5-2024

School Readiness Social Questions and Generalization to NET Using AAC Devices for Early Childhood Students with Autism

Madison Leighr
University of Arkansas, Fayetteville

Honors Internship Experience Write-Up

Madison G. Leighr

Department of Special Education, University of Arkansas

Undergraduate Honors Student Mentored by Dr. Elizabeth Lorah

December 10, 2023

Introduction

School Readiness Social Questions and Generalization to NET: Single Study Methodology

This study's purpose was to provide intervention support with communication for participants on the autism spectrum between the ages of four and five years old before entering kindergarten using a handheld speech-generating device (SGD). With a multiple-baseline across-subjects approach, participants gained the skills to communicate their knowledge on kindergarten readiness questions whether verbally or through the assistance of a handheld speech-generating device (SGD) exposed to them during the intervention. This single-subject research study done during my internship taught school-readiness social questions to preschool students with autism with generalization to the natural environment teaching *(NET)*. Using the natural environment teaching method allowed applied behavior analysis *(ABA)* practitioners to incorporate the learner's natural environment into the teaching, development, and generalization of the skills. During my time completing the internship at the Sunshine School in Rogers, Arkansas we asked participants a variety of personal questions and colors to gauge their kindergarten readiness levels.

Review of Literature

Introduction

This study provides a review of the literature on five important themes including the characteristics of autism, communication and language intervention strategies for autism, kindergarten school readiness, different types of assistive augmentative communication (AAC) devices, and the use of least-to-most prompting within applied behavior analysis (ABA) strategies. The literature reviewed for this study was carefully chosen based on its relevance to the research conducted at the Sunshine School in Rogers, Arkansas. These selected pieces of

literature not only contribute to an enhanced understanding of the background context but also provide valuable insights into the clientele and interventions implemented in the research.

School Readiness in Children with Autism

School Readiness is a vital part of adequately preparing students specifically for kindergarten and the school system as a whole. In the literature titled, *Assessing School Readiness in Children with Autism Spectrum Disorder,* school readiness is defined as the development of a set of skills that are usually expected at the entry point of school enrollment which helps the child excel in social and academic development (Mukkiri, 2022). Families of children with autism experience a high amount of stress emerging into the period of school readiness. During this period when children emerge into being assessed, parents of children with autism realize their child does not check the same boxes as the general population leading up to kindergarten. This is often the start of the gap experienced between students with autism and the general education student body. In popular trends, this only is seen to continue to widen as they get older. The manifestation of the disorder in students varies widely, and in compliance with the Individuals With Disabilities Education Act (IDEA) and its free and appropriate public education (FAPE) mandate, a student's individualized education program (IEP) team must customize interventions to address the distinctive educational requirements of that student. Selecting the most suitable evidence-based intervention programs for students with autism can pose a complex challenge. (Stevenson, 2019).

Autism Spectrum Disorder Characteristics

The prevalence of autism has been steadily rising over the previous decades (Stevenson, 2019). Children diagnosed with autism at such a young age often don't meet the expected set of skills for school enrollment. These tendencies found in a diagnosis of autism spectrum disorder

(ASD), a complex neurodevelopmental condition, include but are not limited to, impairments in the domains of socialization, communication, and behavior. More advanced skills that are critical for developing social skills and predicting social, adaptive, and academic success are often lacking in children with autism as well. Students with autism can appear to have challenges with early social communication skills (ESCS), including eye contact, coordinated eye gaze shifting, joint attention, social referencing, and social orienting (Mukkiri, 2022).

Assistive Augmentative Communication Devices (AAC)

Various models exist within the realm of augmentative and alternative communication (AAC) to assist individuals with communication challenges. In the literature titled, *The Effectiveness of the High-Tech Speech-Generating Device with Proloquo2Go App in Reducing Echolalia Utterances in a Student with Autism,* communication is defined as the following, "The ability to relay information and thoughts using a reliable method of expression that produces a mutually understood message intentionally exchanged between two or more people" (Alrusayni, 2017). Assistive augmentative communication systems also known as AAC withhold a wide range of modalities ranging from low-technology-based to high-technology-based (Gilroy, 2023). Some of the most common forms of AAC systems include the picture exchange communication system (PEC), sign language, and the higher technology advancement being applications on the iPad® and computer systems with speech-generating devices (SGD). Recent technological advancements, particularly in the realm of handheld computing devices like the iPad®, have significantly increased the affordability and accessibility of high-tech Speech speech-generating devices (SGDs). These devices are not only more readily available compared to alternative SGD methods but may also be considered more socially acceptable and easier to

interpret than other forms of Augmentative and Alternative Communication (AAC), such as picture-based communication and manual signing (Lorah, 2015).

Least to Most Prompting Applied Behavior Analysis Interventions

The least-to-most prompting technique, also known as the system of least prompts or increasing assistance, applies to both discrete skills and more complex skills made up of a sequence of tasks. This method employs a prompt hierarchy with at least three levels, starting with independence and escalating from minimal to maximal assistance. The final step in this hierarchy is a controlling prompt, ensuring the correct execution of the behavior. When using least to most prompting, it's important to first identify the target skill or behavior whether that be a discrete or chained task. In step two, the target stimulus, or the event that cues the learner with autism to engage in the target behavior after instruction has ceased, is identified. The stimulus could be a naturally occurring event, completion of a task, or an external signal. From there, teachers and other practitioners identify the stimulus that will cue the learner to perform the target skill. A cue notifies the student that it is time to use the target skill. Cues and task directions aid learners in identifying the target stimulus to then engage in the target response. Appropriate reinforcers then need to be put in place to motivate the student with autism to do the task demands and targeted skill. Before implementing the intervention, practitioners need to identify all the times during the day the learner may utilize the target skill and what kind of prompts will be used whether that be gestural, verbal (e.g., clues, hints, commands, questions, rule statements), visual (e.g., pictures, objects), model (full, partial—can be verbal or motoric), and/or physical (full, partial).

Method

Participants

The participants in this study are children between the ages of four and five with a diagnosis of Autism who attend the Sunshine School in Bentonville, Arkansas. To be a participant in this study, children had to qualify for eligibility by being deemed a good fit for learning how to communicate with an AAC device. It was concluded that six preschoolers were eligible for the study. These participants are all male, five being of Caucasian background and one being African American. The students are all in various classrooms within the school.

Settings and Materials

All sessions were conducted in an unused office at the Sunshine School. The participants were asked to sit at a specific child-sized table with two chairs where they had a box of toys to choose from to play with. The materials used in the study were a variety pack of play dough and markers to be used when asking them their colors, a variety of toys for play, and a 32 GB iPad and the application Proloquo2Go, which functioned as the SGD.

Variables

Dependent Variable

The dependent variable was the different social questions (first name, last name, age, and colors) which were pulled from the kindergarten readiness question guide. The dependent variable was measured through a form of partial interval training using yes or no response probes. If the student answered the question correctly either verbally or using the AAC device within one prompt and three seconds, it was measured with a "yes".

Independent Variable

The independent variable in this study was the least-to-most prompting and the social praise given depending on each participant's response/ action to the dependent variable: the questions. The most-to-least prompting is a type of errorless procedure that systematically fades prompts for each skill using most-to-least criteria, following a set criterion of correct responses.

Data Recording and Analysis Methods

Data was recorded and tracked through a partial interval recording method using the yes or no probe. The data collected was then converted into digital line graphs. A new graph was created every time the student mastered one of the questions, so the graphs could be compared to one another as the student progressed through intervention. Data was collected on the day of by the conductor of the questions and through IOA (inter-observer agreement) on video afterward. This ensured the validity of the study by having two or more observers come to the same agreement on the results of the data. While gathering data, the collector wrote that the participant either correctly answered the question or didn't. On this same data sheet, the collector marked if the data collector was collecting IOA or normal data if this was baseline, maintenance, or training, and if the participant made any verbalizations after being asked the question. Specifically during training, the data collector marked if the probe data for each response was done independently, with a gestural prompt, with a visual and vocal prompt (point to the hotspot on iPad with providing instruction), with a model, or no response. Five seconds of wait time was given between each level of prompting.

Research Design

A multiple-baseline design across target behaviors or responses (social questions) was used to evaluate the effects of the procedure on kindergarten readiness with the assistance of the handheld AAC device.

Research Procedures

Baseline

The first step in baseline was to make sure the participant was attending to the instructor (ie- body oriented toward you, engaging in a shared activity, looking in generally shared space) The instructor then held up the item and asked the question/ SD: "What color?", "What color is it/this?" The data collector then waited five seconds. If the participant did not independently respond, "No" was marked on the datasheet. If the participant independently responded, a praise statement (e.g. "Yes that is red!") was provided, and "Yes" was marked. If the participant made any sound with their mouth within five seconds after giving the SD, "yes" was marked on the datasheet for that vocalization. Repeat three probes for each color at each baseline session.

Teaching

When teaching this intervention, we made sure the participant was attending to the questioner (ie- body oriented toward them, engaged in a shared activity, looking in generally shared space) The participant was then presented with the AAC device. The instructor held up items and proposed a question/ SD: "What color?", "What color is it/this?" Five seconds of wait time was allotted after the question. If the participant gave the correct vocal response, it was marked as +(v). A positive statement was then provided ("Yes! That is red!") and the target behavior was modeled (pressing the hotspot on the iPad) without expecting them to complete the action. The trial was then ended. If the participant did not independently respond, a gesture prompt was provided by pointing at the correct response on the AAC. Another five seconds was given. If the participant pressed the icon, we proceeded to step six and marked "G1" for gesture one on the datasheet. If the participant did not respond to the first gestural prompt, we provided an additional gesture prompt by pointing at the correct response on the AAC. Another five

seconds were waited. If the participant pressed the icon, "G2" for gesture two was marked on the datasheet. If the participant did not respond to the second gestural prompt, a model and vocal prompt were provided by repeating the SD and pressing the correct icon on the AAC. Five seconds were waited. If the participant pressed the icon, the researcher proceeded to step eight and marked "V + M" for the vocal plus model on the datasheet. If the participant did not respond, "NR" for no response was marked. If at any time, the participant activated the incorrect hotspot, the next level of prompting occurred and the researcher blocked all but the correct hotspot with their hand while providing the next level of prompting. If the participant made any sound with their mouth within five seconds after giving the SD, "yes" for vocalization was marked on the datasheet.

Maintenance

Identical procedures to baseline but with AAC device.

Generalization: Baseline

In the generalization baseline, we identified adults outside of the research instructor in a natural environment (Classroom, outside, hallway, etc.) The selected adult was instructed to go over to the participant, point to an object in the natural environment (ball, painting, wagon, etc.), and give the question/ SD: "What color is this?" five seconds were allotted for a response. If the participant did not independently respond, "No" was marked on the datasheet. If the participant independently responded, a praise statement (e.g. "Yes that is red!") was provided, and "Yes" was marked on the data sheet for that probe. If the participant did not meet mastery criteria or show improvement on generalization probes within four sessions, training procedures with peers began.

Generalization: Intervention

In the intervention portion of generalization, the first step was to identify adults outside of the research instructor in a natural environment (Classroom, outside, hallway, etc.) Then, with an AAC device available and ready, the adult was instructed to go over to the participant and point to an object in the natural environment (ball, painting, wagon, etc.) and give the question/ SD: "What color is this?" Five seconds were waited for a response. If the participant did not independently respond, "No" was marked on the datasheet. If the participant independently responded, a praise statement (e.g. "Yes that is red!") was given, and "Yes" was marked for that probe. If the participant did not meet mastery criteria or show improvement on generalization probes within four sessions, training procedures with peers began.

Fidelity

During the research of this study, the following fidelity checklist was used: Did the implementer follow the procedures according to the protocol? Did the implementer use the correct level of the prompt? Did the implementer collect data accurately? Did the implementer provide social praise for the correct response? Did the implementer provide the correct question for each trial?
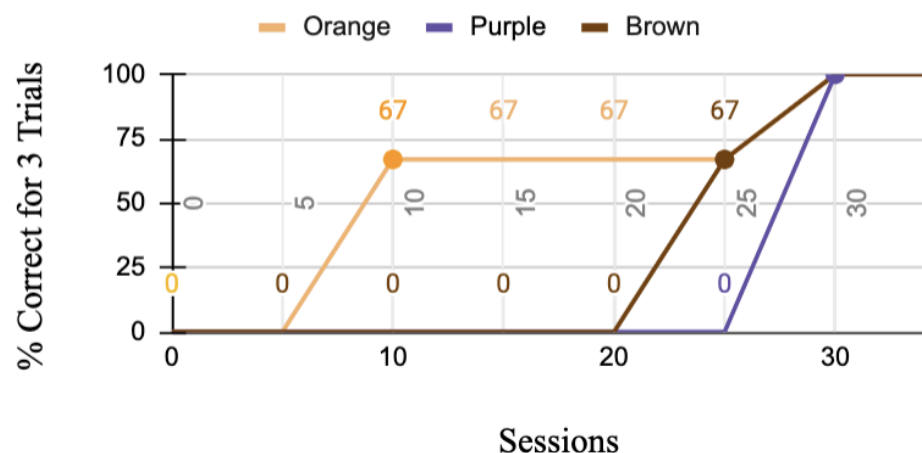
Findings

It was evident from the partial interval recording charted in the line graphs that from baseline to maintenance, the participants had made gains toward effectively communicating questions that pertain to their kindergarten readiness. The overall trend shows an upward movement toward correctly communicating both personal questions and colors. Two specific students showed significant and clear mastery of the intended goal of the research. Below, is graphed data from two of the six students. The students showcased in this study are initialed GM and HM. It can be noted on each graph that the intervention was started where the circle is

present on each line. Communication is a vital part of everyday tasks. By conducting this research, participants with autism will be better equipped to transition to kindergarten due to enhanced communication skills.

Student, GM, Colors Data

The student, GM, was working on the colors orange, purple, and brown. With roughly forty sessions of about half an hour each starting on March fourteenth with baseline data, all the way to June twenty second where generalization occurred, student GM was able to go from zero correct colors out of three prompted times asked to two or three correct colors out of three prompted times asked using both their AAC device and vocally saying it independently at times as well. By session thirty this particular student mastered the color orange in five consecutive sessions. The orange intervention was started in session seven, the brown intervention in session twenty-four, and the purple intervention in session twenty-nine. Linear improvement is shown within all three colors. Concluded that as the sessions increased, student GM became more familiarized with the intervention and mastered the skill of using the AAC device in fewer sessions with each new color introduced.


Relationship Between the # of Intervention Sessions and Correct Colors Expressed For Student GM

Student, GM, Personal Information Data

Showcased below are the findings from student GM over fifty sessions. This particular student needed almost fifteen more sessions for these personal questions for intervention than their colors. Asking student GM their age fluctuated results but consistently stayed within two to three correct out of three times being asked. Intervention for the student's first name started in session seven and ended in session twenty-six. Intervention for the age question started in session twenty-six and ended in session forty-three. Intervention for the student's last name started in session forty-three and went on until session fifty. It only took student GM seven sessions to master their last name which is double as fast as the other two questions. This means, that the greater the sessions, the easier the student was able to pick up on the usage of the AAC device and also independently make the correct vocalizations at times as well.

The Relationship Between the # of Intervention Sessions and Correct Personal Info Expressed for Student GM
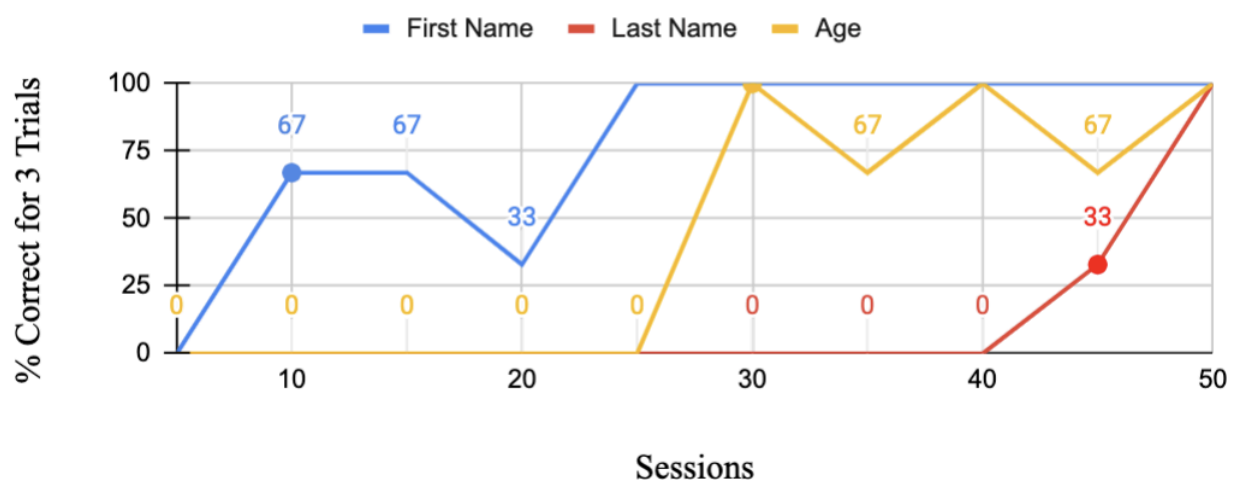
Student, HM, Colors Data

Student HM is the other student's results charted and recorded from this study. Student HM was

working on the colors gold, white, and purple. This student's research started on March

fourteenth and ended on May thirteenth, totaling up to twenty-four sessions of roughly half an

hour each. Student HM was able to go from zero correct colors out of three prompts to 100

percent correct colors said vocally out of three prompts for both white and purple. For the color

gold, student HM was able to get to 100% accuracy using the AAC device. HM started

intervention on gold starting in session eighteen and mastered the color with the AAC device by

session twenty-two. For the color white, the student started the intervention on the sixth session

and mastered the color with vocalizations by session twelve. For the color purple, the student

started on session eighteen and mastered it with vocalizations by session twenty-five. The

findings from this intervention reveal that the student once starting the intervention had only

upward growth toward mastery of each color. White was the only color that had one fall in

percent going from a hundred percent out of the three to thirty-three percent. However, with the

repetition of more sessions student HM was able to reach remediation.

Relationship Between the # of Intervention Sessions and Correct Colors Expressed For Student HM
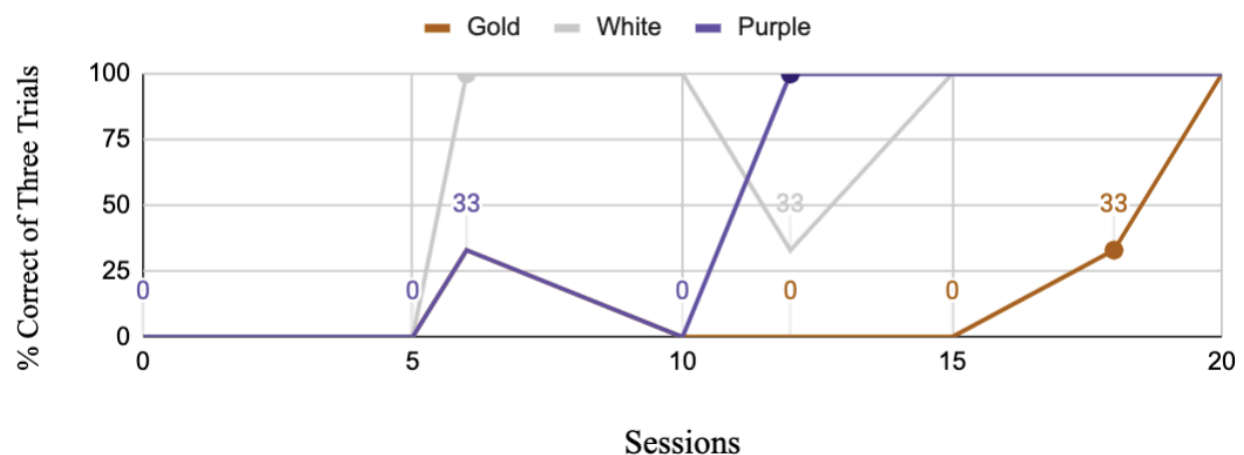
Student, HM, Personal Information Data

Showcased below are the findings from student HM over thirty sessions unlike student GM which took fifty sessions to master all three personal questions. Student HM also needed almost fifteen more sessions for these personal questions for intervention than their colors.

Student HM's last name was the only set of personal question data that declined at some point following the start of the intervention. It makes sense that the student's first name would be the quickest number of sessions to display one hundred percent out of the three times asked. The last name on the other hand took this student the most amount of sessions to consistently perform correctly. It is important to note that the student when asked their age was already at sixty seven percent accuracy before intervention began. This set of data shows an upward trend across all three sets of data from baseline to intervention to remediation. When these questions were generalized, student HM was able to vocalize a hundred percent for his first name out of the three trials. Implementing interventions end goal is to see student's successfully be able to interact with peers and adults in their natural environment. HM showed results in doing so specifically with his first name.

The Relationship Between the # of Intervention Sessions and Correct Personal Info Expressed for Student HM
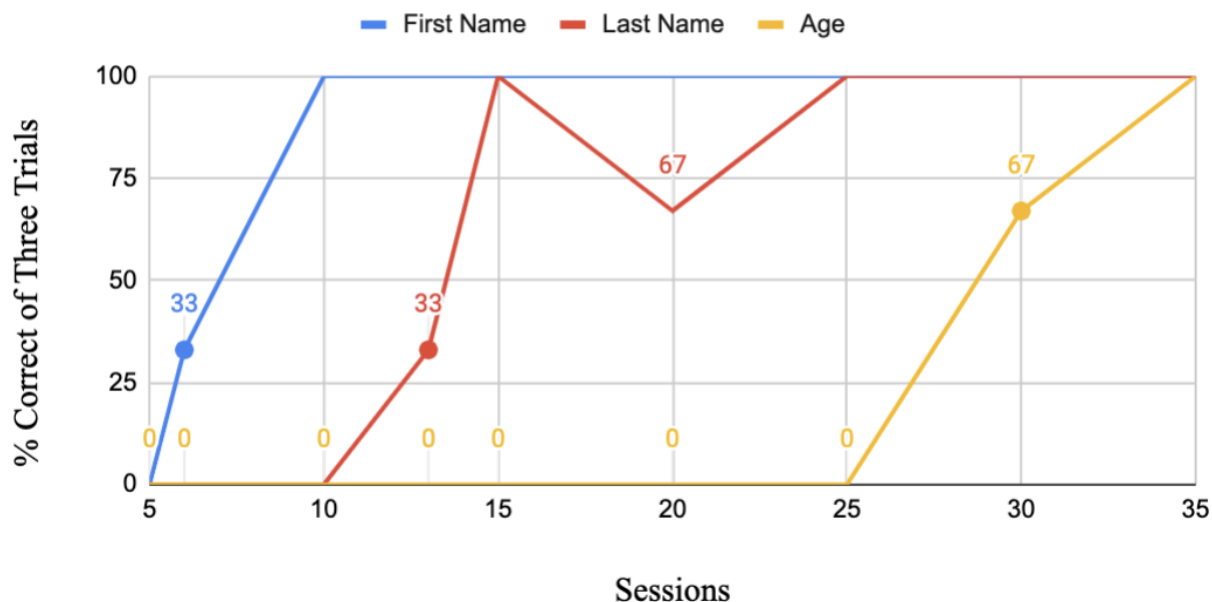
Relationship Between Internship Study to Professional Field Post Graduation

This internship exposed me to barriers students with special needs, specifically autism have with communication amongst others. This hands-on experience has significantly enriched my understanding of how ABA and AAC can be harmoniously applied to enhance communication outcomes for students with delays and challenges. As a future special educator, this knowledge is instrumental in making informed decisions and interventions to support individuals with communication challenges. My experience in observing, interacting, and collecting data on study participants at the Sunshine School provided valuable insights into the practical application of these strategies. When ABA and AAC practices are integrated, they can complement each other to create a more comprehensive approach to improving communication outcomes. ABA strategies can be used to teach and reinforce the use of AAC systems, ensuring that individuals not only have the tools but also the skills to effectively communicate.

Through this internship and honors research, I have had the privilege of understanding further what technology can offer students with special needs when learning to communicate effectively and coherently with peers. I have realized just how important it is to treat AAC devices as someone's voice. AAC devices are a powerful mechanism that are used as leverage to enable individuals the chance to express themselves just like everyone else. My undergraduate coursework for special education did not extensively cover practical strategies for teaching students with communication deficits to effectively use their voices in a manner tailored to their individual needs. The multiple studies I got to partake in with the University of Arkansas AAC Lab during my honors research allowed me to expand my knowledge on shaping and enhancing communication with the assistance of technology.

Although in a school setting, the speech pathologist's role is to specifically target communication, I feel more confident being able to meet the needs of any student who comes in my classroom having the skill set and background gained from this internship. I gained proficiency in navigating various AAC application formats, acquired the skills to conduct unbiased research, and developed the endurance needed for a study that was slow to show substantial amounts of progress. Furthermore, I was introduced to different modes of AAC that I had not previously known about. I learned to customize the applications to create buttons that were relative to each student. For example, we were able to use pictures of the students when asking them personal questions such as their names which then led them to associate the question as a personal question, picking up on the skill more quickly.

Works Cited

Alrusayni, N. (2017). The Effectiveness of the High-Tech Speech-Generating Device with Proloquo2Go App in Reducing Echolalia Utterances in a Student with Autism.

Gilroy, S. P., McCleery, J. P., & Leader, G. (2023). A delayed intervention start randomized controlled trial of high- and low-tech communication training approaches for school-age autistic children with co-occurring intellectual disability. *Journal of Applied Behavior Analysis*, *56*(3), 593-606. https://doi.org/10.1002/jaba.989

Lorah, Elizabeth & Karnes, Alison & Speight, Renee. (2015). The Acquisition of Intraverbal Responding using a Speech Generating Device in School-Aged Children with Autism. Journal of Developmental and Physical Disabilities. 27. 10.1007/s10882-015-9436-2.

Mukkiri, S., Kandasamy, P., Subramanian, M., Chandrasekaran, V., & Kattimani, S. (2022). Content validation of school readiness module and school readiness scale for assessing school readiness in children with autism spectrum disorder. *Asian Journal of Psychiatry*, *71*, 103073–103073. https://doi.org/10.1016/j.ajp.2022.103073

Neitzel, J., & Wolery, M. (2009). Steps for implementation: Least-to-most prompts. Chapel Hill, NC: National Professional Development Center on Autism Spectrum Disorders, Frank Porter Graham Child Development Institute, The University of North Carolina.

Stevenson, B. S., & Correa, V. I. (2019). Applied Behavior Analysis, Students With Autism, and the Requirement to Provide a Free Appropriate Public Education. *Journal of Disability Policy Studies*, *29*(4), 206–215. https://doi.org/10.1177/1044207318799644