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Using iPad Apps to Improve Communication Skills for Special Education Preschool Students

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Using iPad Apps to Improve Communication Skills for Special Education Preschool Students

Maria Gricelda Martínez

Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Arts in Education

California State University, Monterey Bay
May 2017

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Using iPad Apps to Improve Communication Skills for Special Education Preschool Students

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Abstract

Students with mild to moderate disabilities often have communication challenges. These students may benefit from augmented and alternative communication (AAC) systems to improve social and communication skills as well as social interactions. The aim of this study was to measure the effectiveness of GoTalk NOW, an AAC iPad application, in a special day class setting. A single-case AB design was used. Participants with a diagnosis of autism spectrum disorder, limited speech and language abilities, and similar scores on standardized tests were selected for this study. The four participants, one girl and three boys, ages four to five, attended a self-contained special education preschool program for mild to moderate disabilities located in central California. Results indicated that there is a functional relationship between implementation of an AAC system and an increase in communicative attempts. Furthermore, this study demonstrated that the use of AAC systems, such as the GoTalk NOW application, would give the participants independent skills to communicate in a classroom setting for students with developmental disabilities and speech and language disabilities.

Key Words: augmented and alternative communication (AAC), autism spectrum disorder (ASD), intellectual disability (ID), speech and language impairment, iPad
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Gracias a mi familia, en especial a mis padres, por todo el amor incondicional y el inmenso apoyo que siempre me han brindado.
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Using iPad Apps to Improve Communication Skills for Special Education Preschool Students

**Literature Review**

The main goal for integrating technology into schools is to improve student learning and to provide teachers with effective teaching tools (Lei & Zhao, 2007). As the use of technology continues to grow, students encounter a range of technologies (e.g., mobile phones, televisions, game consoles, DVD and MP3 players, desktops, and notebook computers) prior to beginning their formal education (Plowman, Stevenson, Stephen, & McPake, 2012). This range of technology is relevant when finding the best use and technology match for every student. Technology use in education is meaningful when it is: connected to a specific and practical problem, situated in context and connected with users, and changed constantly (Lei & Zhao, 2007). Furthermore, technology use alone without a clear goal and objective has little to no value (Lei & Zhao, 2007). Thus, a comprehensive understanding of the positive and negative use of technology has to be clear in order for the device to be used in the most educational and meaningful way. In addition, Pennington (2010) suggested that a balance for the use of technology can be maintained by incorporating its use in a meaningful way during group activities and by imposing clear limits on time engaged activities.

**Benefits of Technology Use in Classrooms**

Students can learn meaningful skills through the use of technology and the use of technology is also becoming a requirement in the public-school system. Furthermore, the federal legislation mandated that students with disabilities be provided with access to the general education curriculum through the Individuals with Disabilities Education Act of 1997 and No Child Left Behind Act of 2001 (Pennington, 2010). The interest in technology has helped facilitate students’ access to general education core content. Benefits, such as an increase in
expressive language, has been seen when technology is used to enhance learning (Allen, Hartley, & Cain, 2015). Lei and Zhao (2007) found that middle school students from a middle- and upper-class neighborhood could benefit from spending up to three hours per day using computer technology in their classrooms. Students were interviewed and surveyed in order to analyze data regarding technology use in classrooms. Findings showed that computers can help students increase their learning outcomes; however, too much time on a computer can cancel out the benefits (Lei & Zhao, 2007). Research has been inconclusive on how often students should use technology or how teachers should implement said technology.

Another benefit of technology is it can facilitate construction of knowledge in the classroom. Moreover, the use of computers in the classroom can influence the positive effects on teaching and learning processes (Muir-Herzig, 2004). By using technology, teachers can encourage growth, problem solving, and independent thinking for students with special needs as they do for general academic students (Muir-Herzig, 2004). Currently, iPads are being used in general education classrooms as well in special education environments every day. In general education classrooms, the devices are used to engage students in learning to promote higher-level thinking and problem solving which support special education teachers and students to access content and skill specific application (Xin & Leonard, 2014).

All students need to be challenged to use complex thinking skills; however, students with special needs in particular need these challenges along with ample supports. Research has shown that individuals with autism spectrum disorders (ASD) who do speak, often still have deficits in the use of broad vocabulary, complexity of sentence structure, responsiveness to social stimuli, flexibility in conversation, and use of descriptive language when compared to typically developing peers (Ganz et al., 2014). As a result, teachers need to encourage problem solving
and independent thinking for students who are struggling to learn academic material (Muir-Herzig, 2004). In addition, more individualized learning would take place in the classrooms than before. Teachers will be able to improve curriculum to meet students’ academic level, enhance student learning by creating actual experiences from their environment, explore new material with students, and use a variety of tools to meet students’ learning goals (Muir-Herzig, 2004). The use of technology allows students to take charge of their own learning through direct exploration, expression, and experiences (Muir-Herzig, 2004) by allowing students to grow not only their cognitive skills, but also their motor skills as they operate a touch screen device.

Students will use technology for a variety of reasons (e.g., academic, communication, social, daily living skills) depending upon their developmental level. Getting the opportunity to play with technology can extend possibilities for children’s learning by giving them the opportunity to explore, be independent, highlight, slow down, and repeat critical social cues at their own pace (Pennington, 2010). Young children, with time, develop motor skills to be able to operate the mouse or touch screen of a device by acquiring operational skills due to the preference for stimuli and may find the multisensory interactions to be reinforcing (Pennington, 2010). With the use of technology, students are able to extend their knowledge and understanding of the world and the role of technology in everyday life (Plowman et al., 2012). Students are able to succeed when they develop technology skills by learning them in a variety of contexts (e.g., home, school, community) and with a variety of people (e.g., teachers, parents, siblings, peers). For example, students with special needs may use technology for communication whereas a general education student may use technology for academics.
Communication and Students’ with Special Needs

Students with special needs including students with autism spectrum disorder (ASD) often present with deficits in expressive communication, understanding language, play, development of social skills, and relating to others (Flores et al., 2012; King, Thomeczek, Voreis, & Scott, 2014). ASD is a developmental disability that results in impairment in social communication and repetitive/restrictive stereotyped behaviors (King et al., 2014). Xin and Leonard (2014) state that students often rely on various behaviors (i.e., pointing, reaching, eye gazing, and facial expressions) to demonstrate their needs and wants due to the lack of language understanding given their verbal communication skills. Schaefer and colleagues (2016) stated that by increasing the foundation of vocabulary, the range of language skills students utilize will increase. Additionally, these children frequently demonstrate delays in expressive and receptive language; therefore, visual symbols are useful to teach the meaning behind spoken language to students with ASD (Ganz et al., 2014). According to Pennington (2010), individuals with ASD have been shown to exhibit an increase of appropriate behaviors and express enjoyment when using technology than during traditional one-on-one instruction.

Technology and ASD

There are many treatments that have been proven to have an effective outcome for students with ASD such as cognitive behavior intervention, exercise, Picture Exchange Communication System (PECS), and technology-based treatment. For example, children with ASD prefer electronic media due to the game-like nature that provides visual images which help improve their strengths (Flores et al., 2012). Furthermore, a study by Xin and Leonard (2014) suggest that the use of iPad apps (i.e., Sonoflex, Proloquo2Go, and Pick a Word) support non-verbal students with ASD to participate in class activities and be able to interact and
communicate with peers and adults. Ultimately, AAC devices allows teachers to assess students’ comprehension as well as understand individual needs (Xin & Leonard, 2014). Consequently, decisions about technology should be individually based, continually monitored, and used with systematic explicit instruction (King et al., 2014).

Communication skills are important for students with special needs who have little to no functional speech. Technology based teaching allows learners who are struggling to bypass the complexity of social contexts that may confound instructional targets and objectives (Pennington, 2010). These students who need to bypass the complexity of social context are ideal candidates to receive assistance from an augmentative and alternative communication (AAC) approach. Since the debut of technology in the classroom in the 1980s, there has been a positive perception to use AAC approaches to replace or supplement natural speech (Plumm, 2008; Xin & Leonard, 2014). AAC devices provide symbols, pictures, photos, and written words to communicate what a child wants in visuals presentations that inanimate and predict speech. Furthermore, AAC affords students with disabilities opportunities to communicate and interact with various people and contexts throughout their day (Xin & Leonard, 2014).

Responding to questions is critical for important communication skills in the classroom. It gives teachers the opportunity to assess student comprehension and be able to better understand individual needs (Muir-Herzig, 2004; Plumm, 2008).

Speech-generated AAC intervention has been shown to improve social and communication skills in children with disabilities and is a viable and effective option for individuals with ASD (Flores et al., 2012; King et al., 2014; Lei & Zhao, 2007; Muir-Herzig, 2004; Ploog, Scharf, Nelson, & Brooks, 2012; Plumm, 2008; Schaefer et al., 2015). According to Xin and Leonard (2014) visual language on AAC devices is easier for students with ASD to
understand than speech and manual signs because it maximizes the comparatively strong visual processing skills of individuals with ASD. Further, their research indicated that students can benefit from increased visual processing skills which gradually can lead to a better understanding of receptive and expressive language to produce more complex words. These features are an added bonus as they provide students with ASD with less change and more consistency (Xin & Leonard, 2014). Moreover, concepts and vocabulary can be added and programmed into the technological device depending on the need of the child. Existing symbols previously used by the students were used in his study in order to make the process consistent and stable without disrupting routines previously established (Xin & Leonard, 2014). The implementation of an accessible communication system can reduce the student’s anxiety and provide opportunities for communication through touching or pointing to an image or symbol that can then speak for the student.

**Speech generating devices (SGD) for ASD.** Many students who enter special education by the age of five years old and younger are non-verbal (Allen et al., 2015). PECS, visual representation of individual objects that exist in our surroundings, were developed as a picture-based method to improve the failure of children to acquire spoken language in order to communicate. PECS intervention has been widely implemented to improve expressive language (i.e., put words together in sentences, label objects in the environment, describe actions and events) due to the availability to create images based on student needs (Allen et al., 2015). iPad’s offer the same flexibly as PECS and, in addition, offer mobility and individualized learning to support language and literacy development in all academic areas. Allen and colleagues (2015) found that typically developing children from 18 to 24 months started to realize that verbal labels could be paired with pictures. With time, an increasing of symbols and
vocabulary for a child can help them learn to understand and express themselves with more complex words. Therefore, it is critical that children learn that pictures play an important role in children’s early learning in addition to spoken language.

Encouraged teachers, specialist, and parents are interested in finding better ways to improve and gain spoken language for individuals with cognitive delays; this could be accomplished with a SGD. AAC devices generate speech by touching an icon in a communication device, resulting in an audible expression of the icon selected (Xin & Leonard, 2014). SGD combined with naturalistic instruction strategies result in improved communication and an increase in interactions within natural settings of young children with disabilities (King et al., 2014). Technology such as an Apple iPad with an appropriate determined app called GoTalk NOW can provide an alternative opportunity for many students with ASD to meet their communication needs. Xin and Leonard (2014) explain how some apps are designed to serve ASD individuals with a high-tech AAC system that are designed for a portable hardware and software (e.g., mobile phones and tablets) that are available to many consumers in a small size device, easy to transport, and at a low cost to increase availability for all families of different incomes. There are many communication apps available for iPads for every child in need that can be used to function as an AAC device. A teacher and / or the speech-language pathologist can choose apps based on the strengths and needs of the child, the function on a daily basis during classroom tasks, and is critical to consider funding to purchase the app (Xin & Leonard, 2014).

Enhancing interactions in the classroom can lead to better and more effective learning, consequently, social and communication opportunities would occur on a daily basis for students with ASD (Siau, Sheng, & Fui-Hood Nah, 2006). These skills are essential for participation in
all school activities including academics and peer interactions (Allen et al., 2015). Siau and colleagues (2006) also concluded that when interactivity is present in the classroom, students are more motivated to learn, more attentive, and are more willing to participate and exchange ideas with adults and peers. Furthermore, by promoting communication opportunities in social settings, students will become socially recognizable as school members and in return be more likely to be included in general education classrooms with typically developing peers (Xen & Leonard, 2014). Having a viable means of communication, such as a portable SGD, will afford students with mild to moderate disabilities the ability to participate in contexts that otherwise may not have been available.

With the increase use of technology in schools, visual support with flexible formats is recommended for implementation of intervention in the classroom (Ganz et al., 2014). Visual supports via AAC devices may decrease ostracism, allow less individual attention when teacher is in large group instruction, and can be easily and quickly developed and adapted by the teacher as the student progresses (Ganz et al., 2014). Tablets are engaging and popular amongst children which increases their motivation and compliance in the classroom (Flores et al., 2012). In addition, due to increased portability, peer acceptance, and convenience, such as also using portable media players and smartphones to download apps, it is more likely that individuals would be able to access a device with SGD apps (Flores et al., 2012).

Many characteristics of technology (e.g., monotone, limited-affect) might be preferable to individuals with ASD because of their decreased ability to detect changes in prosody, an increased desire for receptiveness, and provides learners with opportunities to replay directions and auditory cues. Furthermore, students with ASD often become anxious in social situations and the use of technology as a medium to communicate may be preferable. In addition, previous
researchers have suggested that touchscreen mobile devices be investigated in order to provide the best support and to explore how individual learning needs could be individualized to monitor the ever-changing learning needs of children with ASD (Fletcher-Watson et al., 2015). The use of technology can increase independence, social skills, and gives the students options when integrated for mainstream activities.

**Methods**

Many preschool age students with mild to moderate disabilities have difficulty communicating their wants and needs. Furthermore, these students may require alternative communication or a way to augment their current communication skills. The purpose of this study is to determine if the use of an iPad application, *GoTalk NOW*, is a reasonable form of AAC for students with minimal communicative attempts.

**Research Question**

What are expressive communication outcomes for preschool special education students using the iPad application *GoTalk NOW* in a special day class environment?

**Hypothesis**

Based on research by Flores and colleagues (2012) and Xin and Leonard (2014), special education preschool students with developmental disabilities and speech and language disabilities that have been exposed to AAC systems would independently possess and use more communication skills by replacing or supplementing natural speech.

**Research Design**

A single-case A-B design was used. To ensure that each student stayed as his or her own control, baseline was collected independently for each participant. Once the participant had five
data points and stability in behavior had been determined, the student was moved to intervention; the same pattern for the remaining three students was repeated.

**Independent variable.** The independent variable in this study was the use of an Apple iPad application downloaded to be used as a communication device for each participant. *GoTalk NOW* is an AAC application that can be customized with different features for beginning and experienced communicators and is similar to the features on apps used on previous research (Flores et al., 2012; Xin & Leonard, 2014). Furthermore, the *GoTalk NOW* app is easily accessible to students of all ages and abilities and offers touch-activated technology. The app is designed to assist with communication with the use of recorded audio, text-to-speech, music, or video. Images were added from the camera and from the web search. A simple grid board was created with images and vocabulary for the snack lesson needed. Scenes were created with an image; as a result, when the hotspots were touched they created speech (Flores et al., 2012; Xin & Leonard, 2014).

**Dependent variable.** The dependent variable in this study were communication responses from each participant. Communication responses were based on (a) signing language responses that were marked as a communication when the student attempted to sign for a desire item when requesting for a snack (e.g., milk, more, want, and help; Xin & Leonard 2014), (b) verbal utterances were marked as communication when the student attempted to produce a small unit of speech or if the student initiated communication in relation to the item when requesting for a snack (e.g., ma for milk; Flores et al., 2012), and (c) pointing responses were marked as communication when the student attempted to point and touch the hotspot screen image on the iPad related to the item when requesting for a snack (e.g., wanting milk and pointing to milk; Xin & Leonard, 2014). A communication sheet was designed to collect data using tally marks made
during observation based on communication responses for sign, verbal utterances, and pointing (Flores et al., 2012; Xin & Leonard, 2014).

**Setting & Participants**

The study took place in a self-contained mild to moderate special education public preschool class located on the premises of an elementary school in central California. The preschool program served approximately 35 students from ages three to five years old that were predominately Hispanic/Latino (93.5%), White (2.3%), Filipino (2.3%), African American (1.1%), and Asian American (0.6%). The students in the Communication-Social Skills (C-SS) class received individualized and small group instruction from a special education teacher for a duration of 720 minutes weekly and 90 minutes monthly of small group instruction from a speech-language specialist. Students received instruction in the classroom with ten or less peers with disabilities and similar needs. The students’ daily schedule included writing centers, indoor play, circle time/large group instruction, outside play/gross motor/social play, snack activity, reading time, centers/small group instruction/fine motor, and closing circle. The study was conducted during snack time since this was the activity during which all four students struggle the most with communicating a need.

Participants were selected based on demonstrating a need to improve communication skills in nonverbal students. The participants were one 4-year-old and three 5-year-old students enrolled in a public special education preschool program. One female and three males diagnosed with ASD, intellectual disabilities (ID), and speech and language impairment with moderate cognitive disabilities participated in the study. All students were diagnosed with limited speech and language abilities and received occupational therapy services as well. Each participant selected by the researcher was assigned a pseudonym to ensure confidentiality and anonymity.
Maria. Maria was a five-year-old Filipino female with a primary disability of autism and a secondary disability of intellectual disability. A full evaluation was completed earlier in the school year by the preschool team to determine disability prior to being enrolled in kindergarten. Her oral vocabulary included less than five words in total. She tended to communicate by pinching, biting, yelling, clapping, and holding an adult’s hand when in need of help.

Jose. Jose was a five-year-old Hispanic male with a primary disability of autism. A full evaluation was completed earlier in the school year by the preschool team to determine disability prior to being enrolled in kindergarten. His oral vocabulary included less than ten words in total. He tended to communicate by crying, engaging in physical aggression towards other students, and segregating himself from peers and staff.

Juan. Juan was a four-year-old Hispanic male with a primary disability of autism. A full evaluation was completed earlier in the school year by the preschool team to determine disability prior to being enrolled in kindergarten. His oral vocabulary included less than five words in total. He tended to communicate by touching the teacher, attempting to make jargon sounds by moving his lips with minimal articulation, and closing his eyes to evade eye contact and directions.

Alejandro. Alejandro was a five-year-old Hispanic male with a primary disability of autism. A full evaluation was completed earlier in the school year by the preschool team to determine disability prior to being enrolled in kindergarten. His oral vocabulary included less than ten words in total. He tended to communicate by repeating what an adult says, makes jargon sounds, and remains quiet most of the time.

Measures
An iPad was used to collect the frequency of communication based on previous data collection methods in studies by Flores and colleagues (2012) and Xin and Leonard (2014) when they used the apps *SonoFlex* and *Pick a Word*. Data was collected based on a modified observation sheet (see Appendix A) to record the type of communication (Xin & Leonard, 2014). Each type of communication was tallied to indicate the frequency level in order to communicate needs to an adult. A previous observation sheet was used to yield similar measures for comparison.

**Validity.** Data was collected by a trained researcher in the classroom setting based on the research question and hypothesis developed as the result of literature reviews. In addition, the researcher analyzed the students’ IEP’s in order to establish appropriate need for intervention related to communication.

**Reliability.** There were two paraeducators helping with the collection of data; both were experienced paraeducators that knew the participants and how to run snack time activities. Every paraeducator involved in the study was trained to develop skills to record data. Each communication behavior was recorded as one attempt to communicate. Frequency of each attempt was counted and length of time of no communication was not marked as an incorrect attempt. Data was collected by a trained researcher currently working with the students participating in the study (Flores et al., 2012). A second observer was trained and was able to understand the patterns and checklist to determine interrater reliability by having the individual observe and tally 20% of the time for each participant using the observation sheet (see Appendix A) to determine research accuracy in calculating the dependent variable, communication, with 80% or higher agreement.

**Intervention**
The intervention consisted of utilizing the GoTalk NOW app on iPads within the classroom. The app was easily accessible to students of all ages and abilities and offered touch-activated technology. The app was designed to assist with communication with the use of recorded audio, text-to-speech, music, or video. Images were added from the camera and a web search. A simple grid board was created with images and vocabulary for the snack lesson needed (see Appendix B). Scenes were created with an image; as a result, when the hotspots were touched they created speech (Flores et al., 2012; Xin & Leonard, 2014). The intervention was implemented for fifteen minutes daily for a period of several days (Flores et al., 2012; Xin & Leonard, 2014). During those days, at least five data points were collected from each participant to find stability of behavior during snack time activity.

**Procedures**

The researcher trained and explained the research to two paraeducators. They became familiar with the observation sheet as well as with the snack routine and vocabulary prior to the research. Together as a team, the paraeducators and the researcher discussed procedures verbally and reviewed the study before implementing the condition with the participants (Ganz et al., 2014). The researcher observed the paraprofessionals to make sure data was collected correctly and snack routines were followed as planned.

Participants sat in one of two kidney tables located inside the classroom. Students remained seated at their table until all remaining students in the class had washed their hands prior to starting snack. One paraeducator sat at the table in order to facilitate snack activities while the researcher and an additional paraeducator were collecting data. A tally was marked on the observation sheet as students requested food from the paraeducator. Components for the
research were modeled after Flores and colleagues (2012); Ganz and colleagues (2014); and Xin and Leonard (2014).

The snack procedures were the same each day for the four participants (Flores et al., 2012). The participants and teachers sang a song called “Hands on your lap” prior to starting to eat. The paraeducators had the iPads placed in front of each participant and set on guided access to keep the iPad on the same app. The snack, paper towels, and utensils were placed in the middle of the table. Furthermore, the paraeducators did not prompt or cue the participants in any way to help them make an attempt to communicate.

A paraeducator asked each student, by taking turns, to request the snack items desired (Flores et al., 2012). The paraeducator started by asking every participant what were the first items they needed; the students needed to request a paper towel and a paper tray. Once the students requested the paper towel and paper tray, the paraeducator asked the participants what they wanted to eat. The students had the option of requesting one snack item at a time (e.g., milk, cereal, crackers, apple). Requests were made by signing, using verbal utterances, and touching the hotspots on the iPad to produce verbal speech (Flores et al., 2012; Xin & Leonard, 2014). If the student did not communicate within five seconds, the paraeducator continued by asking another student but returned to the student that has not made a request for snack. The student had an unlimited number of attempts to request food within the fifteen minutes. Every attempt was considered correct and was marked with a tally; in addition, the participant did not get an incorrect attempt if they did not request any snack items (Flores et al., 2012).

For intervention, the paraeducators followed all of the steps mentions and the students had the same snack routine. When students were prepared to request snack, the paraeducator assisted the student to request snack in two different ways. First, the paraeducator signed and
used full verbal sentences to request desired snack with the student. Second, the paraeducator used full verbal sentences and used the iPad application to request the desired snack by touching the icons in the app. The paraeducators had to make sure students were making eye contact and were facing the snack and iPad when intervention was given. If a participant did not communicate to request snacks, the student was given further prompts or cues in order to receive and consume food (Flores et al., 2012). These prompted/cues requests were not collected for research purposes.

**Data collection.** To move from baseline to intervention, the first participant needed at least five stable baseline data points, as a consequence, the amount of days for baseline was undetermined. Following this, participants moved from baseline to intervention when they had at least five stable data points and when the previous participants had showed an understanding of the iPad hotspots and images. Each participant remained in intervention for a minimum of seven data points to be collected on behavior communication data sheet. The paraeducators and the researcher collected data during a period of fifteen minutes on an observation communication sheet during snack time. These results of intervention were used and compared to baseline to determine if communication increased with the use of the app GoTalk NOW on an iPad.

**Fidelity.** To ensure procedural fidelity two paraeducators were present in the classroom throughout the study. They were present to make sure that baseline and intervention were not integrated at the same time and that iPads were the only AAC devices present. They were instructed not to assist the participants in any way in order to facilitate the student communication. Snack was administered at the same time and with the same vocabulary consistency every day for the four participants, classroom intervention did not exceed more than fifteen minutes per day, and did not continue past seven days. Procedural fidelity was assessed
in the form of a tally in 20% of all sessions during baseline and intervention using a communication observation sheet (see Appendix A) to determine researcher accuracy. Procedural fidelity was 100% for all four participants considering that at least two paraeducators were present at all times.

**Ethical Considerations**

Ethical considerations in the research were primarily to protect confidentiality. Students participating in the study had primary disabilities of ASD and ID and had limited cognitive and speech abilities; to combat behavior issues, the researcher attempted to keep snack routines consistent to prevent unwanted behaviors. Participants were not harmed but rather benefited from using technology. The study took place in their special day class during snack time activities and were not taken away from their regular academic activities and tasks. Students were given a snack during the last ten minutes of the snack activity if they refuse to communicate or use the AAC device presented to them (Flores et al., 2012).

**Validity threats.** Validity threats were caused by students being absent during phases; in consequence, baseline and intervention were implemented once again. In addition, some students were not willing to participate due to behavior or off task issues due to the young age and developmental levels of the participants, baseline and intervention were implemented once again. Data collection training and inter-observer training was implemented to determine operational definitions of the target behaviors and to provide opportunities to use the iPad. Training was implemented until all paraeducators recording communication behavior were 80% in agreement with the researcher across three responses (Flores et al., 2012).

**Social Validity**
At the completion of the study, two completed a four-point Likert scale (i.e., 1 = strongly disagree to 4 = strongly agree) social validity questionnaire (see Appendix C). The questionnaire, adapted from Berger, Manston, and Ingersoll (2016), consists of nine questions designed to understand the perceived usefulness, significance and satisfaction with the implemented intervention (Kennedy, 2005). Participant responses were kept confidential and descriptive statistics were conducted to gain insights regarding the intervention.

The social validity questionnaire was completed by three paraeducators upon completion of the intervention. All three paraeducators strongly agreed to find the treatment effective and acceptable for increasing the student’s skills. Two paraeducators agreed that the treatment improved skills across the classroom. For the rest of the questions all paraeducators agreed that the student’s skills would remain at an improved level, the treatment improved the student’s skills, they will be willing to carry out the treatment, and they would suggest the treatment to other individuals. However, they were uncertain if the study improved family functioning or if the treatment decreased the level of stress experience by the student’s family.

Data Analyses

A visual analysis of the observations was used to compare the baseline and intervention for each participant’s total number of communication during a structure classroom setting (Xin & Leonard, 2014). Furthermore, the percentage of non-overlapping data was calculated to determine the effectiveness of the intervention.

Results

Figures 1-4 depict the frequency of communicative attempts, with and without the use of an iPad application, for four preschool students in a SDC setting. The y-axis on all figures represents the number of communication attempts made by participants, and the x-axis indicates
the number of observed sessions. The vertical dotted line divides the baseline and intervention phases of session observations.

Jose and Alejandro started baseline and intervention simultaneously. Jose’s mean number of communicative attempts during baseline was 0.8 communication attempts per day with a range of 0 to 1. During iPad app intervention, his communication skills increased by 9.75 attempts with a range of 6 to 12 (see Figure 1). Jose’s communication attempts from baseline to intervention increased by 91.8%.

![Figure 1. The impact of an iPad app used to communicate to request snack items for Jose.](image)

Alejandro’s mean for communication skills during baseline was 1.2 communicative attempts per day with a range of 0 to 2. During iPad app intervention, his communication skills increased by 7.75 attempts with a range of 3 to 10 (see Figure 2). Alejandro’s communication skills increased by 87.1% from baseline to intervention.
Maria and Juan started baseline and intervention simultaneously. Maria’s average communication skills during baseline were 1.2 communication attempts per day with a range of 0 to 2. During the iPad app intervention, her communication skills increased by five attempts with a range of 4 to 6 (see Figure 3). Maria’s communicative attempts increased by 76% from baseline to intervention.

Figure 2. The impact of an iPad app used to communicate to request snack items for Alejandro.

Figure 3. The impact of an iPad app used to communicate to request snack items for Maria.
Juan’s average communication attempts during baseline were 0.8 communicative attempts per day with a range of 0 to 1. During intervention, with the use of the iPad app intervention his communication skills increased by 5.25 attempts with a range of 3 to 7 (see Figure 4). Juan’s communicative attempts increased by 84.7% from baseline to intervention.

**Figure 4.** The impact of an iPad app used to communicate to request snack items for Juan.

**Discussion**

The purpose of the study was to examine the impact of implementing an iPad app, *GoTalk NOW*, on communication skills for preschool students in special education. The present study extends the research on technology used to improve communication skills. The results from this single-case AB design showed an increase in communication skills using AAC devices for all four participants. Not only was there a positive trend in communication responses following the implementation of the intervention, but also 100% of the data were non-overlapping. This indicates that the intervention was highly effective for all four participants. The use of the iPad application, *GoTalk NOW*, increased communication skills in four preschool
students with mild to moderate disabilities. Similar to research by Flores and colleagues (2012) and Xin and Leonard (2014), the current study demonstrated that the use of an AAC system, such as an iPad app, would give the participants independent skills to communicate in a structured classroom setting.

Jose consistently demonstrated few communicative responses during baseline. For example, he made one vocal utterance to request for snack items in fifteen minutes of observation per session. When intervention began, Jose was able to touch the hotspots on the iPad to create speech-generated utterances and he also verbally repeated the output from the device to produce complete sentences. His responses were made in complete sentences and took less than five minutes to request all of the food items desired for the rest of the sessions.

Alejandro made few vocal utterances to request food items in fifteen minutes of observation per session during baseline. When intervention began, Alejandro struggled the first two days and the paraeducator had to assist him multiple times; however, he was able to touch the hotspots on the iPad to make verbal utterances and repeated the speech created to produce complete sentences. His responses were made in complete sentences and took less than five minutes to request all of the food items desired for the rest of the sessions.

Maria made a couple vocal utterances to request snack items in fifteen minutes of observation per session during baseline. When intervention began, Maria struggled the first two days and the paraeducator had to assist her multiple times; however, she was able to sign, attempt to make verbal responses, and touch the hotspots on the iPad app to create speech. Maria became more confident in her ability to create a complete sentence for every snack item. Her responses were made in complete sentences and took less than five minutes to request all of the food items desired for the rest of the sessions.
In baseline, Juan signed one time to make his response for a snack item he knew how to sign in the fifteen minutes of observation per session. When intervention began, Juan struggled for the first three days and the paraeducator had to assist him multiple times; however, he was able to touch the hotspots on the iPad to make responses. Juan became more confident in his ability to create a complete sentence for every snack item. His responses were made in complete sentences and took less than five minutes to request all of the food items desired for the rest of the sessions. Juan made different requests every session, at times he did not want to request all snack items available hence the decrease in data points during the last sessions of intervention.

**Limitations and Future Research**

This study took place in two SDC classes, morning and afternoon, with four participants, and for a short duration of fifteen minutes. Although all four participants made improvements throughout the study, the results should be interpreted with caution, as there are limitations to be considered. The study was conducted with a convenience sample instead of a random sample due to participants being enrolled in the researchers’ classroom. In addition, this study was conducted with two students from the morning class and two from the afternoon class who were four to five years old. Future research should explore and compare data from a larger sample of participants from three to five years old with different disabilities.

Furthermore, this study was focused on the use of a specific app that is only available on an iPad. Therefore, the hotspots were created as small icons in order to fit all of the snack items and word images onto one screen. Future research should investigate the impact of using a dynamic display with larger images. It is possible that this would further increase communication as students would have had a better opportunity to create more complex and unique utterances. The current study only focused on snack time as the organized activity. Future studies should
explore the implementation of AAC across multiple contexts. For instance, screen hotspots could be used during inside play, large group instruction during circle time, and small group instruction during centers.

Providing a functional means of communication across settings is critical for young children with communication challenges. Teachers can provide opportunities throughout the day; however, it may be more reasonable to start with one structured activity. The use of the GoTalk NOW, an iPad application, was beneficial to the four preschool participants in requesting snack items. Teachers of young preschool children with communication challenges should be encouraged to implement alternative and augmentative communicative opportunities for their students.
References

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### Appendix A

Data Collection Sheet

<table>
<thead>
<tr>
<th>Day and Date</th>
<th>Baseline</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1 / / 2017</td>
<td>Sign: ______________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Verbal: ______________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Point: ______________________________</td>
<td></td>
</tr>
<tr>
<td>Day 2 / / 2017</td>
<td>Sign: ______________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Verbal: ______________________________</td>
<td></td>
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<tr>
<td></td>
<td>Point: ______________________________</td>
<td></td>
</tr>
<tr>
<td>Day 3 / / 2017</td>
<td>Sign: ______________________________</td>
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<tr>
<td></td>
<td>Verbal: ______________________________</td>
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<tr>
<td></td>
<td>Point: ______________________________</td>
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<tr>
<td>Day 4 / / 2017</td>
<td>Sign: ______________________________</td>
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<tr>
<td></td>
<td>Verbal: ______________________________</td>
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<td>Point: ______________________________</td>
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<tr>
<td>Day 5 / / 2017</td>
<td>Sign: ______________________________</td>
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<td></td>
<td>Verbal: ______________________________</td>
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<td>Point: ______________________________</td>
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<tr>
<td>Day 6 / / 2017</td>
<td>Sign: ______________________________</td>
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<td>Verbal: ______________________________</td>
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<td>Point: ______________________________</td>
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<tr>
<td>Day 7 / / 2017</td>
<td>Sign: ______________________________</td>
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<tr>
<td></td>
<td>Verbal: ______________________________</td>
<td></td>
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<tr>
<td></td>
<td>Point: ______________________________</td>
<td></td>
</tr>
</tbody>
</table>

Tallies to be used and marked next to each response the student makes.
Appendix B

Screenshots of iPad Application
## Appendix C

Social Validity Questionnaire

<table>
<thead>
<tr>
<th>Questions:</th>
<th>1 Strongly disagree</th>
<th>2 Disagree</th>
<th>3 Agree</th>
<th>4 Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. This treatment was effective</td>
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<tr>
<td>2. I found this treatment acceptable for increasing the student’s skills</td>
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<tr>
<td>3. Using the treatment improved skills across multiple contexts (home,</td>
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<tr>
<td>classroom, community)</td>
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<tr>
<td>4. I think the student’s skills would remain at an improved level even</td>
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<tr>
<td>after the treatment ends</td>
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<td>5. This treatment improved family functioning</td>
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<td>6. This treatment quickly improved the student’s skills</td>
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<td>7. I would be willing to carry out this treatment myself if I wanted to</td>
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<tr>
<td>increase the student’s skills</td>
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<tr>
<td>8. I would suggest the use of this treatment to other individuals</td>
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<tr>
<td>9. This treatment decreased the level of stress experienced by the student’s family</td>
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</tr>
</tbody>
</table>