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Proloquo2Go or SwiftKey Symbols: Which Leads to Better Acquisition of Targeted Phrases for a Student with Intellectual Disability and Articulation Concerns?

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Proloquo2Go or SwiftKey Symbols: Which Leads to Better Acquisition of Targeted Phrases for a Student with Intellectual Disability and Articulation Concerns?

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by

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ABSTRACT

Proloquo2Go or SwiftKey Symbols: Which Leads to Better Acquisition of Targeted Phrases for a Student with Intellectual Disability and Articulation Concerns?

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Having a meaningful system for expressing common needs and thoughts is important for overall quality of life for students with intellectual disability and limited expressive language. The current study was conducted to evaluate whether one communication system, Proloquo2Go ($249.99) or SwiftKey Symbols (FREE), is more effective in the acquisition of targeted expressive phrases in one student with intellectual disability who exhibited expressive communication difficulties. The student was provided with instruction in both systems using task analytic instruction and system of least prompting and encouraged to use each system at different times in a single case, alternating treatment design. Results indicated that Proloquo2Go led to faster acquisition of targeted phrases, although gains were shown with both devices. Although, given the cost difference, teachers and parents may want to consider free options, like SwiftKeys, given the student made gains with this device. Future research is needed to provide generalizability of these results.

DEDICATION

I would like to dedicate this thesis to my family and close friends who made this possible. Most importantly, this is dedicated to my husband, Ryan, who constantly pushed me and encouraged me to achieve my full potential with this study. When I felt like giving up, he was always behind me letting me know what I was capable of achieving if I kept pushing forward. I am beyond thankful for a mother and younger brother who have been my biggest supporters in this field and have loved me unconditionally throughout this journey. To my friends Jessie, Courtney, Celia, Kyla, Natalie, and Christian for always standing by my side throughout this process. All of you have encouraged, supported, and loved me through all of this from beginning to end.

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CHAPTER 1

INTRODUCTION

The field of communication is important in numerous ways. Communication is used in a variety of settings to relay a message to those around. By using effective and acceptable expressive communication, we can have our wants and needs met. Bopp, Mirenda, and Zumbo (2009) suggest that when there is an issue with producing effective and acceptable expressive communication, it can lead to a multitude of problems. These issues can include, but are not limited to, problematic behavior, being ignored, and being misinterpreted (Bopp et al., 2009).

In the classroom, ineffective communication skills can become an issue in both academic and functional aspects, especially for those students with disabilities. According to Salend (2005), individuals with disabilities may struggle with expressive communication skills for a variety of reasons. For teachers, the goal is to be able to build the student's current level of expressive communication and where they should potentially be at in correlation to their typically developing same-age peers. When expressive communication is effective, it will not only benefit the individual, but their fellow peers as well. By having an effective communication system in place, students can further demonstrate what they know.

Research that currently exists using different forms of communication applications or systems includes the use of the following: (a) Picture Exchange Communication System (PECS), (b) a Dynavox system, (c) speech generating devices (SGD), and (d) Proloquo2Go. PECS is a communication system often used for students with autism spectrum disorder (ASD) and entails an actual exchange of a picture representing a need/request for the actual item or activity. Many studies have highlighted the effectiveness of PECS. Charlop-Christy, Carpenter, and Le (2002) conducted a study with children with autism to investigate the effects of PECS on speech, social-

communicative behavior, and problem behavior in free-play and academic sessions. Using a multiple baseline design across participants, the interventionist used a time delay strategy to increase spontaneous and imitative speech. All three participants increased their spontaneous and imitation speech significantly over the course of the study.

Another study highlighting the impact of PECS was conducted by Flippin, Reszka, and Watson (2010). They conducted a review of the literature in order to investigate the effects of PECS on communication and speech outcomes for students with ASD. Results from eight single-subject designs with 18 participants and three group studies with 95 participants showed that PECS is an effective system. Only small to moderate gains were demonstrated after the training, while speech gains were small or negative indicating that more evidence-based research needs to occur.

A computer based processing unit with a screen makes up the typical layout of an SGD. An SGD can store information such as photographs, line drawings, and printed words (O'Reilly, Lancioni, Lang, & Rispoli, 2011). SGD's are designed to produce recorded or synthesized speech output depending on the vocabulary item(s) selected (O'Reilly et al., 2011). Examples of SGD's ranging from simple to more complex include BigMack, Dynavox (wide range), iPod Touch, iPhone, and an iPad (all equipped with different applications). Dynavox is another communication system often used for individuals who exhibit communication difficulties. It is a portable SGD that includes multilevel communication options with a wide-range of categories. Mancil, Lorah, and Whitby (2016) conducted a study to investigate the effects of an iPod Touch vs. a Dynavox system (already in place for all participants) in increasing functional communication with peers. Using a comparative intervention design (alternating treatment design with initial baseline and final best practice), the interventionist used direct observations in

order to see when social interaction occurred. Results showed that peer social interaction was highest when the iPod Touch equipped with GoTalk was being used. The new push for iPads and other portable devices in the classroom has become tough competition for older SGD's such as the Dynavox.

SGD's are often more commonly used than PECS and Dynavox due to easier portability. Ganz, Earles-Vollrath, Heath, Parker, Rispoli, and Duran (2012) analyzed single case research about using aided augmentative and alternative communication (AAC) with individuals with ASD. Of the 58 participants involved, positive effects on behavioral outcomes were greater with the use of PECS, as well as SGD's. iPods and iPads equipped with different communication applications are designed to be used as SGD's. Both devices allow the user to produce speech in order to communicate with those around them. When used appropriately, both the iPad and iPod can act as functional SGD's. Kagohara, van der Meer, Ramdoss, O'Reilly, Lancioni, Davis, and Sigafoos (2013) conducted a review of the current literature in order to see the effects of using iPods, iPads, and other related devices as a way to teach 47 participants with ASD and/or an intellectual disability (ID). When using the iPod Touch and an iPad as an SGD for participants to request preferred items, results indicated that positive outcomes were experienced with aiding these individuals in making requests.

Downloadable applications for devices like iPads have become more commonly used as communication systems for students with disabilities as a cheaper alternative to more expensive SGDs like Dynavox. For example, Proloquo2go is an application that is commonly used in classrooms for students in need of a communication system. Proloquo2Go can be defined as an application based communication system. This means that it is a downloadable application available for different communication systems such as an iPad, iPhone, or iPod. There is

minimal research that currently exists on Proloquo2Go and its effectiveness in increasing expressive communication, although O' Reilly et al. (2011) conducted a study to investigate the effects of Proloquo2Go via an iPod on the ability to communicate a snack selection for two participants with ASD and a snack/toy selection for one participant with ASD. Using a delayed multiple-probe across participants design, the interventionist used a time delay strategy to increase acquisition of expressive communication of all participants. Results showed that two of the three participants achieved acquisition of requesting a snack or snack/toy. The third participant was not making progress and did not appear interested in the study. She was therefore excused from the study.

Individuals with disabilities, especially those with more significant disabilities, often respond well to picture symbols. According to Cohen (1998), individuals with autism are more visual learners than they are auditory learners (as cited in Rao and Gagie, 2006, p. 26). It is currently understood that it is beneficial to provide students with disabilities, especially those that struggle with expressive communication, a symbolic, pictorial communication system in which they can effectively communicate with those around them. Visual supports have been used across multiple studies in increasing appropriate interaction with others. Sartini, Knight, and Collins (2013) discussed visual supports being effective in promoting social understanding for students with disabilities. Moody (2012) suggests the importance of both verbal and nonverbal communication when making requests, sharing, and being able to maintain interaction. Turn-taking cards, social stories, and comic strip conversations are just a few of the visual supports that would allow individuals with disabilities to learn how to interact appropriately with peers (Moody, 2012). These supports also allow the individual to express their wants and needs when

used as a means to make choices, initiate conversation, etc. with symbols that everyone can understand.

Cohen and Sloan (2007) state that when considering supports to promote communication, teachers must take into consideration the durability, portability, clarity, size, age appropriateness, response effort required, and cultural and social acceptance when designing visual supports, including visual schedules, visuals to structure the environment, visual scripts, rule reminder cards, and a visual task analysis (as cited in Meadan, Ostrosky, Triplett, Michna, and Fettig, 2011, p. 29). This analogy could be directed towards the use of communication devices and software programs that allow individuals with expressive communication difficulties. When teachers are working with these individuals, they must be sure that it is appropriate for the targeted student in regard to the above listed aspects. Otherwise, this could cause issues including upsetting the individual, causing confusion, etc.

One of the main problems that currently exists with using other SGD's is the cost of these items. Dynavox can range anywhere from the low thousands to nearly $10,000. Although funding is possible, there is still a hefty price that the individual will have to pay. The cost of the device can play a critical role in why families may not use such devices. As compared to Proloquo2Go, there is the cost associated with the technology (e.g.,iPod, iPad, or iPhone; ranging from $200-$500) plus the cost of Proloquo2Go application ($249.99). Although this is a stark difference to the cost of devices like Dynavox, there are other alternatives that are more affordable and potentially just as effective. SwiftKey Symbols is one such application. SwiftKey Symbols is composed of an interface that is made up of multiple shades of blue. It can be customized by allowing the user to upload pictures to the application. The software allows SwiftKey to pick up on terms previously used on that particular day of the week during that time

frame. This allows the user to quickly select an item based around their personalization. SwiftKey Symbols is similar to other applications and communication devices because there are pictures that can be selected that are paired with a term representing that particular symbol. Again, SwiftKey is different from other applications because it has a very basic layout. The pictures used may not be as advanced as the pictures seen in applications such as Proloquo2Go or PECS.

With SwiftKey Symbols, the application is free and an android tablet can be found for as low as $100. The purpose of finding alternative means for these individuals is so they have access to an effective communication application, while also being able to afford one as well. The more affordable the application/device is, access and adoptability to it could be greater.

While the cost of other low tech communication systems, like PECS, is appealing as an application based system like SwiftKey Symbols, there may also be concerns with these systems as well. For example, an issue with the PECS system is that it is designed with Velcro pictures that can be placed on a board in order to communicate wants and needs. Although this is more appropriate for a classroom setting, it would not be as appropriate in the community do to the fact that it is large and the pieces can get lost or destroyed. Making the transition to different devices and applications would be more beneficial to the student.

Issues of cost and portability are two main areas to focus on when it comes to finding communication devices/applications that will work for students who struggle with communication. SwiftKey Symbols, GoTalk Now, and Scene and Heard are some of the cheaper or free app based options currently being offered today. But, with the advent of app based communication systems, there is a need for research to be conducted. Few studies currently exist on these types of communication systems. One study was found by Gevarter et al. (2014) where

they conducted a study to compare the acquisition of communication using GoTalk and Scene and Heard. Using a multielement design, the interventionist was able to demonstrate experimental control by allowing the three participants to select whatever of the six items they wanted. Results showed that rapid acquisition was reached by two of the three participants using Scene and Heard vs. GoTalk, but they did not reach mastery with the Scene and Heard combined condition. The third participant achieved mastery in all three of the conditions. The design elements of the applications appear to contribute to a student's acquisition.

There is such a need to continue further studies on increasing expressive communication through use of a software application for individuals with disabilities. Due to the extremely minimal research that exists on app based communication systems, studies are needed to examine a variety of factors that could inform special education teams. Factors like cost, speed of acquisition, usability, and student engagement are all things to be considered by special education teams. In this particular study, cost (more expensive app- Proloquo2Go and free app- SwiftKey Symbols) and speed of acquisition were the impetus for conducting the study. Since individuals with disabilities oftentimes do not have their needs met to the extent in which they intended, research must move forward in determining which of the two communication applications is more beneficial.

A research gap is evident, given Proloquo2Go has minimal research conducted on its effectiveness, while SwiftKey Symbols currently has no research conducted on effectiveness. Given the prevalence of Proloquo2Go use, despite the cost of the application and device ($450 minimum), research is needed to identify if there are as effective, but cheaper alternatives for an app based communication system.

Specifically, this study investigated the following research question:

What are the effects of SwiftKey Symbols (free communication application) vs. Proloquo2Go (widely used $200+ communication application) on increasing expressive communication for one participant with an intellectual disability and articulation concerns?

Rationale for Research

This study has been conducted to decipher whether there is a difference in the acquisition of expressive communication skills when using Proloquo2Go and SwiftKey Symbols. With Proloquo2Go being a more widely used, expensive application, it would be beneficial and more convenient if the free application, SwiftKey Symbols, could produce similar or better results. By conducting this study, not only will more research be provided for both applications, but the results will allow researchers to see which application produced the best results for the intended purpose of increasing expressive communication.

CHAPTER 2

LITERATURE REVIEW

Intellectual and/or Developmental Disabilities (IDD)

Salend (2005) states that students with disabilities often have some degree of deficit when it comes to communication (as cited in Steele, 2007, p. 60). This can be in expressive language (how one expresses himself/herself), receptive language (how someone receives information), or functional communication (basic communication skills). Depending on a student's specific disability, one or more of these communication areas may be differentially affected. In order for students with disabilities to be as independent as possible, it is important for them to have an appropriate method that allows them to communicate in an effective manner.

Hallahan and Kauffman (2006) state that producing speech and meaningful language are two problems when it comes to communication disorders (as cited in Steele, 2007, p. 59). Students with disabilities can often exhibit these issues. Salend (2005) mentions that "students with communication disorders and learning disabilities often have expressive or receptive oral language deficits" (as cited in Steele, 2007, p. 60). When a student cannot exhibit expressive language skills, it is often difficult for them to express what they are trying to say or what they know. If a student struggles with receptive oral language deficits, it can make it hard for them to absorb the information they are being taught. When deficits in communication occur, whether it be expressive, receptive, or functional, it makes it difficult for the student to progress in multiple aspects of life.

According to Schwartz, Garfinkle, and Bauer (1998), significant difficulty in acquiring and using communication skills are often present in students with autism, as well as other severe disabilities. Not only does this present a problem when trying to communicate in an effective

manner, it can potentially have a negative influence on other areas of development as well (Schwartz et al., 1998). Although research in the area of teaching communication skills to students with severe disabilities has flourished over the past 18 years, some students may never acquire the verbal communication skills or verbal fluency to enable them to effectively communicate in a functional sense (Schwartz et al., 1998). In order for functional communication skills to serve their purpose, students with severe disabilities must be able to generalize these skills across settings, situations, in daily living, and spontaneously at appropriate times (Schwartz et al., 1998).

Picture Exchange Communication System (PECS)

To mitigate this concern for students with significant disabilities, it may be helpful to train them in the use of an augmentative communication system (Schwartz et al., 1998). There are a number of augmentative or alternative communication systems that might be considered. For example, The Picture Exchange Communication System (PECS) is an alternative communication system that can be implemented in order to improve the communication skills of those who often struggle with this. Flippin et al. (2010) state that PECS is often used as a communication-training tool for young children with ASD.

In order to build the expressive communication style of children, reinforcement, delay, and generalization across trainers and settings is used (Flippin et al., 2010). PECS is made up of six phases. Phase one is known as the physical exchange phase. During this phase, the child is physically prompted by two trainers to exchange a picture for a preferred item. In phase one, no distractor pictures are present. Phase two or the expanding spontaneity phase introduces a communication book. A significant amount of space is placed between the child and communicative partner in order to encourage the student to select a picture from their

communication book and carry it to the partner (Flippin et al., 2010). Generalization is important during this phase. Picture discrimination or phase three comes next. The child is expected to discriminate between two picture symbols. This would first occur between a highly desired and non-desired item, and then between two desired items (Flippin et al., 2010). In phase four, the child learns to make a request using an "I want" symbol paired with the preferred item symbol. Once the child gives this sentence strip to the communicator, the communicator states "I want" and uses a time delay before naming the preferred item (Flippin et al., 2010). The communicator then hands the sentence strip and preferred item back to the child. Phase five is where the student learns "What do you want?" When the communicative partner verbally prompts the student with the question, a time delay is given before the gestural prompt is given for the "I want" symbol. Over time, the child answers the question before the gestural prompt is given (Flippin, 2010). Responsive and spontaneous commenting occurs in phase six. When the communicative partner asks a question such as "What do you see?", "What do you have?", or "What do you want?", the child must exchange a sentence strip. This is how students are trained to use comments. Ganz and Simpson (2004) conducted a study using the first four phases of PECS in order to increase the number of spoken words, increase both length and complexity of phrases spoken, and decrease the non-word vocalizations for three participants with ASD and developmental delays (DD). Using a single-subject design within subjects, the interventionist used trainer modeling of verbalizations and training guidelines to see when mastery of each phase was achieved. Results indicated that each of the three participants mastered the system in under 30 sessions. Stoner, Beck, and Bock (2006) conducted a study using the first four phases of PECS in order to determine how effective PECS was for five non-verbal adults with developmental disabilities that lacked access to a functional means of communicating. Using a modified ABAB single-

subject design, the interventionist used a variety of prompts in order to allow the participants to be reinforced with the object in which they selected. Results indicated that PECS was effective for three of the five participants.

Computerized Augmentative/Alternative Communication (AAC) Programs

Another approach to augmentative/alternative communication (AAC) involves the use of computerized programs that allow students to communicate, whether through on-screen text or synthesized text-to-speech. There are many communication software systems that can be used on portable electronic devices such as cell phones, iPads, iPods, etc. Proloquo2Go and SwiftKey Symbols are two application programs designed to increase speech in individuals who struggle with communication. Research has deemed SGDs effective for students with significant disabilities and Leonard (2014) conducted a study with three participants with ASD to determine how using an iPad equipped with the SonoFlex SGD affects communication skills in students with autism. By using a single subject, multiple-baseline design with AB phases across academic and social settings, the interventionist was able to use the system of least to most prompting in order to increase initiating requests, responding to questions, and making social comments. Results indicated that all three participants were engaged in academic lessons (Xin & Leonard, 2014). Two of three participants were able to reach independence without prompting. Lorah, Parnell, Whitby, and Hantula (2015) conducted a review in order to evaluate handheld computing devices and portable multimedia players as SGD's for those diagnosed with ASD or related disorder such as an intellectual disability (ID) or DD. Results indicated that the 17 single-subject research design studies used either an iPad or iPod touch (14 of which used Proloquo2Go) and led to quick acquisition of verbal skills.

Importance to Students

According to Ostrosky, Drasgow, and Halle (1999), we must be able to look at the communication skills selected that will have a positive impact on the student's life. Communication skills should be selected based on how relevant they are to the student (Ostrosky et al., 1999). So, when conducting the study, it is a key element that the communication skills (terms and phrases) will be beneficial to the student and serve a purpose in order to promote independence in their everyday life. When we provide them with the tools necessary to promote this greater level of independence, their level of expressive communication is expected to increase.

When deciding what terms and phrases should be used for the participant, it is important to keep in mind that they must be functional (Ostrosky et al., 1999). For example, if the student uses a toileting schedule, it would be functional to teach him how to request to go to the restroom, rather than waiting for it to be time to go again. This is functional in his life because it serves a purpose, rather than just being a generic request that he probably will not use in everyday life.

By using motivation when teaching functional requests, the communication of the student is likely to be more effective (Ostrosky et al., 1999). When thinking of the participant in the study, it is important to keep in mind objects or activities he prefers that would motivate him to communicate in an appropriate, effective manner. For example, the participant enjoys watching Andy Griffith. Once he has completed an activity and wishes to request this activity, he must have the attention of an adult or peer. Teaching the participant how to obtain the attention comes into play when using Proloquo2Go and SwiftKey Symbols. He must be able to manipulate each

application in order to select the appropriate icon that will allow him to make this functional request.

It is important to observe how the student currently uses gestures, vocalizations, etc. to make requests, protest, comment, etc. and when they use these items (Ostrosky et al., 1999). By being aware of the participant's current communication system, it allows us to build a more functional communication system that will still be meaningful to the student (Ostrosky et al., 1999). When the function and intent of a request is known, educators can modify the request and replace it with a more socially acceptable alternative. It is important to make sure that we are encouraging the more socially acceptable alternative rather than the old communication strategy (Ostrosky et al., 1999). When an attempt to communicate is made using the old communication strategy, be sure to prompt the use of the more desirable strategy.

McMillan and Renzaglia (2014) state when thinking of how to increase communication using an SGD, we must also consider the ability to increase spontaneity. Halle (1987) states that by working on increasing spontaneity, this will allow the participant to increase control over their environment (as cited in McMillan and Renzaglia, 2014, p. 50). In other words, we should be teaching the participant how to initiate requests outside of being prompted to. This will allow them to have more needs met, rather than only having needs met when a prompt is given.

One of the key points discussed by McMillan and Renzaglia (2014) is the correlation between the quality of instruction provided by teachers learning how to use SGD's through professional development and the effect it had on the learning outcomes of the participants. By providing teachers with a professional development focused on the use of SGD's, students were able to increase their use of the SGD's in an appropriate manner. Being that this is one of the few studies based around using professional development in order to allow teacher's to provide more

quality instruction for student's on the use of SGD's, more studies must be conducted in order to see if this correlation can be replicated (McMillan and Renzaglia, 2014).

A major part to consider when thinking of an AAC device is the preference of the child (Grassmann, 2002). Is the device or application selected by the student? Does the student appear to enjoy using the AAC device/application? These are just a few questions to consider when an AAC device/application is used with a student. One of the points of this study is to compare two applications that differ in prices. By allowing the participant to use both applications, it allows them to see which one is more preferred. Lorah et al., 2014 discuss how 23 participants preferred an SGD, three preferred PECS or picture exchange, none preferred manual sign language, and two had no preference.

There are multiple populations that have been researched when it comes to the use of communication devices and software programs that increase communication among students with disabilities. O'Reilly et al. (2011) used an iPod-based SGD with individuals with developmental disabilities. In the study, students used Proloquo2Go on an Apple iPod Touch to request preferred stimuli (O' Reilly et al., 2011). With the three participants, a delayed multiple-probe design was used. In baseline, a tray containing three different snacks (for two participants) and two trays containing three different toys and three different snacks were used. They were placed out of reach of the participants, while the iPod Touch was placed directly in front of each of them in an upright position. The sessions were broken down into five-minute time frames. The trainer stated "Let me know if you want a snack" for two participants and "Let me know if you want snacks or toys" for the other participant. The trays were then moved within reach and allowed each participant to take one item every 30 seconds. This was used to encourage motivation throughout the study. It also allowed the trainers to see if the items that the

participants selected would be eaten or played with. This confirmed that they could function as reinforcers during the subsequent acquisition-training phase (O' Reilly et al., 2011).

During acquisition training, the discrete-trial format was used until participants made three successive independent requests (O' Reilly et al., 2011). The trainer stated "Here are some snacks (toys). Let me know if you want something." The first three discrete trials consisted of a second trainer standing behind the participant. The trainer picked up the participant's right hand and used their index finger to physically guide the participant to touch a snack or toy symbol on the iPod Touch (O' Reilly et al., 2011). This activated the corresponding speech output. Once the speech output occurred, the tray was moved within reach of the participants and they could select one toy or snack. Starting with the fourth discrete-trial, a 10-second time delay occurred between the verbal prompt and the physical prompt. Once acquisition was reached on snacks, the third participant received training in order to request toys. If either of the first two participants pressed the toy symbol, there was no consequence, but if either of the three participants activated the social interaction symbol, a response from the trainer was provided (O' Reilly et al., 2011). Two of the three participants went onto the post-training phase. During this phase, one student could request snacks, while the other could request both snacks and toys. If the one student requested a toy, but could only request snacks, he was informed that he didn't have any toys, only snacks. If either of the participants hit the social interaction symbol, it stated "What's new with you?" and the trainer replied. Both participants did not require verbal or physical prompts during this phase. The iPod Touch was alternated to a different orientation for one participant to make sure he could discriminate during this time. Overall, two of the three participants reached acquisition. This occurred in the ninth trial for one, and the sixth trial for another.

Although there is minimal research on the use of Proloquo2Go and its effectiveness, it appears to be used widespread. As mentioned above in the article, only two out of three participants reached acquisition of expressive communication skills. There are multiple application based communication programs available with little to no research conducted on them. A few of these programs include GoTalk, Dynavox, and SwiftKey Symbols.

The purpose of this study is to determine the effects of SwiftKey Symbols vs. Proloquo2Go on the acquisition of expressive communication. The effects of each communication application on overall engagement and student participation are being noted as well.

CHAPTER 3

METHODS

This study investigated the relative effects of Proloquo2Go vs. SwiftKey Symbols on the acquisition of targeted phrases using a single-case alternating treatment design for a student with an intellectual disability and limited expressive communication skills. The independent variable consisted of the particular communication program and the associated tablet, an iPad equipped with Proloquo2Go and an Android tablet equipped with SwiftKey Symbols. The system of least prompts with a five second wait time before the next prompt was used to instruct the participant in the use of the respective communication application and tablet. The dependent variable was the number of targeted expressive phrases used correctly and independently (i.e., without prompts). The interventionist also conducted visual checks to determine whether or not the participant was engaged and actively participating in the instructional activity. Intervention data were also collected on the specific prompts used for each step of the task analysis. The percentage of independent attempts per session were recorded.

Participant

One male participant, Sam, a 13-year-old 6th grader participated in the study. He had been diagnosed with Down Syndrome, as well as having a language impairment. His language impairment was that he was primarily non-verbal with minimal expressive language; Sam would repeat what others would say to him, but his speech was difficult to understand. He did not have a consistent, reliable alternative system for expressive communication. Sam met the study inclusion criteria, specifically: (a) being in need of a communication device, (b) having an identified disability, and (c) exhibiting expressive communication difficulties. Sam's communication difficulties included initiating interactions and his oral communications being

difficult to understand. The participant did not exhibit adequate reading skills or make any attempts to read materials provided to him. Approximately 30 mins a day is spent on providing the participant with literacy activities.

Setting

This study was conducted at the Sam's assigned school, which was located in a suburban middle school in the Eastern United States in his Comprehensive Development Classroom (CDC). Ten students were in the classroom (including Sam) with one teacher and four paraprofessionals. The school had a total enrollment of approximately 670 students, 49% of whom received free or reduced lunch. Observations were conducted during a portion of the instructional day when the applications were being used across multiple academic subjects or free time, as well as while interacting with adults and peers. The participant's classroom consists of a smaller room attached to a much larger classroom. The smaller section of the classroom consists of four desks each in three rows. A dry erase board is on one wall, with a Promethean board on the opposite wall. Student laptops and iPads are also stored in a cabinet in this classroom. When you walk into the larger portion of the classroom, students hang their backpacks on the hooks on the wall. Next to this area are the washer and dryer and an area with a mat and swing. Two horseshoe shaped tables are primarily used for small group instruction. A small kitchen is in this part of the classroom as well. The kitchen consists of a stove, sink, refrigerator, and an island.

Interventionist

The interventionist was a paraprofessional in the participant's classroom. She had worked with individuals with ID/DD for five years. She had been in this role in this particular classroom for ten months when the study began. She has an undergraduate degree and license in special

education focused on low incidence disabilities and is a current graduate student pursuing a masters degree. This study served as the thesis requirement as part of her program of study.

Research Design

The design for this study was a single-case alternating treatments design (ATD) (Kennedy, 2005). By using an alternating treatments design, the is able to measure the effects and compare the interventions being used (Gast, 2010). The two interventions were able to be randomly alternated by sessions and days (Gast, 2010). The interventions cannot occur more than two times in a row. Since an ATD does not require a significant amount of time, this makes it beneficial to the researcher (Gast, 2010). In this design, two different interventions were applied to Sam's use of a communication application program, Proloquo2Go and SwiftKey Symbols. The applications were alternately used in two different settings each day, one in the morning and one in the afternoon. The use of the devices randomly alternated between the two settings on a daily basis while Sam's frequency of expressive communication with each program was measured. A dice roll was used in order to establish the alternating schedule of interventions in the morning and afternoon sessions. If an odd number was rolled, this determined that Proloquo2Go was used. If an even number was rolled, this determined that SwiftKey Symbols was used. The interventionist made sure that one device was not used more than twice in a row. A total of five morning and five afternoon sessions for each program occurred each week unless there was a scheduled break from school, the participant was absent, or the interventionist was absent.

Measures

Independent use of both Proloquo2Go and SwiftKey Symbols consisted of the participant self-initiating independent (i.e. without prompts) responses within five seconds for each step of

the task analysis for both of the target phrases. A task analysis was created to reflect the steps needed to complete each targeted phrase for each communication system. Data were recorded on the prompt level needed for each step of the task analysis. If Sam was able to make an unprompted, independent response on the steps of the task analysis, an I was recorded for that particular step. Otherwise, the appropriate prompt from the prompt hierarchy was recorded (G-Gestural, NSV-Non-Specific Verbal, FPA (Full Physical Assistance). See figures 1-4 for each task analytic data sheets used in the study. Formal data were not collected on student engagement and active participation. Visual checks were performed in order to determine whether or not the participant was interested in each application. This allowed the interventionist to see if Sam was engaged and actively participating in the instructional activities. If Sam was looking at the screen of each device and consistently moving through each step of the task analysis without stopping or looking away, it was determined that he was actively engaged and participating.

Dependent Variable

The dependent variable consisted of the percent of unprompted, independent correct steps of each task analysis reflecting the targeted expressive communication phrases using each of the two programs. Appropriate use of the independent key/application presses with either application was defined by the following: 1.) when presented with the iPad or Android tablet, Sam was to self-initiate (i.e. without a teacher prompt) opening each application and completing all of the steps outlined in the task analysis for each application until the target phrase was played. Refer to figures 1-4 for examples of the steps included for each phrase and communication device.

The communicative phrases targeted for acquisition were common phrases identified by his classroom teacher as essentials for Sam. These specific target phrases included “I want computer” and “Help please.” The percentage of independent (unprompted) attempts was

measured as well. There are multiple occasions where Sam often needs help throughout daily activities at school. This is why the 'Help please' phrase was selected so that Sam had the opportunity to request help when he needed it. During free time, Sam often chose to use the computer. When free time would occur, this created the perfect opportunity for Sam to request that he wanted the computer versus expecting the teacher or a paraprofessional to bring it to him. Both phrases are common occurrences in his daily routine and they allowed him to exhibit more independence.

Inter-Observer Agreement and Procedural Fidelity

The classroom teacher and paraprofessional were trained by the interventionist in the data collection procedures and steps for intervention implementation in order to collect inter-observer agreement (IOA) and procedural fidelity (PF). IOA was collected on each dependent variable for each application. It was intended that for at least 25% of the observations in each setting would be assessed for IOA by one of the trained observers. Due to circumstances beyond the interventionist's control, this percentage was not achieved. IOA was collected for one trial during one session of the study. During the IOA check, both observers recorded the number of times Sam tapped the iPad application, recording whether each icon tap was independent or if a teacher prompt preceded that icon tap. After each IOA observation, the interventionist and second observer tallied the number of independent icon taps and the number of icon taps preceded by a teacher prompt that each recorded. The percentage agreement formula was used to calculate agreement (# of Agreements/# of Agreements + # of Disagreements) x 100). A similar agreement calculation was used in order to tabulate the number of prompted icon taps for each program. A minimum of 80% agreement was considered necessary to establish sufficient IOA.

Procedural Fidelity (PF) was assessed by another paraprofessional trained on the process.

The paraprofessional followed a checklist in order to ensure that the interventionist was conducting each section as outlined on the checklist. This was to be conducted on 20% of the sessions, but due to circumstances beyond the interventionist's control, this occurred for one trial during one session.

Procedure

The independent variable in this study consisted of the two different communicative applications, Proloquo2Go on an iPad and SwiftKey Symbols on an Android tablet. A task analysis of the use of Proloquo2Go and SwiftKey Symbols was conducted in order to teach Sam how to operate both tablets and their associated applications. Total task presentation was used in order to teach the participant how to work through each task analysis. This particular chaining method was used because it allowed the participant to perform the whole task until he was familiar with each step of the task. Each step of the TA was taught using the system of least prompts (SLP). The prompt hierarchy consisted of I-Independent, G-Gestural, NSV-Non-Specific Verbal, and FPA-Full Physical Assistance. The system of least-to-most prompts was used during the study. This consisted of allowing the participant to initially make an independent attempt on each step of the task analysis. A 5 second wait time was placed in between prompts. If the participant did not initiate an independent response, the interventionist offered the next prompt in the prompt hierarchy (GP-Gestural Prompt). A GP allowed the interventionist to point to the correct button on the device. A 5 second wait time occurred before the next prompt was offered. If the participant did initiate a response after the GP was provided, then a Non-Specific Verbal Prompt (NSV) was provided. A 5 second wait time occurred after this prompt. If the participant did not initiate a response after the NSV prompt was provided, Full Physical Assistance (FPA) was used in order to allow the participant to press the correct key. A step-by-

step presentation showed Sam how to: 1.) locate the appropriate application on the screen; 2.) select the program application icon; 3.) tap the desired icon for each step of the two task analyses to compose each of the sentences; and 4.) activate the sound for the desired object/activity.

The system of least-to-most prompting was used in order to teach Sam how to initiate each command. The prompt codes included the following: I-Independent, G-Gestural, NSV-Non-Specific Verbal, and FPA-Full Physical Assistance. A 5-second wait time was used before the next prompt in the prompt hierarchy was used. Once the participant completed each step of the task analysis, regardless of the prompt required, he was given verbal praise. A data collection sheet accompanied the task analysis in order to record what prompt was needed for each step across multiple trials during each session. 2-30 minute sessions were conducted each day. These sessions consisted of one-30 minute session in the morning and one-30 minute session in the afternoon each day. The participant was provided with multiple trials per session in order to ensure that independence on each step was obtained. Once the participant was able to produce independent responses on every step of each command for a minimum of three back-to-back attempts, the session ended. Since the sessions were designed to be taught in naturally occurring settings, the 'Help Please' command was typically used when he had a book and needed help reading it. The 'I Want Computer' command was used during free time since this is often what the participant chooses to do during this time.

A task analysis was designed and implemented for each command in order to show Sam how to operate each application and become familiar with them. The following steps were included for SwiftKey Symbols 'Help Please'; 1.) Click SwiftKey Symbols icon, 2.) Click 'chat' section, 3.) Click 'help' picture, 4.) Click 'please' picture, 5.) Click play button to play full message. The following steps were included for SwiftKey Symbols 'I Want Computer'; 1.) Click

SwiftKey Symbols icon, 2.) Click ‘sentence builders’ section, 3.) Click ‘I’ picture, 4.) Click ‘want’ picture, 5.) Click back arrow, 6.) Click ‘activity’ section, 7.) Click ‘computer’ picture, 8.) Click play button to play full message. The following steps were included for Proloquo2Go ‘Help Please’; 1.) Click Proloquo2Go icon, 2.) Click ‘more’ arrow, 3.) Click ‘actions’ folder, 4.) Click ‘help’ picture, 5.) Click ‘home’ button, 6.) Click ‘home’ button, 7.) Click ‘chat’ folder, 8.) Click ‘please’ picture, 9.) Click full sentence to play message. The following steps were included for Proloquo2Go ‘I Want Computer’; 1.) Click Proloquo2Go icon, 2.) Click ‘I’ picture, 3.) Click ‘want’ picture, 4.) Click ‘things’ folder, 5.) Click ‘computers’ folder, 6.) Click ‘computer’ picture, 7.) Click full sentence to play message. Below is an example of each task analysis for each device/command in Figures 1 through 4.

SwiftKey Symbols

Command: 'Help please'	**11/7 (Mon)**	**11/9 (Wed)**	**11/10 (Thurs)**	**11/11 (Fri)**	**11/14 (Mon)**	**11/15 (Tues)**	**11/16 (Wed)**
1.) Click SwiftKey Symbols icon							
2.) Click 'chat' section							
3.) Click 'help' picture							
4.) Click 'please' picture							
5.) Click play button to play full message							
Total Correct							

KEY:

FPA-Full Physical Assistance
NSV-Non-Specific Verbal
G-Gestural
I-Independent

Figure 1. Task Analysis for SwiftKey Symbols Phrase 'Help Please.'

SwiftKey Symbols

Command: 'I want computer'	**11/7 (Mon)**	**11/9 (Wed)**	**11/10 (Thurs)**	**11/11 (Fri)**	**11/14 (Mon)**	**11/15 (Tues)**	**11/16 (Wed)**
1.) Click SwiftKey Symbols icon							
2.) Click 'sentence builders' section							
3.) Click 'I' picture							
4.) Click 'want' picture							
5.) Click back arrow							
6.) Click 'activity' section							
7.) Click 'computer' picture							
8.) Click play button to play full message							
Total Correct							

KEY:

FPA-Full Physical Assistance
NSV-Non-Specific Verbal
G-Gestural
I-Independent

Figure 2. Task Analysis for SwiftKey Symbols Phrase 'I Want Computer.'

Proloquo2Go

Command: 'Help Please'	11/7 (Mon)	11/9 (Wed)	11/10 (Thurs)	11/11 (Fri)	11/14 (Mon)	11/15 (Tues)	11/16 (Wed)
1.) Click Proloquo2Go icon							
2.) Click 'more' arrow							
3.) Click 'actions' folder							
4.) Click 'help' picture							
5.) Click 'home' button							
6.) Click 'chat' folder							
7.) Click 'please' picture							
8.) Click full sentence to play message							
Total correct							

KEY:

FPA-Full Physical Assistance
NSV-Non-Specific Verbal
G-Gestural
I-Independent

Figure 3. Task Analysis for Proloquo2Go Phrase 'Help Please.'

Proloquo2Go

Command: 'I want computer'	11/7 (Mon)	11/9 (Wed)	11/10 (Thurs)	11/11 (Fri)	11/14 (Mon)	11/15 (Tues)	11/16 (Wed)
1.) Click Proloquo2Go icon							
2.) Click 'I' picture							
3.) Click 'want' picture							
4.) Click 'things' folder							
5.) Click 'computers' folder							
6.) Click 'computer' picture							
7.) Click full sentence to play message							
Total Correct							

KEY:

FPA-Full Physical Assistance
NSV-Non-Specific Verbal
G-Gestural
I-Independent

Figure 4. Task Analysis for Proloquo2Go Phrase 'I Want Computer.'

Method of Data Analysis

As the intervention sessions were completed, the percentage of Sam's self-initiated (unprompted) expressive communications using Proloquo2Go and SwiftKey Symbols for each session were graphed separately (one for each phrase). Visual analysis of the data was used to compare self-initiated use of the two applications.

Controls for Threats to Validity

With internal validity, the prescribed implementation for an alternate treatment design was followed. Two treatments (Proloquo2Go and SwiftKey Symbols) were alternated according to a dice roll in which an odd number signified the use of Proloquo2Go and an even number signified the use of SwiftKey Symbols. The use of each application could not occur more than two times in a row. For example, if the dice rolls were an even number twice in a row, then that meant that SwiftKey Symbols was used twice in a row and Proloquo2Go automatically followed the second use of SwiftKey Symbols. Then the interventionist returned to the use of the dice roll in order to determine the order in which the sessions occurred.

While external validity focuses on generalization, this did not occur during the study. However, external validity was present through replication across phrases. The purpose of the study was to decide which of the two communication applications led to better acquisition of expressive communication. Better acquisition of expressive communication was exhibited through the use of Proloquo2Go. The study did not make it to the phase of allowing the participant to self-initiate independent (going to get the iPad and initiating the appropriate phrase) use of the iPad and Proloquo2Go. Had this been the case, generalization could have been a factor in the study.

CHAPTER 4

RESULTS

The purpose of this study was to determine which of the two software applications produced more independent use of expressive communication skills for the participant. A secondary question considered whether or not Sam's engagement in the observed instructional activities was greater when using one of the two applications.

Data were collected on data collection sheets designed by the interventionist. It was noted what prompt in the system of least-to-most prompts was needed for each step of the task analysis for each command. The number of each prompt was then graphed using a percentage. Each graph consisted of showing data for every session conducted during the study for each command with both Proloquo2Go and SwiftKey Symbols results present on one graph. Two graphs were constructed with one showing the results for the command 'I Want Computer' with both applications to compare and one showing the results for the command 'Help Please' with both applications present to compare. These can be seen in Figures 5 and 6 below.

Figure 5 presents Sam's percentage of independent uses of the two programs to express the request 'I Want Computer' during the Proloquo2Go (solid line) condition and during the SwiftKey Symbols (dashed line) condition. Figure 6 presents the percentage of independent use for the phrase 'Help Please' with Proloquo2Go (solid line) condition and during the SwiftKey Symbols (dashed line) condition. Similar variability was seen for 'Help Please' under the Proloquo2Go and SwiftKey Symbols conditions although the variability under the SwiftKey Symbols conditions seemed to be somewhat less than Proloquo2Go. When looking at Proloquo2Go for the first session, it took seven attempts before the participant achieved consecutive attempts at a higher acquisition. The participant did not reach 100% independence

on all steps until the last two sessions. This may be due to a design flaw in the Proloquo2Go application for the command 'Help Please.' Two of the steps in this command required the participant to press a small home picture (approximately the size of a pea) and then the button that said home (approximately the size as just typed). This was a major difference compared to the size of the picture buttons the participant was used to pressing. The participant appeared to struggle with this. For those two steps in the task analysis of the command 'Help Please,' the participant needed FPA in order to press these two buttons for a majority of the sessions. As in the above graph, when the lines dip back down, this shows that a new session has begun. With the 'Help Please' command, it appears as though the participant performed better with SwiftKey Symbols. Again, this could be due to the design flaw within the Proloquo2Go application for this same command.

By using the SLP's, this allows the participant to make more independent attempts before more intrusive prompts are used. As you follow the lines, they show how many attempts it took before Independent attempts were made on each step outlined in the task analysis for each command. As the study continued, the participant was able to achieve more steps completed independently at a faster rate. The percentages of independent attempts for Proloquo2Go SwiftKey Symbols with the 'I Want Computer' command can be seen below in Table 1.

Table 1.

Percentage of Unprompted, Independent Trials for the Phrase 'I Want Computer '

'I Want Computer'	Date 1	Date 2	Date 3	Date 4	Date 5	Date 6	Date 7	Date 8	Date 9
Proloquo2Go	0% 0% 0% 0% 0% 100% 100% 100%	0% 14% 14% 14% 14% 100% 100% 100%	14% 100% 100% 100%	86% 100% 100% 100%	71% 100% 100% 100%	71% 100% 100% 100%	71% 100% 100%	100% 100% 100% 100%	100% 100% 100%
SwiftKey Symbols	0% 0% 0% 0% 0% 0% 100% 100% 100%	0% 0% 0% 0% 0% 0% 0% 100% 100% 100%	0% 0% 13% 13% 13% 100% 100% 100%	50% 50% 50% 50% 50% 50% 63% 63%	38% 75% 100% 100% 100%	63% 75% 75% 75% 75%	75% 100% 100% 100% 100%	63% 75% 100% 100%	50% 50% 63% 100% 100% 100% 100%

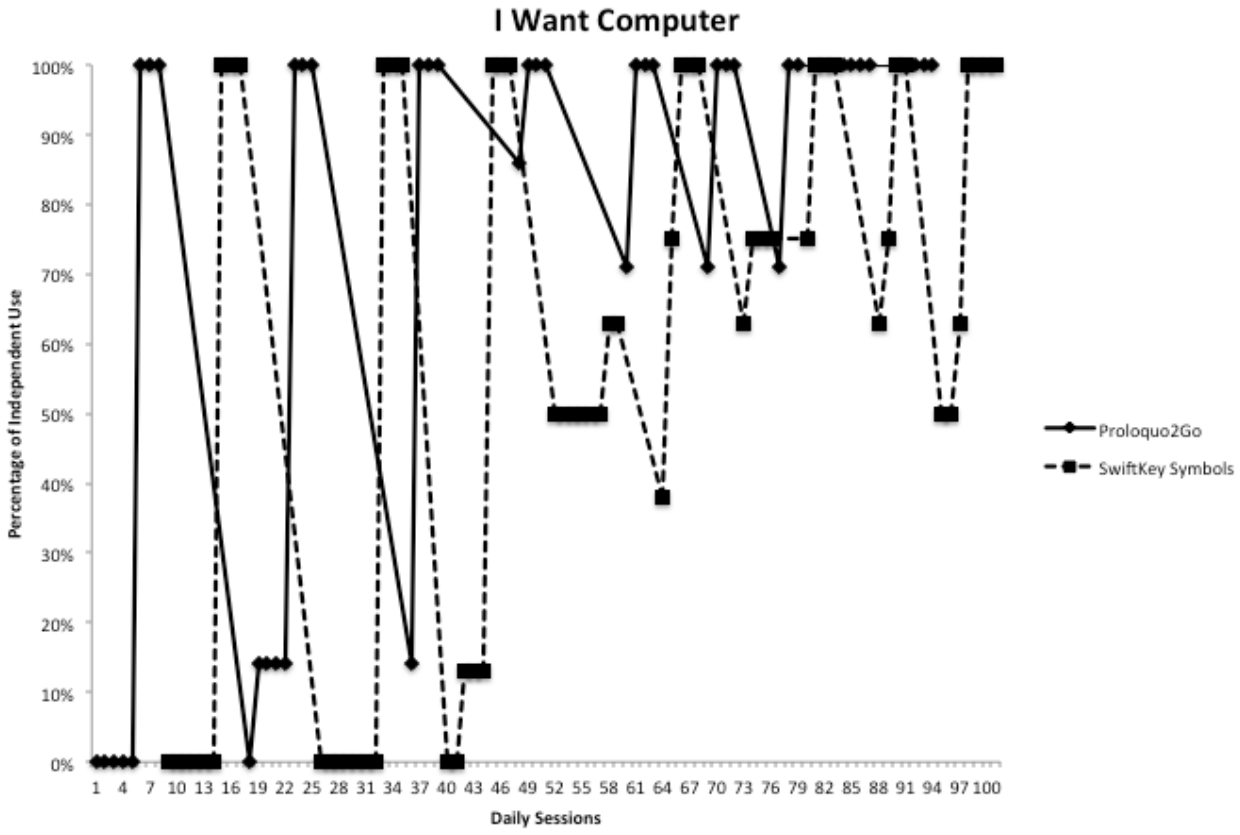

Figure 5. Graphed Percentages of Independent Attempts for Phrase 'I Want Computer.'

The percentages of independent attempts for Proloquo2Go and SwiftKey Symbols with the 'Help Please' command can be seen below in Table 2.

Table 2.

Percentage of Unprompted, Independent Trials for the Phrase 'Help Please.'

'Help Please'	Date 1	Date 2	Date 3	Date 4	Date 5	Date 6	Date 7	Date 8	Date 9	Date 10
Proloquo2Go	0% 0% 0% 78% 78% 78% 78%	0% 0% 0% 0% 0% 78% 78%	11% 11% 11% 78% 78%	67% 78% 78% 78%	44% 44% 78% 78% 78%	67% 78% 78%	67% 78% 78%	67% 78% 78% 78%	44% 44% 44% 56% 100% 100% 100%	67% 89% 100% 100% 100%
SwiftKey Symbols	0% 20% 20% 20% 20% 20% 80% 80% 80% 100% 100% 100%	0% 0% 0% 0% 0% 100% 100% 100%	0% 0% 0% 100% 100% 100%	40% 40% 40% 40% 40% 40% 100% 100% 100%	80% 80% 100% 100%	80% 80% 100% 100%	80% 80% 100%	80% 100% 100% 100%	80% 80% 80% 100% 100% 100%	60% 80% 100% 100% 100% 100%

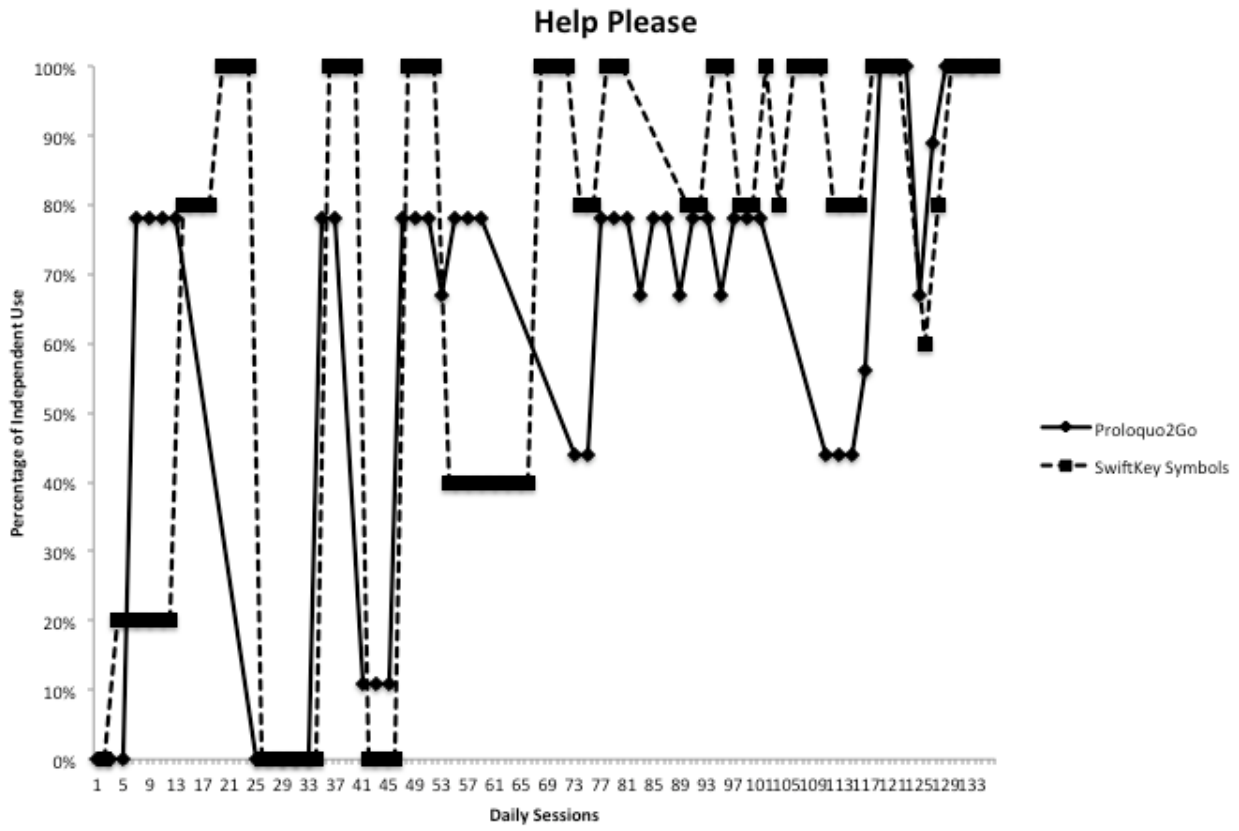

Figure 6. Graphed Percentages of Independent Attempts for Phrase 'Help Please.'

As for the research question 'What are the effects of SwiftKey Symbols (free communication application) vs. Proloquo2Go (widely used $200+ communication application) on the acquisition of expressive communication?', the graphs allow us to see which of the two programs was more effective for each of the commands. For 'I Want Computer,' Proloquo2Go was more effective in allowing the participant to achieve acquisition of expressive communication with this command. With 'Help Please,' it appears as though SwiftKey Symbols was more effective in increasing acquisition of expressive communication, however, this could mostly be due to the design of the Proloquo2Go application and how it was set up for this specific command. Nonetheless, when looking primarily at the graph, SwiftKey Symbols is more effective for this specific command.

Although no formal data was collected on student engagement, the interventionist made visual checks in order to see if the participant appeared to be engaged (looking at the device, responding in an alert manner, facial expressions). While using Proloquo2Go, it was noted that the participant always appeared to be more engaged. He quickly initiated the use of the device, whereas when using SwiftKey Symbols, the participant would have to sit directly in front of the device and had to look around more so for the correct key to press.

CHAPTER 5

DISCUSSION

The objective for the study was to determine the relative effects of Proloquo2Go and SwiftKey Symbols in order to see which of them led to greater increased acquisition of expressive communication, that is the independent use of the two programs to make specific requests of 'I Want Computer' and 'Help Please.' The student, Sam, a suburban middle school student with Down Syndrome and little oral expressive communication, was trained to follow task analyses steps using each of the two communication applications. He was then observed twice a day during each of two naturally occurring school activities and alternately provided with the Proloquo2Go and SwiftKey Symbols on an iPad and an Android tablet. Sam's performance under each of these experimental conditions was highly variable, become less variable as the study went on. The relative effectiveness of the two applications seemed to be affected by the specific communicative request, 'I Want Computer' being somewhat less variable with Proloquo2Go and 'Help Please' being less variable with SwiftKey Symbols. It appeared that Sam's participation and engagement were better when using Proloquo2Go than when using SwiftKey Symbols.

While watching the participant interact with each device and communication application, it was evident that he preferred the use of Proloquo2Go vs. using SwiftKey Symbols. When Proloquo2Go was presented to him and he knew which of the phrases he would be using, he immediately would begin using the application. When SwiftKey Symbols was presented to him, he would get really close to the screen before making his selections and spent more time between each step of the TA looking for his selection of the next key attempt. During sessions, there were times when the classroom teacher or a paraprofessional was observing the participant to see how

he responded to each application. On multiple occasions, they stated that he appeared to prefer and perform better with the use of the Proloquo2Go application.

Engagement Data

With student engagement and participation, it was visually noted during each session that the participant was always more responsive to Proloquo2Go than SwiftKey Symbols. The participant often had to place the SwiftKey Symbols application right in front of him in order to see the pictures. This may be due to the design of the SwiftKey Symbols software consisting of an entire screen on different shades of blue. It may have been more difficult for him to see the pictures. When using SwiftKey Symbols, the interventionist reported that the participant did not appear very engaged in the activity or the use of the application. Proloquo2Go is designed with a variety of colors that coordinate with the picture. Below you will find examples of how each of the software applications looks. It is important to note that these are example screenshots and not actual screenshots from the study. They are only used to explain the difference in appearance. The first picture shows how the icons and screen appear on Proloquo2Go. The second picture is an example of how SwiftKey Symbols interface is designed. The color of the screens may play a role in the overall engagement and participation of the participant.

Once it was determined which of the two software applications was more effective in increasing the acquisition of expressive communication, as well as overall student participation and engagement, the goal was to continue using that specific communication application in order to see if the participant was able to make fully independent attempts (i.e. going to find the device and activating it independently vs. just having the device already present). Due to circumstances in the classroom beyond the interventionist's control, the study did not make it to this phase. Had the circumstances been different, it would have been determined that (outside of the design of

Proloquo2Go for the command 'Help Please') Proloquo2Go was more effective in increasing the acquisition of expressive communication, as well as increasing overall student engagement and participation.

Given that Proloquo2Go is a costly communication application and SwiftKey Symbols is a free program, it may be more appropriate or effective to allow Sam the use of SwiftKey Symbols since there were not large consistent differences between the two programs in terms of Sam's acquisition and expressive use. Teachers looking for a relatively effective and low/no cost program might then choose SwiftKey Symbols. Keep in mind, however, that this was a study conducted with one participant, and consequently, it needs further replication with additional students and other investigators to evaluate the generality of these findings.

This study allowed new research to be conducted on the use of a more widely used communication application (Proloquo2Go) vs. a far less common communication application (SwiftKey Symbols). Research currently exists on multiple communication applications, but the goal of this study was to see if a free communication application could be just as effective in increasing the acquisition of expressive communication as a more expensive one. It would be more beneficial for a free or cheap communication application to be effective in this sense. This study allowed more research on Proloquo2Go to be conducted, while adding some of the first research on SwiftKey Symbols.

Limitations and Future Research

In order to become more familiar with the use of different communication applications and their effectiveness on increasing acquisition of expressive communication, more research needs to be conducted with these two applications. A concern to be noted for this study was that it was conducted in the participant's Comprehensive Development Classroom (CDC) that he

spends a majority of his day in (aside from gym and lunch). This was done everyday of the week (Monday through Friday) with a morning and afternoon session conducted each day. There were some skipped days/session due to breaks from school or no access to materials in order to introduce the applications at a naturally occurring time. Very minimal instruction occurred in the classroom on a typical basis, which made it difficult to find natural opportunities for the student to use the identified communication phrases on the device. Classroom instruction should be occurring everyday for a majority of the day outside of breaks such as lunch or related arts classes. The interventionist had to construct opportunities for the participant to use the phrases on the devices in order to collect data. Without proper classroom instruction, it makes it difficult for the use of these applications to be taught in a naturally occurring setting. It also skews the data somewhat because opportunities are having to be created in order to collect such data. Future research should ensure that participants are engaged in daily age appropriate instruction that would allow ample opportunity for targeted communication phrases to be used.

Another study limitation was in regard to IOA and PF. The interventionist trained the classroom teacher and a paraprofessional on how to conduct both IOA and PF. Each stated that they understood how to do this after being trained. However, once a session was conducted, neither the classroom teacher nor paraprofessional marked their responses on the paper. This resulted in the interventionist walking them through the training again after the session was conducted. The appropriate percentage of IOA and PF was not achieved as outlined in the study guidelines. In retrospect, the interventionist should have included a role play opportunity for the teacher and paraprofessional during the IOA and PF training. Before moving on to actual IOA and PF collection, the teacher and paraprofessional should have had to “check out” by demonstrating they had firm understanding of the IOA and PF training. If they did not meet the

criteria to “check out”, they would be retrained until they were able to demonstrate proficiency. With future research, IOA and PF would have to meet the above listed criteria in order to be deemed fit for furthering research. By having both of these items collected, it makes the data more trustworthy.

A third limitation was that social validity data were not collected. Although it is a quality indicator of Single Case Design, it was not employed during this study as time did not allow for a formal measure to be collected. Future research should include a formal measure of social validity to capture both teacher and student perspective of the process and outcomes.

A fourth limitation was the lack of formal engagement data. If formal engagement data were collected, this would have provided critical information on student interest in each of the two communication systems.

A fifth limitation was that the two communication app systems were on two different types of devices. The Proloquo2Go was on an iPad and the SwiftKeys app was on an Android tablet, which could have impacted the results as the student may have been more familiar with one device over another. Unfortunately, SwiftKeys is not available via an iPad and vice versa. If the programs were to be developed for each device system, this study should be conducted again with a focus on both apps appearing on the same device.

A sixth limitation included the interventionist suddenly being moved from the participant’s classroom to a different position that required inclusion in multiple general education classrooms. This limited start time, as well as intervention time.

Implications for Practice

Practitioners can use the results of this study in order to implement use of the two communication applications in their classroom. Given that SwiftKey Symbols is free and

effective in increasing acquisition of expressive communication, it would be beneficial for practitioners to use this communication application in order to assist students with communication difficulties. Access to SwiftKey Symbols and other cheap or free communication applications is the goal for serving students with communication deficits. If a free or cheap version works just as well as a more expensive application, this would be a potential breakthrough in assisting those with communication disorders in having a better quality of life.

Conclusion

Based on the results of the study, it was determined that Proloquo2Go was more efficient in increasing the participant's acquisition of expressive communication. If the study were to continue or be replicated again, it would be highly beneficial to address the following areas. In order to allow the participant more plentiful opportunities in order to use each software application, it would be important that classroom instruction occurs often and the interventionist does not have to create opportunities for the participant to use these applications. Since classroom instruction was at a bare minimum during the study, this made it difficult for the interventionist to collect accurate, meaningful data.

Devices such as iPads and iPod touches are replacing typical SGD's such as Dynavox. Minimal research exists in order to guide teams in the identification of a proper expressive communication system for students to use. This study added to the literature base on application based communication systems. Additional studies are needed in order to properly identify the effectiveness of such applications on expressive communication. It is essential that students with minimal verbal communication skills are provided the opportunity to use a communication system that works for them and improves their overall quality of life.

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APPENDICES

Appendix A. Procedural Fidelity for System of Least Prompts (SwiftKey Symbols-'I Want Computer')

- = incorrect/doesn't perform
√ = performs step correctly
Ø = N/A

SwiftKey Symbols- I Want Computer - Intervention Procedural Fidelity

Date: _____ Observer:_____
Interventionist:_____

Length of lesson:_____ Student ID:_____

Lesson Components	Teacher response Notes:	

First Step of TA (Click SwiftKey Symbols icon)	1._____PI gains student's attention and presents tablet. 2._____Student independently pushes first step of TA on app. 3. _____If correct response, praise and move to second step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Second Step of TA (Click 'sentence builders' section)	1._____PI gains student's attention. 2._____Student independently pushes second step of TA on app. 3. _____If correct response, praise and move to third step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Third Step of TA (Click 'I' picture)	1._____PI gains student's attention. 2._____Student independently pushes third step of TA on app. 3. _____If correct response, praise and move to fourth step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	

Fourth Step of TA (Click 'want' picture)	1._____PI gains student's attention. 2._____Student independently pushes fourth step of TA on app. 3. _____If correct response, praise and move to fifth step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Fifth Step of TA (Click back arrow)	1._____PI gains student's attention. 2._____Student independently pushes fifth step of TA on app. 3. _____If correct response, praise and move to sixth step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Sixth Step of TA (Click 'activity' section)	1._____PI gains student's attention. 2._____Student independently pushes sixth step of TA on app. 3. _____If correct response, praise and move to seventh step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Seventh Step of TA (Click	1._____PI gains student's attention. 2._____Student independently pushes seventh step of TA on app.	

'computer' picture)	3. _____If correct response, praise and move to final step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Click play button to play full message	1._____PI gains student's attention. 2._____Waits 5 seconds for student to independently push play button to have full message read by app 3._____If correct response, praise and session is over. 4._____If no response or incorrect response within 5 seconds, follows prompting sequence below a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and session is over.	

Appendix B. Procedural Fidelity for System of Least Prompts (SwiftKey Symbols-'Help Please')

- = incorrect/doesn't perform
√ = performs step correctly
Θ = N/A

SwiftKey Symbols- Help Please - Intervention Procedural Fidelity

Date: _____ Observer:_____
Interventionist:_____

Length of lesson:_____ Student ID:_____

Lesson Components	Teacher response Notes:	

First Step of TA (Click SwiftKey Symbols icon)	1._____PI gains student's attention and presents tablet. 2._____Student independently pushes first step of TA on app. 3. _____If correct response, praise and move to second step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Second Step of TA (Click 'chat' section)	1._____PI gains student's attention. 2._____Student independently pushes second step of TA on app. 3. _____If correct response, praise and move to third step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Third Step of TA (Click 'help' picture)	1._____PI gains student's attention. 2._____Student independently pushes third step of TA on app. 3. _____If correct response, praise and move to fourth step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	

Fifth Step of TA (Click 'please' picture)	1._____PI gains student's attention. 2._____Student independently pushes fifth step of TA on app. 3. _____If correct response, praise and move to final step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Click play button to play full message	1._____PI gains student's attention. 2._____Waits 5 seconds for student to independently push play button to have full message read by app 3._____If correct response, praise and session is over. 4._____If no response or incorrect response within 5 seconds, follows prompting sequence below a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and session is over.	

Appendix C. Procedural Fidelity for System of Least Prompts (Proloquo2Go-'I Want Computer')

- = incorrect/doesn't perform
√ = performs step correctly
Ø = N/A

Proloquo2Go- I Want Computer- Intervention Procedural Fidelity

Date: _____ Observer:_____
Interventionist:_____

Length of lesson:_____ Student ID:_____

Lesson Components	Teacher response	Notes:

First Step of TA (Click Proloquo2Go icon)	1._____PI gains student's attention and presents iPad. 2._____Student independently pushes first step of TA on app. 3. _____If correct response, praise and move to second step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Second Step of TA (Click 'I' picture)	1._____PI gains student's attention. 2._____Student independently pushes second step of TA on app. 3. _____If correct response, praise and move to third step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Third Step of TA (Click 'want' picture)	1._____PI gains student's attention. 2._____Student independently pushes third step of TA on app. 3. _____If correct response, praise and move to fourth step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	

Fourth Step of TA (Click 'things' folder)	1._____PI gains student's attention. 2._____Student independently pushes fourth step of TA on app. 3. _____If correct response, praise and move to fifth step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Fifth Step of TA (Click 'computers' folder)	1._____PI gains student's attention. 2._____Student independently pushes fifth step of TA on app. 3. _____If correct response, praise and move to sixth step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Sixth Step of TA (Click 'computer' picture)	1._____PI gains student's attention. 2._____Student independently pushes sixth step of TA on app. 3. _____If correct response, praise and move to final step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Click full sentence to play message	1._____PI gains student's attention. 2._____Waits 5 seconds for student to independently push final phrase to be read by app	

	3._____If correct response, praise and session is over. 4._____If no response or incorrect response within 5 seconds, follows prompting sequence below a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and session is over.	

Appendix D. Procedural Fidelity for System of Least Prompts (Proloquo2Go-'Help Please')

- = incorrect/doesn't perform
√ = performs step correctly
Θ = N/A

Proloquo2Go- Help Please - Intervention Procedural Fidelity

Date: _____ Observer:_____
Interventionist:_____

Length of lesson:_____ Student ID:_____

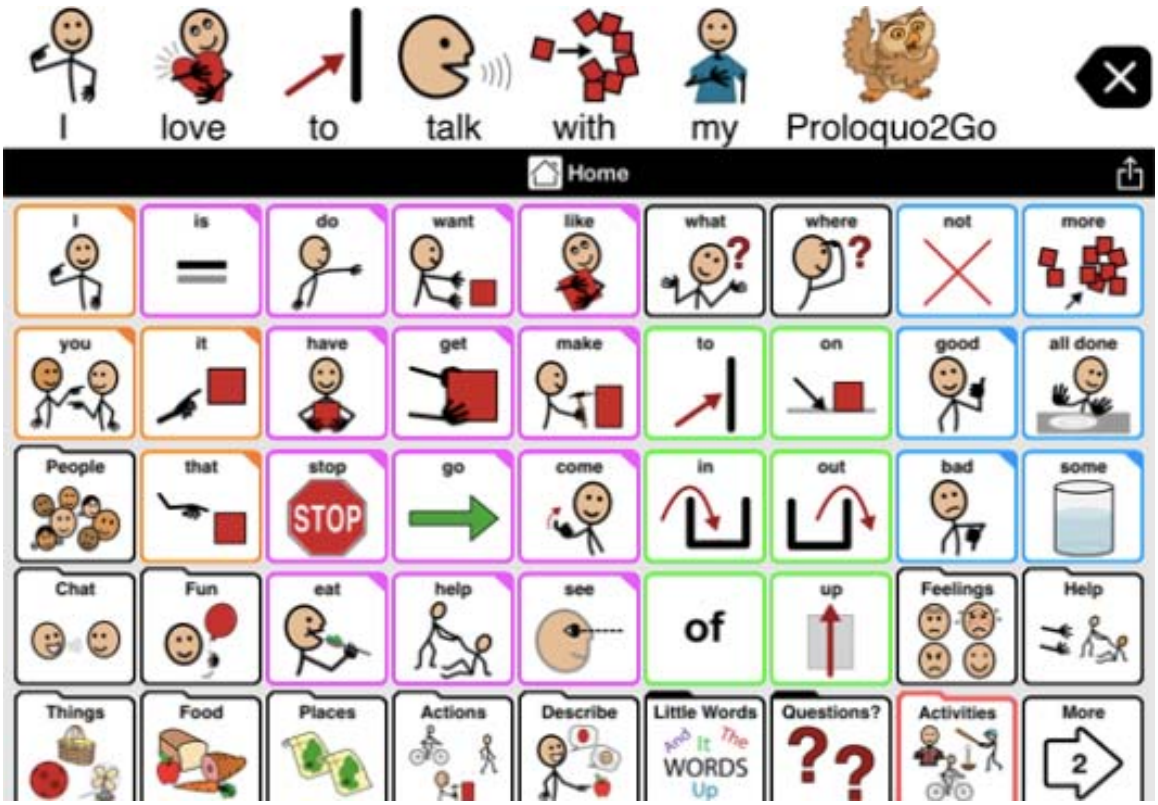
Lesson Components	Teacher response Notes:	

First Step of TA (Click Proloquo2Go icon)	1._____PI gains student's attention and presents iPad. 2._____Student independently pushes first step of TA on app. 3. _____If correct response, praise and move to second step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Second Step of TA (Click 'more' arrow)	1._____PI gains student's attention. 2._____Student independently pushes second step of TA on app. 3. _____If correct response, praise and move to third step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Third Step of TA (Click 'actions' folder)	1._____PI gains student's attention. 2._____Student independently pushes third step of TA on app. 3. _____If correct response, praise and move to fourth step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	

Fourth Step of TA (Click 'help' picture)	1._____PI gains student's attention. 2._____Student independently pushes fourth step of TA on app. 3. _____If correct response, praise and move to fifth step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Fifth Step of TA (Click 'home' button)	1._____PI gains student's attention. 2._____Student independently pushes fifth step of TA on app. 3. _____If correct response, praise and move to sixth step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Sixth Step of TA (Click 'chat' folder)	1._____PI gains student's attention. 2._____Student independently pushes sixth step of TA on app. 3. _____If correct response, praise and move to seventh step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Seventh Step of TA (Click 'please' picture)	1._____PI gains student's attention. 2._____Student independently pushes seventh step of TA on app.	

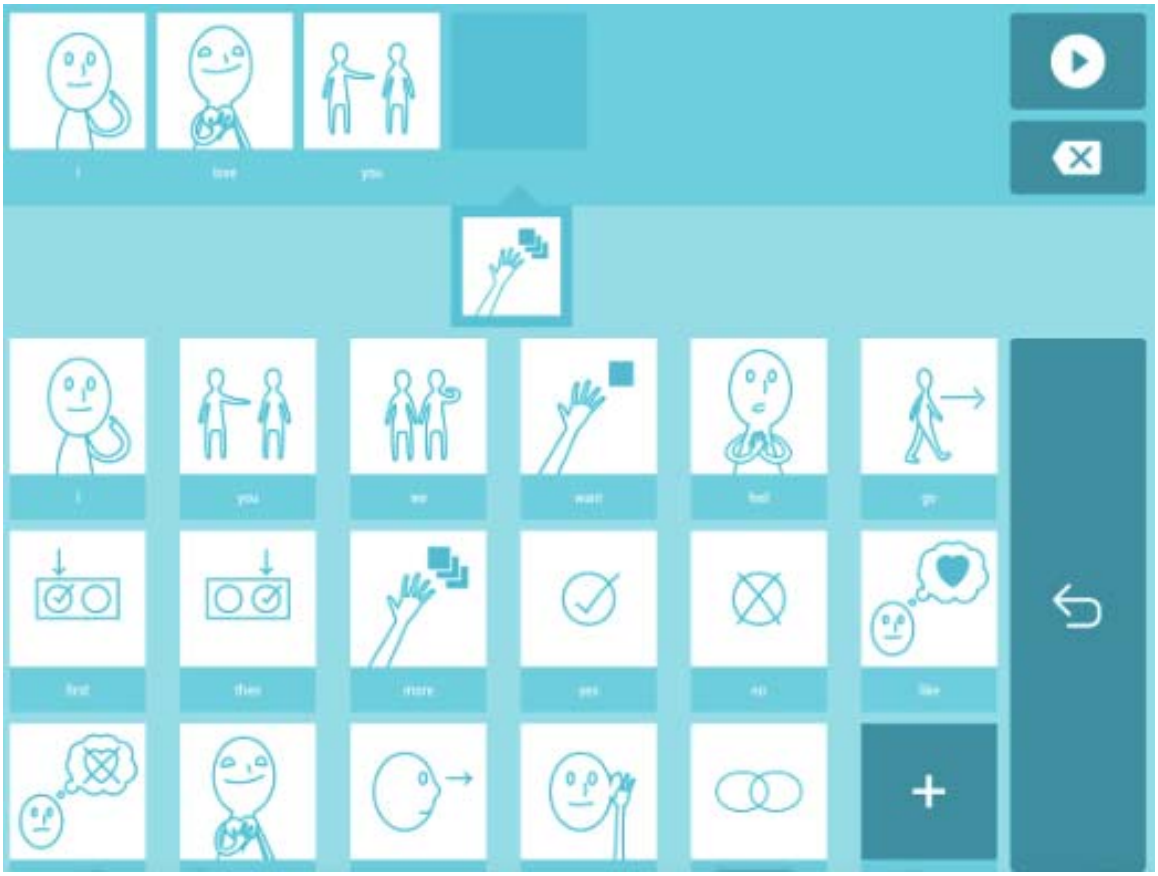
	3. _____If correct response, praise and move to final step of TA (skip to next section below and score n/a for the remainder of the list below). 4._____If no response or incorrect response within 5 sec, follows prompting sequence a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and move on to next section.	
Click full sentence to play message	1._____PI gains student's attention. 2._____Waits 5 seconds for student to independently push final phrase to be read by app 3._____If correct response, praise and session is over. 4._____If no response or incorrect response within 5 seconds, follows prompting sequence below a.___after 5 sec., if no response or incorrect response, provide a gestural prompt b.___after 5 sec., if no response or incorrect response, provide a non-specific verbal prompt c.___after 5 sec., if no response or incorrect response, provide a full physical prompt 5._____Record the prompt required and session is over.	

Appendix E. Example Screenshot of Proloquo2Go Screen (Proloquo2Go, 2016)



Proloquo2Go® is an AssistiveWare® product. Image(s) used with permission.

Appendix F. Example Screenshot of SwiftKey Symbols Screen (SwiftKey Symbols, 2015)



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