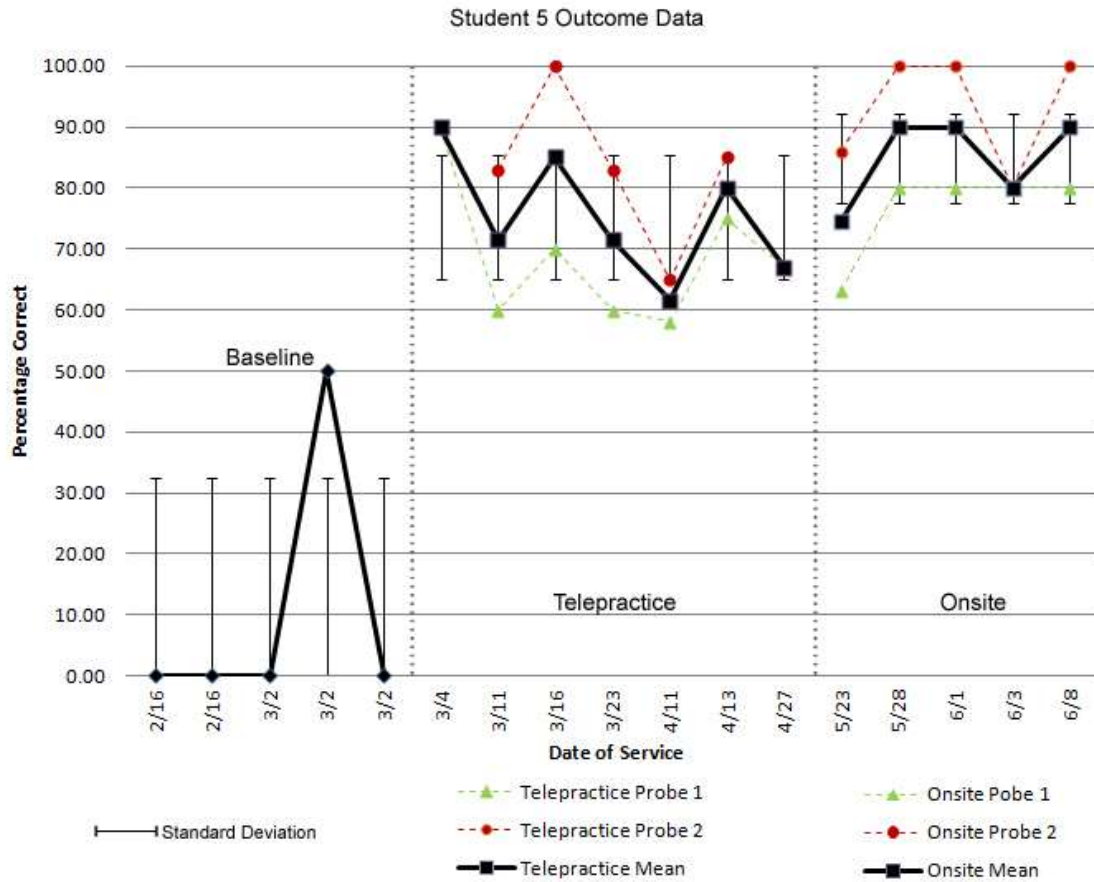


Figure 10: Student 5's Documented Progress Across the Study

Student 6: This participant's baseline data were obtained over two sessions. The participant received 10 telepractice sessions followed by 10 on-site intervention sessions. Five pairs of probes were administered the target goal in condition 1 (telepractice) and four pairs of probes were administered in condition 2 (on-site).

This participant's target goal and objective included a treatment program to remediate an articulation problem for a lateralized lisp that distorted the production of the fricative sound, "sh." At baseline, Student 6 produced a lateralized lisp for all productions of this target speech sound and demonstrated a mean of 6% (SD = 13.42) as shown in Figure 11 and Table 9. The outcomes of this intervention program delivered

via telepractice followed by on-site services resulted in an overall increase of performance of the target skill.

Description of Intervention: Student 6's overall mean for intervention delivered via telepractice was 57% (SD = 21.48). The IRD between the baseline and first treatment condition was 20%, which suggests that 20% of condition 1 resulted in an improved demonstration of skill. During the telepractice condition, Student 6 demonstrated an improvement for the production of "sh" fricative using visual-tactile cueing and an articulatory type of oral-motor warm-up activity (to facilitate tongue and jaw stability). To facilitate greater precision of articulation during production of this fricative, on-site personnel and/or the participant used a hands-on tactile cueing approach.

Once intervention switched to the on-site setting, Student 6 continued to demonstrate improvement. The overall mean for the on-site setting was 79% (SD = 12.95) as seen in Table 9. He appeared to enjoy the activities presented on the computer. Despite some redirection needed for minor behavior and focusing difficulties, Student 6 participated in all expected tasks. He continued to respond well to 1:1 attention and positive reinforcements such as stickers. He demonstrated adequate progress of the target sound "sh" and generalization of this skill at the phrase and sentence level. For this participant, there was a correlational difference between the two conditions, $z = 2.14$, $p < 0.05$ (see Table 9).

Qualitative Observations: The treating clinician reported that Student 6 willingly participated in telepractice sessions and remained engaged throughout the sessions. This participant responded well to positive reinforcement, such as online rewards (i.e., a pop-

up of a cartoon dog or fish) and stickers. During the telepractice setting, tangible rewards were given to the participant by the on-site facilitator. Although an increase in skill level is observed during condition 1, this participant also appeared to be distracted by his own video image on the videoconferencing monitor. As a result, the on-site personnel was asked to refocus this participant's attention to the task. With a verbal cue he was redirected to the task at hand. On-site personnel reported that Student 6 engaged in slight rocking movements during the telepractice sessions. During the most of the on-site sessions it was noted that Student 6 engaged in rapid eye-blinking.

Visual Analysis: A visual analysis of the data represented in Figure 11 and Table 11 indicated that Student 6 demonstrated a positive mean shift from baseline to telepractice and from telepractice to on-site services. There was variability noted in each condition with the most pronounced being the telepractice condition. Once the student received on-site services, the level of fluctuation in the data was not as large. An upward trend or slope was noted within both conditions. However, the degree of the slope is higher during on-site services.

External factors: It was verbally reported by the treating clinician that the acoustic-perceptual and speech quality of the "sh" was difficult to determine through the use of the telepractice equipment. In addition, telepractice services were hindered by some infrequent technical difficulties (i.e., slow Internet resulting in a decreased audio/video quality), which may have compromised the acoustic assessment of the speech target. During the treatment session on 3/16 it was noted that the participant's production of "sh" was inconsistent. This may account for the higher performance noted on the first probe as compared to the second probe. On 3/30, Student 6 demonstrated a

low overall performance, and Probe 1 was higher than Probe 2. On that day, it seemed that he was distracted by the technological issues which may have impacted his performance. A delay in the videoconferencing was reported with impacted the quality of the audio and video connection. A perceived gap in services occurs from 4/6 - 5/13. During this time the "sh" sound was targeted during intervention sessions however the beginning and end probes were not given and therefore the data is not reported. On 5/13 and 6/8 Student 6 performed better on Probe 1 as compared to Probe 2. On 5/13, there is no specific factor that could account for this difference, however on that day, rapid eye blinking was observed from the treating clinician and on-site facilitator, which could be an indication that the participant felt some anxiety. On 6/8 it was reported that the participant appeared calm during the first several minutes of therapy but then required increasing redirection from both the treating clinician and on-site facilitator. Rapid eye blinking was noted during this session as well.

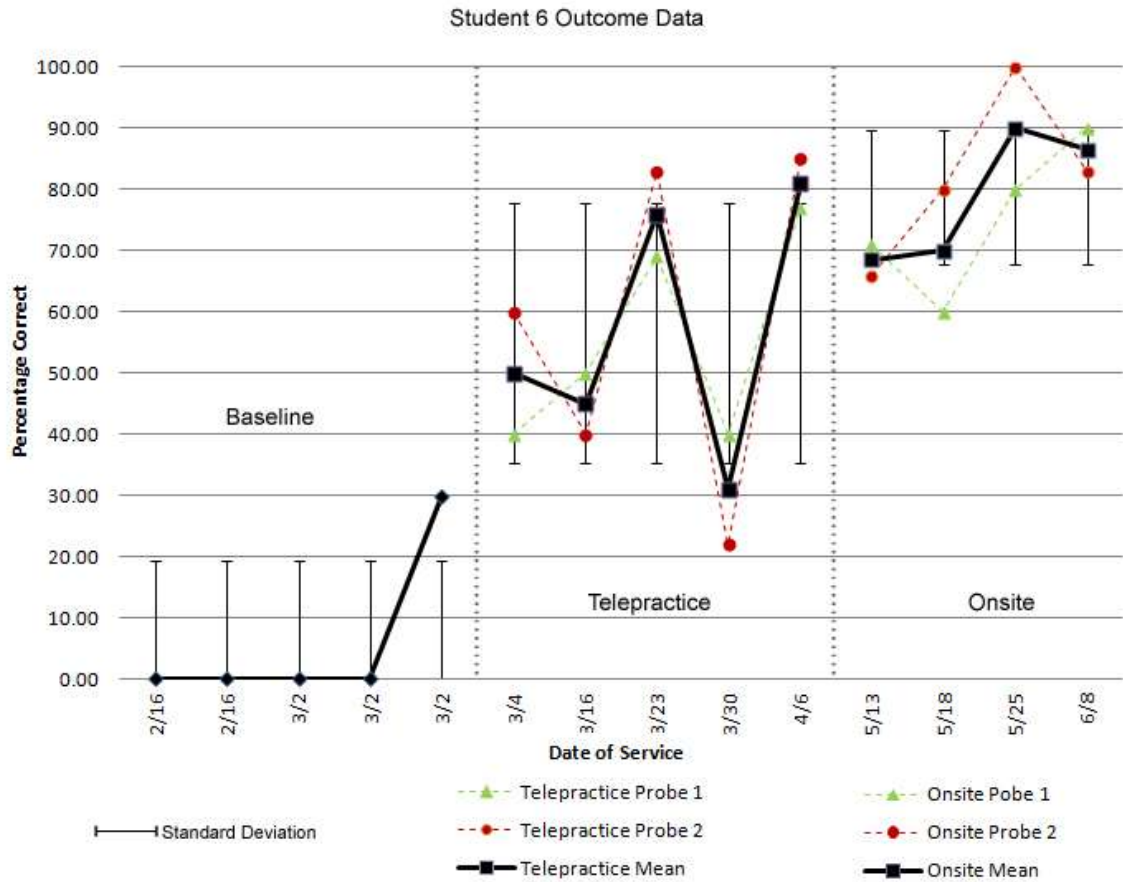


Figure 11: Student 6's Documented Progress Across the Study

It is important to note that this study initially included a seventh participant, however, this participant was eliminated from the study due to technical difficulties that plagued the delivery of telepractice services to this participant. The research team reported that the results obtained were judged to be incomplete and unreliable due to the number of technical difficulties encountered during the telepractice sessions. This participant received a total of 10 telepractice sessions with five of them (50%) encountering technical difficulty and 11 on-site sessions with one of them (10%) resulting in technical difficulty. These technical difficulties included losing the Internet connection during treatment sessions or slow transmission of videoconferencing due to

poor interconnectivity and/or issues with the modem not transmitting the signal which resulted in a loud and frequent noise. A decrease in the quality of the audio/visual connection interfered with the collection and assessment of outcome data. The research team consulted with the on-site IT specialist at the participating school and it was determined that the above noted difficulties were a result of the high bandwidth demand at the school during the time of the participant's telepractice sessions. The treating clinician was typically scheduled to deliver services to this student during the lunch hour. The access and use of the Internet significantly increased during this period of the school day and as such, these technical issues had a detrimental effect on the quality of services that were provided via telepractice. To compensate for these technical issues, the treating clinician rescheduled some of the missed therapy sessions at different times during the school day. However, since there was a significant discrepancy between the number of high-quality telepractice intervention sessions and treatment data collected during the telepractice as compared to the on-site condition, the research team eliminated Student 7 from the study. The technical difficulties noted with this participant were isolated and did not impact the services provided to the other students receiving services from that school site.

Table 9: Individual Results for Participants 1-6

Participant	Baseline		Onsite		Telepractice		IRD	Tau - U Significance
	Mean	SD	Mean	SD	Mean	SD		
1	52%	9.44	82%	11.54	94%	7.70	0.66	p < 0.05
Group 1 2	-	-	76%	19.38	88%	10.61	-	p = 0.090
3	44%	17.29	66%	20.35	61%	23.41	0.17	p = 0.934
4	24%	21.96	68%	21.15	91%	12.68	1.00	p < 0.05
Group 2 5	10%	22.36	85%	11.95	75%	13.50	1.00	p = 0.137
6	6%	13.42	79%	12.95	57%	21.48	0.70	p < 0.05

* The baseline data for Student 2 not collected

Probe 1 and 2 data were used to calculate the means and SD for all participants

Group 1 received services in an ABC design (baseline, on-site, telepractice)

Group 2 received services in an ACB design (baseline, telepractice, on-site)

Group Results

The visual analysis was examined to determine if any patterns were evident throughout the groups (Tables 10 and 11). All participants in Group 1 demonstrated an upward mean shift when comparing the baseline mean to the on-site mean. Two participants demonstrated an increase in the mean shift when comparing on-site services to telepractice. For the two Group 1 participants for which there was baseline data, an increase in the variability occurred when comparing baseline to on-site services. When the services switched to telepractice, two students demonstrated a reduction in the level of variability and one student demonstrated an increase in the level of variability. An upward slope was observed when comparing baseline data to on-site service data for all Group 1 participants. There was a decrease in the slope for all participants when services again changed to telepractice.

Table 10: Visual Analysis Data for Group 1 Participants

	Group 1 Participants		
	1	2	3
Mean Shift			
Baseline - On-site	.57	N/A	.51
On-site - Telepractice	.15	.16	-.07
Variability			
Baseline	9.44	N/A	17.29
On-site	11.54	N/A	20.35
Change	2.10	N/A	3.06
Variability			
On-site	11.54	19.38	20.35
Telepractice	7.70	10.61	23.41
Change	-3.84	-8.77	3.06
Slope			
*Baseline	-1.4	N/A	1.00
* On-site	3.57	N/A	1.03
*Change	2.17	N/A	.03
Slope			
* On-site	3.57	3.84	1.03
* Telepractice	-1.52	.11	.10
*Change	-5.09	-3.73	-.93

Group 1 received services in an ABC design (baseline, on-site, telepractice)

* A minimum of eight data points are recommended to achieve a reliable slope calculation, the datasets used do not meet that minimum

As with Group 1, all participants in Group 2 demonstrated an upward mean shift when comparing the baseline mean to the telepractice mean. One participant demonstrated a decreased mean level shift when comparing the telepractice mean to the on-site mean. Two participants demonstrated an increase in the mean shift when comparing telepractice to on-site. For two Group 2 participants, there was an decrease the variability of the data when services telepractice services were compared to onsite services. One participant demonstrated a higher variability during the telepractice

services as compared to on-site services. There was a decrease in the trend or slope of data for two Group 2 participants when comparing baseline to telepractice services. When comparing the slope for telepractice services and on-site services, one participant demonstrated a decreased slope or trend and the other two demonstrated an increased trend or slope.

Table 11: Visual Analysis Data for Group 2 Participants

	Group 2 Participants		
	4	5	6
Mean Shift			
Baseline - Telepractice	2.85	6.47	8.43
Telepractice - On-site	-.23	.14	.39
Variability			
Baseline	21.96	22.36	13.42
Telepractice	12.68	13.50	21.48
Change	-9.28	-8.86	8.06
Variability			
Telepractice	12.68	13.50	21.48
On-site	23.22	11.95	12.95
Change	10.54	-1.55	-8.53
Slope			
*Baseline	13.00	5.00	6.00
* Telepractice	-.90	-2.70	4.80
*Change	-13.90	-7.70	-1.20
Slope			
* Telepractice	-.90	-2.70	4.80
* On-site	-1.10	2.10	7.40
*Change	-.20	4.80	2.60

Group 2 received services in an ACB design (baseline, telepractice, on-site)

* A minimum of eight data points are recommended to achieve a reliable slope calculation, the datasets used do not meet that minimum

To determine the difference between the two conditions at a group level, a Pearson's r correlation was conducted. This analysis compared the aggregated data collected during the on-site condition to the aggregated data collected during the

telepractice condition and the means of both conditions were compared. Although these comparisons are made with a small n, the functional value of the group relationship will support the ultimate determination whether or not telepractice is as effective as on-site services in terms of a treatment delivery methodology. As seen in Table 12, there was no significant relationship or effect between the treatment data for the two conditions in terms of student outcomes, $r^2(4, N=6) = 0.036, p = 0.718$. To determine if there was a difference in the variances demonstrated by the participants, a Pearson's correlation was conducted. The variances for each participant in each condition were compared. The differences in variances did not result in a finding of significance $r^2(4, N=6) = 0.199, p = 0.375$, at the group level. The pre and post assessment scores from the CASL were subject to the Pearson's correlation. The correlated differences in the assessments did not result in a finding of significance at the group level, $r^2(3, N = 5) = 0.241, p = 0.401$.

Table 12: Group Correlations for Mean Scores, Variances, Pre/Post Assessments

	Pearson's Correlation	
	r^2	Significance
Group 1 and Group 2 Mean Scores	0.036	p = 0.718
Group 1 and Group 2 Variances	0.199	p = 0.375
Group 1 and Group 2 Pre and Post Assessments	0.241	p = 0.401

Probe 1 and 2 data were used to calculate the mean and the SDs for all participants

The SDs for all participants were squared to determine the variance

Inter-Observer Reliability

A doctoral researcher and a doctoral level certified and licensed speech language pathologist that was not affiliated with the study served as observers for the study. Inter-observer reliability (IOR) measures were conducted for 20% of the treatment probes for data obtained during on-site and telepractice conditions. Twenty percent of each student

participant's outcome data from each group were randomly selected. Inter-observer reliability agreement was calculated by dividing the number of scored agreements by the total number of possible agreements and multiplying by 100. The percentage of agreement for this study was 93% (range was 83% - 100%), which is suggestive of a fairly high inter-rater reliability (Jackson, 2006).

Study Related Personnel Satisfaction

To determine clinician satisfaction of telepractice as a service delivery model, the treating clinicians completed surveys at the onset and at the completion of the study. The surveys required that the clinicians rate six statements regarding telepractice as either (1) Not Very Good; (2) Below Average; (3) Above Average; or (4) Very Good. The larger the score for each item (with 4 being the highest), the more positive the clinicians' perception of each statement.

Pre-study surveys were available for four out of the four treating clinicians. One of the treating clinicians left the country and therefore only three out of the four treating clinicians were available for the post-study. Over the course of the study, the treating clinicians reported an increase in their satisfaction and impressions of telepractice as a service delivery model for SLP services (see Table 13). The averaged mean for all treating clinicians prior to the start of the study was 2.7. The averaged mean for all treating clinicians at the completion of the study was 3.4. All of the statements resulted in a positive change with the exception of "ability to communicate with the on-site team over the course of the study" which resulted in a negative change.

Table 13: Treating Clinicians' Responses to the Survey Pre/Post Study

Question	Averaged Clinician Rating	
	Pre-Study	Post-Study
Delivery of speech language therapy using telepractice.	2.5	2.7
Student's progress over the course of the study.	2.5	3.7
Your ability to communicate with the on-site team over the course of the study.	3.5	3.3
Your attitude about speech and language services via telepractice.	2.5	3.7
How do you think telepractice compares to face-to-face therapy?	2.25	3.25
What is the likelihood that you would recommend telepractice to your colleagues?	3.0	3.7
Average Mean Score	2.7	3.4

The Pearson's correlation statistic was calculated to determine whether there was statistical significance in the relationship of the treating clinician's perception before and after the study. The comparison resulted in a finding of non-significance $r^2(4, N = 6) = .012, p = 0.83$.

In addition, school personnel completed surveys. Two out of the four on-site facilitators completed the pre-study survey, and all four completed the post study survey. In regards to the pre-study survey, one on-site personnel joined the study approximately one month after the start of the study and the other on-site personnel did not return the survey. Consistent with the judgments reported by the treating clinicians, the on-site facilitators reported an increase in the overall satisfaction of the program as compared to their initial impressions of the program pre-study. The averaged mean for all on-site staff prior to the start of the study was 3.1. The averaged mean for all on-site staff at the completion of the study was 3.8. The surveys queried the on-site facilitators using the

same statements as those utilized to obtain ratings among the treating clinicians (see Table 14). The on-site facilitators reported an increase of the statements with the exception of "what is the likelihood that you would recommend telepractice to your colleagues?" which did not result in a change.

Table 14: On-Site Facilitator Responses to the Survey Pre/Post Study

Question	Aggregated On-Site Staff Rating	
	Pre-Study	Post-Study
Delivery of speech language therapy using telepractice.	2.5	4.0
Student's progress over the course of the study.	2.75	3.5
Your ability to communicate with the treating clinicians over the course of the study.	3.5	4.0
Your attitude about speech and language services via telepractice	3.0	4.0
How do you think telepractice compares to face-to-face therapy?	3.25	3.5
What is the likelihood that you would recommend telepractice to your colleagues?	3.75	3.75
Average Mean Score	3.1	3.8

These outcome data were subjected to a Pearson's correlation to determine if there was a statistical significance between the satisfaction surveys completed by the on-site facilitator pre- and post-study. These results were not statistically correlated $r^2(4, N = 6) = .003, p = 0.91$.

CHAPTER 4

DISCUSSION

Discussion

Individual student outcomes for three out of the six student participants did not yield statistically significant findings between those services provided via telepractice compared to those delivered on-site. Student 1 (for whom the target skill focused on conversational skills), Student 4 (for whom the target skill was using transition words) and Student 6 (for whom the target skill involved remediation of a lateral lisp) exhibited a difference between telepractice vs. on-site services. Student 1 and Student 4 responded better to those intervention services delivered in a telepractice setting, however, Student 6 demonstrated more favorable outcomes for intervention services provided in the on-site setting. The differences between the two conditions, telepractice vs. on-site services, for Student 1 and Student 6 may be due to the fact that both students demonstrated improved skill during the second treatment condition and improvement would have been noted regardless. Moreover, the specific type of skill that was targeted may have impacted the difference between the conditions. For example, Student 1's target skill involved conversational speech rules. During intervention delivered via telepractice, he was able to explicitly learn conversational rules, practice in a structured setting and then role play with the clinician. These findings are consistent with other published studies that use technology to facilitate social skills individuals with ASD (Reed, Hyman & Hirst, 2011). Further research should be conducted to determine the effect that technology, specifically telepractice, has on learning and generalizing social skills in a school-based setting. The

proposed research studies should provide a direct comparison between the use of telepractice and more commonly accepted and utilized approaches.

Student 6's target goal entailed reducing a lateralized lisp. Although progress was noted in both conditions, based on empirical findings, Student 6 responded better to the on-site intervention setting. This finding could be due to maturation, however it could also be related to the need for precise clinical judgment required to treat a lateralized lisp. Intervention for a lisp includes ongoing assessment regarding the acoustic quality of speech, the production and analysis of the deviant speech sound, and the method in which correct placement is achieved. Hands-on manipulation and tactile cueing from the clinician is impossible to be achieved through telepractice.

It should be noted that the statistical difference observed in Student 6 with an articulation problem is not consistent with similar clinical case studies reported in published literature. There is empirical evidence to support the use of telepractice for those communication disorders that require a high level of clinical precision and proprioceptive cueing and feedback. For example, telepractice has been utilized successfully as a service delivery mechanism to treat voice disorders, speech sound and phonological differences that require judgments be made on the basis of one's speech precision and the acoustic perceptual qualities of their voice (Theodoros, 2011; Grogan-Johnson, Alvares, Rowan & Creaghead, 2011; Mashima & Holtel, 2005).

Student 4 received telepractice as the first condition. He responded well to the use of the material and equipment associated with a telepractice methodology. His observed skill level increased and school-based personnel reported that he enjoyed

receiving intervention in that setting. Once services were rendered in an on-site setting, Student 4 displayed adverse behavior and refused to engage in therapy on several occasions. It is probable, that the documented outcomes are not a reflection on the skill level of the student, but rather his willingness to participate. It is possible that certain variables, such as a high interest in technology and computers, may have contributed to this student's motivation to participate in the telepractice sessions, whereby he demonstrated a mastery of the target skill. To this authors knowledge, there is not any published literature that directly compares the motivation and willingness to engage in telepractice versus on-site therapeutic interventions with students diagnosed with ASD.

One major finding as a result from the current study and was highlighted by difficulties in providing telepractice services to Student 7, is the need for reliable equipment and a stable high-speed Internet connection. This finding was consistent with Rule et al. (2006) in that the unreliable high speed Internet impacted the quality of the connection and therefore services were unable to be provided (Rule et al., 2006). Due to the development of new methodologies within the educational and clinical setting, such as telepractice, clear guidelines regarding specific broadband interconnectivity and equipment must be established prior to the onset of intervention to ensure high-quality services. (Appendix G).

Correlational analysis at the group level did not indicate a statistical difference between the outcomes students demonstrated when receiving services in a telepractice setting as compared to an on-site setting. This author acknowledges that the small sample size limits the ability to generalize this finding to all students with ASD. However, this finding at the group level is consistent with published literature that

compared the use of telepractice methodologies to provide training to parents of children with ASD (Vismara et al., 2009). In that study, Vismara and her research team implemented a similar research design and alternated the method of training parents on a specific protocol over the course of one year.

Limitations

There are several limitations associated with this study. As previously stated, this study included a small number of participants with ASD. As such, the ability to generalize the results to other students with ASD and/or other individuals with communication disabilities is limited. A randomized double blind clinical trial is the gold standard needed to further validate the use of telepractice in a public-school setting for the provision of telepractice services to students with ASD.

Furthermore, the independent variables of this study included specific IEP goals that targeted a speech and/or language disorders on each participant. The research design did not control for the type and level of severity of the communication disorder for the inclusion and exclusion of participants.

It should also be noted that baseline sessions for several of the students indicate that they were demonstrating progress toward the treatment goal prior to the onset of intervention. Moreover, all students had been receiving intervention for their IEP goals and objectives prior to the study. Also, each participant was studied utilizing a different set of target goals and objectives obtained from their IEP.

Maturation must also be considered a limitation of this study. Two of the three students that resulted in a significant difference between the conditions demonstrated the

higher mean in the second condition. This improvement of behavior could be a result of intervention in general rather than the service method in which the intervention was delivered.

At the time of this study, a predetermined list of equipment or Internet capabilities was not available. A list of equipment along with Internet usage considerations would have helped this research team avoid the technical issues that were present for Student 7. For most telepractice services, the requirements needed to engage in this practice include a reliable "off the shelf" computer, web-camera and high-speed Internet with minimum bandwidth requirements. The use of "off the shelf" equipment is consistent with other published research that demonstrated a successful implementation of telepractice services to individuals with ASD. Gibson et al. (2010) used Dell computers to provide remote training and intervention services to teaching staff working with a child with ASD. In all three of Machalicek et al.'s (2009, 2009, 2010) studies, Mac-Book laptops were used in conjunction with external iSight cameras to guide teachers to conduct functional analysis and paired choice assessments with a total of 10 students with ASD. Throughout all of the studies, stable high speed Internet was a necessity.

Furthermore, there was not a standardized probe resource that was used for all the participants. All probes were customized for the participant and the level of difficulty changed depending on their skill progression. Nor was there any guideline to how material and activities should be presented through telepractice. Throughout out the study, treating clinicians qualitatively noted features, computer functions and display of materials that seemed to reduce "visual clutter" on the screen. Visual clutter refers to ads, tool bars, chat boxes and/or any other extra visual stimuli present on a web-page or

activity that may impact and distract students from the intended purpose of the activity. Again, these observations are anecdotal and to this authors knowledge there is no reference in any study to the optimal positioning of monitors or display of material as it directly pertains to the direct services of students with ASD.

A qualitative method or matrix to judge behavior, interest and attention was not used for this study. The treating clinician and on-site facilitator reported differences in the number and type of stereotypical behaviors exhibited by some of the participants. In general, the telepractice setting seemed to result in a reduction of the number and level of stereotypic behaviors (i.e., hand-flapping, eye blinking and rocking). This observation was qualitatively reported by treating clinicians and on-site facilitators throughout the study and quantitative data were not collected on the specific type, number and duration of such repetitive behaviors. These observations were beyond the scope of the current study but it is suggested that researchers in speech and language pathology work with behavior specialists to quantify and compare the behaviors displayed by participants in both conditions.

Throughout this study, the on-site personnel provided insightful observations and facilitated intervention sessions through a variety of measures. However, tasks other than setting up the equipment and bringing the student to and from services, were not pre-determined nor identified at the onset of the study. Therefore, the role and responsibility of the on-site facilitator must defined and determined in advance. An initial training on the equipment, purpose of the intervention and carryover strategies is warranted and should be provided by individuals with expertise in the use of videoconferencing for treatment purposes. The on-site facilitator plays a very important role in the delivery of

telepractice interventions. In addition to coordinating the services and schedule, this person also acts as a liaison between the off-site clinician and other school-based personnel. A strong working relationship is essential as the on-site facilitator will have access and knowledge to recent events, classroom based themes and other school based activities. Moreover, if properly trained, on-site personnel may be able to offer assistance in terms of judging correct and incorrect speech and language productions, provide tactile modeling and help manipulate the environment/SLP room for clinical purposes. The use of on-site personnel must be examined within the context and scope of practice at a state-by-state level for paraprofessionals, 1:1 aides, SLP-As and other educational assistants.

This study did not include a large dataset for each participant. If this study were longer in duration, the external factors noted in the results section may not have impacted each participant's mean score to the extent reflected in this study. For example, several students demonstrated an unwillingness to participate in some activities which resulted in a reduction of their performance for that session. These low data points impacted their overall outcomes to a much greater degree as a result of the small dataset collected for each target goal.

A comprehensive, evidence-based telepractice framework would have been beneficial for a study such as this. At the time of this study, such a framework was not available. The development of a framework would support and guide clinicians in terms of communicating and collaborating with off-site colleagues. This may have impacted the way study related personnel communicated with each other and their overall perception of telepractice. At the completion of the study, the professionals involved

with this investigation acknowledged that telepractice was an appropriate and acceptable method for delivering intervention services to this population of students. The overall lower scores obtained at the start of the study suggest that the treating clinicians' and on-site facilitators' initial impressions or knowledge of telepractice were relatively limited which supports the need to extend the use of telepractice outside of direct services and use this methodology for consultation, training and collaborative efforts.

Lastly, telepractice and on-site intervention sessions were consistent as much possible, however, students in Group 1 received less therapy than students in Group 2. This was due to disruptions such as snow days, half days and holidays that occurred during the days Group 1 students were scheduled for intervention.

Conclusions

The purpose of this study was determine if there was a difference in outcome data of IEP goals and objectives between two delivery methods, telepractice and on-site with participants with ASD. For this current study, analyses were conducted at various individual levels, both with treatment probe data and standardized assessments and no statistically significant differences were found in three participants between the two conditions, on-site verses telepractice. Upon individual analysis, three students did not demonstrate a correlated difference between the two conditions and as such, the null hypothesis could not be rejected. For the other three participants, a correlated difference was noted and therefore, the alternative hypothesis was rejected. Results at a group level suggest that there was not a correlated difference in progress outcomes on IEP goals and

objectives, the variance within each condition and the pre/post assessments. Therefore, the null hypothesis could not be rejected at the group level.

With respect to the three participants that did demonstrate a correlational difference between the two conditions, two students with ASD responded better to the telepractice condition and the other student with ASD responded better to the on-site condition. The results of this study support that telepractice was at least equivalent, and in many cases more satisfactory, than an on-site service delivery model to students with ASD receiving SLP interventions.

This investigation consisted of a small number of students with ASD. Participants were studied individually as part of a series of single-subject experiments. The collection of data points within the two conditions for the six participants established initial evidence for the benefits of telepractice as a service delivery model for this population of students with ASD. It is of utmost importance that clinicians use evidence-based practices when working with and treating individuals with ASD. This study demonstrated that telepractice is a reliable and effective method to provide intervention services to those that require mandated speech and language services for students diagnosed with ASD. These findings are consistent with the few published studies that have examined the use of telepractice methodologies with other populations.

Future Research

Given the success providing intervention services via telepractice to students diagnosed with and ASD and the critical shortage of specialists, it is essential that this

research strand continue to be investigated. Future research should explore the use of telepractice with a greater number of students with ASD and with a greater variety of target skills. Follow up studies should be conducted to examine the findings of statistical significance with Student 1, Student 4 and Student 6. Specifically, research should focus on the delivery of services to students whose target goals include social pragmatics, expressive language and the reduction of a lateralized lisp. It is of utmost importance that these future studies consist of a larger sample size so that group generalizations can be made.

Further studies are warranted to examine the perceived difference in the amount and level of stereotypy behaviors (i.e., hand-flapping, eye blinking, rocking) noted between the two conditions. It would be beneficial for the future of telepractice to quantify the differences in behaviors in an attempt to determine if and why a difference occurs. In this current study, the treating clinicians and on-site facilitators reported that the level of attention demonstrated by the participants seemed to be greater when services were rendered through telepractice. Although these observations are purely anecdotal, they are nonetheless interesting and warrant further study. The observed level of attention may be attributed to the built in “motivation” that the participants possibly experience through the use of the telepractice technology and equipment utilized during this study. The treating clinicians reported that the participants exhibited a high level of independence when engaging in telepractice and as such, needed very little hands-on instruction on how to navigate the computer’s mouse to select their responses to treatment stimuli. Their success and familiarity with the computers, gadgets and technology in general are believed to have contributed to the participants’ observed level

of focused attention during the telepractice condition. In future research, these observations must be quantified so that comparisons can be made between an on-site service delivery setting and a telepractice service delivery setting.

Researchers who continue to examine and expand the use of telepractice with individuals across the spectrum of autism should consider employing an alternate treatment design. The frequent change of service delivery method will highlight any differences that may occur in the two different settings. Research should be conducted to identify what additional supports and techniques can be implemented within the therapeutic context so that individuals with significant disabilities can receive services through this method. Furthermore, if these future research studies include standardized protocols to judge factors such as behavior and level of attention, the use of an alternating treatment design will identify if one treatment setting effects the stereotypic behavior observed in participants with ASD.

Future research investigations should also focus on the equipment, applications and supplementary techniques that could be used when providing telepractice. Specific and ongoing technical support needed for long-term telepractice must be identified, as well as the use and the development of intervention materials ideal for remote service delivery. For example, if both the treating clinician and student used a webcam with zoom features and a high quality microphone, it is expected that the transmission of visual and audio information would be enhanced. The use of software programs used in conjunction with telepractice may result in an effective visual representation of the speech sound production. This additional feedback may support the production of the target sound when treated in a telepractice setting.

Future research studies should be conducted across a range of service delivery locations including controlled trials in laboratory settings and real-world locations such as clinics, schools, and client homes in both rural and urban areas. Lastly, future research should investigate the use of telepractice for other populations of individuals with communication needs. These studies should address the provision of telepractice services across various disciplines, including behavioral analysis, speech and language pathology, audiology, special education and psychology.

The use of technology is evolving from static applications to dynamic interactions. In some instances, telepractice for some populations of individuals is more practical and cost-effective as compared to on-site services. Some populations of individuals with neurodevelopmental disabilities, such as ASD, exhibit a preference for the use of technologies. The strategic use of technology enables service providers to collaborate, communicate and educate regardless of geographical locale. With this enhanced clinical outreach, the use of telepractice should be considered for not only direct services, but also for indirect and consultative services as well. The use of telepractice enables clinicians to be an integral part of a student's team and partake in activities such as, IEP meetings, parent/teacher conferences, conduct observations, provide consultation and mentor caregivers.

Telepractice, as a service delivery model, is changing the manner in which speech and language services are delivered to students with complex needs. The benefits of telepractice include an increased access to students in need of SLP interventions and collaboration and communication between professionals regardless of their geographical locale. Based on current statistics, the SLP profession is in the midst of a serious

shortage of master's and doctoral level graduates. High gas prices, larger caseloads, increased travel time to reach those with communicative disabilities, and the need to contain overhead with more cost-effective practices in the current economy exacerbate matters. As such, SLP professionals are examining more innovative uses of technologies to deliver services and facilitate greater clinician-client contact time.

APPENDIX A:

RESULTS OF THE USE OF TELEPRACTICE WITH CHILDREN DIAGNOSED WITH ASD REVIEW

Citation	Participant Characteristics	Technology	Services Delivered	Research Design and Outcomes
Barretto, Wacker, Harding, Lee, & Berg, 2006	<p>1 male, 5 years old, autism</p> <p>Although only 1 participant with ASD was involved, he was representative of a number of participants who have received telepractice services through this clinic.</p>	Iowa Communications Network (ICN), a 2,800 mile fiber optic telecommunications system connects a host hospital to rural communities using a television monitor, a camera for transmitting and recording, microphone, and multimedia projector. A microphone and the multimedia projector were placed in a classroom. Teachers were coached via video and audio transmitted from the experts.	A brief functional analysis [25] was conducted in a school classroom by consulting clinicians located at university-based hospital who guided the actions of local service teams in rural areas.	<p><i>Research Design:</i> The brief functional analysis was conducted within a multi-element design.</p> <p><i>Results:</i> The functional analysis was successfully conducted. The results of the functional analysis differed from the results of an interview assessment done without the use of telemedicine.</p>
Gibson, Pennington, Stenhoff, & Hopper, 2010	1 male, 4 years old, autism	Two Dell Latitude D820 notebook computers with an internal microphone, 1.83 GHz processor, and 504 MB of RAM were used to run the desktop videoconferencing application Skype ³ . A high-speed	University-based behavioral consultants conducted a FBA ⁶ , developed an intervention, trained	<i>Research Design:</i> ABAB design was used to evaluate the effectiveness of FCT in reducing challenging behavior.

		Internet connection was available via Ethernet cable. A Logitech Quickcam Pro USB camera was hung from the ceiling of the classroom. Video was transmitted at 15 fps ² . The experts' feedback was transmitted to the teacher's ear bud via an Azden UHF wireless microphone.	teaching staff to implement FCT ⁴ , collected data on target behavior, and provided ongoing feedback to teachers in the school.	<i>Results:</i> Teachers accurately implemented the intervention and challenging behavior was significantly reduced. This suggests that the services provided via videoconferencing were effective. Teachers rated the remote consultation as acceptable on the BIRS-R ¹ .
Machalicek et al., 2009a	2 females, 7 and 11 years old, autism	Two Mac-Book laptop computers with 2 GHz processors, external iSight cameras, internal microphones, and broadband internet connection were used to run iChat ⁵ video conferencing software. A high speed internet connection was available via FireWire 400 (IEEE 1394a) cable. Video was transmitted at 30 fps.	University-based behavior analysts guided the teachers' implementation of a functional analysis and collected data on challenging behavior in the school.	<i>Research Design:</i> The functional analysis was conducted within a multi-element design. An intervention created from the functional analysis was evaluated in an alternating treatment design for each student. <i>Results:</i> The intervention created based on the results of the functional analysis was successful in reducing challenging behavior and increasing on task behavior. This suggests that the functional analysis conducted via videoconferencing was accurate.

Machalicek et al., 2009b	2 males, 5 and 7 years old, autism 1 male, age 34 months with PDD-NOS	Two Mac-Book laptop computers with 2 GHz processors, external iSight cameras, internal microphones, and broadband internet connection were used to run iChat ⁵ video conferencing software. A high speed internet connection was available via WiFi. Video was transmitted at 30 fps.	University-based behavior analysts guided the pre-service teachers' implementation of a paired-choice preference assessment [29] and collected assessment data in the school.	<i>Research Design:</i> Interventions created from the results of these preference assessments were evaluated in alternating treatment designs. <i>Results:</i> The intervention based on the result of the preference assessment was successful in increasing desirable behavior. This suggests that the preference assessment conducted via videoconferencing was accurate.
Machalicek et al., 2010	4 males, 2 females, <i>M</i> years old = 5.9, autism	Two Mac-Book laptop computers with 2 GHz processors, external iSight cameras, internal microphones, and broadband internet connection were used to run iChat ⁵ video conferencing software. A high speed internet connection was available via Ethernet net cable and WiFi. Video was transmitted at 30 fps.	University-based behavior analysts guided the teachers' implementation of a functional analysis and collected data on challenging behavior and implementation fidelity in the school.	<i>Research Design:</i> The teachers' fidelity of implementation of functional analysis procedures was evaluated in a multiple baseline design across teacher-student dyads. <i>Results:</i> With performance feedback, teachers learned to implement the functional analysis procedure. This skill was maintained without expert guidance across teachers for a <i>M</i> of 5 weeks following videoconferencing. Teachers rated the videoconferencing as satisfactory

				and effective with a <i>M</i> of 5.4 on a 6-pt. Likert Scale.
Rule, Salzberg, Higbee, Menlove, & Smith, 2006	1 preschool age child with autism	An unspecified Polycom system was connected to the internet via a T-1 line.	University-based researchers and educational consultants attempted to interact with teachers to develop and implement an IEP in a school.	<p><i>Research Design:</i> Pilot testing, research design not reported</p> <p><i>Results:</i> Technology and logistical-programmatic challenges were never overcome and videoconferencing was considered unsuccessful. The introduction of the Polycom system in the schools networked created bandwidth issues and limitations. Insufficient tech-support personnel were available to address technology problems.</p>
Savin, Garry, Zuccaro, & Novins, 2005	3 children with autism or pervasive developmental disorder out of a larger group of 21 children with other diagnoses.	A videoconferencing unit was connected to an integrated services digital network (ISDN) circuit in which six bonded channels transmit at 384 kilobits per second. Video was transmitted at 30 fps.	Psychologists and psychiatrists provided psychiatric and psychological evaluations and consulting to Native American children living in rural areas.	<p><i>Research Design:</i> Research design was not reported.</p> <p><i>Results:</i> Patients and parents reported feeling comfortable with the technology and satisfied with the services. Specialists reported it took longer to establish rapport with the patients but, believed they were able to make accurate diagnoses and treatment recommendations.</p>

Vismara, Young, Stahmer, Griffith, & Rogers, 2009	29 children, 2 to 4 years old, autism	The system was referred to as “telehealth technology”, but the specific technology or equipment utilized was not reported in the study.	University-based researchers taught community-based early intervention specialists and parents to implement the Early Start Denver Model, a comprehensive early in life intervention program in children’s homes.	<p><i>Research Design:</i> 10 therapists were assigned to 1 of 2 groups. One group received training via live in person instruction and a second group received instruction via telepractice technology. Changes in child social-communicative behaviors, therapist implementation fidelity, and satisfaction with services were measured for both groups.</p> <p><i>Results:</i> Although both groups (live instruction and telepractice instruction) made significant improvements in fidelity of implementation overtime ($F_{(3, 24)} = 8.85, p < .001$). No difference between groups in child outcome, therapist/parent implementation of the intervention or therapist/parent satisfaction with services was found. This suggests that distance education technology was as effective as live instruction.</p>

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APPENDIX B:

SAMPLE PROBE TASK

Target IEP Goal: Participant will respond to what questions independently in 4/5 trials.

Procedure: Graduate student clinician will present the participant with one flashcard and ask a "what" question. Graduate student clinician will document the response, provide a verbal reinforcer if the answer is correct and move on to the next item in the probe session.

Stimuli



Procedure

Graduate Student Clinician: "What is in the boy's hand?"

Participant: "RESPONSE"

Graduate Student Clinician (if correct): "Good job!"

Graduate Student Clinician (if incorrect): Will move on to the next stimuli.

Graduate Student Clinician: "What is running toward the boy?"

Participant: "RESPONSE"

Graduate Student Clinician (if correct): "Good job!"

Graduate Student Clinician (if incorrect): Will move on to the next stimuli.

Graduate Student Clinician: "What are they playing?"

Participant: "RESPONSE"

Graduate Student Clinician (if correct): "Good job!"

Graduate Student Clinician (if incorrect): Will move on to the next stimuli.

Graduate Student Clinician: "What is the girl looking at?"

Participant: "RESPONSE"

Graduate Student Clinician (if correct): "Good job!"

Graduate Student Clinician (if incorrect): Will move on to the next stimuli.

Graduate Student Clinician: "What is the girl standing on?"

Participant: "RESPONSE"

Graduate Student Clinician (if correct): "Good job!"

Graduate Student Clinician (if incorrect): Will move on to the next stimuli.

APPENDIX C:

GRADUATE STUDENT CLINICIAN TRAINING DOCUMENT

Overview of Telepractice

Telepractice (also called “telehealth” & “telemedicine”) involves the application of communication technologies (e.g., computer-based videoconferencing software and the internet) to enable specialists to consult and delivery services in real-time over a geographical distance. Telepractice is a way to provide speech therapy services to clients in another part of the city, state, country or world. It is supported by the American Speech Hearing association and there is a body of literature that supports this method of service delivery.

Why is telepractice needed?

The Individuals with Disabilities Education Act (IDEA, 2004) requires that schools provide speech and language services to all eligible children. Benefits under IDEA include the identification, diagnosis and treatment of students with a suspected or confirmed communication impairments. However, a chronic, national shortage of speech-language pathologists (SLPs) is preventing schools from meeting this obligation. This shortage severely impacts the ability to diagnose and treat students with disabilities. Due to the difficulty that schools are facing in recruiting and retaining SLPs, students with communication disabilities are either not being served or are being served by less qualified personnel or by out-of-field professionals. The shortage of SLPs causes some schools go for months without services. As a result, students with suspected or confirmed communication disorders are not assessed in a timely manner and therefore do not receive services appropriate to their disability. One solution to address the critical shortage and to provide evidenced based services to students diagnosed with ASD regardless of geographical location is telepractice.

Purpose of the Study

The purpose of the proposed study is to empirically demonstrate the beneficial effects of “telepractice” as a reliable and valid service delivery model for providing speech and language intervention services, especially to those individuals with Autism Spectrum Disorder (ASD). The proposed study will provide empirical evidence regarding the effective use of telepractice technology and its implementation to overcome critical barriers in service delivery especially to those with ASD. Telepractice will be investigated with respect to its use and effectiveness as a method to deliver evidence-based language intervention to students diagnosed with ASD.

Research Objective

To determine the effectiveness of telepractice as a method of delivering evidence-based speech and language intervention services to children with ASD when SLP services are delivered via telepractice as compared to when services are delivered on-site.

Goals of the Project

The investigator will: 1) Gather baseline data prior to the onset of the study to establish students' performance in the absence of telepractice; 2) Conduct standardized assessments at the onset, between conditions and completion of the study; 3) Conduct probe sessions at the beginning of each therapy session to quantifiably identify student progress in relation to target IEP goals; 4) Use counterbalancing controls for order effect by presenting the treatment conditions in all possible orders to the treatment group; 5) Determine the reliability of telepractice as a service delivery method by using inter-observer agreement using two independent and unbiased doctoral and SLP judges and graphical representation of student progress using standardized graphs; 6) Determine the validity of telepractice as a service delivery method by conducting within and between group comparisons and social validity and 7) Establish efficacy by comparing a set of standardized evaluation tools including standardized assessments, student progress measures, observational evaluations and quantitative objective measurements.

Student Participants

For participation in this study, prospective participants will meet the following inclusionary criteria: a) a formal diagnosis of ASD from a physician, neurologist, or psychologist on record; b) participation in an integrated or mainstream public school class at least 80 % of each school day; c) Individual Educational Plan (IEP) that includes communication specific goals; d) primary language is English to eliminate potential confounding variables related to language differences, e) health status is good to excellent in that participants with ASD will have no history of cardiovascular, pulmonary, or metabolic chronic diseases, or craniofacial abnormalities; f) minimal communication of 50 words (oral and/or signed) of which at least 10 are oral; and g) prospective participants meet the American Speech Language Hearing Association telepractice client candidacy (see below).

Exclusionary criteria are as follows: a) other primary diagnoses (e.g., Down syndrome, Cerebral Palsy, etc.); b) prospective participants in an integrated or mainstream public school class less than 80% of each school day; c) other uncorrected sensory deficits (e.g., vision, hearing); d) recent history (past 6 months) of significant destruction of property or injury to self or others; e) less than 50 oral or signed words and less than 10 oral words; and f) prospective participants does not meet the American Speech Language Hearing Association telepractice client candidacy.

- Attention (e.g., ability to sit in front of a monitor and attend to the clinician)
- Auditory comprehension (e.g., ability to follow directions to operate equipment)
- Hearing ability
- Visual ability (e.g., ability to see material on a computer monitor)
- Speech intelligibility
- Physical endurance (e.g., sitting tolerance)
- Manual dexterity (e.g., ability to operate a keyboard if needed)
- Willingness of client and family/caregiver (as appropriate) to participate in telepractice

- Access to and availability of resources (e.g., telecommunications network, facilitator)

Setting

All research will be conducted in established or commonly accepted educational settings and involving normal educational practices. Specifically, practices will include research on evidence-based strategies and service delivery methods. The setting for both conditions will be consistent. For example, a student will receive telepractice services in the same place he/she receives on-site services.

Study Procedures

Student participants will receive pull-out speech therapy in a 1:1 setting at their educational setting. Two treatment conditions will be administered to two (2) groups of participants. The clinician, setting, therapy time and therapy frequency will be consistent between the two conditions.

Group 1 participants will receive speech and language therapy starting with telepractice and then change to on-site therapy. Each method of therapy (telepractice vs. on-site services) will comprise of approximately ten (10) therapy sessions in duration. The specific goals identified for each participant will be outlined in the participant's IEP. The treatment target task or goal and the duration of therapy will not be modified.

Similarly, Group 2 participants, will receive on-site therapy first and then change to telepractice therapy. The participants will continue to work on the communication goals/targets specified in the remedial program from participants' IEPs and the target and duration of therapy will not be modified.

The Treatment Conditions

Telepractice Condition: The equipment used for the telepractice condition will include: a computer and an external webcam. All therapy sessions will be recorded at the UMass clinic using a digital recorder. Online material and activities will be conducted with the Presence Learning platform, Adobe ConnectNow and various websites and software. Video and audio will be conducted using the videoconferencing software Skype. Prior to the onset of therapy, an on-site helper will log on to the Presence Learning or Adobe ConnectNow software and Skype. The on-site helper will ensure that the software and audio/video software is connected and ready for the telepractice therapy session.

On-Site Condition: The equipment used for the on-site condition will include: a computer and an external webcam. All therapy sessions will be recorded at the UMass clinic using a digital recorder. Online material and activities will be conducted with the Presence Learning platform, Adobe ConnectNow and various websites and software. Video and audio will be conducted using the videoconferencing software Skype. Prior to the onset of therapy, the graduate clinician will log onto Presence Learning or bring up

any other electronic material that will be used during the session. The graduate clinician will ensure that the Internet is connected and ready for the on-site therapy session.

Data Collection Procedures

This study will measure student progress when evidenced based interventions are delivered using telepractice vs. on-site methods. Objective measures used to collect data will be baseline data, standardized assessments, and student progress data. Data will be collected at baseline, throughout the study and at the end of the second treatment period. Qualitative data will also be collected through surveys with study related personnel.

Baseline Sessions: Baseline data will be gathered prior to the implementation of telepractice/on-site services to establish each student participants' performance. The baseline observation will be obtained without the introduction of telepractice or the software required using telepractice.

Treatment History and Student Progress: A summary of the treatment history and progress of each child participant will be compiled. Progress reports, treatment notes and numerical data collected by study personnel will be collected throughout the investigation to identify changes in each student participant's performance on speech and language treatment goals and objectives.

After obtaining the signed parent consent, a review of the student participant's file will be conducted. The student's IEP and two (2) most recent progress reports will be reviewed.

Standardized Assessments: Standardized assessments will specifically target the student participants' IEP goals and objectives. The assessment will be administered to each student two (2) times throughout the study: 1) at baseline and 2) at completion of the second condition. All methods of delivering the standardized assessment will follow established protocols outline in the assessment user guide/manual.

Probe Sessions: Quantitative data will be collected through the probe sessions by the participating SLP. At the onset and completion of each intervention session, a probe will be administered to determine student progress relating to the specific treatment objective that will be targeted in each therapy session utilizing either telepractice or traditional on-site services. Raw data depicting mastery for each treatment goal and objective per child participant and per session will be converted to percentages. This method of comparison will be repeated for all participants over the course of all treatment sessions. Progress in the probe sessions will be categorized as follows:

- Mastery - Student meets the established criteria as stated on their IEP and/or >80%
- Adequate Progress - Student is reaching target objective via the probes with 50 - 79% consistency/accuracy.
- Limited Progress - Student is reaching target objective via the probes with 20 - 49% consistency/accuracy.
- No Progress - Student is reaching target objective via the probes with < 20% consistency/accuracy.
(ASHA, 2003)

Data Collection Forms: Standardized data collection forms will be used for all probes. The forms will identify the total trials, total correct responses and the type of prompting needed. A description of the probe will also be included on the form.

Treatment Session Schedule

	Actions
Beginning of Therapy Session	Probe - 5 question probe that targets therapy objective
Middle of Therapy Session	Games/Stories/Activities that target therapy objective
End of Therapy Session	Probe - 5 question probe that targets therapy objective

Web-based applications that will be used for the study

Presence Learning

The Presence Learning platform includes videoconferencing technology, has engaging games and activities.

Web address: <https://telecare.presencelearning.com>

Note: All graduate clinicians and students will use the same username/password.
 Important: Remember to *LOG OFF* when you are done. If you do not log off the next clinician will not be able to log in.

e-SLP username and password:

Username: USERNAME GIVEN

Password: PASSWORD GIVEN

Student username and password:

Username: USERNAME GIVEN

Password: PASSWORD GIVEN

Presence Learning Training Videos :

Introduction: <http://www.youtube.com/watch?v=oTM7OHE41xg&feature=related>

Initial Overview of Platform: <http://www.youtube.com/watch?v=ngcJ9yTW5qY>

Documents Overview:

<http://www.youtube.com/watch?v=oanm5pFpPKY&feature=related>

Memory Overview: <http://www.youtube.com/watch?v=iu0nGTfuSYc>

Adding New Videos: <http://www.youtube.com/watch?v=4t4Cca8PgoQ>

Screen Sharing: <http://www.youtube.com/watch?v=9gIKbK-XDMY&feature=related>

Adobe Connect - Screen Sharing

Adobe Connect is free program that can be used to web conference and share your screen with 2 individuals only.

Web address: <https://acrobat.com/>

Sign up for Adobe Connect with your own information. If you don't already have a username/password and do not want to sign up, inform the doctoral researcher immediately.

Skype

Skype is a free video conferencing software.

Web address: <http://www.skype.com>

Graduate clinicians should sign up for Skype. If a graduate clinician does not have or want a username/password inform the doctoral researcher immediately.

Description of Data Collection System: iSchoolWare

The web-based data collection system that will be used for this study is iSchoolWare.com. It is a secure web-based system that will allow registered users access to information and data anytime from anywhere .

Graduate clinicians will use iSchoolWare to record/document student progress data on a continuous basis after each therapy session with a participant. There are help files on each page of iSchoolWare and if interested, a full manual is available upon request.

Please use the following information as a resource to log in and start to become familiar with the layout and functionality of the site.



Website: iSchoolWare.com

To log into the system:

District ID: Umass

UserName: First Initial + Last Name

PassWord: First Initial + Last Name

Click on MY CASELOAD on the right tool bar.



IMPORTANT!! You must select Edit My Caseload and select the student participants that you are servicing.



MY CASELOAD will provide you a list of the students that you will be collecting data on.



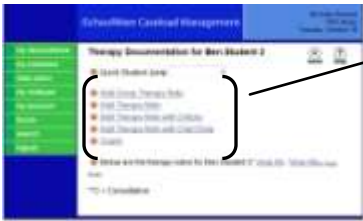
To collaborate with other graduate students, click the STUDENT FORUM link that that will bring you to a page where you will be able to communicate with the other graduate students.

To document and collect data:



After logging in, click on MY CASELOAD on the right tool bar.

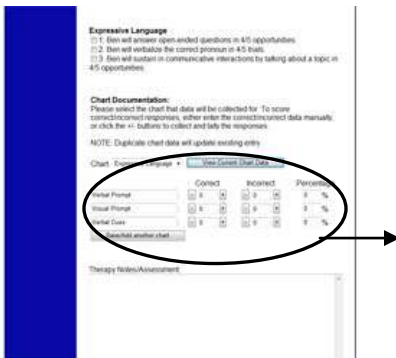
Click the THERAPY NOTES link on the student that you will be documenting data for.



The THERAPY NOTES link will bring you to a page where you will be able to collect data on the video that you will be viewing.

Click on Add Therapy Note with Chart Data. All therapy documentation will appear in chronological order. The month in which they were entered will be in bold with the therapy documentation listed underneath.

- Add Therapy Note - To document a therapy note, users must click on the ADD THERAPY NOTE button.
- View - To view a therapy documentation, click on the VIEW button.
- Edit – To edit a previously entered therapy documentation click on the EDIT button.



To document a student's therapy please complete the therapy documentation form.

APPENDIX D:

SURVEYS

TELEPRACTICE Survey – TREATING CLINICIANS

Name:	
Age:	
Gender:	
Person filling out form:	
Date:	PRE-Intervention <input type="checkbox"/> POST-Intervention <input type="checkbox"/>

Dear [Name]: This survey is an important part of our research and it will help to determine the quality of services that were delivered. The results of your feedback will be carefully examined and used to make decisions regarding the feasibility of telepractice. *Your responses will be held in the strictest confidence.*

For each question below, circle the number that best fits your judgment.

Question	Scale			
	Not Very Good	Below Average	Above Average	Very Good
Delivery of speech language therapy using telepractice	1	2	3	4
Student's progress over the course of the study	1	2	3	4
Your ability to communicate with the ON-SITE STAFF over the course of the study	1	2	3	4
Your attitude about speech and language services via telepractice	1	2	3	4
How do you think telepractice compares to face-to-face therapy?	1	2	3	4
What is the likelihood that you would recommend telepractice to your colleagues?	1	2	3	4
Additional Comments				

**APPENDIX E:
DATA COLLECTION FORM**

Objective Written in Here	DATE	Onset of Therapy Session PROBE														
														✓&✓+	✓	
														_____	_____	
														Total Trials:		
														Prompts: Visual, Verbal, Tactile		
	Description of Probe:															
	Notes:															
		Therapy Session Data														
															✓&✓+	✓
															_____	_____
															Total Trials:	
															Prompts: Visual, Verbal, Tactile	
Spontaneous Utterances/Notes:																
Activities:																
	Completion of Therapy Session PROBE															
														✓&✓+	✓	
														_____	_____	
														Total Trials:		
														Prompts: Visual, Verbal, Tactile		
Description of Probe:																
Notes:																

APPENDIX F:

IRB FORMS



*University of Massachusetts Amherst
School of Public Health and Health Sciences
Human Subjects Review Committee
(SPHHS-HSRC)*

DATE: 2-3-11

TO: Michelle Boisvert, Mary Andrianopoulos

FROM: Karen Helfer, Ph.D, Chair, SPHHS-HSRC

SUBJECT: The following action resulted from human subjects review of your proposal entitled: "An investigation of the efficacy of language interventions with children with ASD using telepractice"

SPHHS-HSRC file #: 11-33

- ✓ **1a.** Your revised protocol has been **APPROVED** by the **SPHHS-HSRC** after expedited review under 45CFR46.110(b).
- 1b.** Administratively approved by the chair of **SPHHS-HSRC** for continuing research of previously approved protocol.
- 2a.** The **SPHHS-HSRC** requests the following information from the investigator before a final decision is made:
- 2b.** The **SPHHS-HSRC** has **NOT APPROVED** the above proposal for the following reasons:
- 3.** Your proposal was determined **EXEMPT** under 45CFR46.101 by the Chair of the **SPHHS-HSRC**.

A handwritten signature in black ink, appearing to read "K. Helfer".

Karen Helfer, Ph.D.
Chair, SPHHS-HSRC

Caregiver Consent Form

Study Title: An Investigation of the Efficacy of Language Interventions with Children with ASD Using Telepractice

Dear Caregiver,

The University of Massachusetts - Amherst department of Communication Disorders would like to invite your child to participate in a study conducted by doctoral candidate, Michelle Boisvert, M.A. CCC-SLP. This study will examine the effectiveness of evidence-based speech language intervention delivered through telepractice. Telepractice is a method of service delivery that utilizes technology and equipment such as a computer, webcam and secure videoconferencing software. This method of service delivery has the potential to significantly improve access to services for children with special needs, including children on the autism spectrum.

An important part of this research is to collect data. We are asking permission to administer a standardized assessment/screening, collect baseline and student progress data and to administer a survey to your child. Your child will participate in speech therapy services *for the same amount of time* as indicated on their IEP or intervention program, however the method in which services are delivered will be modified. For *half of the study* your child will receive speech and language services via telepractice for the other half of the study they will receive services on-site with a UMass clinician. The research team will use the data to analyze the effectiveness of the telepractice.

We are also asking permission to record therapy sessions. These recordings will only be used for educational purposes. The recordings will be stored on a secure computer and only the UMass research team will have access to them. These recordings will only be used for educational purposes and will be destroyed within five years after the data are collected.

The risks associated with this study include a potential breach of confidentiality of student data. To address this concern, security measures have been implemented and are in compliance with federal regulations on student confidentiality and privacy. In addition your student will receive direct speech and language services through telepractice and the results from this study will benefit the field of Communication Disorders as a whole. Providing services through telepractice may significantly improve access for services for students diagnosed with autism.

You are under no obligation to participate in this project. You may withdraw your participation at any time with no negative consequences for you or your child. If you do withdraw from the study, your child will continue to receive speech therapy services as indicated on his or her IEP or intervention program. If you choose to participate in this study, you agree not to enroll your child in any outside speech and language intervention for the duration of the study.

Your signature below indicates that you have read the information provided above and have decided to allow your child to participate. You will receive a copy of the consent form once it has been signed. We thank you for your participation for this important research project.

If you have any additional questions, please do not hesitate to contact "Contact Person" at "Email Address" or by phone at "Phone Number".

Sincerely,

Michelle Boisvert, M.A., CCC-SLP

Caregiver Consent Form

Study Title: An Investigation of the Efficacy of Language Interventions with Children with ASD Using Telepractice

____ I give permission for my child _____ to be a participant in the study described above. I will not enroll my child in any outside speech and language intervention for the duration of the study. I *give* permission for my child's speech therapy sessions to be recorded.

____ I give permission for my child _____ to be a participant in the study described above. I will not enroll my child in any outside speech and language intervention for the duration of the study. I *do not give* permission for my child's speech therapy sessions to be recorded.

____ I do not wish my child _____ to participate in this study.

I confirm that Michelle Boisvert, M.A. CCC-SLP or an administrator from my school has explained to me the purpose of the research, the research procedures my child will undergo and the possible risks and benefits that my child may experience. I have read and I understand this consent form. Therefore, I agree to allow my child to participate as a subject in this research project.

Parent/guardian print name

Parent/guardian signature

Date

Witness print name

Witness signature

Date

Use of Research Recordings for Educational Purposes or Presentation Purposes

Title: An Investigation of the Efficacy of Language Interventions with Children with ASD Using Telepractice

_____ I agree that segments of the recordings made of my child's participation in this research may be used for *conference presentations*.

_____ I do not want segments of the recordings made of my child's participation in this research to be used for *conference presentations*.

_____ I agree that segments of the recordings made of my child's participation in this research may be used for *education and training of future researchers/practitioners*.

_____ I do not want segments of the recordings made of my child's participation in this research to be used for *education and training of future researchers/practitioners*.

Once video segments have been chosen, the remainder of the recordings will be destroyed.

Parent/guardian print name

Parent/guardian signature

Date

Appendix G:

TECHNICAL REQUIREMENTS

Technical Requirements for Telepractice

Initially, all that is needed for telepractice is a computer, web-camera, high-speed internet and headset (optional). Below, are the minimum technical requirements needed to provide telepractice for providing excellent remote therapy services. The quality and speed of your online meeting experience will be governed by the features you use, your Mac or PC and video hardware, and the bandwidth available to you in real-time. Please note that both sides (off-site and on-site) require the same requirements and standards to ensure optimal services. If either site cannot achieve the standards, there may be some intermittent video freezing and delays in hearing the speaker.

Bandwidth

Bandwidth indicates the speed of the on-line connection and interactions. Broader bandwidth permits greater speed of transmission, resulting in sharper, faster, and larger video images. The *minimum* bandwidth requirements for the provider and recipient of telepractice therapy are:

Incoming signal: 150 kbps (more is better)

Outgoing signal: 150 kbps (more is better)

Delay: 200 ms (less is better)

To test a location's bandwidth go to:

<http://www.bandwidthplace.com/>

To maximize the strength of your bandwidth for on-line therapy, consider the following options:

- **SCHEDULE:** Schedule on-line sessions when other school computers are not also accessing the internet. For example, avoid scheduling therapy at the same time as a classroom's e-learning class.
- **CLOSE PROGRAMS:** Close all other programs that may be open on the computer. These programs may slow down computer processing speed. Only the window that is using your online therapy software should be open. Close all documents and emails.
- **DEDICATED LINE:** Dedicate an internet line to the school that is not dependent on a community network. Sharing bandwidth decreases the quality of the sessions.

Computer or Laptop

Windows Minimum System Requirements:

Table 1. Minimum System Requirements

System Component	Minimum Requirement
Display Resolution	Required: Super VGA 800x600 Recommended: Super VGA 1024x768 or higher Note: Microsoft Windows XP Tablet PC Edition portrait mode is supported.
Operating System	Windows Vista, 32-bit Edition and 64-bit Edition (running in 32-bit mode) Windows XP Professional with Service Pack 1 (Service Pack 2 recommended) Windows XP Professional 64-bit Edition Windows 2000 Professional with Service Pack 4 Windows Server 2003 with Service Pack 1
Computer/Processor	Data and Voice: 500-megahertz (MHz) or higher processor, Intel Pentium-compatible For Webcam video: 1 GHz or higher
Memory	256 megabytes (MB) of RAM Recommended: 512 MB
Disk Space Needed for Installation	125 MB
Video Memory	Video card with 64 MB of RAM (video RAM or VRAM) and Microsoft DirectX application programming interface generation
For VOIP	Sound card, speaker, and computer microphone

For sending Video	Webcam device
Bandwidth Requirements for Data Only	56 kbps or better (Recommended: DSL or Cable high speed internet access)
Bandwidth Requirements for Voice and Video	Voice: 50 kbps minimum, 80 kbps high quality Webcam: 50 kbps minimum, 350 kbps high quality RoundTable: 100 kbps minimum, 700 kbps high quality
Other Software	Microsoft Office PowerPoint 2002 or later presentation graphics program or Microsoft Office Standard Edition or Professional Edition (which includes PowerPoint software) to upload presentations. Adobe Flash Player version 8 or higher to view Flash content in the meeting. On Windows Vista, Adobe Flash Player version 9.0.45 to view Flash content in the meeting. Windows Media technologies player, version 9 or later (version is checked when the meeting client starts) to view Windows Media content in the meeting.

Mac OSX 10.4 Tiger Minimum requirements

System requirements to initiate or participate in audio and video chats and conferences in iChat.

- For any audio-only chats, you'll need an iSight or any microphone.
- For any video conferencing, you'll need a microphone and a camera. What kind of camera? An iSight, FireWire webcam, Digital Video (DV) camcorder with FireWire, or USB Video Class (UVC) webcam should work fine.

	Good	Better	Best
Video resolution (in pixels)	160-by-120	320-by-240	640-by-480
System required	600 MHz G3, any G4, any G5, or any Intel	1.8 GHz G5, 1.66 GHz Intel Core Duo	1.83 Intel Core Duo
Bandwidth required	100 Kbps Internet connection (up/down)	500 Kbps Internet connection (up/down)	900 Kbps Internet connection (up/down)

Web Camera

Web camera with 15 FPS (frames per second) capture rate: Check to see if the webcam has a built in microphone. If either user experiences an echo use a headset with attached microphone.

Headset with attached Microphone

- Analog headsets are a good option for people who want to use a splitter. A splitter enables two headsets to plug into the computer so that the student's helper can also hear the therapist during the session. This is a great way to indirectly train the support staff about using strategies to support the student. It also enables the staff to have a clear picture of what happens during the session and how the child is responding. It is very helpful to have the computer's speaker turned off so that there is no echo. The headset allows the speakers to be off, yet the staff or parent can still hear the session.
- USB headsets provide quality sound, but they do not have a splitter option.

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