THE DEVELOPMENT AND USE OF A MODIFIED TEXT MESSAGING APPLICATION UTILIZING VOICE OUTPUT AND PICTURES/PICTURE SYMBOLS TO INCREASE INSTANCES OF INDEPENDENT ELECTRONIC COMMUNICATION FOR INDIVIDUALS WITH MODERATE TO SEVERE INTELLECTUAL AND DEVELOPMENTAL DISABILITIES

by

David A. Lojkovic
A Dissertation
Submitted to the
Graduate Faculty
of
George Mason University
in Partial Fulfillment of
The Requirements for the Degree
Doctor of Philosophy
Education

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Date: ______________________ Summer Semester 2015
George Mason University
Fairfax, VA
The Development and Use of a Modified Text Messaging Application Utilizing Voice Output and Pictures/Picture Symbols to Increase Instances of Independent Electronic Communication for Individuals with Moderate to Severe Intellectual and Developmental Disabilities

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Dedication

This dissertation is dedicated to my much better half, Michael, without whom this would not have been possible and to my parents Paul and Donna for their constant encouragement and support.
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List of Abbreviations or Symbols

American Psychological Association ................................................... APA
American Speech-Language-Hearing Association ................................ ASHA
Application .......................................................................................... App
Attention Deficit Disorder ................................................................ ADD
Augmentative and Alternative Communication ................................. AAC
Autism Spectrum Disorder ................................................................ ASD
Developmental Disability .................................................................... DD
Diagnostic and Statistical Manual of Mental Disorders 5th Edition .... DSM-5
Individuals with Disabilities Education Improvement Act ................ IDEA
Intellectual Disability ........................................................................ ID
Internal Review Board ...................................................................... IRB
Interobserver Agreement ................................................................... IOA
National Joint Committee for the Communication Needs of Persons with Severe Disabilities ............................................................. NJC
Percentage of Nonoverlapping Data .................................................. PND
Picture Exchange Communication System ...................................... PECS
Postsecondary Education .................................................................... PSE
Universal Design for Learning ............................................................. UDL
Voice Output Communication Aid ..................................................... VOCA
Abstract

THE DEVELOPMENT AND USE OF A MODIFIED TEXT MESSAGING APPLICATION UTILIZING VOICE OUTPUT AND PICTURES/PICTURE SYMBOLS TO INCREASE INSTANCES OF INDEPENDENT ELECTRONIC COMMUNICATION FOR INDIVIDUALS WITH MODERATE TO SEVERE INTELLECTUAL AND DEVELOPMENTAL DISABILITIES

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Dissertation Director: Dr. Michael M. Behrmann

Text messaging is a common communication tool used by young adults. Instant messaging and text messaging technologies are becoming increasingly popular, however, individuals with more significant intellectual and developmental disabilities may have difficulties accessing these modes of communication due to deficits in both receptive and expressive language skills. A multiple-baseline across participants design was used to investigate the effects of the use of a modified text messaging application, the EZPic2Txt app, on independent electronic communication instances of young adults with moderate to severe intellectual and developmental disabilities. This single-subject study was composed of two concurrent experiments. The first experiment included four 18- to 24-year old young adults with moderate to severe disabilities who demonstrated communication deficits. There were three female participants and one male participant.
Participants attended a postsecondary education program for individuals with intellectual and developmental disabilities outside of a major metropolitan area in the Mid-Atlantic region of the United States. The second experiment included four 21- to 25-year old young adults with moderate to severe disabilities who demonstrated communication deficits. There were two female and two male participants who lived semi-independently in a large metropolitan area in the Mid-Atlantic region of the United States.

This study investigated receptive and expressive text based communication skills using unsolicited and solicited messaging instances. In the first experiment, participants were shown how to use the app, via demonstration and practice, and the frequency of unsolicited messaging attempts thereafter was recorded. In the second experiment, participants were also shown how to use the app, and the frequency of unsolicited messaging attempts was recorded, measure I. After measure I, in the treatment phase, participants were sent messages that sought to elicit a response, measure II. The response rate for measure II was recorded. Each experiment had a baseline, intervention, generalization, and maintenance phase.

Results indicate that there is a functional relation between use of the EZPic2Txt app and instances of independent expressive electronic communication. All of the participants in both experiments were able to increase instances of independent electronic communication via the use of the app. In experiment 2, participants were able to respond to messages sent to them via the app. Prior to this study none of the existing few studies on modified text messaging technologies for this population included social validity, participant levels of satisfaction with the technology, generalization of skills acquired,
and maintenance of acquired skills. Several positive outcomes correlate to increasing communication skills for this population, including, personal safety, independence, socialization, and inclusion. This study adds to the body of literature that indicates that individuals with moderate to severe intellectual and developmental disabilities can increase levels of independent expressive and receptive communication instances via the use of modified text messaging technologies.
Chapter One

In 1992 the National Joint Committee for the Communication Needs of Persons with Severe Disabilities (NJC) established a “Communication Bill of Rights,” the main tenant being that, “All persons, regardless of the extent or severity of their disabilities, have a basic right to affect, through communication, the conditions of their own existence” (p. 2). Additionally, 12 more specific rights were particularized. These specific rights include being offered choices, making requests, access to treatment and interventions, access to augmentative and alternative communication, be communicated with in ways that maintain dignity and that are meaningful.

Also in 1992, TASH issued its “Resolution on the Right to Communicate,” which was updated in 2000 to include augmentative and alternative communication (AAC). TASH suggests that all persons with disabilities should be provided with access to communication. In this document access is described as trifold, including access to assessment, training, and equipment. Individuals with disabilities that have an impact on their communication have the right to make their preferences for AAC known, and should be given the tools to communicate in the manner of their choosing.

The current study investigated the effectiveness of a modified text messaging system utilizing pictures/picture symbols, text to speech software, and touch screen technology in increasing instances of independent expressive electronic communication
and instances of responsive electronic communication by young adults with moderate to severe intellectual and developmental disabilities. This was an effort to examine a potential intervention, instruction, via demonstration and practice, in and use of the modified text messaging system, to increase instances of independent electronic communication by the aforementioned population.

**Statement of the Problem**

Individuals with moderate to severe intellectual disabilities (ID) and developmental disabilities (DD) often present deficits in the realms of both expressive and receptive communication (APA, 2013; Chung, Carter, & Sisco, 2012; Snell et al., 2010). According to the diagnostic criteria outlined in the DSM-5, ID is delineated into four levels of severity: mild, moderate, severe, and profound. Each level of severity is further discussed in terms of three domains: conceptual, social, and practical. A common element across all levels of severity in the social domain is a deficit in the area of communication. In the moderate severity level, “The individual shows marked differences from peers in social and communicative behavior across development,” while the severe severity level is characterized by limited speech that “may be supplemented through augmentative means,” and the profound severity level is demarcated by a “very limited understanding of symbolic communication in speech or gesture” (APA, pp. 35-36). The three domains, conceptual, social, and practical, are the components of adaptive behavior (Tasse et al., 2012).

Like ID, DD are characterized by deficits in adaptive behavior, which may include both receptive and expressive communication (Belva & Matson, 2013). Adaptive
skills, including communication skills, are essential in achieving independence in daily life (Matson, Rivet, Fodstad, Dempsey, & Boisjoli, 2009). Increasing levels of expressive and receptive communication for this population is directly linked to several beneficial outcomes. Levels of quality of life, personal safety, and independence are all positively correlated to increases in levels of communication (Beukelman & Mirenda, 2013; Collins, 2007; Snell & Brown, 2011).

Emerging technologies have the potential to address some of the communication needs of this population. Often adaptations and modifications are required for individuals with moderate to severe ID and DD, to access these technologies. However, the body of literature and research studies concerning modified texting programs for individuals with moderate to severe ID and DD is very limited. Lancioni et al. (2010), Lancioni et al. (2011), Lancioni et al. (2012a), Lancioni et al. (2012b), and Lancioni et al. (2013) all measured participants’ with more significant disabilities abilities to write and send messages and listen to received messages using modified messaging systems. Participants in these studies were able to effectively send and receive messages. While these few studies that do exist do show promising results, replication and extension of these studies is necessary to verify existing results and determine effectiveness of the programs and interventions on other populations.

**Background of the Problem**

Advances in technology have changed the ways in which individuals communicate. E-mail, smart phone technology, text messaging, the use of applications (apps), advances in AAC methods and devices, tablet personal computers, and the like
have altered the communicative landscape and culture (Pinchot, Paulet, & Rota, 2011; Rosen, 2004). Over twenty years ago, Neil Papworth, a software engineer from the United Kingdom sent the first text message on December 3rd, 1992. The rather simple message read “Merry Christmas.” Currently, there are around 8.6 trillion text messages sent annually (Kelly, 2012). The ways in which we communicate have fundamentally changed. Individuals with moderate to severe intellectual and developmental disabilities can make use of these technologies with appropriate instruction and modifications (Lancioni et al., 2011; Lancioni et al., 2012a; Mcnaughton & Light 2013).

Interventions with the intent of increasing communicative practices for individuals with ID and DD must be age appropriate and meaningful. The technological landscape is ever changing. Young adults are spending more time communicating via mobile devices than ever before. The same opportunities to communicate via mobile devices and instant messaging technologies should be afforded to young adults with disabilities. In accord with the “Communication Bill of Rights” (NJC, 1992) and the “Resolution on the Right to Communicate” (TASH, 2000) individuals must be offered choices concerning their own personal communication and have access to AAC.

According to Wilcox and Bellamy (1982), one of the intentions of best practices is to account for and attempt to eliminate strategies, materials, and practices that further stigmatize individuals with disabilities. Age inappropriate materials may further stigmatize individuals with disabilities. There is a correlation between positive perception of individuals with disabilities by individuals without disabilities and the use of age appropriate materials (Bates, Morrow, Pancsofar, & Sedlak, 1984; Calhoun & Calhoun,
Rush (2008) states that, “an important function of adult-like materials and activities is to support emergent-level skills and behaviors for older learners” (p. 4). So, while young adults who live on college campuses or live independently or semi-independently utilize smart phone, instant messaging, and text messaging technologies the same level of access to these technologies should be afforded to their peers with disabilities.

While there have been some recent studies that do examine the use of instant messaging technologies for persons with moderate to severe disabilities and show positive results, which shall be discussed in greater detail in the next chapter, these studies do present with limitations (Lancioni et al., 2010; Lancioni et al., 2011; Lancioni et al., 2012a; Lancioni et al., 2012b; Lancioni et al., 2013). These studies do not examine participant satisfaction in regard to the devices, process and ease of using the devices, which are both important considerations (Hanley, 2010; Lancioni et al., 2013; Scherer, Craddock, & Mackeogh, 2011).

**Purpose of the Study**

Adapted and modified texting technologies have enabled individuals with significant ID and DD access to this mode of expressive communication. The purpose of the current study is to test the usability of the EZPic2Txt app, a modified texting app for Android and Apple iOS platforms. The EZPic2Txt app was developed at the Keller Institute for Human disAbilities at George Mason University. The app was designed for use by individuals with moderate to severe ID and DD who do not use currently available texting and instant messaging technologies. Family members, residential directors,
caregivers, and support staff of individuals with ID and DD who were enrolled in a postsecondary education program or living semi-independently with supports expressed frustration that during the day, while at work, while at a day habilitation program, home alone, or on campus, their respective young adults were often unreachable. While these students did have cellular telephones they were either reluctant or unable to use the texting technology.

**Research Questions**

Two concurrent experiments were designed to investigate if the *EZPic2Txt* app could potentially increase instances of communication amongst young adults with moderate to severe ID and DD. The independent variable, the intervention itself, consisted of instruction, via demonstration and practice, in the use of the communication app and use of the app itself. For experiment 1, the dependent variables were frequency and completion of communication instances. In experiment 2 the dependent variables were frequency and completion of communication instances, response rate to messages sent to elicit a response, and latency of response time. The anticipated proximal outcome for both experiments was an increase in frequency and completion of instances of electronic communication, and for experiment 2 an increase in the response rate to messages sent to participants. The anticipated distal outcomes for both experiments were that participants using this app and strategies shall have greater access to independence and safety as communication skills are directly tied to levels of independence and independent living (Collins, 2009; Snell & Brown, 2011). Specific research questions for experiment 1 were:
1. Is there a functional relation between use of the EZPic2Txt app, and an immediate increase in level of frequency of self-initiated electronic communication instances amongst young adults with moderate to severe ID and DD?

2. Are participants able to generalize and maintain the skills learned through application of the intervention?

Experiment 2 sought to investigate the same two questions as experiment 1, with the addition of a third research question:

3. Is there a functional relation between use of the EZPic2Txt app, and an immediate increase in the response rate to received messages amongst young adults with moderate to severe ID and DD?

**Definition of Terms**

Operationalized definitions help ensure that treatment is consistent across participants and settings (Gresham, MacMillian, Beebe-Frankenberger, & Bocian, 2000). In order to maintain consistency and treatment fidelity throughout the study, the following key terms have been operationalized.

*Communication:* the National Joint Committee for the Communicative Needs of Persons With Severe Disabilities (1992) defines communication as “any act by which one person gives or receives from another person information about that person’s needs, desires, perceptions, knowledge, or affective states. Communication may be intentional or unintentional, may involve conventional or unconventional signals, may take linguistic or nonlinguistic forms, and may occur through spoken or other modes” (p. 2).
Developmental Disability: According to the Developmental Disabilities Assistance and Bill of Rights Act of 2000, §102(8), "the term 'developmental disability' means a severe, chronic disability of an individual that:

1. Is attributable to a mental or physical impairment or combination of mental and physical impairments;
2. Is manifested before the individual attains age 22;
3. Is likely to continue indefinitely;
4. Results in substantial functional limitations in three or more of the following areas of major life activity:
   (i) Self-care;
   (ii) Receptive and expressive language;
   (iii) Learning;
   (iv) Mobility;
   (v) Self-direction;
   (vi) Capacity for independent living; and
   (vii) Economic self-sufficiency.

5. Reflects the individual's need for a combination and sequence of special, interdisciplinary, or generic services, supports, or other assistance that is of lifelong or extended duration and is individually planned and coordinated, except that such term, when applied to infants and young children means individuals from birth to age 5, inclusive, who have substantial developmental delay or specific congenital or acquired conditions with a high probability of resulting in developmental disabilities if services are not provided."

Expressive Communication: the American Speech-Language-Hearing Association (ASHA) (2013) defines expressive language as “sharing thoughts, ideas, and feelings” for
the purposes of this study expressive communication, as related to the use of the
EZPic2Txt app, shall refer to the process of composing and sending a message.

*EZPic2Txt app:* In this app, developed at the Keller Institute on Human
disAbilities at George Mason University, the interface allows presetting and displaying
up to 5 recipients and 5 messages as image and text buttons. The user connects the
buttons by drawing a line between recipient(s) and message(s) to send the message(s) to
email address(s) or phone number(s) of the recipient(s).

*Intellectual Disability:* According to the criteria for intellectual disability
described by the DSM-5 (APA, 2013, p. 33), “Intellectual disability (intellectual
developmental disorder) is a disorder with onset during the developmental period that
includes both intellectual and adaptive functioning deficits in conceptual, social, and
practical domains. The following three criteria must be met:

A. Deficits in intellectual functions, such as reasoning, problem solving,
   planning, abstract thinking, judgment, academic learning, and learning from
   experience, confirmed by both clinical assessment and individualized,
   standardized intelligence testing.

B. Deficits in adaptive functioning that result in failure to meet developmental
   and socio-cultural standards for personal independence and social
   responsibility. Without ongoing support, the adaptive deficits limit
   functioning in one or more activities of daily life, such as communication,
   social preparation, and independent living, across multiple environments, such
   as home, school, work, and community.
C. Onset of intellectual and adaptive deficits during the developmental period.

*Demonstration and Practice:* sometimes referred to as modeling or example-based instruction is an instructional strategy “in which an expert, teacher, or peer student – the model – demonstrates and (often) explains how to complete a task” (Hoogerheide, Loyens, & van Gog, 2014, p. 80).

*Multiple Disabilities:* According to IDEA 2004, §300.8(c)(7) the term multiple disabilities is defined as, “concomitant [simultaneous] impairments (such as intellectual disability-blindness, intellectual disability-orthopedic impairment, etc.), the combination of which causes such severe educational needs that they cannot be accommodated in a special education program solely for one of the impairments. The term does not include deaf-blindness.”

*Receptive Communication:* ASHA (2013) defines receptive language as “understanding others” for the purposes of this study receptive communication, as related to the use of the EZPic2Txt app, shall refer to the process of receiving and understanding a message.

*Young Adults:* Individuals aged 18-25.

**Summary**

There are several positive outcomes that are correlated to an increase in communication skills for individuals with moderate to severe ID and DD. Some of the documented benefits include, greater personal autonomy, self-expression, and an increase in safety skills. The National Joint Committee for the Communication Needs of Persons with Severe Disabilities maintains that persons with severe disabilities should, “Be
communicated with in ways that are meaningful, understandable, and culturally and linguistically appropriate communications” (1992, p. 3). Since new technologies have changed the ways in which individuals in contemporary society do communicate, it is necessary to explore ways to make the new technologies accessible to all members of the population, including those with moderate to severe ID and DD. Not only are there benefits to increasing communication skills for this population, but the use of popular technologies can aid in the inclusion and acceptance in greater society, which is imperative since individuals with moderate to severe disabilities have a history of being excluded (Collins, 2007).
Chapter Two

In this section the characteristics of individuals with moderate to severe ID and DD shall be discussed with particular attention to socialization, communicative responsiveness, literacy as related to expressive and receptive communication. Needs and characteristics of this population in postsecondary education (PSE) programs and those living in post school settings shall also be considered. AAC use and potential benefits for this population shall also be presented. Varying forms of AAC are presented including picture symbols and mobile device technologies. Additionally, the evaluation of applications or apps for use on mobile devices shall be discussed. The pilot study methodology, results and recommendation for design changes are also presented in this chapter.

**Literature Search Procedures**

Comprehensive searches of the available literature identified relevant studies. Searches on text and instant messaging and electronic communication use, communication interventions and literacy, and the use of mobile devices by persons with moderate to severe ID and DD were conducted. Key search terms included: AAC, apps, applications, augmentative and alternative communication, communication, communicative responsiveness, developmental disabilities, expressive communication, instant messaging, intellectual disabilities, literacy, mobile devices, moderate and severe
disabilities, reading, receptive communication, socialization, speech generating device, text messaging, touch screen, voice output, writing. The researcher conducted computer-assisted searches in the following databases: Communication & Mass Media Complete, Communication Abstracts, Dissertations Abstracts, Education Research Complete, ERIC, PsycInfo, Sage, and Social Citation Index. Ancestral searches of article/study reference sections provided additional studies.

**Literacy and Expressive and Receptive Communication and Individuals with Intellectual and Developmental Disabilities**

Increasing literacy skills has a positive impact on both receptive and expressive communication skills. Literacy instruction for students with moderate to severe ID and DD traditionally has focused on the teaching of sight words and functional skills, e.g. writing a shopping list or reading a recipe (Bochner, Outhred, & Pieterse, 2001; Downing, 2005; Lacey, Layton, Miller, Goldbart, & Lawson, 2007). While a functional sight word vocabulary is essential, instruction in comprehension and expressive communication particularly in the area of writing is still necessary. Sight word instruction does fulfill certain literacy needs for the population of individuals with moderate to severe communication needs, however it does not go far enough. Reading and writing are reciprocal processes (Kay-Raining Bird, Cleave, White, Pike, & Helmkay, 2008). Learning new writing skills can enhance reading skills acquisition and vice versa. The ability to write or to communicate expressively has profound impacts that can increase autonomy and participation in school, community, and vocational settings (Cohen, Allgood, Heller, & Castelle, 2001). The limited amount of current research on writing
instruction and writing processes for learners with moderate to severe ID and DD suggests that with proper instruction, these learners do benefit when writing instruction is included in their educational program. Learners with moderate to severe ID and DD face greater challenges when it comes to learning to write or communicate expressively. This is due, in part, to their unique learning challenges and lack of opportunity. However, learning to compose text and express themselves via writing or representation offers advantages to these learners. A permanent product can be revisited many times in order to increase understanding of content as well as reorganizing and revising in order to increase clarity of the message (Farrell & Elkins, 1995).

Traditional definitions of literacy often exclude the types of expressive and receptive communication skills and abilities that are most appropriate for learners with moderate to severe disabilities. Sturm and Koppenhaver (2000) define writing as “a holistic and authentic process of communicating by construction of a meaningful text” (p. 75). Van Kraayenoord, Moni, Jobling, & Ziebarth (2002) define writing as a process that “involves constructing meanings by choosing and arranging symbols and understanding how these meanings change as a result of audience, context, and purpose” (p. 36). The latter definition allows for the inclusion of text that is composed of letters, words, pictures, graphics, or any combination thereof.

Digital literacy is a new skill that is becoming more pervasive and important in daily life. As the general population utilizes mobile devices and computers for electronic communication, it is important for individuals to learn the skills necessary to also use these technologies or else face the possibility of increased isolation in the social arena.
Authentic literacy and authentic literacy instruction needs to include elements of digital literacy as individuals and society at large embrace electronic communication (Ruppar, 2013). Reading and writing skills are essential components of digital literacy.

Purposeful and effective writing instruction for learners with moderate to severe ID and DD begins with high expectations that these students do have something of value to say, providing multiple opportunities to utilize writing, choosing topics that are relevant and of interest to the learner, and providing the necessary supports that these learners require in order to express themselves via writing.

Koppenhaver, Hendrix, and Williams (2007) contend that the only existing quality research for literacy development for learners with moderate to severe disabilities is done via experiments with small populations. The intent of instruction in writing and literacy is to increase gains in emergent literacy for learners with moderate to severe disabilities. Koppenhaver and his colleagues have outline several factors that can aid this population in making meaningful gains. The first being that learners in this population have greater difficulty with print related tasks than their non-disabled peers. These learners are often provided less access and experiences to interact with literacy materials at home when compared to non-disabled peers.

Lack of access to materials is detrimental to the writing and reading development of students with moderate to severe ID and DD. There are many ways to adapt materials to meet the needs of individuals with moderate to severe disabilities. Adapting materials requires an understanding of each student's strengths, needs, and interests, and then
identifying the most effective tools for meeting those needs. These adaptations do not always require high-technology solutions. Interactive books, digital books, and picture as well as tactile materials (multi-sensory) can be useful when teaching literacy to learners with moderate to severe ID and DD. Each of the aforementioned adapted materials has been shown to have positive effects on student learning and communicative abilities for the population examined (Carnahan, Williamson, Hollingshead, & Isreal, 2012).

Joseph and Konrad (2009) identified effective methods for teaching writing to students with intellectual disabilities. Findings revealed that strategy instruction was found to be very effective. Researchers defined writing instruction as teaching students to express ideas in written form. This included selecting words as opposed to only generating words. Cohen, Allgood, Heller, and Castelle (2001) looked at the use of picture dictionaries by students with intellectual and hearing disabilities as related to expressive communication by students with deafness and limited literary skills at community-based vocational sites. The results of the study demonstrate that the picture dictionaries for writing facilitated the students’ written, expressive communication. The dictionaries were preferred by the students over symbol based communication boards.

In addition to difficulties in acquiring writing and expressive communication skills, individuals with moderate to severe ID and DD may also present with deficits in acquiring reading and receptive communication skills (Allor, Gifford, Otaiba, Miller, & Cheatham, 2013; Courtade, Test, & Cook, 2014; Fajardo et al., 2014; Lundberg & Reichenberg, 2013). Ratz and Lenhard (2013) in their study of school-aged youth with ID in Germany found that, “the severity of ID is closely related to achievements in reading
and writing” (p. 1746). Yet, individuals across the spectrum of ID, even those with the most severe disabilities, do benefit from evidence based practices in literacy and reading instruction (Allor et al., 2013). Using case-studies, Allor, Mathes, Jones, Champlin, and Cheatham (2010), further contend that while all learners, including those with ID, can and do improve their reading abilities, intense, daily, individualized instruction maybe required for those with more significant ID.

Specific adaptations maybe required for individuals with moderate to severe ID and DD to access text. Hudson, Browder, and Wakeman (2013) discuss several adaptations that can assist individuals with more significant disabilities access text. Some of the strategies suggested were, creating response option cards pairing words with pictures, using object to answer comprehension questions, text summaries, and adding a repeated story line for the main idea. All of the strategies mentioned have the potential to help individuals with ID learn to comprehend and read texts.

In order to determine which strategies and interventions could be deemed evidence based practices, in 2006, Browder, Wakeman, Spooner, Ahlgrim-Delzell, and Algozzine, used the formula established by Horner et al. (2005). For teaching reading skills to students with severe ID, Browder et al. found that for the teaching of vocabulary (sigh words), massed trial, time delay, and systematic prompting (besides delay) qualified as evidence based practices, and for the teaching of vocabulary (pictures) massed trial and systematic prompting (varied) qualified as evidence based practices. Evidence based practices for teaching reading comprehension included massed trial training, systematic prompting (varied), use of pictures, and the use of sight words. Time delay was identified
as an evidence based practice for improving fluency, and no evidence based practices were identified for the teaching of phonics and phonemic awareness for individuals with severe ID. While, updating the 2006 meta-analysis might reveal new evidence based practices for the teaching of reading skills to individuals with severe ID, the study indicates that learners with severe ID do make gain in the realm of reading with instruction in specific areas.

Instruction is not always meaningful instruction. Assistive technology has the potential to increase access to materials for meaningful instruction. Teachers’ views of technology as a tool for effective literacy instruction are important to consider. A survey of over 1,000 special educators showed that 85% use technology in literacy instruction, 97% believe that technology can help students acquire literacy skills, and 91% expect to increase their use of technology in the future (MacArthur, Ferretti, Okolo, & Cavalier, 2001). Low-tech solutions, such as making adapted books can be just as effective as high-tech solutions such as digital books. Regardless of the methods and materials used, literacy instruction leading to increased comprehension has a positive impact on both expressive and receptive language. However, there are indications that availability of materials alone is not enough for a positive development of literacy abilities. Rather, the interaction which learners have with materials and the quality of that interaction that leads to gains in expressive, verbal and written, language skills (Sandberg, 1998).

**Augmentative and Alternative Communication**

Expressive language does not just include literacy and writing, but speech as well. However, individuals with disabilities that prevent vocalized speech or a functional form
of vocalization still have a need and a right to the communication of their needs and wants. Persons with moderate to severe ID and DD may have difficulty in the production of functional speech (Sundberg, 1993). Training in AAC is an option for individuals who do not readily learn speech or have deficits in reading and writing skills used for both expressive and receptive communication. The AAC Special Interest Division of ASHA (2005) defined AAC as:

Augmentative and Alternative Communication (AAC) refers to an area of research, clinical, and educational practice. AAC involves attempts to study and when necessary compensate for temporary or permanent impairments, activity limitations, and participation restrictions of individuals with severe disorders of speech-language production and/or comprehension, including spoken and written modes of communication. (p.1)

The Picture Exchange Communication System (PECS) is an example of an AAC system that teaches individuals to exchange picture symbols to mand and tact items, among other functions. Studies suggest that individuals taught PECS acquire independent use of the system, and many even acquire functional speech (Bondy & Frost, 1994). Some have argued for the benefits of teaching one AAC system over others (Sundberg & Partington, 1998), however, it is unlikely that any single system best meets the diverse needs of all individuals with disabilities. A number of factors, including cognitive and motor abilities, may influence an individual’s acquisition of an AAC system (Bonvillian, Nelson, & Rhyne, 1981). Learners that utilize AAC have specific needs related to literacy and writing instruction. Lund and Light (2003) examined the effectiveness of an
instructional program designed to teach grammar skills to individuals who communicated via AAC. A single-subject, multiple probe across behaviors design was used to measure the effect of the instructional program on the acquisition and maintenance of the skills learned. The two participants were adults with cerebral palsy who had severe expressive language issues, defined as an expressive vocabulary of less than ten words. Also, the ability to understand basic conversation and to follow directions in a functional context was required for participation in the study.

The instructional program/intervention was used to teach two grammatical forms to each participant. The instructional program was shown to be effective. Both participants learned to produce the grammatical forms taught. The results suggest that the intervention can help learners who use AAC to improve their writing skills and grammar.

While single intervention studies do specifically examine a single AAC devise or method, a meta-analysis has the potential to reveal themes related to AAC use and its benefits. Snell, Chen, and Hoover (2006) provided results of a descriptive analysis of peer-reviewed, intervention research on AAC for individuals with severe disabilities, from birth to 21 years, published in 1997 and 2003. A final sample of 40 studies was found that met their seven specified criteria. The meta-analysis showed that a variety of intervention components, typically used in combination, were effective in improving communication. Targeted communication forms were either “prelinguistic” or symbolic AAC expressive responses. Of the interventions that were reported on, the ones involving AAC appear to be the most effective, contributing to gains in both expressive and receptive language/communication skills.
While, Snell, Chen, and Hoover (2006) did not specifically look at only one research design methodology, Ganz, Eartles-Vollrath, Heath, Parker, Rispoli, and Duran (2011) conducted a meta-analysis of single case research studies involving AAC and individuals with ASD. Their analysis represents findings across 58 participants. All of the participants had a diagnosis of autism, PDD-NOS, or a combination of autism, PDD-NOS and DD. The specific interventions fell into one of three categories, speech generating devices, PECS, and picture based systems other than PECS. Strong effects were recorded for AAC on communication skills for individuals with autism or PDD-NOS. AAC also positively impacted social skills, challenging behaviors, and spelling. The effects were not as strong as those for communication skills yet it appears that improving communication may lead to improved social interactions and academics and decreased challenging behavior. The researchers hypothesized that because communication and social interaction are closely related, improvements in one results in related improvements in the other.

Also examining the use of AAC by individuals with autism spectrum disorders, Koul, Schlosser, and Sancibrian (2001), via their study looked at individuals with ASD who did not communicate via functional speech and who often used aided or unaided AAC devices, symbols, or signs to “augment” expressive language also were interested in identifying the factors that contribute to the acquisition of symbols for these students in terms of written language. Participants were able to reproduce symbols that represented nouns to request said noun or identify a need or want for the noun. On the whole, nouns were easier to learn than verbs. The hypothesis being that nouns represent concrete,
physical objects and verbs represent something that is harder to conceptualize. Also of interest to researchers was the mode of presentation, specifically was the symbol introduced in isolation or part of a series? Symbols introduced one at a time appeared to be the easiest to learn for the participants.

While AAC devices have potential to increase instances of expressive communication for individuals with ID and DD and the potential to increase receptive language skills, not all devices are appropriate for all individuals. Individual preference for AAC of the user must also be taken into consideration. Van Der Meer, Sigafoos, O’Reilly, and Lancioni (2011) synthesized several studies that examined choice making and preference for AAC options. In the studies examined, participants were given choices between, picture exchange systems, manual signs and speech generating devices. Preference assessments were conducted in each study. After the initial intervention to teach requesting skills, the general approach used by the studies synthesized was to give the individual an opportunity to choose which of the AAC options, picture exchange or speech generating, to use. When the individual consistently chose one option over another, it was considered to be his/her preferred mode of communication. It appeared that most participants did in fact appear to show some degree of preference for one AAC option over another. The majority of participants showed preference for the speech generating devices. There are a plethora of AAC options available, and a preference assessment approach described in this review maybe one-way to incorporate self-determination in choosing AAC options. Rispoli et al. (2010), synthesized communication interventions that involved the use of speech generating devices for
individuals with developmental disabilities. The scope of the synthesis covered 35 studies. Their findings conclude that speech generating devices are a successful intervention for persons with developmental disabilities.

Several studies have examined the use of voice output and text to speech communication systems for younger students with moderate to severe ID and DD. While the majority of the studies do focus on the school aged population, these studies do illuminate some of the benefits, potentials, and concerns when using these types of AAC devices. Cosbey and Johnston (2006) examined the use of voice output communication aids (VOCAs) to initiate communicative interaction with peers, by young children with severe disabilities. An additional goal of the study was to examine how staff at the preschool where the study took place rated the effectiveness and acceptability of the intervention. Results indicated that use of the VOCA was effective in teaching the participants to initiate interaction with their peers. Of particular interest is the range of abilities possessed by the participants. They all had a diagnosis of severe DD involving motor issues and communication deficits; yet, their cognitive abilities were varied. This might suggest, given that all participants were successful in using the device that the intervention may provide benefits for individuals of varying abilities and needs.

Lancioni et al. (2008) also examined the use of VOCA as a component of an intervention. In this study, participants used microswitches to activate a voice output device. Activation of the device produced one of the phrases available to request play contact. All three participants were successful in acquiring skills to activate the microswitches to request play and responding with the microswitches and the VOCA.
Participants demonstrated high levels of engagement in microswitch responses with independent access to the device.

However, simply providing access to a VOCA is not enough. In their 2007 study, Olive at al. attempted to show the effectiveness of using enhanced milieu teaching with VOCA use to increase the communication skills of children with autism. The authors contend that this study is unique as it combines the two intervention strategies which may be of particular relevance for individuals with autism as up to a third of this group do not develop functional speech. Results indicated that the pairing of interventions was effective in increasing instances of communication for the participants in this study.

**Barriers to AAC Use**

Individuals/students with AAC needs generally have a greater risk of not developing functional literacy skills as compared to individuals without such needs (Da Fonte, Pufpaff, & Taber-Doughty, 2010; Pufpaff, 2008; Taibo, Iglesias, Mendez, & del Salvador, 2009). The acquisition of literacy skills is paramount for students with AAC needs in order for these students to access the general education curriculum and to interact meaningfully and appropriately with their teachers, other support staff, and classmates (Pufpaff). Previous research in the field shows that individuals with disabilities who have AAC needs generally fail to attain the levels of literacy that their same age non-disabled peers are able to attain. This is due to both intrinsic and extrinsic factors. Intrinsic factors being those associated with the nature of a given disability or condition, and extrinsic factors being those associated with instruction, classroom
dynamics, etc. These factors or barriers to effective literacy instruction for individuals with AAC needs.

In order to examine both extrinsic and intrinsic factors relating to access and opportunity, case study methodology was used to examine the literacy development of one 7 year-old student with “little to no intelligible speech” who was diagnosed with mild ID, a communication disorder, and fine motor impairments in an inclusive kindergarten classroom. Access to and opportunity to participate in literacy instruction were recorded for all students in the classroom and compared to the student with AAC needs. Analysis of the data revealed that the student with AAC needs was not able to participate fully in literacy instruction due to both access barriers related to his disabilities and opportunity barriers related to materials and delivery of instruction (Pufpaff, 2008).

In studying the literacy development of adolescents and young adults with cerebral palsy who have AAC needs Taibo, Iglesias, Mendez, and del Salvador (2009) found that working memory span is a skill that must be considered and interventions must be developed to increase working memory span in individuals with AAC needs in order to increase visual vocabulary. Analysis showed a statistically significant difference between groups (working memory high vs. working memory low) in reading ($t = 3.43; p < .001$). Also found was that typically emphasis is placed on the acquisition of visual vocabulary, even when individuals with AAC needs are capable and better served through the use of text vs. visual representations (Taibo, Iglesias, Mendez, & del Salvador).
These studies explore literacy skills instruction and the development/acquisition of literacy skills (or barriers to) in persons with AAC needs. Da Fonte, Pufpaff, and Taber-Doughty (2010) found that while AAC devices and techniques may be used in a classroom to facilitate the education of an individual with AAC needs, these materials may be inappropriate or do not include the requisite vocabulary. Pufpaff (2008) found that while materials may be in place in a particular classroom, without proper training of the teacher and support staff in the classroom access to the curriculum is similarly denied to the student with AAC needs. Also found was that during certain periods of instruction the student did not have access to his/her AAC device and was therefore unable to participate during those periods (Da Fonte, Pufpaff, & Taber-Doughty).

The lack of access to materials being a barrier to AAC use are corroborated by Taibo, Iglesias, Mendez, and del Salvador (2009). This study specifically identified ways in which materials can be barriers to effective literacy instruction to students with AAC needs. They found that when students are under estimated in their abilities and given lower level materials access to higher level materials and thusly appropriately leveled instruction is denied. Pufpaff (2008) describes this under estimation of ability as an attitude barrier. Attitude barriers are the result (by teachers, supports staff, and other students) of stereotypical, exclusionary, and prejudicial beliefs and attitudes toward a student with AAC needs. These barriers can result in the limited expectations of the student with AAC or other communication needs, leading to limited opportunities for participation.
Individuals with AAC needs are capable of developing literacy skills with proper supports (Pufpaff, 2008). All of the aforementioned studies, through research, illuminate barriers that hinder or prevent individuals with AAC needs from accessing the most appropriate curriculum. Having identified these barriers, it is up to policy makers, assistive communication technology developers, advocates, and practitioners to alleviate said barriers so that all students with AAC needs have equal and full access to the curriculum (Da Fonte, Pufpaff, & Taber-Doughty, 2010).

**Mobile Devices**

While AAC is not synonymous with high-tech mobile devices the use of these devices can offer certain advantages. Recently, there has been an increase in the number of studies that utilize apps with iPods, iPads, and other personal tablet computers. This technology is still relatively new with the first iPhone debuting in 2007 and the iPad only first introduced in 2009. The advantages of using this technology include student interest in technology, the “cool factor” of the devices, ability to present information in new ways, ubiquity of mobile devices, touch screen technology as a form of alternate input, ability to engage all types of learners, accessibility options, to name a few (Gosnell, 2011; Ingraham, 2013; Korner & Leske, 2012; Manuguerra & Petocz, 2011). These new types of technology show much promise, in the fields of education and AAC.

In Kagohara, van der Meer, Ramdoss, O’Reilly, Lancioni, Davis, and Sigafous (2012) the authors conducted a systematic review of fifteen empirical studies that involved iPods, iPads and related screen media in schools for students with developmental disabilities across five domains; academic skills, communication skills,
employment skills, leisure and transitioning skills. The successes were measured by convenience of completing tasks, navigating the media, and viewing instructional videos. Repeatedly, studies have shown including screen media as an “assistive device” can support students’ learning outcomes, in all populations. The review mentioned a gap of showing improvement in a specific skill (spelling, for example) by the use of iPad-based applications. The iPad device is widely accepted by the society, and is less stigmatizing when used as assistive device.

While an iPad might be seen as less stigmatizing, other design considerations are important as well. Speed of delivery of speech generating devices is also a concern. Bedrosian, Hoag, and McCoy (2003) identified the effects of conversational trade-offs between certain variables on public attitudes toward AAC system users and their communication. In their study, the trade-offs between the relevance of a prestored message and its speed of delivery were examined. Participants included 96 sales clerks. Twelve scripted videotaped conversational conditions, involving a customer who used AAC and a clerk at a checkout counter, were used to manipulate message relevance, speed of message delivery, and participant/AAC user gender. Following each assigned viewing, participants completed a questionnaire designed to assess their attitudes toward the AAC user and his or her communication. Significantly higher mean ratings were found for the conditions involving the slowly delivered relevant messages when compared to the quickly delivered partly relevant message condition.

Two students with a diagnosis of ASD and limited speech learned to use an iPod Touch to request access to preferred stimuli (Achmadi et al., 2012). The researchers
contend that while functional use of a device for similar communicative purposes has been demonstrated before in a number of studies, their study was unique in its focus on teaching more advanced operations of an iPod based speech generating device. The intervention sought to teach the students to turn on the iPod, unlock the screen, and navigate through multiple screens to perform multi-step requests. The results suggest that the intervention procedures were effective in teaching these more advanced operational steps for using a touch screen, iPod based speech generating device.

These studies all demonstrate that mobile devices do have the potential to aid individuals with communication deficits in acquiring and mastering new communicative skills. Not only do these devices aid in the social acceptance of their respective users (Johnson, 2013), but ease of portability and the plethora of apps available make these devices preferred over larger, older devices that can only perform one function (Chan, Lambdin, Graham, Fragale, & Davis, 2014; Flewitt, Kucirkova, & Messer, 2014; Powell, 2014).

**Modified Text Messaging**

One of the features of mobile devices is the ability to send and receive instant message or text messages. The literature on modified and adapted text messaging systems is very limited. To date only a handful of studies have examined the use of modified text messaging technologies by individuals with significant disabilities. Lancioni et al. (2010) utilized an ABAB single subject design methodology to examine the use of modified text message technology by two individuals with brain injuries and motor and visual disabilities. Participants were able to send out and receive messages. Contacts and
messages for the two participants were chosen by surveying caregivers and family members and direct observation of the participants’ needs. For each contact between four and six messages were available. The messages concerned areas such as health, “I am well, how are you?”, work/school, “How is the work or the school going?”, affection, “I miss you” and appointments/visits, “When can you visit me?”. If the participant responded within three to four seconds from the end of a message, the computer sent that message out and confirmed that it had been sent. An incoming message was signaled to the participant by alerting beeps and a computer’s verbal announcement, which could be repeated. The participant would get the computer to read the name of the sender and the message to him or her through microswitch activation. Names of the persons to whom messages could be sent and of those from whom messages could be received and related phone numbers were stored in the device. The main finding was that special messaging technology may help persons with multiple disabilities acquire higher levels of independent, basic communication.

The following year, Lancioni et al. (2011) examined the use of a modified messaging system on communication opportunities for individuals with significant and multiple disabilities. The participants learned how to independently send out and receive messages during the course of the intervention. The system required minimal motor responses and the ability to discern preprogrammed messages rather than produce the messages. The ability to discern between preprogrammed messages is an indication of receptive language ability and not dependent on expressive capabilities, so it is appropriate for individuals who have difficulties producing functional speech.
Two cases are presented in Lancioni et al. (2012a). In the first study vocal scanning of the alphabet was utilized to facilitate letter selection for writing messages for a woman with blindness and a severe motor disability. In the second case, a touch screen was used to accesses the letters of the alphabet by touch to make a selection to compose messages by a male participant with acquired brain injury, motor disability, and lack of speech. Both participants were able to compose and send out messages and listen to incoming messages during intervention sessions.

Lancioni et al. (2012b) conducted two studies involving adults with advanced ALS. Both of the participants presented with very limited body movements. Their respective body movements included slight head movements, eye gaze, and eye blinking. In each of the studies the participants were taught how to use a microswitch to access a modified text messaging program. Participants were able to request preferred leisure and recreation activities and send messages to friend and family members. Specifically the data from the first study indicated that the participant could listen to incoming messages and compose and send out messages to selected contacts. The participant was able to use the microswitch to access a videophone to listen to contacts while communicating with them by sending written messages. The second study showed that the participant could make leisure engagement requests and send basic messages to familial contacts.

Text messaging for the two participants enabled these individuals to have contact, communication, and maintain relationships with family members. This contact/communication is important for maintain connections, expressing needs and wants, and sharing thoughts and daily activities, all of which have the potential to
improve quality of life (McDougall, Evans, & Baldwin, 2010). While the outcomes were positive, there were concerns with regard to the technology used to achieve the outcomes. Both of the systems used relied on experimental software, which may not be readily available. Additionally, the costs involved were not necessarily prohibitive but were substantial nonetheless. In 2013 Lanconi et al. continued to study alternate text messaging systems for persons with disabilities, reaching similar conclusion to previous studies. Study characteristics are described in Table 1.
### Table 1

**Studies Examining the Use of Modified Text Messaging Systems by Individuals with Significant/Multiple Disabilities**

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample</th>
<th>Setting</th>
<th>Research Design</th>
<th>Targeted Skills</th>
<th>Dependent Variable</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lancioni et al. (2010)</td>
<td>2 adults, 39 and 30, ABI and MD</td>
<td>Care and rehabilitation facility</td>
<td>ABAB</td>
<td>a) Write and send messages b) Listen to received messages</td>
<td># and frequency of messages sent and of messages listened to</td>
<td>Participants learned to send out and access/listen to received messages</td>
</tr>
<tr>
<td>Lancioni et al. (2011)</td>
<td>2 adults, 40 and 44, ABI and MD</td>
<td>Rehabilitation clinic</td>
<td>ABAB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lancioni et al. (2012a)</td>
<td>2 adults, 42 and 80, MD</td>
<td>A quiet room in a rehabilitation center</td>
<td>ABAB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lancioni et al. (2012b)</td>
<td>2 adults, 51 and 66, ALS</td>
<td>Client room at medical care center</td>
<td>ABAB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lancioni et al. (2013)</td>
<td>2 adults, 22 and 31, MD</td>
<td>Center for persons with sensory and MD</td>
<td>ABAB</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: ABI = Acquired Brain Injury; MD = Multiple Disabilities; ALS = Amyotrophic Lateral Sclerosis.

As previously noted the available data on modified text messaging technologies is very limited, and only represents a limited number of participants. Additionally, all studies were conducted in the same geographic region and no social validity was established in any of the studies. It is essential to extend and replicate these studies to
include individuals with differing disabilities and needs who may benefit from these technologies and techniques. Consumer satisfaction with the technologies/intervention is an important piece missing from the current literature. Additionally, maintenance and generalization are missing from the aforementioned experiments involving modified text messaging for persons with significant ID and DD. Research needs to continue in this field to determine if skills can be generalized and maintained.

**Applications (Apps)**

A wide variety of applications or apps are available for use on mobile devices. In 2010 the American Dialect Society voted “app” the word of the year. In a press release, the American Dialect Society defined app as “noun, an abbreviated form of application, a software program for a computer or phone operating system” (p. 1). A feature of mobile devices, text messaging can be made available to individuals with moderate to severe ID and DD through the use of applications or apps on mobile devices. When deciding whether a specific device, program, piece of technology, or, in this case app, is appropriate for meeting the needs of a particular individual there are several factors that needs to be considered. According to Lancioni et al. (2012b), “Technology-aided programs can be evaluated (a) on the basis of the access devices they rely on and the responses those devices require, (b) on the time needed for their establishment and their working reliability, and (c) on their overall cost” (p. 1606). Indeed, there are several published tools for evaluating mobile devices and apps. Walker (2011) created a rubric to evaluate apps on a scale from 1-4 across six domains. The rubric was later edited by Schrock (2011) to include a seventh domain. The seven domains include: curriculum
connection, authenticity, feedback, differentiation, user friendliness, student motivation, and reporting. Van Houten (2011) further adapted the original rubric by Walker to include gender neutrality and some considerations for learners with disabilities, customization and alternative access.

eSkills Learning (2011) developed an independent rubric with a slightly different focus, alignment of the app to common core standards, levels of difficulty, and various modes of play. App evaluation rubrics exist for considering apps within the context of Bloom’s Taxonomy (Darrow, 2011), and a checklist for librarians was created by the Chicago Public Schools (n.d.). The principles of UDL should be taken into consideration when evaluating apps for individuals with disabilities (Center for Applied Special Technology, 2012; More & Travers, 2013). The Technology and Media Division of the Council for Exceptional Children, editors Ault and Bausch, published a monograph, *Apps for All Students: A Teacher’s Desk*. In the monograph, Tammaro and Jerome (2012) created a checklist for evaluating apps that considers advanced accessibility features and other domains of particular concern when considering an app for individuals with intellectual and developmental disabilities, specifically, sensory, auditory, visual, cognitive and access/input features. Additionally in the same monograph, Lojkovic (2012) goes on to discuss ways in which apps can be used in the attainment of educational goals for individuals with low incidence disabilities.
Transition and Postsecondary Education Options for Individuals with Moderate to Severe ID and DD

Enhancement of communication skills aids all individuals as they transition from K-12 schooling to PSE or to the workforce. The importance and value of education for any individual cannot be overestimated. Education is certainly important for individuals with moderate to severe disabilities, who were often excluded from the traditional/formal educational process in the past, from a wrongly presumed inability to learn. Individuals with moderate to severe disabilities, of all age groups typically need more time and more opportunities to acquire and generalize new skills. However, low expectations for progress, with regard to academic, independent living, and social skills, have reduced the amount of exposure to typical educational experiences in the past. Traditionally, individuals with more severe disabilities were separated from those without disabilities and placed in institutions. Even in today’s schools, the majority of students with severe disabilities spend most of their school day in segregated classrooms (Downing, 2008). Segregated schools and segregated classrooms allow for no interaction with same age peers who do not have disabilities. Moreover, these classrooms do not reflective of the outside world where the students will ultimately be expected to work and live in society.

While early intervention is a highly recommended and evidence based practice for persons with disabilities, learning can occur at any age for any individual. In recent years there has been movement toward providing more age appropriate and more inclusive educational opportunities for students with more severe intellectual and developmental disabilities (Neubert, Moon, Grigal, & Redd, 2001). Now numbering over 200 across the
United States, PSE programs are located on college campuses and allow students with intellectual disabilities to continue their education alongside typical peers (Consortium for Postsecondary Education for Individuals with Developmental Disabilities, 2009). In PSE programs, students learn academic material, expand social networks, gain employment skills, and develop independence. Although colleges have historically excluded students with intellectual disabilities, PSE programs offer these students an alternative to traditional college admission and participation (Hart, Grigal, Sax, Martinez, & Will, 2006).

As more PSE programs become available, families are increasingly considering this option (Hart et al., 2006; Neubert et al., 2001). Since families, especially primary care givers or parents are instrumental in transition planning, understanding their perspectives can improve the approaches taken by educators and service providers (Chambers et al., 2004). In prior studies, researchers had focused on general transition outcomes for students with intellectual disabilities compared to typical students and to students with other disabilities (Wagner et al., 2005). Kraemer and Blach (2001) found that the primary concern for parents is determining what the young adult will do during the day after high school; however, this study did not discuss PSE programs as a transition option. Similarly, Cooney (2002) found that parents were very concerned about the transition process, but also did not address PSE options. In another study of both parent and sibling perspectives, Chambers et al. (2004) found that respondents considered PSE an important outcome, but that their knowledge of programs was limited and they did not think their family member would pursue this option.
Self-determination has been identified as an important component of effective transition planning for students with disabilities (Eisenman, 2001; Wehmeyer, 1992). In fact, research has shown that the core component skills of self-determination are correlated with an improved quality of life for adults with disabilities, particularly those outcomes as employment, community living, and postsecondary education. The importance of self-determination is reinforced by the Study of Personnel Needs in Special Education (SPeNSE), funded by the U.S. Department of Education. This large-scale, national study identified teaching self-determination as one of the key practices in facilitating transition. Approximately 62% of teachers reported teaching self-determination "often" and approximately 29% of teachers reported teaching self-determination "sometimes" (U.S. Department of Education, 2002). However, many secondary teachers do not include activities for students with disabilities that will foster self-determination as part of their transition planning. Given the importance of learning self-determination skills in general, the number of core component skills that are part of self-determined behavior, and the lack of time that special educators are devoting to teaching these skills, it would be important to understand which of those core component skills students themselves found to be most important to their success in postsecondary education settings. Wehmeyer (1992) defined self-determination as "acting as the primary causal agent in one's life free to make choices and decisions about one's quality of life, free from undue influence or interference" (p. 302). Twelve component skills were identified that are important to the emergence of self-determined behavior. Those elements are: "choice-making; decision-making; problem-solving; goal setting and
attainment; independence, risk-taking and safety skills; self-observation, evaluation, and reinforcement skills; self-instruction; self-advocacy and leadership skills; internal locus of control; positive attributes of efficacy and outcome expectancy; self-awareness; and self-knowledge" (Wehmeyer, Agran, & Hughes 1998, p. 11). It is clear that the goal of transition planning is to prepare students with disabilities for their lives after high school by teaching skills they will need in the new settings. Increasing communication skills can aid in successful transition and in the developing self-determination skills for these students.

**Socialization and Social Skills**

A fundamental part of the human experience is making friends and creating a support system. Having friendships can aid in the transition process. However, individuals with moderate to severe ID and DD tend to have smaller social circles than individuals without disabilities (Duggan & Linehan, 2013; Johnson, Douglas, Bigby, & Iacono, 2010; Walton & Ingersoll, 2013). In 2006, McVilly, Stancliffe, Parmenter, T. R., and Burton-Smith, adapted an existing loneliness scale (Asher & Wheeler, 1985). The researchers contend that establishing quality interpersonal relationships is a key component to determining quality of life. Participants’ data revealed that:

- personal networks are most effective in meeting people’s social and emotional needs if they include opportunities for relationships that involve people with and without intellectual disability. For the current participants, relationships with family members and professionals could address some important needs (e.g. practical support and assistance to solve some
problems). However, relationships with those who had shared life experiences associated with or linked to their intellectual disability were also very important (p. 200).

A variety of strategies for increasing social networks and ways to increase opportunities for individuals with more significant disabilities to access social and leisure activities have been discussed in the literature. In 2012 Hughes et al. conducted a review of published interventions for increasing social skills for secondary school students with ASD and/or ID. In total they identified 36 participants across 13 studies. They discovered that which specific interventions do hold promise, generalizing specific skills is a way to broaden effects. Instead of examining specific strategies to teach social skills, Forts and Luckasson (2011) discussed the roles of literacy, reading, and writing in establishing friendships. Literacy affords one greater opportunities for interaction and maintaining friendships.

While Forts and Luckasson (2011) discussed writing letters and e-mail as a way to maintain friendship, social media and other forms of electronic communication have become more prevalent. Shpigelman and Gill conducted two studies, both published in 2014, that examined facebook use by persons with disabilities. The results of both studies suggest that persons with disabilities utilize social media, such as facebook, to communicate with individuals that they have primarily already met face to face. Their findings also show that persons with disabilities on social media behave in a manner consistent with that of the general population.
Personal Safety Concerns

In addition to aiding transitions and increasing social networks, use of mobile devices, social media, and messaging technologies have the potential to increase personal safety. Research shows us that individuals with more significant disabilities are more likely to be victimized than their non-disabled peers (Leutar, Vitlov, & Leutar, 2014; Sequiera & Hollins, 2003). Increasing levels of expressive communication has the potential decrease this likelihood. Stalker and McArthur’s (2012) research shows that there is “a strong association between disability and child maltreatment, indicating that disabled children are significantly more likely to experience abuse than their non-disabled peers” (p. 24). According to Hershkowitz, Lamb, and Horowitz (2007) children with disabilities are more likely to be victims of child abuse and may have more difficulty than their non-disabled peers when it comes to reporting their experiences.

Sullivan and Knutson’s (2000) study suggested that children with communication disorders and behavioral disabilities had a much greater risk of maltreatment, between five and seven times that of non-disabled children. Knutson, Johnson, and Sullivan (2004) also reported that children with communication disorders could be at greater risk of physical abuse. Expressive language disabilities can increase the vulnerability of sexual abuse as limited language may impede disclosure and detection of the victimization. Language and speech disorders may also affect how the abuse is understood and processed by the victims (Newman, Christopher, & Berry, 2000). “Children with disabilities are often perceived as easy targets, because their intellectual limitations may prevent them from being able to discern the experience as abuse and
impaired communication abilities may prevent them from disclosing abuse” (Hibbard & Desch, 2007, p. 1021). Increased expressive language skills for this population decreases the likelihood that these individuals will become victims of maltreatment and physical and sexual abuse. Several parents of participants in the pilot study expressed concern that if something ever happened to their child, e.g. crime or abduction, the EZPic2Txt app would be a way for them to be in touch.

**Single Subject Multiple-Baseline Research Design**

In order to examine the effect that use of the EZPic2Txt app might have on levels of instances of independent electronic communication, a single subject multiple baseline design was used. A single-subject research design is particularly well suited to the study of small, heterogeneous populations (Horner et al., 2005). Low incidence disabilities such as moderate to severe ID and DD represent small portions of the population. According to Morstad (2012) of the Bethesda Institute, individuals with ID and DD represent 1.5 to 2.5 percent of the entire population in the United States. According to the DSM 5 (APA, 2013), individuals with ID represent 1 percent of the population, while prevalence for severe ID is estimated at 6 per 1,000 (p. 38). Persons with moderate to severe disabilities are a heterogeneous group; while two individuals may share the same diagnosis, their characteristics and needs may vary greatly (McDonnell, Hardman, & McDonnell, 2003).

In multiple-baseline designed research there are two component phases, baseline phase and the intervention phase. There may be a third and fourth phase that occurs after intervention, these are the maintenance and generalization phases. Baseline is the measure of the status quo, the existing circumstances that are measured before the
intervention is introduced. After stable baseline is established, the intervention is
introduced to the first participant. If stable outcomes are achieved during the intervention
phase, the next participant is introduced to the intervention. This continues until all
participants have completed the intervention phase. Replication of the intervention across
at least three tiers is necessary to establish experimental control (Gast, 2010).

**Pilot Study**

Conducting a pilot study is advisable when planning a research study for multiple
reasons (Stake, 1995; van Teijlingen & Hundley, 2001; van Teijlingen, Rennie, Hundley
& Graham, 2001; Yin, 2009). Specifically, pilot studies “help researchers, identify design
flaws, develop data collection and analysis plans, and gain experience with participants”
(Beebe, 2007, p. 213). A pilot study was conducted in October of 2013, IRB protocol #
477742-2, to test the usability of the original app, then called OneMoveSender.

**Method**

**Design.** A single subject/case, multiple baseline design (Gast, 2010; Kazdin,
2011) across four participants was utilized to assess the efficaciousness of the modified
texting app in increasing instances of independent expressive electronic communication.
Participants were randomly assigned to tiers and regulated randomization was used to
determine when to begin treatment for each participant (Koehler & Levin, 1998). In order
to comply with design standards, at least five data points are necessary in baseline, so it
was predetermined that the intervention would begin on session 6 or 7 for participant 1,
session 8 or 9 for participant 2, session 11 or 12 for participant 3, and session 14 or 15 for
participant 4. Sessions 6, 8, 11, and 15 were randomly selected from the aforementioned pairs.

Participants. At the time of this investigation, all of the participants were in current attendance in a postsecondary education program for individuals with moderate to severe ID and DD on a college campus. The program includes four years of course work and job training with an optional year of internship. The director of the program identified the participants for this study based on their reluctance to use or inability to use traditional text messaging technologies. Four participants in total were identified, one female and three males. Participants were all between the ages of 20 and 25. Participant characteristics are presented in the Table 2.

Table 2

Pilot Study Participant Demographic Characteristics

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Gender</th>
<th>Race</th>
<th>Year in postsecondary education Program</th>
<th>Disability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robert</td>
<td>24.1</td>
<td>Male</td>
<td>Caucasian</td>
<td>Intern</td>
<td>ID/Chromosomal</td>
</tr>
<tr>
<td>Mike</td>
<td>24.7</td>
<td>Male</td>
<td>Bi-racial</td>
<td>3rd year</td>
<td>CP/ID</td>
</tr>
<tr>
<td>Stephen</td>
<td>24.3</td>
<td>Male</td>
<td>Caucasian</td>
<td>3rd year</td>
<td>ASD</td>
</tr>
<tr>
<td>Barbara</td>
<td>20.1</td>
<td>Female</td>
<td>African American</td>
<td>2nd year</td>
<td>ID</td>
</tr>
</tbody>
</table>

Note: Age = at the beginning of the study; ID = Intellectual Disability; CP = Cerebral Palsy; ASD = Autism Spectrum Disorder.
Participant 1. Robert was a 24-year-old Caucasian male who was identified as having an intellectual disability. He was in his final year, internship, of the postsecondary education program. He generally appeared to be in a good mood, and was often smiling and agreeable to working with the primary researcher. His verbal expressive communication skills are severely limited; in response to questions he often would repeat the last word of the question. He did use a mobile phone receptively. He would receive calls from his mother, for example, and he would listen, but not respond verbally. His phone did have traditional texting capabilities, but he did not utilize this feature. Initially he required hand-over-hand assistance to turn on the iTouch and access the app, but after three hand-over-hand demonstrations, he was able to access the app independently.

Participant 2. Mike was a 24-year-old Caucasian male who was identified as having cerebral palsy and an ID. He was in his third year of the postsecondary education program. He was always willing to work with the primary researcher. He was able to maintain conversations with program staff and researchers. He did have a mobile phone that he used for both expressive and receptive communication. His phone did have traditional texting capabilities, however he did not utilize the texting feature. Mike was able to access the app after having it modeled once.

Participant 3. Stephen was a 24-year-old Bi-racial male who was identified as having ASD. He was in his third year of the postsecondary education program. He was often reluctant to work with the primary researcher. Initially, it appeared that his reluctance had to do with scheduling. Sessions took place when he had free access to the computer lab, and he seemed to not like having that time interrupted. After the first five
sessions the primary researcher rescheduled sessions with Stephen so that his computer lab time was not interrupted. He did have a mobile phone that he used receptively. When asked a question he would respond with one-word answers. His phone did have traditional texting capabilities that he was able to use, but he chose not to send messages.

**Participant 4.** Barbara was a 20-year-old African American female who was identified as having an ID. Barbara was in her second year of the postsecondary education program. She was eager to work with the primary researcher, but did have difficulty maintaining focus during initial sessions. In terms of expressive communication, Barbara was able to communicate in phrases and respond to questions. She did require hand-over-hand assistance in order to learn how to turn on the iTouch and access the app. After the first two initial sessions she was able to access the app independently.

**Setting.** Each of the participants met the researcher in the postsecondary education program office or in one of the program classrooms. After meeting the researcher, participant and researcher when to an empty conference room located down the hall from the program office and the classroom. The conference room had a large oval table in the center with eight chairs situated around the table. There were two windows on the southern facing wall. There were no posters or pictures on the wall, they were bare cinderblock painted a tan color. The room dimensions were approximately 12 X 13 feet.

**Materials.** The app program, pictures and picture symbols related to the contacts and pre-programmed messages, two iPhone 4s phones, and two 4th generation iTouch iPods were the materials used for this pilot study. Two of the participants already had
iPhones that would support the program, so their phones were used while the other two participants were given the iTouch iPods.

**Procedures.** IRB was first contacted to obtain permission for the study. Subsequently, participants’ permission was obtained as well as parent/guardian permission for those participants who were not their own legal guardians.

**Baseline.** In the baseline phase of the study the researcher wanted to determine if the participants were using the existing text messaging technology that was available to them. All four participants did have mobile phones with text messaging capabilities. Participants’ mobile phones were examined daily to determine if there was a record of having sent text messages via traditional text messaging technologies. Of the four participants only one, Mike, sent a message during baseline. Examination of messaging history revealed that Mike’s other most recent message was sent 11 months before, indicating that he did not have high frequency or consistency in making use of traditional text messaging technologies. Looking back at the other three participants’ text messaging histories revealed that there was no history of having sent any messages from their respective devices within the past year. This was corroborated by interview of participants’ parents/guardians, primary care givers, and postsecondary education program staff.

**Intervention.** During the intervention phase, participants were shown via demonstration use of the app by the primary researcher. The next step was to ensure that participants knew how to access the app independently. Two of the participants, Robert and Barbara, required hand-over-hand assistance to access the app. This initial step in the
intervention phase consisted of demonstrating how to turn on the device; this step was required for the two participants who’s current phones would not support the app. Robert and Barbara were given 4th generation iTouch iPods for the duration of the study. The second step involved locating the icon for the app and then touching the icon to open the app. Once the app was open, the participants were shown how to send a message using the OneMoveSender app. In order to send a message one draws a line on the touch screen from the image of the contact to the image of the pre-programmed message. This was done hand-over-hand for those that required this level of instruction, and was modeled for those that did not require that level of assistance.

After the use of the app was demonstrated two times, the participants were asked to use the app to send a message. Devices were powered down and the participants demonstrated that they could turn on the device, locate the icon for the app, open the app by touching the icon, and send a message to one of their contacts. Stephen and Mike were able to independently send messages after being shown the app twice. Robert and Barbara each required additional demonstration, and were able to independently send a message after five and four demonstrations, respectively.

Each participant was in a variety of setting throughout the day. The messages that were programmed into their specific devices varied according to need. Robert had one contact programmed into his device, “Mom”, and two messages, “pick me up,” and “I’m at work.” Mike had two contacts, “Mom” and “Resident Director”, and three messages, “I’m at work,” “I’m on the metro,” and “I’m in class.” Stephen had two contacts, “Mom” and a program staff member, and three messages, “I’m in class,” “I’m at work,” and “I’m
on the bus.” And, Barbara had two contacts, “Mom” and “Aunt”, and two messages, “I’m in class,” and “Everything is okay.” The contacts and messages were determined by asking program staff and parents/guardians which messages would be the most useful.

Daily, each of the participants’ devices was accessed by the primary researcher so that data reports could be generated and sent via e-mail to the primary researcher. On every third session during the intervention phase, the participants were asked if they could demonstrate to the researcher how they have been sending messages to see if the participants remembered how to access the app and send a message.

**Results.**

The results of the pilot study are presented in Figure 1.
Figure 1. Number of messages sent, pilot study results.
The results of the pilot study suggest that there is a functional relation between direct instruction in the use of the app and use of the app and an increase in instances of independent expressive electronic communication amongst participants. Additionally, qualitative results revealed several possible modifications/changes to the app that could improve the use experience and outcomes.

**Visual Analysis and Randomization Test.** Visual analysis of the data indicated that all of the participants had an immediate increase in the frequency of messages sent. A randomization test was run to determine the probability of having a functional relation between the baseline and treatment phases across the participants by chance. The randomization test was conducted using the ExPRT (Excel Package of Randomization Tests) software for single-subject data analysis (Levin, Evmenova, & Gafurov, 2014). The calculations of statistical significance were based on the mean differences between baseline and treatment phases across four participants for the dependent variable. The test results yielded a statistic of $p = .003$ indicating that the results of this study are statistically significant and not the result of chance.

**Interobserver Agreement.** Since the data collection resulted in a permanent product, the data reports generated by the *OneMoveSender* app, a total agreement approach was used to calculate IOA. The total agreement formula of “$S \div L \times 100\%$” where $S$ is the smaller total and $L$ is the larger total” (Kennedy, 2005, p. 115) was utilized. In order to calculate IOA, 50% of the data reports were scored/coded by an associate researcher. These results were compared to the primary researcher’s coding of
the same data reports. The agreement on each of the data reports ranged from 95% to 100%, with an overall agreement of 99%.

**Social Validity.** Social validity was assessed through qualitative interviews with the participants and participants’ contacts. Participants were asked if they liked using the OneMoveSender, all indicated that they liked using the app. Additionally, participants were asked if it was easy or difficult to use the app. Robert, Stephen, and Barbra indicated that it was easy to use the app. Chris said that, “using it wasn’t easy but it wasn’t hard, just normal.” Upon completion of data collection participant contacts were asked the following questions: What, if any, changes did they notice in the ways the participants communicated? Were the messages useful to you? All of the participants’ contacts reported that the messages were useful and that they observed positive changes in the way the participants communicated.

**Considerations and Design Changes**

As a result of the pilot study, several changes were made to the OneMoveSender app and to the study design moving forward. Those changes included adding voice output so that those individuals who need supports reading messages can access them via voice output. Modification of inclusion criteria to include only individuals who already possess cellular phones, or other devices with cellular data plans that were compatible to the app’s running platform was a change made to study design. Using wifi on the iPods, proved too difficult for the participants. Given that participants have difficulty texting, having them log into wifi before sending messages proved to be too cumbersome for the participants to manage independently. Also, the number of messages and number of
contacts for each participant would be the same for each participant. Additionally, the *OneMoveSender* app could only initially send messages, the system was modified to receive messages. The name of the app was also change to the *EZPic2Txt* app.

**Literature Review Summary**

Definitions of literacy for individuals with moderate to severe/profound ID and DD continue to expand and are becoming more inclusive of the types of expressive and receptive communication skills and abilities that these individuals use to communicate (Sturm & Koppenhaver, 2000; Van Kraayenoord, Moni, Jobling, & Ziebarth, 2002). Literacy instruction for this population needs to include more than functional life skills (Bochner, Outhred, & Pieterse, 2001; Downing, 2005; Lacey, Layton, Miller, Goldbart, & Lawson, 2007). Selecting words or symbols or pictures to create meaning and construct a message is a form of literacy that meets some of the communicative needs of this population (Joseph & Konrad, 2009). AAC strategies and technologies have the potential to increase receptive and expressive communicative skills for individuals with moderate to severe ID and DD.

Several barriers to AAC use and literacy have been identified for the population of individuals with significant ID and DD. The use of age appropriate materials, a notion embedded in best practices, is paramount when teaching new communication skills to individuals with moderate to severe/profound ID and DD. While the literature on modified text messaging technologies for individuals with moderate to severe ID and DD is rather limited, to date only six studies examining this technology have appeared in the
professional literature, the need for these individual to be able to communicate expressively is of utmost importance.

Communication has changed with the advent of new technologies. However, traditional text messaging technologies may be inadequate to meet the needs of individuals with moderate to severe ID and DD. Alternatives to traditional technologies need to be explored. Cell phones have become ubiquitous in our culture, as have apps. If an app can lead to increases in expressive and receptive communication skills for individuals with more significant disabilities it warrants exploration, assuming the app and device on which it operates are appropriate tools for the user. Communication skills have been linked to levels of safety, socialization, inclusion, and independence. Additionally, of the research that does exist in the field, the majority of it has been conducted on K-12 school aged children. Further research must include individuals who have transitioned from the K-12 setting in order to promote independence after transitioning from secondary school.
Chapter Three

This chapter presents the methodology for the current study, which was comprised of two concurrent experiments. The first experiment was designed to examine the effectiveness of direct instruction in and the use of the EZPic2Txt app in increasing the frequency of independent expressive electronic communication instances via modified text messaging technology by young adults with moderate to severe intellectual and developmental disabilities. The second experiment was designed to expand the first experiment and to examine the participants’ response rate to messages sent to them via the app. Information about the participants’ educational backgrounds, demographic characteristics, and current communication strengths and needs is presented along with information concerning the protection of human subjects. The current study design and rationale for the design are described. The independent and dependent variables are operationalized. Materials required to conduct the current study and research procedures are outlined. The processes of data collection and data analyses are also presented here in addition to the processes of obtaining interobserver agreement (IOA), implementation fidelity, and qualitative data for the purpose of establishing social validity.

Research Design

A single-subject multiple baseline design was chosen for both independent experiments in this study. A multiple-baseline design across participants was selected for
this study because the design allows the researcher to examine intervention effects in depth and across different participants (Kennedy, 2005). Specifically, a multiple-baseline design allows the researcher to determine if there is a functional relation between the independent variable and the change in the dependent variable without a return to baseline (Gast, 2010). A return to baseline, in these experiments, would be impossible since that would entail “unlearning” information about the use of the app by the participants. Additionally, the researcher wished to investigate if participants were able to generalize and maintain the skills learned through application of the intervention. Data were graphed and all points of datum from the baseline phase were compared to all points of datum in the reciprocal intervention phases across participants. Processes were replicated across participants. After the completion of the intervention phase, generalization and maintenance phases were conducted.

**Design Standards for Single-Subject Research**

According to Kratochwill et al. (2010), there are specific requirements that must be met for a single subject designed study to be robust. These include, the intervention “must be systematically manipulated with the researcher determining when and how the independent variable conditions change,” (p. 14) each variable must be “measured systematically over time by more than one assessor, and the study needs to collect inter-assessor agreement in each phase and on at least twenty percent of the data points in each condition (e.g., baseline, intervention) and the inter-assessor agreement must meet minimal thresholds,” (p. 15) “at least three attempts to demonstrate an intervention effect at three different points in time or with three different phase repetitions,” (p.15) and “for
a phase to qualify as an attempt to demonstrate an effect, the phase must have a minimum of three data points” (p.15).

**Experiment 1**

This first experiment was designed to examine the outcomes of use of the *EZPic2Txt* app. Experiment 1 sought to directly answer the first and second research questions of the current study: 1.) Is there a functional relation between use of the *EZPic2Txt* app, and an immediate increase in level of frequency of self-initiated electronic communication instances amongst young adults with moderate to severe ID and DD? 2.) Are participants able to generalize and maintain the skills learned through application of the intervention?

**Sample**

In this section the protection of human subjects, participant demographic characteristics, current communication strengths and needs, inclusion/exclusion criteria for participation in the current study, recruitment of participants, and the process of obtaining informed consent shall be discussed. Individuals with diagnoses of moderate to severe ID and DD who participated in this study are referred to as participants. The primary researcher, IOA scorer, fidelity of implementation checker, siblings of participants, parents of participants, postsecondary education program director, and postsecondary education program staff are referred to by their respective titles.

**Protection of Human Subjects and Informed Consent**

Prior to any participant recruitment or data collection IRB was first contacted to obtain permission to conduct the study. All of the procedures and methods in this study
were subject to IRB approval. The IRB at George Mason University approved all of the procedures and methods involved in the completion of the study, IRB protocol # 509373-1 (Appendix A).

In order to protect the privacy of potential participants, and not divulge contact information to the primary researcher, the postsecondary education program director sent out the initial recruitment e-mail. This was done to ensure that only individuals who gave consent/assent to participate would be made known to the researcher and protect the anonymity of those who might decline. Potential participants were identified for experiment 1 by the director of the PSE program based on the inclusion criteria described in the next section.

Individuals who agreed to participate were asked to contact the researcher directly. If the potential participants responded affirmatively to the initial recruitment e-mail (Appendix B) or if parents/legal guardians responded affirmatively to the recruitment e-mail arrangements were made to meet participants in person to obtain informed assent. Participants were given an informed assent form while parents/legal guardians were given an informed consent form (Appendices C and D), which was adapted to varying levels of reading ability. To ensure comprehension of the assent form, the researcher read the form aloud to the potential participant as he/she followed along. Parents/guardians, siblings, and program staff, were also recruited for inclusion in qualitative analysis of study findings. Informed consent forms for participants’ parents/guardians, siblings, and program staff were signed electronically and collected via email. All involved parties were given copies of their respective consent/assent forms.
for their records. Participants were reminded that their participation in this study was completely voluntary, and that they could withdraw from the study at anytime for whatever reason. In order to protect the confidentiality of the participants in this study, participants were given pseudonyms, and all identifiers were deleted.

**Inclusion/Exclusion Criteria for Study Participants in Experiment 1**

Purposeful sampling of a specific population was necessary to answer the research questions as the research questions required that the sample have certain characteristics in common, i.e. a diagnosis of moderate to severe intellectual and developmental disabilities (Patton, 2002). Additionally, convenience sampling was employed as participants for the study were all in attendance at the same postsecondary education program (Warner, 2013). All participants had a diagnosis of moderate to severe ID and DD and were between the ages of 18.4 and 24.1 at the beginning of the study.

Potential participants where included in experiment 1 based on the following criteria: (a) they agreed to participate by providing informed assent and informed consent was granted by either a parent or legal guardian, (b) had a diagnosis of moderate to severe ID or DD, (c) had expressive and receptive communication needs as demonstrated by past performance on the Woodcock-Johnson® III Tests of Achievement, (c) had the physical capabilities of operating a touch screen device demonstrated by current use of touch screen technologies, and (d) currently had a cellular phone operating platform that was capable of supporting the **EZPic2Txt** app or a device such as an iPod or iPad with a cellular data plan.
Potential participants were excluded from the study if they: (a) they did not agree to participate by providing informed assent and informed consent, (b) did not have a diagnosis of moderate to severe ID or DD, (c) did not have expressive and receptive communication needs as demonstrated by past performance on the Woodcock-Johnson® III Tests of Achievement, (c) did not have the physical capabilities of operating a touch screen device demonstrated by current use of touch screen technologies, or (d) did not currently had a cellular phone operating platform that was capable of supporting the EZPic2Txt app or a device such as an iPod or iPad with a cellular data plan. Since the intent of the study was to examine use of the app and not use of the specific phone/mobile device participants that did not have a cellular phone or a device with a cellular data plan that had an operating platform capable of supporting the operation of the EZPic2Txt app were excluded.

Initially, six participants expressed interest in participating in the study, however, the researcher was not able to obtain parental consent for two of the participants and those two were thusly excluded from participation in the study. The final sample for experiment 1 included four participants from the postsecondary education program.

**Participant Characteristics in Experiment 1**

The four participants included one male and three female students with moderate to severe intellectual and developmental disabilities. Participant demographic characteristics including age, ethnicity, primary and ancillary disabilities, and functional reading and writing levels are summarized in Table 3.
Table 3

**Participant Demographic Characteristics for Experiment 1**

<table>
<thead>
<tr>
<th>Participant</th>
<th>Gender</th>
<th>Age</th>
<th>Ethnicity</th>
<th>Primary Disability</th>
<th>Ancillary Disability</th>
<th>Reading Level GE*</th>
<th>Writing Level GE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandra</td>
<td>F</td>
<td>18.4</td>
<td>AF</td>
<td>DS</td>
<td>SLI</td>
<td>2.5</td>
<td>1.1</td>
</tr>
<tr>
<td>Vanessa</td>
<td>F</td>
<td>22.8</td>
<td>C</td>
<td>9p-</td>
<td>CM/DD</td>
<td>4.4</td>
<td>3.0</td>
</tr>
<tr>
<td>Kate</td>
<td>F</td>
<td>23.4</td>
<td>C</td>
<td>PBD</td>
<td>SD</td>
<td>3.6</td>
<td>2.0</td>
</tr>
<tr>
<td>Chris</td>
<td>M</td>
<td>24.1</td>
<td>C</td>
<td>DS</td>
<td>ADD</td>
<td>K</td>
<td>K</td>
</tr>
</tbody>
</table>

Note: Age = at the beginning of the study; GE = Grade Equivalent; * = Woodcock-Johnson® III Tests of Achievement; AF = African American; C = Caucasian; DS = Down syndrome; 9p- = 9p minus Syndrome/Alfi’s Syndrome; PBD = Pervasive Brain Damage; SLI = Speech Language Impairment; CM = Chromosomal Monasticism; DD = Developmental Disability; SD = Seizure Disorder; ADD = Attention Deficit Disorder.

Grade equivalencies for all participants are based on Woodcock-Johnson® III Tests of Achievement scores. The researcher did not administer the test, but examined participant records to find the most recent assessment results.

**Sandra.** At the beginning of the study Sandra was 18.4 years of age. She was an African American female with a primary diagnosis of Down syndrome, which was diagnosed at birth, and an ancillary diagnosis of speech language impairment. Her grade equivalency for reading, according to test results from the fall of 2012, was 2.5 and for writing 1.1. She was able write single words of varying length, but did not write in complete phrases or sentences. She was able to read and comprehend adapted materials. Sandra completed high school in June of 2013 earning a special diploma.

She was a gregarious young woman who seemed eager to participate in the study and was pleasant and cooperative with the researcher. She quickly developed a rapport with the researcher. At times she was distractible and would often wish to discuss her
favorite musicians. When on task she had no difficulty in understanding directions. Sandra seemed very interested in learning to use the app, but would also ask the researcher to download music and games for her. She primarily used her phone to receive phone calls from family members. She indicated that her mother had programmed all of the contacts into her phone. She was not able to tell the researcher her phone number, but knew how to look up the number on her phone.

**Vanessa.** At the beginning of the study, Vanessa was 22.8-year-old. She was a Caucasian female with a primary diagnosis of 9p minus Syndrome, diagnosed at birth, and an ancillary diagnosis of chromosomal monasticism and developmental disability. It was also reported that she has weak muscle tone and had surgery as a child to correct strabismus. Her grade equivalency for reading, according to test results from the fall of 2010, was 4.4 and 3.0 for writing. She was able to write complete sentences and read and comprehend short paragraphs. She completed high school in June of 2011, earning a special diploma.

Vanessa was always cooperative and attentive during initial lessons on use of the app. In addition to receiving phone calls on her phone she placed calls as well. However, she indicated that she primarily used her phone to look at youtube videos and to listen to music. Vanessa was able to follow multi-step directions. She maintained focus during meetings with the researcher. She indicated that she preferred to be shown how to do tasks and not told how to do them.

**Kate.** Kate was 23.4 years old at the beginning of the study. She was a Caucasian female with a diagnosis of pervasive brain damage and an ancillary diagnosis of seizure
disorder. Records indicate that she did have a slight vision impairment, however she does not wear glasses or corrective lenses. At the age of 17 months, Kate was diagnosed with Acute Lymphoblastic Leukemia, and as a result of the chemotherapy treatments has PBI and seizure disorder. Her grade equivalency for reading, according to test results from the spring of 2010, was 3.6 and 2.0 for writing. She was able to write in complete phrases and short sentences, and she was able to read and comprehend short paragraphs. She completed high school in June of 2010 and earned a special diploma.

Kate was very eager to work with the researcher. She was cooperative and attentive when meeting with the researcher when the two met one on one. However, in group settings she was highly distractible. Kate utilized her phone to receive calls, but did not initiate calls herself. She said the she enjoyed looking at music videos on her phone, and that she wanted to learn how to buy music from the app store. She required extra time to process what was said to her, but she was able to follow multi-step directions.

Chris. Chris was 24.1 years old at the beginning of the study. He was a Caucasian male with a primary diagnosis of Down syndrome, diagnosed at birth, and an ancillary diagnosis of ADD, diagnosed when he was in the 1st grade. He currently takes medication to control the symptoms of ADD. It was also reported that he had a ventricular septal defect and hypospadias, which were both corrected with surgery shortly after birth and have no current impact on his health. His grade equivalency for both reading and writing, according to test results from the fall of 2010, was K. Chris could write single words, and printed material needed to be read aloud to him. He was able to identify sight words and
the letters of the alphabet. He completed high school in June of 2011, graduating with a special diploma.

His demeanor was always pleasant, and he stated that he wanted to learn about the app so he could send messages to his brothers. He would answer calls on his phone, and he did make calls. He showed the researcher that he had three contacts’ phone numbers in his phone. Chris was very interested in movies, and he would attempt to steer the conversation around to ideas that he had for making movies. He required constant reminders to remain on task. He was able to follow two and three step directions, but he would forget steps or appear confused if more than three steps were involved.

**Setting**

At the time of the study, each participant in experiment 1 was currently enrolled in a PSE program for students with ID and DD on a university campus. The PSE program was located on the campus of a large public university in the Mid-Atlantic region of the United States. The program was specifically designed for students with ID and DD. The program incorporates functional education in the realms of independent living skills and employment with academic instruction. Students audit college level courses with their same age peers without disabilities, and are provided with opportunities for employment and internships. Students specify an area of interest that leads to a certificate in that chosen area.

All of the research for this experiment was conducted on that universities’ campus. The researcher met the participants individually before or after one of his/her classes. The four participants in experiment 1 were all enrolled in the same culinary arts
class, and the researcher met the participants before or after this particular class. The class took place in the kitchen area of one of the on campus dorms, and the researcher met with the two participants individually before the class and two participants individually after the class in the lobby of said dorm. The dorm lobby was quiet with little to no activity during meeting sessions. There was a couch and two chairs in one corner of the lobby where the researcher would meet with the participants. The initial lesson on the purpose and process of text messaging in general that was conducted prior to establishing baseline, and all intervention and training sessions were conducted in this space.

**Materials**

Materials required for implementation of the study include the app itself, the *EZPic2Txt* app. Pictures/picture symbols that were needed to be programmed into the *EZPic2Txt* app to accompany messages were also required. Additionally, the Apps Evaluation Checklist (Tammaro & Jerome, 2012) was used to determine specific requirements and considerations for instruction in use of the app for participants as well as the appropriateness of the app as a tool for participants. The participants had cellular phones or devices with cellular data plans that supported the app. The participants’ devices are required as vehicles for the app. The text messaging on Apple devices task-analysis lesson plan was used in the pre-baseline phase.

**EZPic2Txt App**

The *EZPic2Txt* app uses the email account name and password set up by the researcher to transmit text directly through email server of the provider using SMTP
email sender, provided that Internet connection is available. The SMTP email sender utilizes free shareware SKPSMTPMessage project, created by Ian Baird on 10/28/08 Copyright (c) 2008 Skorpiostech, Inc. As soon as user connects recipient and message buttons, EZPic2Txt app composes the text sentence and selects addresses on the basis of the buttons selected. The EZPic2Txt app, if an internet connection is available, will speak the content of the selected message by using Text-To-Speech engine FliteTTS, an iPhone TTS free shareware synthesizer, developed by Sam Foster Copyright (c) 2010, and then transmit the message. If a connection is not available, the user will hear the message, “connection unavailable”. While the user selects the buttons, composing the message, EZPic2Txt app will speak the text provided for the buttons too, so user can hear message being composed. The operating requirements for the EZPic2Txt app are:

iPhone/iPad/iTouch iOS5.0 and higher, Android 2.3 and higher.
Figure 2. *EZPic2Txt* start up screen.

Figure 2 is a screen shot of the start up screen of the *EZPic2Txt* app. Upon locating the icon for the app, which is a miniature version of the start up screen, on a mobile device and activating/opening the app, this the first screen that appears. This image of the start up screen remains on screen for approximately seven seconds before the main menu screen pops up.
Figure 3. Main menu screen.

Figure 3 is a screen shot of the main menu screen of the EZPic2Txt app. On the left side of this screen are the buttons that represent contacts, in this case David, Mom, and RA (Residential Aide). On the right side of the screen are the buttons that represent
messages, in this case the message ‘Hello’ is available. The ‘eMsg’ button on the top left will take the user to a screen when traditional text messages can be entered and sent via the app. The ‘SetUp’ button on the top right will take the user to the set up screen. The ‘KiHd’ button at the center bottom of the screen will pull up a menu of four pages, ABOUT, LEGAL, HELP, MORE.

*Figure 4. Sending a message.*
In order to send a message using the *EZPic2Txt* app the user must connect a contact button with a message button as shown in Figure 4. In the current study participants used their fingers to draw a line connecting the two buttons, however a stylus or other adapted device could be utilized if it has touch screen compatibility. Upon connecting the two buttons a message appears at the bottom of the screen to indicate that the message is being sent. This message remains until the message is successfully sent. The red line remains on the screen as the message is being sent. The line visually lets the user know that he/she has successfully made contact with the touch screen and has activated the buttons. In order to activate and connect buttons, the line must overlap the button, and a button can be activated at any point on said button, i.e. it is not necessary to have the line cross the center of the button.

The app is additionally equipped with voice output. If a user activates a button the voice output will say the contents of the button, for example if a user activates the button ‘David’ a computerized voice will say “David.” Also, the app will tell the user if the message has been sent successfully. In this case the voice output was, “message hello was sent to RA.” If the message had failed to go through the voice output would have been, “message hello was not sent.” Messages that are received by the app are also read aloud to the user via the voice output technology.
Figure 5 shows the message that appears to the user if he/she attempts to send a message while the device is not connected to a wireless network. Voice output also indicates that the device has lost connectivity with the verbal message, “no internet, cannot send.” This might occur when the user is not in range of a cellular network or...
connected to wifi. Participants in this study all had cellular data plans so connecting to wifi was not an issue, however if participants ever travelled out of cellular range they might receive the loss of connectivity message. The app continues to record attempts at sending messages even when the user is not connected to a cellular network.

*Figure 6. Traditional text message screen.*
If a user desires to send a message other than those that have been pre-programmed, activating the ‘eMsg’ button will take the user to the screen shown in Figure 6. Here a user can enter a traditional text message; this feature enables contacts to send messages to the participant, which will be spoken via voice output. However, this feature was not utilized during this study.

*Figure 7. Login screen.*
If the user activates the ‘SetUp’ button on the main menu screen, he/she is taken to the Login page which is shown in Figure 7. To create a password the user activates the ‘New Code’ button, if this is done, the password will be required to proceed further. If the user wishes to alter the color setting for the app he/she needs to activate the ‘Set Colors’ button.

Figure 8. Set colors screen.
If a user wishes to change the color configuration of the app, that can be done by accessing the set colors screen. The background color, the color of the buttons, and color of text can all be customized using this feature. Figure 8 shows the set colors screen programmed with the default color settings.

*Figure 8. Set colors screen.*

*Figure 9. SetUp screen.*
Figure 9 is a screen shot of the SetUp screen. The ‘Contacts,’ ‘Actions,’ and ‘My Email’ buttons will take the user to those various screens. The ‘Send Usr Data’ button generates a data report in an email. In order for the app to keep a record of messaging activity, a user must first turn on the ‘Collect User’s Data’ button.

Figure 10. Contacts screen.
Figure 10 shows the contacts screen. In order to set up the contacts list a user a user must provide a name for the contact. In this case the contact is named Mom, and enter the contact’s email address. If an accompanying photo is desired an image or photo is selected from the mobile device’s camera. The image or photo must already exist in the camera roll of the device. Once the contact’s information is entered, the user must activate the ‘Add As New’ button. The contact then appears on the list of contacts on the main menu screen. In order for the contact to appear on the main menu screen the user must activate the button to the right of the contact’s name by pushing it with a fingertip or stylus. If the user has been added to the main menu a check mark appears in the button to the right of the contact’s name.
Figure 11 shows the actions screen. In order to set up the actions or messages list, a user must provide a name for the message and the message content. In this case, the message is named O.K., and the content of the message is, “I’m fine, everything is okay.” If an accompanying photo/picture symbol is desired, an image or photo is selected from the mobile device’s camera. The image or photo must already exist in the camera.
roll of the device. If picture symbols are required, they must be loaded into the device’s camera. Once the message name and content is entered, the user must activate the ‘Add As New’ button. The message then appears on the list of messages at the top of the screen. In order for the contact to appear on the main menu screen the user must activate the button, by pushing it with a finger or stylus, to the right of the message’s name. If the user has been added to the main menu a check mark appears in the button to the right of the message’s name.

Figure 12. My email screen.
It is necessary to enter the user’s email address on the screen represented in Figure 12. In order to send and receive messages the app must be linked to an email account. Additionally, the user must provide the password linked to the email account and the provider.

*Figure 13. Generating data reports.*
Figure 13 shows the screen that is called up when the ‘Send Usr Data’ button is activated on the SetUp screen. An email is generated containing a record of all messaging attempts that have been made on the device via use of the app.

Figure 14. About screen.
If the user activates the ‘ABOUT’ button on the main menu screen he/she is taken to the About screen which is show in Figure 14. Details concerning the app’s features and development are provided.

Figure 15. Help screen 1.
Figure 15 shows the screen that is called up when the user activates the ‘HELP’ button at the bottom of the main menu screen. Information about programming and setting up the app is provided.

*Figure 16. Help screen 2.*
Figure 16 shows the remainder of the information contained on the help screen which is accessed by scrolling down on the help page.

Figure 17. Legal screen.
Figure 17 shows the contents of the page that is accessed by activating the ‘LEGAL’ button on the main menu screen.

Figure 18. More screen.
Figure 18 shows the webpage that is called up if a user activates the ‘MORE’ button on the main menu screen. The user is redirected to the internet where a page displaying all of the apps developed at the Keller Institute on Human disAbilities.

**Independent Variable**

The independent variable is the use of the *EZPic2Txt* app and instruction, via demonstration and practice, in its use. In the *EZPic2Txt* app, pre-setting recipients and messages is required and was done by the researcher by: a) selecting a desired image from device’s photo library, b) supplying a name for it, c) providing either the contact’s email address or phone number in email format of the phone services provider for the recipient and d) typing in an actual text for the message. GMAIL accounts were created for each participant. The account name and password were entered in my email settings to link the app with the e-mail account.

Participants were shown how to send a message using the app by the researcher. Participants were all able to send messages after the process was modeled. In addition to the app and modeling/demonstration of its use, in order to ensure that participants were aware of the processes of traditional text messaging, a scripted pre-baseline lesson was conducted. The lesson was a six-step task analysis on text messaging on Apple devices. The focus of this lesson was on the purposes and procedures for sending traditional text messages. This was done so that all participants were aware of the traditional text messaging technologies available to them before introduction of the *EZPic2Txt* app. This way the baseline and the intervention were measuring the same thing, instances of unsolicited expressive electronic communication, and participants’ lack of sending text
messages was not do to a lack of knowledge about sending text messages. The script of the lesson is provided in Appendix F.

**Messages and Contacts**

Each participant was in a variety of setting throughout the day. The messages that were programmed into their specific devices varied according to their respective settings. While participants had varying numbers of contacts and numbers of messages in the pilot study, participants in the current study all had an equal number of messages. The exact number was determined after surveying the participants and their respective contacts. Contacts and messages needed to be useful and meaningful to the individual participants, this was determined by asking program staff, parents/guardians, and participants which messages would be the most useful; they were specifically asked either via email or in person to identify messages that would be useful. All responses were recorded. Responses/messages were grouped into categories by the researcher. In total four categories emerged, and since the EZPic2Txt app is capable of having up to five messages programmed into it, four messages per participant was decided upon, one message for each category. Identical messages were not used for each participant, however categorically the messages were the same, for example each participant had a message regarding transportation, but individual variances were taken into account so one participant might have a message, “I’m on the bus” while another might have a message that says, “please pick me up” both deal with transportation, but were individualized. Messages were in one of four categories. Participant messages are presented in Table 4 while participant contacts are presented in Table 5.
Table 4

*Participant Messages*

<table>
<thead>
<tr>
<th>Participants</th>
<th>Transportation</th>
<th>Well-being</th>
<th>Employment/Day habilitation</th>
<th>Class/Support Group Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandra</td>
<td>I’m going to campus.</td>
<td>Everything is okay; I’m fine.</td>
<td>I’m at work.</td>
<td>I arrived to class.</td>
</tr>
<tr>
<td>Vanessa</td>
<td>I’m going to campus.</td>
<td>Everything is okay; I’m fine.</td>
<td>I’m at work.</td>
<td>I arrived to class.</td>
</tr>
<tr>
<td>Kate</td>
<td>I’m going to campus.</td>
<td>Everything is okay; I’m fine.</td>
<td>I’m at work.</td>
<td>I arrived to class.</td>
</tr>
<tr>
<td>Chris</td>
<td>Please pick me up.</td>
<td>Everything is okay; I’m fine.</td>
<td>I’m at work.</td>
<td>I arrived to class.</td>
</tr>
</tbody>
</table>

Table 5

*Participant Contacts*

<table>
<thead>
<tr>
<th>Participants</th>
<th>Contact 1</th>
<th>Contact 2</th>
<th>Contact 3</th>
<th>Contact 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandra</td>
<td>Primary Researcher</td>
<td>Mom</td>
<td>Sister</td>
<td>PSE Support Staff</td>
</tr>
<tr>
<td>Vanessa</td>
<td>Primary Researcher</td>
<td>Mom</td>
<td>Sister</td>
<td>PSE Support Staff</td>
</tr>
<tr>
<td>Kate</td>
<td>Primary Researcher</td>
<td>Mom</td>
<td>Sister</td>
<td>PSE Support Staff</td>
</tr>
<tr>
<td>Chris</td>
<td>Primary Researcher</td>
<td>Mom</td>
<td>Brother</td>
<td>PSE Support Staff</td>
</tr>
</tbody>
</table>

It is possible to add picture or picture symbols to the message and contact button on the *EZPic2Txt* app. In order to remove the confounding variable of picture symbol versus photograph versus text in this experiment, photographs of participants were used. Each participant contact was contacted via email and asked to send the primary
researcher a recent digital photograph of themselves. These photographs were then used for the contact buttons when programming the devices.

A similar approach was taken for messages. For the well-being category participants were given the option of choosing the photo or symbol that would represent “Everything is okay; I’m fine.” Participants were presented with a photo of themselves smiling and giving ‘thumbs up,’ a smiley face emoticon, and the letters OK, in large boldfaced font. Sandra, Kate and Chris, all chose the smiley face emoticon that is shown in Figure 11. Vanessa chose the picture of herself. For the transportation category, Sandra, Vanessa, and Kate take the bus to campus, so a photograph was taken of one of the busses that they ride to campus. Chris is driven to and picked up from campus by his brother, so a picture of his brother’s car was used for his transportation message. In order to maintain confidentiality, the pictures used are described, but not presented here.

A message would be considered attempted if the data report showed that the participant was able to access the app and choose a recipient of the message, but not send the message itself. A completed message would be recorded if the contact was chosen and a message was then selected and the data report showed the time at which the message was sent. If no time was recorded, the message would be recorded as an incomplete attempt.

**Evaluation of the App**

The appropriateness of the app as a tool for the participants was evaluated using the evaluation tool developed by Tammaro and Jerome (2012). The evaluation tool takes into consideration cognitive level and motor skills of the participant. Results of this
evaluation allowed the researcher to design specific lessons based on individual participant needs. Each lesson was then tailored to meet participant needs. Considerations for lesson planning and participant needs as revealed by use of the checklist are presented in Table 6. A completed apps evaluation checklist for participant Sandra is contained in Appendix E.

<table>
<thead>
<tr>
<th>Participants</th>
<th>App Features Useful to Participant</th>
<th>Lesson Planning Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandra</td>
<td>Voice output/Pictures to accompany text</td>
<td>Does not require instruction in the any of the advanced accessibility features</td>
</tr>
<tr>
<td>Vanessa</td>
<td>Voice output/Verbal feedback</td>
<td>Does not require instruction in the any of the advanced accessibility features</td>
</tr>
<tr>
<td>Kate</td>
<td>Verbal feedback/Ability to adjust colors and contrast</td>
<td>Will need to use larger font on materials for her</td>
</tr>
<tr>
<td>Chris</td>
<td>Voice output/ Pictures to accompany text/ Verbal feedback</td>
<td>Will require explicit and repeated instruction in all aspects of app use</td>
</tr>
</tbody>
</table>

Validation of the Independent Variable

As described in Chapter 2, a pilot study was conducted prior to implementation of the current study. The app, then called the OneMoveSender, was tested in a single-subject multiple baseline design study across participants. The results of that study lead to specific changes in the app itself and in the processes used in conducting the study.
Specific changes to the app included the addition of voice output software so that messages could be read aloud for participants who were nonreaders. Also, the software was programmed so that the app system could receive messages. Previously the system could only send messages and not receive messages. Changes to the study design included modification of inclusion criteria to include only individuals who already possess cellular phones, or other devices with cellular data plans that were compatible to the app’s running platform because connecting to wifi on the iPods, proved too difficult for the participants in the pilot study. The participants had extreme difficulty in identifying and accessing the proper settings menu, picking a network, and remembering and entering a password to connect to a wireless internet service. Given that participants had difficulty texting, having them log into wifi before sending messages proved to be too cumbersome for the participants to manage independently. The number of messages and number of contacts for each participant would be the same for each participant. In the pilot study participants had varying numbers of messages and contacts based on individual participant needs and preferences. However, to control for variables, such as the number of messages or contacts, the number was standardized across participants.

Dependent Variable

The dependent variable in this study is the frequency with which the participants complete instances of unsolicited expressive electronic communication via the use of the EZPic2Txt app. For the purposes of this study, a completed instance of unsolicited expressive electronic communication is a successfully sent message. The frequency with which participants completed instances of unsolicited expressive electronic
communication was recorded by the app. The app generated data reports, which log all messaging attempts. A message was considered attempted if the data report showed that the participant was able to access the app and choose a recipient of the message, but not send the message itself. A completed message would be recorded if the contact was chosen and a message was then selected and the data report showed the time at which the message was sent. If no time was recorded, the message would be recorded as an incomplete attempt. In addition to frequency, messages were further examined by category of message, by contact and by time of day. While all of the participants used mobile devices that had traditional text messaging capabilities, the participants did not make use of traditional text messaging technologies. Adaptations to this technology were made to see if the adaptations would increase instances of independent expressive unsolicited electronic communication across participants. For the purposes of this study one session is one week day.

The app records communicative attempts and data is reported via e-mail to the researcher. Figure 19 is an example of a data report that the EZPic2Txt generates. This is an example of one data report for the participant Kate on November 8th, 2013.
<table>
<thead>
<tr>
<th>Contacts</th>
<th>N Contacts</th>
<th>Actions</th>
<th>N Actions</th>
<th>T Start</th>
<th>T End</th>
<th>T If Sent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support Staff</td>
<td>1</td>
<td>I arrived to class</td>
<td>1</td>
<td>2013/11/08 09:28:48</td>
<td>2013/11/08 09:28:49</td>
<td>2013/11/08 09:28:49</td>
</tr>
<tr>
<td>Mom</td>
<td>1</td>
<td>I arrived to class</td>
<td>1</td>
<td>2013/11/08 09:29:44</td>
<td>2013/11/08 09:29:44</td>
<td>2013/11/08 09:29:44</td>
</tr>
<tr>
<td>Mom</td>
<td>1</td>
<td></td>
<td>0</td>
<td>2013/11/08 04:19:32</td>
<td>2013/11/08 04:19:32</td>
<td></td>
</tr>
<tr>
<td>Support Staff</td>
<td>1</td>
<td>I’m at work</td>
<td>1</td>
<td>2013/11/08 04:19:33</td>
<td>2013/11/08 04:19:35</td>
<td>2013/11/08 04:19:35</td>
</tr>
</tbody>
</table>

*Figure 19. Sample of data collection report.*
On this particular day, Kate attempted to send five messages (Actions) to six contacts (two different people, a PSE program support staff member and her mother). She successfully sent five of the messages to five contacts. On her third messaging attempt of the day, Kate selected a contact but did not select a message and complete the process.

**Procedures**

In this section the procedures for conducting all phases of the experiment 1 are outlined. This experiment consisted of a pre-baseline phase, a baseline phase, a treatment or intervention phase, a generalization phase, and a maintenance phase.

**Pre-baseline Procedures**

First, potential participants were identified, the researcher then met with participants to obtained informed consent. Participants were randomly assigned to tiers. Prior to establishing baseline the researcher wanted to determine if the participants were using the existing text messaging technology that was available to them. All participants did have mobile phones with traditional text messaging capabilities. Participants’ mobile phones were examined to determine if there was a record of having sent text messages via traditional text messaging technologies. None of the participants had a record of sending messages via the text messaging technology that was available to them.

Next, the researcher conducted the pre-baseline lesson with each participant. After this scripted lesson, participants were then asked to access and show the researcher that they could access the text-messaging screen. Vanessa and Kate were able to access the text-messaging screen on their devices independently without any instruction. Initially, Sandra and Chris could not access the text-messaging screen on their devices.
So, Sandra and Chris were shown how to access the text-messaging screen on their respective devices three times. Sandra and Chris were then asked to demonstrate that they could access the text-messaging screen independently. Sandra was able to access the screen at this point. Chris could not access the screen independently at this point, and he was shown the process again. After the fifth instance of being shown how to access the screen before he was able to do so independently.

After participants were able to demonstrate that they were able to independently access the text-messaging screen, they were asked to compose the message “hello or hi” and send the message to the primary researcher. Participants were provided with the primary researcher’s phone number on a piece of paper. Sandra composed the message “hi,” while Vanessa and Kate both compose the message “hello.” These three participants then identified the correct place to enter the phone number to sent the message, entered the phone number and independently identified and activated the send button to send the message to the primary researcher. Chris was able to compose the message “hi” independently, but he was not able to enter in the phone number of the researcher. After being shown how to enter in the phone number Chris was able to do so independently. After the scripted lesson and after participants demonstrated that they could send a completed text message, baseline procedures began. Fidelity of implementation data were collected as described later in the chapter.

**Baseline Procedures**

During baseline participants’ devices were checked daily to determine if messages were being sent via traditional text messaging means. A session was construed to mean
one weekday. The procedural nature of the messages being tested in the intervention necessitated that data collection occur when the participants were either on campus or at work. Thusly, weekends and holidays were excluded from analysis. During baseline, the researcher would meet with the participant to examine his/her cellular phone to determine if any text messages had been sent the previous day. The researcher would ask the participant if he could examine the device and asked to see the device. Once the participant indicated that it was okay for the researcher to examine the device, either verbally or gesturally, the participant handed the device to the researcher. After examining the device, participants were told “Thank you.” And the device was returned to the participant. A message in baseline was considered sent if it contained at least one character. In order to meet design standards, baseline for the initial participant contained a minimum of five sessions and the participant would not proceed to the intervention phase until stable baseline was established. Before teaching procedures began, participants and their contacts were asked which messages would be most useful for them to have programmed into their devices.

**Teaching and Treatment Procedures**

During the intervention phase, participants were shown via demonstration and practice how to access the app. This initial step in the intervention phase consisted of demonstrating how to turn on the device. The second step involved locating the icon for the app and then touching the icon to open the app. Once the app was open, the participants were shown how to send a message using the *EZPic2Txt* app. In order to send a message one draws a line on the touch screen from the image of the contact to the
image of the pre-programmed message. This was then modeled for all participants three times. Unlike the pilot study no direct hand over hand intervention or other prompting was used as participants did not require that level of support in the current study.

After the use of the app was demonstrated three times, the participants were asked to use the app to send a message. Devices were powered down and the participants demonstrated that they could turn on the device, locate the icon for the app, open the app by touching the icon, and send a message to one of their contacts. Fidelity of implementation data were collected as described later in the chapter.

Daily, each of the participants’ devices were examined by the researcher so that data reports could be generated and sent via e-mail to the primary researcher. Data reports are not generated nor sent automatically to the researcher. In order to generate a data report from each participants’ device, the researcher was required to access the set up screen on the app, and activate the ‘Send Usr Data’ button to e-mail the report to himself. The procedure was the same as in baseline.

**Generalization Procedures**

In order to determine if participants were able to generalize the skills learned through use of the intervention, a generalization phase covering three sessions was included in the experiment. Generalization was assessed after the intervention phase ended. In this phase participant messages were changed to see if participants would continue to send unsolicited messages. Participants were notified that the messages had been altered and were told what the content of the new messages were. Contacts
remained the same while the content of the messages was changed. Table 7 shows the messages by participant for this phase.

Table 7

*Messages for Generalization Phase of Experiment 1*

<table>
<thead>
<tr>
<th>Participants</th>
<th>Lunch</th>
<th>Campus</th>
<th>Employment</th>
<th>Class Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandra</td>
<td>I’m at lunch.</td>
<td>I’m on campus.</td>
<td>I’m finished with work.</td>
<td>Class is over.</td>
</tr>
<tr>
<td>Vanessa</td>
<td>I’m at lunch.</td>
<td>I’m on campus.</td>
<td>I’m finished with work.</td>
<td>Class is over.</td>
</tr>
<tr>
<td>Kate</td>
<td>I’m at lunch.</td>
<td>I’m on campus</td>
<td>I’m finished with work.</td>
<td>Class is over.</td>
</tr>
<tr>
<td>Chris</td>
<td>I’m at lunch.</td>
<td>I’m on campus</td>
<td>I’m finished with work.</td>
<td>Class is over.</td>
</tr>
</tbody>
</table>

In addition to changing the messages, photos of the message buttons needed to be changed as well. Pictures were taken of the campus food court to accompany the lunch message for all participants. A photo was taken of the main campus square to accompany the campus message for all participants. And, individual photos were taken of the participants leaving their respective places of employment and their respective classes to accompany the employment and class status messages. As in the intervention phase, participants’ devices were accessed daily to generate data reports on participant usage of the app. The procedure of assessing devices and generating data reports was identical to those of baseline and treatment.
**Maintenance Procedures**

Westling and Fox (2009) indicate that an important concern in teaching new skills to individuals with ID is their ability to maintain skills over time. In order to determine if participants did maintain skills over time a maintenance phase was included. After the generalization phase messages were changed back to the original set of messages for all participants. Data were collected on two consecutive sessions.

Two weeks after the completion of intervention and generalization phases, participants’ devices were accessed to generate data reports to determine if they continued to use the *EZPic2Txt* app. The maintenance phase consisted of two sessions.

**Experiment 2**

The second experiment was designed to examine the outcomes of direct instruction in and the use of the *EZPic2Txt* app. As in experiment 1, experiment 2 also sought to directly answer the first and second research questions of the current study. Additionally, experiment 2 sought to answer a third research question: Is there a functional relation between direct instruction in the use of the EZPic2Txt app, and an immediate increase in the response rate to received messages amongst young adults with moderate to severe intellectual and developmental disabilities? Text-messaging and instant messaging are reciprocal processes, so the second experiment was conducted to attempt to answer this additional third research question.

**Protection of Human Subjects and Informed Consent**

The process for obtaining IRB approval is identical to the process as described in experiment 1. The same consent and assent forms were used for participants in both
experiments. In order to protect the privacy of potential participants, the semi-independent living program/support group director sent out the initial recruitment e-mail. Potential participants where identified for experiment 2 by the director of the program based on the following criteria: participants were initially contacted if they (a) were living semi-independently in the program for persons with moderate to severe intellectual and developmental disabilities, (b) had expressive and receptive communication needs as demonstrated by past performance on the Woodcock-Johnson® III Tests of Achievement, (c) had the physical capabilities of operating a touch screen device demonstrated by current use of touch screen technologies, (d) were between that ages of 18 and 25, and (e) currently had a cellular phone operating platform that was capable of supporting the EZPic2Txt app or a device such as an iPod or iPad with a cellular data plan.

Individuals who agreed to participate contacted the program director. If the potential participants responded affirmatively to the initial recruitment e-mail or if parents/legal guardians responded affirmatively to the recruitment e-mail arrangements were made to meet participants in person to obtain informed assent. Participants were given an informed assent form while parents/legal guardians were given an informed consent form, which was adapted to varying levels of reading ability. To ensure comprehension of the assent form, the researcher read the form aloud to the potential participant as he/she followed along. Parents/guardians, siblings/cousins, and residential aides, were also recruited for inclusion in qualitative analysis of study findings. Informed consent forms for participants’ parents/guardians, siblings/cousins, and residential aides were signed electronically and collected via email. All involved parties were given copies
of their respective consent/assent forms for their records. Participants were reminded that their participation in this study was completely voluntary, and that they could withdraw from the study at anytime for whatever reason. In order to protect the confidentiality of the participants in this study, participants were given pseudonyms, and all identifiers were deleted.

**Inclusion/Exclusion Criteria for Study Participants in Experiment 2**

Potential participants for experiment 2 were all members of a support group for individuals with significant disabilities who lived semi-independently with supports. All participants for experiment 2 lived in the same apartment building and were included if they (a) agreed to participate by providing informed consent or informed assent and consent granted by either a parent or legal guardian, (b) were living semi-independently in the program for persons with moderate to severe intellectual and developmental disabilities, (c) had expressive and receptive communication needs as demonstrated by past performance on the Woodcock-Johnson® III Tests of Achievement, (d) had the physical capabilities of operating a touch screen device demonstrated by current use of touch screen technologies, (e) were between that ages of 18 and 25, and (f) currently had a cellular phone operating platform that was capable of supporting the *EZPic2Txt* app or a device such as an iPod or iPad with a cellular data plan.

As in experiment 1, purposeful sampling of a specific population was necessary to answer the research questions as the research questions (Patton, 2002), and convenience sampling was again employed as participants for the study were all lived in the same
building under the auspices of the same semi-independent living program and attended the same support group (Warner, 2013).

Potential participants were excluded from the study if they: (a) did not agree to participate by providing informed consent and informed assent, (b) were not living semi-independently in the program for persons with moderate to severe intellectual and developmental disabilities, (c) did not have expressive and receptive communication needs as demonstrated by past performance on the Woodcock-Johnson® III Tests of Achievement, (d) did not have the physical capabilities of operating a touch screen device demonstrated by current use of touch screen technologies, (e) were not between that ages of 18 and 25, and (f) did not currently a cellular phone operating platform that was capable of supporting the EZPic2Txt app or a device such as an iPod or iPad with a cellular data plan. Initially, four participants expressed interest in participating in the study, and all four participants met the inclusion criteria and were thusly included. The final sample for experiment 2 included four participants from the semi-independent living program.

**Participant Characteristics in Experiment 2**

The four participants included two male and two female young adults with moderate to severe intellectual and developmental disabilities. Participant demographic characteristics including age, ethnicity, primary and ancillary disabilities, and functional reading and writing levels are summarized in Table 8.
All participants had a diagnosis of moderate to severe intellectual and developmental disabilities and were between the ages of 22.1 and 25.0 at the beginning of the study. As in experiment 1, grade equivalencies for all participants are based on Woodcock-Johnson® III Tests of Achievement scores. The researcher did not administer the test, but examined participant records to find assessment results.

**Fares.** Fares was 22.1 year old Asian American male with a primary diagnosis of Cerebral Palsy, diagnosed at birth, and an ancillary diagnosis of traumatic brain injury, due to the result of a car accident when he was travelling as a passenger at the age of 19, and hearing impairment, diagnosed when he was in the 2nd grade. His hearing impairment was mild and he did not require the use of any device or hearing aids to supplement residual hearing. His grade equivalency for reading was 1.1 and for writing 1.0. He completed high school in June of 2012, graduating with a special diploma.
Fares had a sight word vocabulary of approximately 50 words. He was able to independently write his name, address, phone number, and the letters of the alphabet. Fares would answer his phone when it rang, and would answer questions when asked on the phone. He primarily communicated via phone with staff at his living facility. Fares was very willing to work with the researcher and was always cooperative. He was however, highly distractible and his stamina during lessons was low. He required frequent breaks during initial intervention lessons.

**Winston.** Winston was a 24.3-year-old Hispanic American male with a primary diagnosis of Autism Spectrum Disorder, diagnosed in infancy, and an ancillary diagnosis of ID, also diagnosed in infancy. His grade equivalency for reading was 4.1 and 2.5 for writing. He completed high school in June of 2011, earning a special diploma. Winston expressively communicates via the use of a VOCA app installed on an iPad. He would compose sentences using symbols using software on his iPad, which were then read aloud by text-to-speech software.

For Winston, the *EZPic2Txt* app was installed on his iPad versus a cellular phone because he was familiar with the device and accustomed to carrying the iPad around. He was cooperative eager to learn. Winston appeared very interested in the app. He seemed to enjoy showing the researcher all of the additional apps that he had installed on his iPad.

**Stephanie.** Stephanie was a 25.0-year-old Asian American female with a primary diagnoses of multiple disabilities which was described as a combination of both severe developmental an intellectual disabilities in her medical files, diagnosed at birth, and an
ancillary diagnosis of orthopedic impairment, also diagnosed at birth, and ADD, diagnosed in the 3rd grade. She used a motorized wheelchair for mobility. Her grade equivalency was pre-K for both reading and writing. She completed high school in June of 2010, graduating with a special diploma.

She had a sight word vocabulary of approximately 30 words. Stephanie was able to write the letters of the alphabet and her first name. Stephanie appeared to enjoy working with the researcher, yet it was often difficult for her to remain on task during the initial lessons in use of the app. She was able to answer her phone when it rang and carry on short conversations. She primarily communicated with her mother.

**Lucia.** Lucia was a 21.9-year-old African American female with a primary diagnosis of Cerebral Palsy, diagnosed at birth, and an ancillary diagnosis of ID and hearing impairment, both diagnosed in infancy. The hearing impairment was moderate and she used hearing aids. Her grade level equivalency for reading was 1.0 and K for writing. She completed high school in June of 2013, earning a special diploma.

The app was installed on her iPod touch as she had a cellular data plan and the iPod touch had traditional text messaging capabilities. She had a pleasant demeanor and was cooperative during sessions. Lucia had a sight word vocabulary of approximately 75 words and she could write the letters of the alphabet.

**Setting**

For experiment 2, all of the participants lived in the same apartment building in a large urban area in the Mid-Atlantic region of the United States. All of the data collection and training for experiment 2 was conducted in this apartment building. The building had
several meeting rooms, and the researcher would meet the participants in one of these rooms. The rooms were bare save for a desk and two chairs on either side of the desk in the center of the room. The rooms varied in color, but were white, yellow, or beige.

**Materials**

Materials required for implementation of the study were identical to those required to conduct experiment 1, those materials included the app itself, the *EZPic2Txt* app. Pictures/picture symbols that were needed to be programmed into the *EZPic2Txt* app to accompany messages were also required. Additionally, the Apps Evaluation Checklist (Tammaro & Jerome, 2012) was used to determine specific requirements and considerations for instruction in use of the app for participants as well as the appropriateness of the app as a tool for participants. The participants had cellular phones or devices with cellular data plans that supported the app. The participants’ devices are required as vehicles for the app.

**Independent Variable**

The independent variable is the *EZPic2Txt* app and instruction, via demonstration and practice, in its use, as in experiment 1. However, in experiment 2, participants were also sent messages that sought to elicit a response by the primary researcher. The appropriateness of the app as a tool for the participants was evaluated using the evaluation tool developed by Tammaro and Jerome (2012), as in experiment 1. Results of this evaluation allowed the researcher to design specific lessons based on individual participant needs. Each lesson was then tailored to meet participant needs. Considerations
for lesson planning and participant needs as revealed by use of the checklist are presented in Table 9.

Table 9

\textit{Apps Consideration Checklist Data}

\begin{tabular}{|l|l|l|}
\hline
Participants & App Features Useful to Participant & Lesson Planning Considerations \\
\hline
Fares & Voice output/Pictures to accompany text/Verbal feedback & Will require explicit and repeated instruction in all aspects of app use \\
Winston & Voice output/Picture symbols to accompany text/Verbal feedback & Is technologically savvy in the use of his device and VOCA software, will not have to focus on these aspect of using the app \\
Stephanie & Voice output/Pictures to accompany text/Verbal feedback & Will require explicit and repeated instruction in all aspects of app use \\
Lucia & Voice output/ Pictures to accompany text/ Verbal feedback & Will require explicit and repeated instruction in all aspects of app use \\
\hline
\end{tabular}

\textbf{Messages and Contacts}

Participants were in various settings throughout the day. The messages that were programmed into their specific devices varied according to need. As in experiment 1 participants all had an equal number of messages. The exact number was determined after surveying the participants and their respective contacts. Contacts and messages were determined by asking the program director, parents/guardians, residential aides and participants which messages would be the most useful; they were specifically asked either via email or in person to identify messages that would be useful. All responses
were recorded. Responses/messages were grouped into categories by the researcher. The same categories that were used for experiment 1 were used in experiment 2 with a few alterations. The employment category included day habilitation in this experiment since three of the participants went to a day habilitation program during the day, and one participant went to work. Class status became support group status since the participants in experiment 2 attended a support group and were not enrolled in classes. Identical messages were not used for each participant, however categorically the messages were the same. Participant messages are presented in Table 10 while participant contacts are presented in Table 11.

Table 10

*Participant Messages*

<table>
<thead>
<tr>
<th>Participants</th>
<th>Transportation</th>
<th>Well-being</th>
<th>Employment/Day habilitation</th>
<th>Support Group Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fares</td>
<td>I’m on the metro.</td>
<td>Everything is okay; I’m fine.</td>
<td>I’m at day hab.</td>
<td>I arrived to support group.</td>
</tr>
<tr>
<td>Winston</td>
<td>Please pick me up.</td>
<td>Everything is okay; I’m fine.</td>
<td>I’m at day hab.</td>
<td>I arrived to support group.</td>
</tr>
<tr>
<td>Stephanie</td>
<td>Please pick me up.</td>
<td>Everything is okay; I’m fine.</td>
<td>I’m at day hab.</td>
<td>I arrived to support group.</td>
</tr>
<tr>
<td>Lucia</td>
<td>I’m on the bus.</td>
<td>Everything is okay; I’m fine.</td>
<td>I’m at work.</td>
<td>I arrived to support group.</td>
</tr>
</tbody>
</table>
In addition to messaging categories and the content of specific messages, it was necessary to determine the levels of visual supports that participants would require. In order to remove the confounding variable of picture symbol versus photograph versus text in this experiment, photographs of participants were used. Each participant contact was contacted via email and asked to send the primary researcher a recent digital photograph of themselves. These photographs were then used for the contact buttons when programming the devices. In order to maintain confidentiality, the photographs are described but not presented here.

For messages, a similar approach was taken. Prior to the initiation of the intervention, the primary researcher met with participants throughout the day to take photographs of participants’ day habilitation program and places of employment. Winston’s device was programmed with the same type of picture symbols that his VOCA program utilized for all messages since he was already familiar with those symbols. As in experiment 1, for the well-being category the remaining participants were given the

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**Table 11**

**Participant Contacts**

<table>
<thead>
<tr>
<th>Participants</th>
<th>Contact 1</th>
<th>Contact 2</th>
<th>Contact 3</th>
<th>Contact 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fares</td>
<td>Primary Researcher</td>
<td>Dad</td>
<td>Brother</td>
<td>Residential Aide</td>
</tr>
<tr>
<td>Winston</td>
<td>Primary Researcher</td>
<td>Dad</td>
<td>Sister</td>
<td>Residential Aide</td>
</tr>
<tr>
<td>Stephanie</td>
<td>Primary Researcher</td>
<td>Mom</td>
<td>Cousin</td>
<td>Residential Aide</td>
</tr>
<tr>
<td>Lucia</td>
<td>Primary Researcher</td>
<td>Mom</td>
<td>Sister</td>
<td>Residential Aide</td>
</tr>
</tbody>
</table>
option of choosing the photo or symbol that would represent “Everything is okay; I’m fine.” Participants were presented with a photo of themselves smiling and giving ‘thumbs up,’ a smiley face emoticon, and the letters OK, in large boldfaced font. Fares, Stephanie, and Lucia chose the smiley face emoticon that is shown in Figure 11. For the transportation category, Fares took the metro and Stephanie was driven to the day habilitation program and Lucia takes the bus to work, so a photograph was taken of one of the city busses, the metro, and of the car that Stephanie is driven in for the transportation button. A photograph was taken of the room where the support group meets for the support group status button for Fares, Stephanie, and Lucia.

**Dependent Variable**

There are two dependent variables for this experiment: 1) the frequency with which the participants complete instances of unsolicited expressive electronic communication via the use of the *EZPic2Txt* app, as defined in experiment 1. Messages were also examined by category, by contact and by time of day the same as in experiment 1; and 2) the frequency of response, response rate and latency of participants to messages sent to them that sought to illicit a response. For this second measure, data reports generated from the researcher’s device recorded the time that messages were sent to individual participants. Incoming messages sent in response by participants all had a time stamp that indicated when the messages were delivered to the primary researcher. This time stamp was then compared to the data reports that were generated by participants’ devices to confirm when participants did respond to messages sent by the primary
researcher. The time reported on the data reports was used to calculate response rate and latency.

**Procedures**

In this section the procedures for conducting all phases of the experiment are outlined. This experiment consisted of a pre-baseline phase, a baseline phase with measure I and II, a treatment or intervention phase with measure I and II, a generalization phase, and a maintenance phase.

**Pre-baseline Procedures**

After informed consent was obtained, participants were randomly assigned to tiers. Prior to establishing baseline the researcher wanted to determine if the participants were using the existing text messaging technology that was available to them. Pre-baseline procedures for experiment 2 are the same as described in experiment 1.

After being shown how to enter in the phone number Fares, Stephanie, and Lucia were able to send the message. Winston required further prompts to complete and send the message. He was able to send the message after being shown how to do so six times. After the scripted lesson and after participants demonstrated that they could send a completed text message, baseline procedures began. Fidelity of implementation data were collected as described later in the chapter.

**Baseline Procedures**

**Measure I.** During baseline participants’ devices were checked daily to determine if messages were being sent via traditional text messaging means, the same as experiment 1. The procedural nature of the messages being tested in the intervention necessitated that
data collection occur when the participants were either in day habilitation or at work. Thusly, weekends and holidays were excluded from analysis. During baseline, the researcher would meet with the participant to examine his/her cellular phone to determine if any text messages had been sent the previous day. A message was considered sent if it contained at least one character. In order to meet design standards, baseline for the initial participant contained a minimum of 5 sessions and the participant would not proceed to the intervention phase until stable baseline was established.

**Measure II.** During phase two of baseline, participants’ devices were examined to determine if they had received any messages. Baseline probe data were collected during phase two by examining participants’ phones/mobile devices to see if they had received traditional text messages and if they responded to said messages. All participants had received messages, but none had responded to the received messages. The received messages were recorded as baseline probes.

**Teaching and Treatment Procedures**

**Measure I.** During the intervention phase, participants were shown via demonstration and practice how to access the app. The initial step involved locating the icon for the app and then touching the icon to open the app. Once the app was open, the participants were shown how to send a message using the *EZPic2Txt* app. In order to send a message one draws a line on the touch screen from the image of the contact to the image of the pre-programmed message. This was then modeled for all participants three times.
After the use of the app was demonstrated three times, the participants were asked to use the app to send a message. Devices were powered down and the participants demonstrated that they could turn on the device, locate the icon for the app, open the app by touching the icon, and send a message to one of their contacts. During the first phase of the intervention data were collected on the frequency of the successful completion of unsolicited sent messages, the same as the intervention phase of experiment 1. Fidelity of implementation data were collected as described later in the chapter.

**Measure II.** During phase two, participants were sent four messages per session by the primary researcher that sought to illicit a response from them. Phase two data represents response rate to sent messages. Participants were sent the messages, “how are you doing?” and “where are you?” each message was sent twice daily, randomly between 8am and 5pm.

**Data Collection**

Daily, each of the participants’ devices was examined by the primary researcher so that data reports could be generated and sent via e-mail to the primary researcher, the same as experiment 1.

**Generalization Procedures**

In order to determine if participants were able to generalize the skills learned through use of the intervention, a generalization phase covering three sessions was included in the experiment. After the completion of both phases of the intervention, a fifth contact was added to the participants’ devices. This was done to determine if participants would generalize the skill by responding to messages sent by another contact.
The messages remained the same, and were sent randomly within the same time frame as during the intervention phase, measure II. The fifth contact was the program director. The director sent the same two messages that the primary researcher sent during the intervention phase, measure II, twice each message, daily over a period of three consecutive days.

**Maintenance Procedures**

As in experiment 1, to determine if participants did maintain skills over time a maintenance phase was included in the current study for both experiments. Two weeks after the completion of intervention and generalization phases, participants’ devices were accessed to generate data reports to determine if they continued to use the EZPic2Txt app. The maintenance phase consisted of two sessions.

**Validity and Reliability of Both Experiments**

In this section, the rationale and processes for establishing validity and reliability are outlined and discussed. Interobserver agreement and fidelity of treatment are established to ensure that confounding variables or researcher error are minimized. Social validity is assessed to determine how the intervention is perceived by participants, their families, and related support staff.

**Interobserver Agreement**

Interobserver agreement or interrater reliability is a process whereby two or more researchers independently score, observe, or rate a phenomenon, behavior, or permanent product and compare scores to determine similarities and differences in scoring (Creswell, 2012; Kennedy; 2005; Rolider, Iwata, & Bullock, 2012). There are multiple
methods used to calculate IOA, which include total agreement, exact agreement, interval agreement, etc. (Repp, Deitz, Boles, Deitz, & Repp, 1976; Watkins & Pacheco, 2000).

When a permanent product agreement is to be calculated, Kennedy (2005) states that total agreement is a good approach to use in calculating IOA. Additionally, he reports that while based in tradition and not science, the standard for an IOA score is 80% or higher. In single-case designs the number of sessions or permanent products included should at a minimum be 20% yet 33% is desired.

For both experiments, the same IOA scorer was used. The IOA scorer was a doctoral student in the field of education with five years of teaching experience in special education in the District of Columbia public schools. She was enrolled in a doctoral program in special education. The scorer was taught by the primary researcher how to read the data reports generated by the app. The scorer was also given the criteria for what constituted a sent/completed message, versus an attempted but unsent/uncompleted message. The criteria for categorizing messages by category, contact, and time of day was also taught to the IOA scorer. During the baseline phase of both experiments the IOA scorer independently examined participants’ devices to record traditional text messages sent by participants in experiment 1 and in experiment 2, measure I, and response to traditional text messages in experiment 2, measure II. Recordings of baseline data by the IOA scorer were compared to recordings made by the researcher. The agreement of reports was 100% for baseline data across both experiments. During the intervention phases, fifty percent of the data reports generated by each participants’ device were given to the IOA scorer to score independently. After the IOA scorer completed scoring the
data reports, they were compared to the corresponding data reports scored by the researcher. The data collection resulted in a permanent product so the total agreement formula of “$S \div L \times 100\%$ where $S$ is the smaller total and $L$ is the larger total” (Kennedy, 2005, p. 115) was utilized. The agreement on each of the data reports ranged from 96% to 100%, with an overall agreement of 98% across both experiments.

**Fidelity of treatment**

In order to help establish internal validity, it is necessary to measure fidelity of treatment. Fidelity of treatment is the process of monitoring the treatment and its implementation and then detailing the methods used to monitor the treatment (Smith, Daunic, & Taylor, 2007). This is an essential step in intervention research as it helps ensure that any measured change is a result of the intervention and not another confounding variable (Horner et al., 2005; Zvoch, 2012).

There are multiple ways of collecting data on and measuring treatment fidelity (Lane, Bocian, MacMillan, & Gresham, 2004; Swanson, Wanzek, Haring, Ciullo, & McCulley, 2013). Fidelity of treatment was measured by use of a checklist (O’Donnell, 2008). The treatment was broken down into component steps. A checklist was created, based on results from the pilot study and specific needs of the targeted population, to include each step in the treatment process in a specific order.

A fidelity of treatment checklist (Appendix G) was used to ensure that teaching procedures were the same for all participants in both pre-baseline and in app introduction sessions. In both experiments, an employee of the program, PSE program and semi-independent living facility, respectively, were given lesson protocols and copies of a
fidelity checklist. The fidelity checkers observed lessons in person and completed checklists to ensure procedures were followed. As the steps of the treatment were delivered, the fidelity checkers marked off the steps off of the list, ensuring that none of the essential elements of treatment lessons were missed. All of the treatment sessions (100%) were examined for fidelity via use of the checklist. A fidelity of treatment percentage score was calculated by dividing the number of steps completed by the number of steps detailed on the checklist and multiplying by 100. The fidelity of treatment score across experiments 1 and 2 was 99%.

Social Validity

When conducting intervention research one important consideration is the establishment of social validity (Gresham & Lopez, 1996; Schwartz & Baer, 1991; Wolf, 1978). Social validity helps establish the appropriateness and usefulness of the intervention. Wolf suggested that the work in his field, Applied Behavior Analysis, should be validated on three levels: goals, procedures, and outcomes. Goals: the social validity of the goal(s) of the research implies that from the onset of a study the aim of the research must be of value/use to greater society. Procedure: essentially this is a question of the process. Is the process or procedure of conducting the research appropriate, to all those involved and to answer the research questions. Effects: the end results are deemed acceptable to consumers, including unintended results.

Schwartz and Baer (1991) contend that establishment of social validity is a process that has two steps. The first step is making sure that an “accurate and representative sample” (p. 190) of participant/consumer thoughts, opinions, and ideas is
collected. Second, the opinions and ideas are used to maintain or improve viability of the program or intervention. Surveys, questionnaires, interviews, and focus groups are tools that can be used to establish social validity (Kazdin, 1977; Merriam, 2009; Patton 2002). Strain, Barton, and Dunlap (2012) examined five studies from their previous research to discuss the implications that social validity may have on future research. They concluded that choosing an intervention that has been previously socially validated and successful does not ensure that same success in a different time or place, and that measuring social validity is usually necessary to obtain successful outcomes for clients/consumers/participants. Lastly they suggest that practitioners may be more likely to implement and intervention with fidelity if they find it acceptable. Finn and Sladeczek (2001) also discuss the correlation between treatment acceptability and fidelity, they conclude there is a positively correlation.

Initially, messages were validated before being programmed into the EZPic2Txt app by asking participants’ contacts which messages would be most useful and by asking participants which messages would be most useful for them. Social validity for both experiments was assessed through qualitative interviews with the participants and participants’ contacts. Participants were asked if they liked using the EZPic2Txt app. Additionally, participants were asked if it was easy or difficult to use the app. Upon completion of data collection participant contacts were asked the following specific questions: What, if any, changes did they notice in the ways the participants communicated? Were the messages useful to you? All interviews with participants were
conducted face-to-face and participants’ contacts were asked the aforementioned questions via e-mail.

**Data Analysis**

Visual analysis is the most commonly used method for analyzing data from a single subject study (Gast, 2010). Researchers are afforded the opportunity to see trends in the data. Six features are examined in visual analysis: level, trend, variability, immediacy of the effect, overlap, and consistency of data. This level of analysis is conducted for each participant and across participants (Kratochwill et al., 2010).

According to Kratochwill et al. (2010) “‘Level’ refers to the mean score for the data within a phase. ‘Trend’ refers to the slope of the best-fitting straight line for the data within a phase and ‘variability’ refers to the range or standard deviation of data about the best-fitting straight line” (p. 18). The purpose of examination of the data within a phase is to illustrate a participant’s performance in regard to the independent variable.

Looking at data across phases, one examines overlap, immediacy of effect, and consistency of the data pattern. Data are examined across phases to further examine if there is and the strength of the functional relation between the independent and dependent variables. In order to determine overlap, one examines the data from each phase to determine if any points of datum from one phase are equal to any points from another phase. Describing immediacy of effect involves looking at the last three data points of one phase and the first three data points of the next phase. The level between the two sets of data points is used to determine immediacy of effect. And, consistency of the data pattern describes how the data from all of the same phases compares, for example one
looks at all baseline phases to determine consistency of the data pattern across all participants (Kratochwill et al., 2010).

**Percentage of Nonoverlapping Data**

In order to examine change from baseline to intervention phase percentage of nonoverlapping data (PND) was calculated to quantify the change (Scruggs, Mastropieri, & Casto, 1987). PND is calculated by first determining the range of data points in baseline. Then the data points in the intervention phase are counted. Then one must determine the number of intervention data points that do not extend over the range of baseline data points. To come up with a PND score, the number of data points that do not extend over the range of baseline are divided by the total number of data points and multiplied by 100 to obtain a percentage. This percentage is the calculation of non-overlapping data (Scruggs, Mastropieri, & Casto).

Ideally one hopes for 100% PND. The higher the PND the more effective the intervention is assumed to be for the specific participant. According to Scruggs and Mastropieri (1998) PND scores above 90% are generally considered very effective. If a PND score falls within the range of 70% to 90% the intervention is determined to be effective. A score in the range of 50% to 70% can be describes as questionable, while a PND score below 50% is described as ineffective.

**Study Design Criteria Applied to Both Experiments**

The four study design criteria outlined by Kratochwill et al. (2010) for the purpose of evaluating single case research designs are all met in the current study. The first criterion for single case design is that the intervention must be systematically
manipulated by the researcher. A multiple-baseline design across participants was used to stagger implementation of direct instruction in the use of the EZPic2Txt app for participants.

The second criterion for single-case designs is that dependent variables must be measured systematically over time and IOA agreement data should be collected in each phase for at least 20% of the data points with a score between 80 and 90% (Kratochwill et al., 2010). In this study, IOA agreement was assessed on 50% of the data reports in each phase and thusly exceeded the 20% minimum standard. The percentage of IOA in the current study exceeded the acceptable range of 80-90% with a score of 98%. For fidelity of treatment 100% of treatment checklist were examined for a fidelity score of 98%.

For single-case multiple-baseline designs the third criterion is that there needs to be at least three attempts to demonstrate the effect of the intervention and at least three different points in time or with three different phase repetitions. This study had two experiments, each with four tiers with one participant in each tier. The effect of the intervention was demonstrated at four points in time in each experiment since each participant began the intervention phase during different sessions. All participants had a baseline phase. The fourth design criterion for single-subject designs is that each phase must have at least three data points to qualify as an attempt to demonstrate an effect. There were at least five data points in each phase of the intervention (Kratochwill et al., 2010). The current study met design standards based on the criteria recommended by Kratochwill et al. for single-subject research.
Summary

Installation of the app on participants’ cellular phones, or other device with an activated cellular plan and instruction, via demonstration and practice, in the use of the app are the independent variables that were used in this study to see if they have an effect on the frequency of messages sent via text by the participants in experiment 1 and if the independent variables had an effect on the response rate to messages sent to participants in experiment 2. A multiple-baseline design was used across two experiments with four participants each. The eight participants were assigned to one of two concurrent experiments based on location, and then randomly assigned to tires in that experiment. Baseline was established to determine with what frequency, if at all, the participants made use of traditional text messaging technologies. Once stable baseline was established, for the first participant in each experiment, the intervention phase began. Participants in experiment 1 self-initiated messages while participants in experiment 2 sent messages and responded to messages sent to them. PND and visual analysis were used to examine the data. Maintenance and generalization data were also collected.
Chapter Four

In this chapter the results of a multiple-baseline single-subject research design study, investigating the effect that the EZPic2Txt communication app has on instances of unsolicited, independent expressive electronic communication and solicited, independent expressive electronic communication of young adults with moderate to severe ID and DD, are presented. The effects of instruction in use of the application, via demonstration and practice, and independent use of the application on expressive electronic communication attempts via modified text messaging technologies are reported based on the frequency of instances of completed electronic communication by category of messages sent, contact to whom the message was sent, and by time of day that the message was sent. Generalization and maintenance data are presented by category of message sent and by contact. Additionally, in the second experiment, intervention phase, measure II, the latency time of the participants’ responses to messages sent to them in order to elicit a response was reported.

Two independent experiments are the focus of this study. The first experiment examined participants’ instances of independent or unsolicited expressive electronic communication following introduction of the app; participants used the app to send pre-programmed messages to persons available from a menu of contacts. The second experiment focused on both unsolicited and solicited instances of electronic
communication via the app; participants sent unsolicited messages, in the intervention phase, measure I, and, in intervention phase, measure II, participants responded to messages that had been sent to them to elicit a response.

Eight participants with moderate to severe ID and DD participated in the two experiments in this study. The participants were divided into two groups of four based on programmatic location. At the time of the study four of the participants were enrolled in a postsecondary education program and four of the participants were living semi-independently with supports in a large metropolitan area. Within the two groups, participants were assigned to the four tiers of the intervention randomly. One participant was assigned to each tier.

In both experiments, potential participants were identified, informed consent was obtained, and baseline was established, and then the intervention phase began, followed by generalization and maintenance phases. Data are first presented graphically. Then data are presented as an aggregate of participants’ instances of completed electronic communication via use of the app, and then data are presented for each participant individually. Data were examined to look at the frequency of messages sent from each category of messages, by contact to whom the message was sent, the time of day messages were sent, and in the second experiment the latency period between a message being sent to elicit a response and the response. Data were also collected regarding participant perceptions of the usability of the intervention, satisfaction in regard to the intervention, and on participant communication patterns.
Intervention, generalization and maintenance data were collected via reports generated by the EZPic2Txt app. Data that are presented graphically are examined in regard to the six components of visual analysis: level, trend, variability, overlap, immediacy of effect, and consistency of data pattern in similar phases (Gast, 2010; Kazdin, 2011; Kratochwill et al., 2010) across participants.

**Experiment 1**

For experiment 1, the participants were taught about the uses and purposes of electronic communication, specifically text messaging. All participants had cellular phones that were capable of sending and receiving traditional text messages. In order to establish baseline it was necessary to ensure that all participants were aware of text messaging as a mode of communication, to be aware that their respective phones had such capabilities, situations were it would be appropriate to send text messages, and appropriate messages for different situations. The graphic results of experiment 1 are presented in Figure 20.
Figure 20. Experiment 1.

The number of unsolicited messages sent across baseline (*), intervention (■), generalization (○), and maintenance (■) across four young adults with moderate to severe intellectual and developmental disabilities.
Table 12 summarizes the mean and standard deviation for participants’ performance across all phases of experiment 1.

### Table 12

**Experiment 1: Unsolicited Messages**

<table>
<thead>
<tr>
<th>Participants</th>
<th>Baseline $M (SD)$</th>
<th>Intervention $M (SD)$</th>
<th>Generalization $M (SD)$</th>
<th>Maintenance $M (SD)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandra</td>
<td>0.00 (0.00)</td>
<td>2.77 (0.81)</td>
<td>2.67 (0.58)</td>
<td>2.00 (0.00)</td>
</tr>
<tr>
<td>Vanessa</td>
<td>0.43 (0.53)</td>
<td>3.35 (0.81)</td>
<td>3.00 (0.00)</td>
<td>2.50 (0.71)</td>
</tr>
<tr>
<td>Kate</td>
<td>0.78 (0.44)</td>
<td>3.50 (0.82)</td>
<td>3.33 (0.58)</td>
<td>3.00 (0.00)</td>
</tr>
<tr>
<td>Chris</td>
<td>0.00 (0.00)</td>
<td>2.19 (0.75)</td>
<td>2.00 (0.00)</td>
<td>2.00 (0.00)</td>
</tr>
<tr>
<td>Total</td>
<td>0.27 (0.23)</td>
<td>2.94 (0.51)</td>
<td>2.75 (0.00)</td>
<td>2.38 (0.18)</td>
</tr>
</tbody>
</table>

For baseline the mean of the group in Experiment 1 was 0.27 ($SD = 0.23$). Participants increased their average frequency of sent messages to a mean of 2.94 ($SD = 0.51$) during the intervention and generalized ($M = 2.75, SD = 0$) the skill immediately after intervention phase. All participants maintained an increased level of performance after two weeks of termination of the generalization phase ($M = 2.38, SD = 0.18$). The mean PND for all participants across all phases for experiment 1 was 100%.

**Sandra.** As seen in Figure 20, Sandra’s performance during the baseline phase on sending unsolicited messages was low ($M = 0.00, SD = 0.00$). Her performance indicates no trend or variability in the baseline condition and her performance was consistently stable. When the intervention was introduced, Sandra’s performance demonstrated an
immediate change in level from baseline ($M = 0.00, SD = 0.00$) to intervention phase ($M = 2.77, SD = 0.81$). Additionally, there was no trend in the data during the intervention phase, and the data had moderate variability. Sandra’s performance was higher in the intervention phase as compared to the baseline phase. The PND was calculated to be 100% from baseline to intervention phase for Sandra.

Sandra generalized sending unsolicited electronic communication instances via the app ($M = 2.67, SD = 0.58$) immediately following the intervention phase. The PND was calculated to be 100% from baseline to generalization and maintenance phases. Sandra maintained her performance at 100% PND two weeks after the intervention phase ($M = 2.00, SD = 0.00$).

**Vanessa.** Vanessa’s performance on sending unsolicited messages during baseline was low. There was no trend and slight variability in the baseline condition and her performance was relatively stable. When the intervention was introduced, Vanessa’s performance demonstrated an immediacy of change in level from baseline to intervention phase from ($M = 0.43, SD = 0.53$) in baseline to the intervention phase ($M = 3.35, SD = 0.81$). Following introduction of the intervention, no trend in her independent, unsolicited electronic communication instances was seen. The data showed moderate variability in the intervention phase. Vanessa’s performance was higher in the intervention phase as compared to the baseline phase. The PND was calculated to be 100% from baseline to intervention phase for Vanessa.

Vanessa generalized sending unsolicited electronic communication instances via the app ($M = 3.00, SD = 0.00$) immediately following the intervention phase. The PND
was calculated to be 100% from baseline to generalization and maintenance phases. Vanessa maintained her performance at 100% PND two weeks after the intervention phase ($M = 2.50$, $SD = 0.71$).

Kate. Kate’s performance on sending unsolicited messages during baseline was low. There was no trend and slight variability in the baseline condition and her performance was relatively stable. When the intervention was introduced, Kate’s performance demonstrated a change in level from baseline ($M = 0.78$, $SD = 0.44$) to intervention phase ($M = 3.50$, $SD = 0.82$). The data during the intervention phase did not reveal a trend. The data showed slight variability during the intervention phase, and there was an immediacy of change from the baseline phase to the intervention phase. The PND was calculated to be 100% from baseline to intervention phase for Kate.

Kate generalized sending unsolicited electronic communication instances via the app ($M = 3.33$, $SD = 0.58$) immediately following the intervention phase. The PND was calculated to be 100% from baseline to generalization and maintenance phases. Kate maintained her performance at 100% PND two weeks after the intervention phase ($M = 3.00$, $SD = 0.00$).

Chris. Chris’ performance on sending unsolicited messages during baseline was low. There was no trend and no variability in the baseline condition and his performance was stable. When the intervention was introduced, there was an immediacy of change. Chris’ performance demonstrated an immediate change in level from baseline ($M = 0.00$, $SD = 0.00$) to the intervention phase ($M = 2.19$, $SD = 0.75$). Data during the intervention phase did not reveal a trend. The data showed moderate variability. Chris’ performance
was higher in the intervention phase as compared to the baseline phase. The PND was calculated to be 100% from baseline to intervention phase for Chris.

Chris generalized sending unsolicited electronic communication instances via the app ($M = 2.00, SD = 0.00$) immediately following the intervention phase. The PND was calculated to be 100% from baseline to generalization and maintenance phases. Chris maintained his performance at 100% PND two weeks after the intervention phase ($M = 2.00, SD = 0.00$).

**Categories of Sent Messages**

Participants sent a total of 10 messages during baseline. During the intervention phase of experiment 1, participants sent a total of 219 messages. Sandra sent a total of zero messages in baseline and 61 messages during the intervention phase, Vanessa a total of three messages during baseline, she sent the messages “HeLO” and “call me” to her mother and “call Me” to a sibling, and 67 messages, Kate a total of seven messages during baseline, she sent the same message, “home now” on each occasion to a parent, and 56 messages during the intervention phase, and Chris sent a total of zero messages during baseline and 35 messages during the intervention.

As described in chapter 3, all intervention phase messages fit into one of four categories. Those categories were transportation, well-being, employment, and class status. Across participants 52 messages (23.74%) were sent regarding transportation. Fifty-seven messages (26.03%) were sent concerning well-being. In the employment category 37 (16.89%) messages were sent. And, in regard to class status 73 messages
(33.33%) were sent. Totals and percentages of messages sent in each category by each participant are presented in Table 13.

Table 13

*Intervention Phase Experiment 1: Number of Messages Sent by Category*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Transportation</th>
<th>Well-being</th>
<th>Employment</th>
<th>Class Status</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandra</td>
<td>6 (9.83%)</td>
<td>23 (37.70%)</td>
<td>11 (18.03%)</td>
<td>21 (34.43%)</td>
<td>61 (100%)</td>
</tr>
<tr>
<td>Vanessa</td>
<td>20 (29.85%)</td>
<td>8 (11.94%)</td>
<td>19 (28.36%)</td>
<td>20 (29.85%)</td>
<td>67 (100%)</td>
</tr>
<tr>
<td>Kate</td>
<td>11 (19.64%)</td>
<td>16 (28.57%)</td>
<td>6 (10.71%)</td>
<td>23 (41.07%)</td>
<td>56 (100%)</td>
</tr>
<tr>
<td>Chris</td>
<td>16 (45.71%)</td>
<td>10 (28.57%)</td>
<td>1 (2.86%)</td>
<td>8 (22.86%)</td>
<td>35 (100%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>52 (23.74%)</strong></td>
<td><strong>57 (26.03%)</strong></td>
<td><strong>37 (16.89%)</strong></td>
<td><strong>73 (33.33%)</strong></td>
<td><strong>219 (100%)</strong></td>
</tr>
</tbody>
</table>

**Messages sent by Contact**

As mentioned above, participants sent a total of 10 messages in baseline and 219 messages during the intervention phase of experiment 1. Participants could send messages to four different contacts during the intervention phase. Totals and percentages of messages sent to each contact by each participant are presented in Table 14.
Table 14

*Intervention Phase Experiment 1: Number of Messages Sent by Contact*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Primary Researcher</th>
<th>Mom</th>
<th>Sibling</th>
<th>Postsecondary Education Support Staff</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandra</td>
<td>11 (18.03%)</td>
<td>37 (60.66%)</td>
<td>8 (13.11%)</td>
<td>5 (8.2%)</td>
<td>61 (100%)</td>
</tr>
<tr>
<td>Vanessa</td>
<td>16 (23.88%)</td>
<td>29 (43.28%)</td>
<td>12 (17.91%)</td>
<td>10 (14.93%)</td>
<td>67 (100%)</td>
</tr>
<tr>
<td>Kate</td>
<td>12 (21.43%)</td>
<td>24 (42.86%)</td>
<td>15 (26.79%)</td>
<td>5 (8.93%)</td>
<td>56 (100%)</td>
</tr>
<tr>
<td>Chris</td>
<td>6 (17.14%)</td>
<td>11 (31.43%)</td>
<td>16 (45.71%)</td>
<td>2 (5.71%)</td>
<td>35 (100%)</td>
</tr>
<tr>
<td>Total</td>
<td>45 (20.55%)</td>
<td>101 (46.12%)</td>
<td>51 (23.29%)</td>
<td>22 (10.05%)</td>
<td>219 (100%)</td>
</tr>
</tbody>
</table>

**Messages sent by Time of Day**

The *EZPic2Txt* app records the time that each message was initiated, and if completed the time it was sent. The messages all fall within three general time categories. These categories are before school or work, this category includes messages sent before 8am and includes messages sent while at home or while en route to school or work, while on campus or at work, 8am to 5pm, and finally after work or school, after 5pm. Totals and percentages of messages sent by time of day are presented in Table 15.
Table 15

*Intervention Phase Experiment 1: Number of Messages Sent by Time of Day*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Before School/Work</th>
<th>While on Campus</th>
<th>After School/Work</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandra</td>
<td>6 (9.84%)</td>
<td>52 (85.25%)</td>
<td>3 (4.92%)</td>
<td>61 (100%)</td>
</tr>
<tr>
<td>Vanessa</td>
<td>21 (31.34%)</td>
<td>39 (58.21%)</td>
<td>7 (10.45%)</td>
<td>67 (100%)</td>
</tr>
<tr>
<td>Kate</td>
<td>11 (19.64%)</td>
<td>40 (71.43%)</td>
<td>5 (8.93%)</td>
<td>56 (100%)</td>
</tr>
<tr>
<td>Chris</td>
<td>1 (2.86%)</td>
<td>16 (45.71%)</td>
<td>18 (51.43%)</td>
<td>35 (100%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>39 (17.81%)</td>
<td>147 (76.12%)</td>
<td>33 (15.07%)</td>
<td>219 (100%)</td>
</tr>
</tbody>
</table>

**Generalization**

After the completion of the intervention, participant messages were changed to determine if they could generalize the skill by sending alternate messages. Contacts remained the same while the content of the messages was changed. The generalization phase consisted of three consecutive sessions.

During the generalization phase, participants sent a total of 33 messages. Generalization results are presented by category of messages and by contact. Results, raw scores and percentages, pertaining to the categories of sent messages and messages by contact person during the generalization phase are presented in Table 16 and Table 17 respectively.
**Generalization Experiment 1: Number of Messages Sent by Category**

<table>
<thead>
<tr>
<th>Participant</th>
<th>Lunch (Percentage)</th>
<th>Campus (Percentage)</th>
<th>Employment (Percentage)</th>
<th>Class Status (Percentage)</th>
<th>Total (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandra</td>
<td>2 (25%)</td>
<td>1 (12.50%)</td>
<td>1 (12.50%)</td>
<td>4 (50%)</td>
<td>8 (100%)</td>
</tr>
<tr>
<td>Vanessa</td>
<td>3 (33.33%)</td>
<td>2 (22.22%)</td>
<td>1 (11.11%)</td>
<td>3 (33.33%)</td>
<td>9 (100%)</td>
</tr>
<tr>
<td>Kate</td>
<td>3 (30%)</td>
<td>2 (20%)</td>
<td>2 (20%)</td>
<td>3 (30%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td>Chris</td>
<td>2 (33.33%)</td>
<td>2 (33.33%)</td>
<td>0 (0%)</td>
<td>2 (33.33%)</td>
<td>6 (100%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>10 (30.30%)</td>
<td>7 (21.21%)</td>
<td>4 (12.12%)</td>
<td>12 (36.36%)</td>
<td>33 (100%)</td>
</tr>
</tbody>
</table>

**Generalization Experiment 1: Number of Messages Sent by Contact**

<table>
<thead>
<tr>
<th>Participant</th>
<th>Primary Researcher (Percentage)</th>
<th>Mom (Percentage)</th>
<th>Sibling (Percentage)</th>
<th>Postsecondary Education Support Staff</th>
<th>Total (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandra</td>
<td>3 (37.50%)</td>
<td>2 (25%)</td>
<td>2 (25%)</td>
<td>1 (12.50%)</td>
<td>8 (100%)</td>
</tr>
<tr>
<td>Vanessa</td>
<td>1 (11.11%)</td>
<td>4 (44.44%)</td>
<td>2 (22.22%)</td>
<td>2 (22.22%)</td>
<td>9 (100%)</td>
</tr>
<tr>
<td>Kate</td>
<td>3 (30%)</td>
<td>3 (30%)</td>
<td>3 (30%)</td>
<td>1 (10%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td>Chris</td>
<td>2 (33.33%)</td>
<td>2 (33.33%)</td>
<td>1 (16.67%)</td>
<td>1 (16.67%)</td>
<td>6 (100%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>9 (27.27%)</td>
<td>11 (33.33%)</td>
<td>8 (24.24%)</td>
<td>5 (15.15%)</td>
<td>33 (100%)</td>
</tr>
</tbody>
</table>

**Maintenance**

After the generalization phase messages were changed back to the original set of messages for all participants. Maintenance data were collected two weeks after the completion of the generalization phase. Data were collected on two consecutive sessions. During the generalization phase, participants sent a total of 19 messages. Maintenance results are presented by category of messages and by contact. While messages were
changed back to the original set which were applicable to different circumstances throughout the day, before, during, and after being on campus, all messages in this phase were sent while participants were on campus. Results, raw scores and percentages, pertaining to the categories of sent messages and messages sent to particular contacts during the generalization phase are presented in Table 18 and Table 19 respectively.

Table 18

*Maintenance Experiment 1: Number of Messages Sent by Category*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Transportation</th>
<th>Well-being</th>
<th>Employment</th>
<th>Class Status</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandra</td>
<td>0 (0%)</td>
<td>3 (75%)</td>
<td>0 (0%)</td>
<td>1 (25%)</td>
<td>4 (100%)</td>
</tr>
<tr>
<td>Vanessa</td>
<td>0 (0%)</td>
<td>3 (60%)</td>
<td>0 (0%)</td>
<td>2 (40%)</td>
<td>5 (100%)</td>
</tr>
<tr>
<td>Kate</td>
<td>0 (0%)</td>
<td>2 (33.33%)</td>
<td>2 (33.33%)</td>
<td>2 (33.33%)</td>
<td>6 (100%)</td>
</tr>
<tr>
<td>Chris</td>
<td>2 (50%)</td>
<td>1 (25%)</td>
<td>0 (0%)</td>
<td>1 (25%)</td>
<td>4 (100%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2 (10.53%)</strong></td>
<td><strong>9 (47.37%)</strong></td>
<td><strong>2 (10.53%)</strong></td>
<td><strong>6 (31.58%)</strong></td>
<td><strong>19 (100%)</strong></td>
</tr>
</tbody>
</table>

Table 19

*Maintenance Experiment 1: Number of Messages Sent by Contact*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Primary Researcher</th>
<th>Mom</th>
<th>Sibling</th>
<th>PSE Support Staff</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandra</td>
<td>1 (25%)</td>
<td>2 (50%)</td>
<td>1 (25%)</td>
<td>0 (0%)</td>
<td>4 (100%)</td>
</tr>
<tr>
<td>Vanessa</td>
<td>1 (20%)</td>
<td>4 (80%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>5 (100%)</td>
</tr>
<tr>
<td>Kate</td>
<td>0 (0%)</td>
<td>3 (50%)</td>
<td>3 (50%)</td>
<td>0 (0%)</td>
<td>6 (100%)</td>
</tr>
<tr>
<td>Chris</td>
<td>0 (0%)</td>
<td>2 (50%)</td>
<td>2 (50%)</td>
<td>0 (0%)</td>
<td>4 (100%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2 (10.53%)</strong></td>
<td><strong>11 (57.89%)</strong></td>
<td><strong>6 (31.58%)</strong></td>
<td><strong>0 (0%)</strong></td>
<td><strong>19 (100%)</strong></td>
</tr>
</tbody>
</table>
Experiment 2

The intervention phase of experiment 2 consisted of two measures. Measure I, similar to experiment 1, examined the frequency of unsolicited messages sent by participants. Measure II data represents the response rate of participants to messages sent to them that sought to illicit a response.

Measure I

For experiment 2, measure I, baseline procedures and data collection methods were identical to those in experiment 1. During phase I of the intervention, data were collected on the frequency of the successful completion of unsolicited sent messages by category, contact, and time of day, the same as the intervention phase of experiment 1. The graphic results of experiment 2, measure I are presented in Figure 21.
Figure 21. Experiment 2, measure I.

The number of unsolicited messages sent across baseline (*) and intervention (■) phases across four young adults with moderate to severe intellectual and developmental disabilities.
For baseline during measure I of experiment 2 the mean of the group was 0.00 (SD = 0.00). Participants increased their average frequency of sent messages to a mean of 1.90 (SD = 0.49) during the first phase of the intervention with a PND score of 100%.

**Fares.** Fares’ performance on sending unsolicited messages during baseline for measure I was low. There was no trend and no variability in the baseline condition and his performance was stable. When the intervention was introduced, Fares’ performance demonstrated a change in level from baseline ($M = 0.00, SD = 0.00$) to intervention phase ($M = 1.59, SD = 0.50$). There was an immediacy of change from baseline to measure I of the intervention. The data showed stability, and slight variability. His PND score for measure I of the experiment was 100%.

**Winston.** Winston’s performance on sending unsolicited messages during baseline was low. There was no trend and no variability in the baseline condition and his performance was stable. When the intervention was introduced, Winston’s performance demonstrated an immediate change in level from baseline ($M = 0.00, SD = 0.00$) to intervention phase ($M = 2.04, SD = 1.24$). Winston’s data showed no trend in his independent, unsolicited electronic communication instances. His PND score for the intervention phase, measure I was 100%.

**Stephanie.** Stephanie’s performance on sending unsolicited messages during baseline was low. There was no trend and no variability in the baseline condition for measure I of the experiment and her performance was stable. When the intervention was introduced, Stephanie’s performance demonstrated a change in level from baseline ($M = 0.00, SD = 0.00$) to intervention phase ($M = 2.13, SD = 0.76$). There was an immediacy of
change from baseline to measure I of the intervention. The data showed slight variability. The PND score for phase I of the experiment was 100%.

**Lucia.** Lucia’s performance on sending unsolicited messages during baseline was low. There was no trend and no variability in the baseline condition and her performance was stable. When the intervention was introduced, Lucia’s performance demonstrated a change in level from baseline ($M = 0.00, SD = 0.00$) to intervention phase ($M = 1.89, SD = 0.47$). There was an immediacy of change from baseline to measure I of the intervention. The data showed moderate stability. The data did not show a trend. For the intervention phase, measure I of the experiment, the PND score was 100%.

**Categories of Sent Messages for Measure I**

During the intervention phase, measure I of experiment 2 participants sent zero messages during baseline and a total of 177 messages during the intervention phase. Fares sent a total of 43 messages, Winston sent a total of 51 messages, Stephanie sent a total of 49 messages, and Lucia sent a total of 34 messages. As described in chapter 3, all messages fit into one of four categories. Those categories were transportation, well-being, employment/day habilitation, and support group status. Totals and percentages of messages sent in each category by each participant are presented in Table 20.
Table 20

Experiment 2: Number of Messages Sent by Category for Intervention Phase, Measure I

<table>
<thead>
<tr>
<th>Participant</th>
<th>Transportation</th>
<th>Well-being</th>
<th>Employment/Day Hab. Status</th>
<th>Support Group Status</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fares</td>
<td>1 (2.33%)</td>
<td>27 (62.79%)</td>
<td>7 (16.28%)</td>
<td>8 (18.60%)</td>
<td>43 (100%)</td>
</tr>
<tr>
<td>Winston</td>
<td>24 (47.06%)</td>
<td>5 (9.80%)</td>
<td>10 (19.61%)</td>
<td>12 (23.53%)</td>
<td>51 (100%)</td>
</tr>
<tr>
<td>Stephanie</td>
<td>25 (51.02%)</td>
<td>15 (25.42%)</td>
<td>3 (6.12%)</td>
<td>6 (12.24%)</td>
<td>49 (100%)</td>
</tr>
<tr>
<td>Lucia</td>
<td>9 (26.47%)</td>
<td>6 (17.65%)</td>
<td>9 (26.47%)</td>
<td>10 (29.41%)</td>
<td>34 (100%)</td>
</tr>
<tr>
<td>Total</td>
<td>59 (33.33%)</td>
<td>53 (29.94%)</td>
<td>29 (16.38%)</td>
<td>36 (20.34%)</td>
<td>177 (100%)</td>
</tr>
</tbody>
</table>

Messages sent by Contact for Intervention Phase, Measure I

As mention above, participants sent a total of zero messages during baseline and 177 messages during measure I of experiment 2. A total of 71 messages (40.11%) were sent to the primary researcher. Twenty-eight messages (15.82%) were sent to parental contacts. Forty-nine messages (27.68%) were sent to participants’ siblings/cousin. A total of 29 messages (16.38%) were sent to participants’ residential aides. Totals and percentages of messages sent to each contact by each participant are presented in Table 21.
Table 21

*Experiment 2: Number of Messages Sent by Contact for Intervention Phase, Measure I*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Primary Researcher</th>
<th>Parent</th>
<th>Sibling/Cousin</th>
<th>Residential Aide</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fares</td>
<td>30 (69.77%)</td>
<td>5 (11.63%)</td>
<td>0 (0%)</td>
<td>8 (18.60%)</td>
<td>43 (100%)</td>
</tr>
<tr>
<td>Winston</td>
<td>8 (15.69%)</td>
<td>7 (13.73%)</td>
<td>25 (49.02%)</td>
<td>11 (21.57%)</td>
<td>51 (100%)</td>
</tr>
<tr>
<td>Stephanie</td>
<td>19 (38.78%)</td>
<td>4 (8.16%)</td>
<td>20 (40.82%)</td>
<td>6 (12.24%)</td>
<td>49 (100%)</td>
</tr>
<tr>
<td>Lucia</td>
<td>14 (41.18%)</td>
<td>12 (35.29%)</td>
<td>4 (11.76%)</td>
<td>4 (11.76%)</td>
<td>34 (100%)</td>
</tr>
</tbody>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>71 (40.11%)</td>
<td>28 (15.82%)</td>
<td>49 (27.68%)</td>
<td>29 (16.38%)</td>
</tr>
</tbody>
</table>

Messages sent by Time of Day for Intervention Phase, Measure I

The messages all fall within the same three general time categories as experiment 1. These categories are before day habilitation or work, while at day hab. or at work, and finally after work or day hab. Totals and percentages of messages sent by time of day are presented in Table 22.

Table 22

*Experiment 2: Number of Messages Sent by Time of Day for Intervention Phase, Measure I*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Before Day Hab./Work</th>
<th>While at Day Hab./Work</th>
<th>After Day Hab./Work</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fares</td>
<td>1 (2.33%)</td>
<td>22 (51.16%)</td>
<td>20 (46.51%)</td>
<td>43 (100%)</td>
</tr>
<tr>
<td>Winston</td>
<td>0 (0%)</td>
<td>26 (50.98%)</td>
<td>25 (49.02%)</td>
<td>51 (100%)</td>
</tr>
<tr>
<td>Stephanie</td>
<td>3 (6.12%)</td>
<td>18 (36.73%)</td>
<td>28 (57.14%)</td>
<td>49 (100%)</td>
</tr>
<tr>
<td>Lucia</td>
<td>6 (17.65%)</td>
<td>21 (61.76%)</td>
<td>7 (20.59%)</td>
<td>34 (100%)</td>
</tr>
</tbody>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>10 (5.65%)</td>
<td>87 (49.15%)</td>
<td>80 (45.20%)</td>
<td>177 (100%)</td>
</tr>
</tbody>
</table>
**Measure II: Solicited Messages**

Baseline probe data were collected during the baseline phase, measure II by examining participants’ phones/mobile devices to see if they had received traditional text messages and if they responded to said messages. During the treatment phase, participants were sent four messages per session randomly between the hours of 8am and 5pm that sought to illicit a response from them. Measure II data represents response rate to sent messages. Generalization and Maintenance data were also collected for measure II. The graphic results of experiment 2 are presented in Figure 21.
The number of solicited messages sent across baseline (●), intervention (x), generalization (Δ), and maintenance (x) phases across four young adults with moderate to severe intellectual and developmental disabilities.

*Figure 22. Experiment 2, measure II.*
During the intervention phase, measure II of the experiment, participants increased their average frequency of responding to messages from a baseline mean of 0.00 ($SD = 0.00$) to a mean of 3.07 ($SD = 0.55$) with an overall PND score of 97.18%. Participants generalized ($M = 3.42, SD = 0.14$) the skill immediately after intervention phase. All participants maintained an increased level of performance after two weeks of termination of the generalization phase ($M = 3.00, SD = 0.71$). The mean PND for all participants across all phases for experiment 2 was 98.91%. For measure II the response rate across all participants was 78.77%. There was also an increase in level for measure II of the experiment from baseline ($M = 0.00, SD = 0.00$) to intervention ($M = 2.86, SD = 0.47$).

**Fares.** Fares’ performance for measure II was higher in the intervention phase as compared to the baseline phase. There was no trend and no variability in the baseline condition and his performance was stable. His results demonstrated an immediate change in level from baseline ($M = 0.00, SD = 0.00$) to intervention ($M = 2.86, SD = 0.47$). Data during the intervention phase did not reveal a trend. The data showed slight variability. The PND was calculated to be 100% from baseline to intervention phases for Fares. His response rate for measure II was 71.59%.

Fares generalized responding to solicited (from the researcher) electronic communication instances via the app to responding to others’ messages ($M = 2.67, SD = 0.58$) immediately following the intervention phase. The PND was calculated to be 100% from baseline to generalization and maintenance phases. Fares maintained his
performance at 100% PND two weeks after the intervention phase ($M = 2.50$, $SD = 0.71$). Fares’ data has a PND score of 100% across all phases of experiment 2.

**Winston.** During the intervention phase, measure II of the experiment, Winston’s demonstrated an immediate change in level from baseline ($M = 0.00$, $SD = 0.00$) to intervention ($M = 3.50$, $SD = 1.00$). Data during the intervention phase did not reveal a trend. The data showed moderate variability. Winston’s performance was higher in the intervention phase as compared to the baseline phase. The PND was calculated to be 95.00% from baseline to the intervention phase for phase II for Winston. His response rate for phase II was 87.50%.

Winston was able to generalize responding to solicited (from the researcher) electronic communication instances via the app to responding to others’ messages ($M = 3.33$, $SD = 0.57$) immediately following the intervention phase. The PND was calculated to be 100% from baseline to generalization and maintenance phases. Winston maintained his performance at 100% PND two weeks after the intervention phase ($M = 3.00$, $SD = 0.00$). Winston’s data has a PND score of 98% across all phases of experiment 2.

**Stephanie.** During intervention phase, measure II of the experiment Stephanie’s performance demonstrated an immediate change in level from baseline ($M = 0.00$, $SD = 0.00$) to the intervention phase ($M = 3.06$, $SD = 0.54$). Data during the intervention phase did not reveal a trend. The data showed slight variability. Stephanie’s performance was higher in the intervention phase as compared to the baseline phase. The PND was calculated to be 100% from baseline to intervention phase for Stephanie. Her response rate was 76.39% for measure II.
Stephanie generalized responding to solicited (from the researcher) electronic communication instances via the app to responding to others’ messages ($M = 4.00, SD = 0.00$) immediately following the intervention phase. The PND was calculated to be 100% from baseline to generalization and maintenance phases. Stephanie maintained her performance at 100% PND two weeks after the intervention phase ($M = 3.50, SD = 0.71$). Stephanie’s data has a PND score of 100% across all phases of experiment 2.

**Lucia.** During the intervention phase, measure II of the experiment there was an immediate change in level from baseline ($M = 0.00, SD = 0.00$) to intervention ($M = 3.31, SD = 1.25$). Data during the intervention phase did not reveal a trend. The data showed moderate variability. Lucia’s performance was higher in the intervention phase as compared to the baseline phase. The PND was calculated to be 92.3% from baseline to the intervention phase for Lucia. Her response rate for measure II was 80.77%.

Lucia was able to generalize responding to solicited (from the researcher) electronic communication instances via the app to responding to others’ messages ($M = 3.67, SD = 0.58$) immediately following the intervention phase. The PND was calculated to be 100% from baseline to generalization and maintenance phases. Lucia maintained her performance at 100% PND two weeks after the intervention phase ($M = 3.00, SD = 1.41$). Lucia’s data has a PND score of 97.22% across all phases of experiment 2.

**Response Rate and Response Times (Latency) for Measure II**

The latency period between messages sent by the primary researcher and the response message sent by the participants is reported in this section. On average, participants in experiment 2, intervention phase, measure II took 33.2 minutes to respond
to messages; the range was between 1.5 minutes and 242.7 minutes. Across participants the response rate was 78.77%. Response rate and response times are presented in Table 23.

Table 23

*Experiment 2: Response Rate and Latency for Measure II*

<table>
<thead>
<tr>
<th>Participants</th>
<th>Number of Messages Sent to Participant</th>
<th>Number of Responses</th>
<th>Response Rate Percentage</th>
<th>Average Response Time in Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fares</td>
<td>88</td>
<td>63</td>
<td>71.59%</td>
<td>20.6</td>
</tr>
<tr>
<td>Winston</td>
<td>80</td>
<td>70</td>
<td>87.50%</td>
<td>57.2</td>
</tr>
<tr>
<td>Stephanie</td>
<td>72</td>
<td>55</td>
<td>76.39%</td>
<td>42.9</td>
</tr>
<tr>
<td>Lucia</td>
<td>52</td>
<td>42</td>
<td>80.77%</td>
<td>51.3</td>
</tr>
<tr>
<td>Total</td>
<td>292</td>
<td>230</td>
<td>78.77%</td>
<td>33.2</td>
</tr>
</tbody>
</table>

**Generalization and Maintenance**

After the completion of both phases of the intervention, a fifth contact was added to participants’ devices. This was done to determine if participants would generalize the skill of responding to messages sent by another contact. The messages sent remained the same, and were sent randomly within the same time frame as the intervention, between 8am and 5pm. The fifth contact added was the director of the support group and semi-independent living program. The director sent the same two messages that the primary researcher sent during intervention phase, measure II, twice each, daily over a period of three consecutive days. As a group, participants responded to 41 of the 48 messages sent to them during this phase for an average response rate of 85.42%. On average participants
took 24.7 minutes to respond to messages; the range was from 4.9 minutes to 90.8 minutes. Participant response rates and response times are presented in Table 24.

Table 24

*Experiment 2: Response Rate and Latency for the Generalization Phase*

<table>
<thead>
<tr>
<th>Participants</th>
<th>Number of Messages Sent to Participant</th>
<th>Number of Responses</th>
<th>Response Rate Percentage</th>
<th>Average Response Time in Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fares</td>
<td>12</td>
<td>8</td>
<td>66.67%</td>
<td>16.6</td>
</tr>
<tr>
<td>Winston</td>
<td>12</td>
<td>10</td>
<td>83.33%</td>
<td>28.6</td>
</tr>
<tr>
<td>Stephanie</td>
<td>12</td>
<td>12</td>
<td>100.00%</td>
<td>40.6</td>
</tr>
<tr>
<td>Lucia</td>
<td>12</td>
<td>11</td>
<td>91.67%</td>
<td>9.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>48</strong></td>
<td><strong>41</strong></td>
<td><strong>85.42%</strong></td>
<td><strong>24.7</strong></td>
</tr>
</tbody>
</table>

The director of the support group and semi-independent living program again sent the same two messages, twice each, two weeks after the generalization phase to participants, and a day later the primary researcher sent the same messages to determine if participants had maintained the skill of responding to messages that sought to elicit a response. Participants responded to 24 of 32 messages sent to them. For the group, the average response rate in the maintenance phase was 75.00%. The average response time was 20.3; the range was from 5.4 minutes to 42.5 minutes. Maintenance data are presented in Table 25.
Table 25

*Experiment 2: Response Rate and Latency for the Maintenance Phase*

<table>
<thead>
<tr>
<th>Participants</th>
<th>Number of Messages Sent by Director</th>
<th>Number of Responses</th>
<th>Number of Messages Sent by Primary Researcher</th>
<th>Number of Responses</th>
<th>Response Rate Percentage for Both Sessions</th>
<th>Average Response Time in Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fares</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>62.50%</td>
<td>20.8</td>
</tr>
<tr>
<td>Winston</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>75.00%</td>
<td>23.3</td>
</tr>
<tr>
<td>Stephanie</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>87.50%</td>
<td>21.5</td>
</tr>
<tr>
<td>Lucia</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>75.00%</td>
<td>15.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
<td><strong>14</strong></td>
<td><strong>16</strong></td>
<td><strong>10</strong></td>
<td><strong>75.00%</strong></td>
<td><strong>20.3</strong></td>
</tr>
</tbody>
</table>

**Social Validity: Experiments 1 and 2**

In an attempt to establish the social validity of the intervention, data were collected on participants’ attitudes toward the intervention using pre- and post-intervention participant interviews, interviews of participants’ parent or primary care giver, and anecdotal notes. All the pre- and post-intervention participant interviews were recorded and transcribed. Family member, parent or primary care giver interviews were conducted via e-mail by sending the questions out via e-mail, filled out by interviewees, and were e-mailed back to the primary researcher.

*Sandra.* In response to the interview questions (Appendix H), Sandra reported that she enjoyed using the app. She liked that she could text “like her sister.” She wanted to add “all of her friends” as contacts, and she wanted to add more messages. Before introduction of the intervention Sandra indicated that she knew about text messaging, but
that she did not send messages because it took too much time. In the pre-interview she also indicated that she would like to be able to send messages to her family.

Sandra’s mother indicated that she appreciated that the app allowed her to have more points of contact throughout the day with her daughter. Her mother indicated that when Sandra was on campus she tended to not call home to indicate when she had arrived or was leaving campus. She appreciated that Sandra could easily let her know when she was arriving and leaving campus, which she did via use of the app. Sandra’s mother said that while she really liked ability to have greater contact with her daughter throughout the day, “Sandra wanted to know when she could use it for more social communication with her friends.”

**Vanessa.** Prior to the introduction of the intervention Vanessa indicated that she never sent text messages. Looking at the history on her phone confirmed this. She had no history of any sent messages in her phone. She did however receive daily texts from her mother, the majority being one word, “CALL.” Vanessa said that when she got that message she was supposed to call her mom. During baseline, Vanessa did send a message on three out of seven sessions. She sent the same message on each occasion, “hi” to her brother. During post-intervention interviews, Vanessa indicated that she liked not having to call home so often because she did not like to have to call home when she was with her peers.

Vanessa’s mother indicated that she was pleased with the **EZPic2Txt** app because it gave her more piece of mind when Vanessa was away at school. She also indicated that she thought that the app was important for a variety of safety related issues. “If she is
sending me periodic messages during the day, I know she is okay. If something were to happen and she could not call me, she could send a message.”

Kate. During an interview session Kate indicated that she left her phone in a friend’s dorm room and was without it for two days during the intervention phase, data points 17 and 18. Which is why the app recorded zero messages for those sessions. In a pre-intervention interview session Kate demonstrated that she could and did send short text messages. Looking through her message history revealed that she received several messages a day, but responded to one a day at most, usually she responded to none. She indicated that she liked to get messages and she meant to send them, but she often forgot to respond to others’ messages. After the intervention, Kate stated that she liked using the app because it was easy.

Kate’s family lives out of state. The family indicated that they liked the fact that she could update them about her day and how she was doing without having to interrupt her day with a phone call. While Kate did send occasional texts, the family reported that there was a much greater frequency of messages coming from her after the app was installed. Kate indicated that the app was easy to use, and that she liked not having to worry about getting the right words down all of the time.

Chris. Initially, Chris did not know what text messaging was or how to send messages. He would receive calls on his phone, but would rarely make verbal responses. He would just listen to the caller, always a family member. He was very eager to learn about texting because he liked “using the phone, everybody has one to play games on.”
After the intervention phase Chris responded affirmatively when asked if he wanted to continue to use the app.

One of Chris’ siblings indicated that use of the app helped coordinate pick-up times when Chris was on campus. Chris could send a message when he was finished with activities, so if he finished earlier or later on a given day they could adjust the time when they went to get him. The sibling stated that, “we used to get him at the same time, but usually either we had to wait or he did. This makes things more convenient.”

**Fares.** In regard to traditional text messaging, Fares would use his phone receptively. He would receive one-word messages from his dad, brother, or residential aide. These messages were the contacts names and he knew to call his dad when “Dad” was the incoming message. In his repertoire were six names that he recognized and would then call back. Fares said that he enjoyed using the app because he “didn’t always have to call back. It was easy to respond.”

Fares’ father indicated that it was “nice to get a response right away, when he was in support group or at day hab. I didn’t have to wait for him to have free time to make a call. He could send me updates.”

**Winston.** Winston used the app on his iPad. This device along with VOCA software was used as his primary mode of expressive communication. Winston indicated that he liked using the *EZPic2Txt* app. He also indicated that he wanted to be able to compose messages like he did with his VOCA software. He indicated that it was easy to use as well; when asked the question directly he used his iPad to say “easy.”
Winston’s family members indicated that it was a, “pleasant surprise to be able to hear from him during the day. Generally we only can talk to him when we see him.” They noted that they were impressed with the system, but thought that it might be limiting for Winston since he could compose longer sentences on his iPad with VOCA software.

**Stephanie.** Stephanie reported that she, “wanted to send messages to everyone I know.” She also reported that the app was easy to use and that she enjoyed using it. Prior to the intervention Stephanie said that she never texted because it was, “hard to write.” Stephanie had no history of using expressive text messaging technologies prior to the intervention. She indicated that she liked being able to tell her cousin to come and get her rather than waiting for her cousin to arrive. “I send the get me message, she comes, it’s better.”

Stephanie’s cousin reported that it was nice to know if support group or another appointment ended early or later than expected. “I feel better knowing that she isn’t waiting around for me to come get her, if one of her meetings ends early.”

**Lucia.** Lucia reported that she liked using the app, and that it was easy to use. She did indicate that she did not like the computerized voice that gave auditory confirmation of messages sent or read aloud received messages. She said the voice was “funny and sounds like a robot.”

The residential staff where Lucia lives report that not only does she continue to use the app, but she also writes notes and draws pictures sends them to all the residents in her building. “She never did that before, she talks a lot more too.” Lucia’s mother and
sister both report that that she is more communicative as well. Her sister reported that, “she is more willing to engage when someone, anyone talks to her.”

**Summary**

Increased communication skills are positively correlated to a variety of benefits for all individuals including those with significant intellectual and developmental disabilities (Collins, 2009; Snell & Brown, 2011). All of the participants in this study were able to increase instances of independent electronic communication via the use of the app. In experiment 2, participants were able to respond to messages sent to them via the app. Prior to this study none of the existing few studies on modified text messaging technologies for this population included social validity, participant levels of satisfaction with the technology, generalization of skills acquired, and maintenance of acquired skills.

This study adds to the body of literature that indicates that individuals with moderate to severe ID and DD can increase levels of independent expressive and receptive communication instances via the use of modified text messaging technologies. Additionally, participants were able to generalize and maintain learned skills. While this research shows promise, continued research needs to identify effectiveness of the intervention of a larger swath of the population of persons with moderate to severe ID and DD.
Chapter Five

The purpose of this study was to investigate the relationship between instruction, via demonstration and practice, in and use of the EZPic2Txt app and instances of expressive, independent electronic communication in individuals with moderate to severe ID and DD. Specifically, was there a functional relation between the independent variable and the change documented in the dependent variable? The study consisted of two concurrent independent experiments that utilized a multiple-baseline single-subject research design. The first experiment examined participants’ unsolicited instances of independent expressive electronic communication following introduction of and direct instruction in the use of the app. This experiment had a sample of four young adults with moderate to severe ID and DD who were enrolled in a postsecondary education program. The second experiment examined both participants’ unsolicited and solicited instances of independent expressive electronic communication following introduction of and direct instruction in the use of the app. The second experiment had a sample of four young adults with moderate to severe ID and DD who lived semi-independently with supports. Additionally, attitudes and perceptions of the participants related to the intervention were also examined.

Specific research questions for experiment 1 were:
1. Is there a functional relation between use of the EZPic2Txt app, and an immediate increase in level of frequency of self-initiated electronic communication instances amongst young adults with moderate to severe ID and DD?

2. Are participants able to generalize and maintain the skills learned through application of the intervention?

Experiment 2 sought to investigate the same two questions as experiment 1, with the addition of a third research question:

3. Is there a functional relation between use of the EZPic2Txt app, and an immediate increase in the response rate to received messages amongst young adults with moderate to severe ID and DD?

The results of both experiments in this study reveal that young adults with moderate to severe ID and DD do benefit from direct instruction in the use of text messaging technologies and do increase instances of expressive, electronic communication via use of the EZPic2Txt app. The study’s major findings are presented in this chapter; evidence standards for single subject research were applied to these findings and presented here. Additionally, a discussion of participant attitudes and perceptions is presented in this chapter. Limitations of the current study and implications for future practice are also discussed.

Major Findings, Experiment 1 and Experiment 2 (Measure I)

In experiment 1, messages were examined by frequency and category, contact, and time of day. A total of 219 messages were sent during the intervention phase of experiment 1. In experiment 2, measure I messages were also examined by frequency,
category, contact, and time of day. During the intervention phase of measure I, a total of 177 messages were sent by participants.

**Messages, Frequency and Category**

The frequency of messages sent indicates that, when compared to baseline, the intervention did have a positive effect on the number of messages sent. When looking at messages sent by category during the intervention phase, the majority of messages sent were in the class status category or well-being category with transportation and employment messages sent less frequently. For Sandra, for example, the intervention phase consisted of 22 days where Sandra was involved in activities related to the PSE program. According to Sandra’s schedule she was in class, either a university course or a class related to programming for the PSE program, each of those 22 days. Out of 22 days that she had class, she sent a message indicating that she arrived to class on 21 of those days. During that same period she was scheduled for work 10 of those days. On one workday she sent a message that she was at work twice, one right after the other. Every other workday during that period she sent the message that she was at work once a day, for a total of 11 messages. In regard to the message concerning well-being, Sandra sent that message once every day, except one day where she sent the message twice approximately five hours apart, for a total of 23 messages in this category. And, finally, in regard to the message concerning transportation, Sandra only sent that message on six separate days.

One of the participants in experiment 1 forgot her device in a friend’s dorm room over the course of two days. Rather than record zero sent messages for those days, this
was treated as a break in the data. It was not possible for the participant to send messages on those days. Mobile devices, being portable and relatively small, can be misplaced, and misplacing a device is something that happens across all populations of mobile device users (Porath, 2011).

In experiment 2, measure I, as in experiment 1, the frequency of messages sent indicates that, when compared to baseline, the intervention did have a positive effect on the number of messages sent. When looking at messages sent by category, the majority of messages sent were in the transportation and well-being categories, and support group status and employment/day hab. status. Winston’s results, for example, corroborate this pattern. The intervention phase of measure I consisted of 25 days where Winston was either involved in activities related to his day habilitation program or his support group. During that time period, he sent 24 messages related to transportation. During this phase, Fares sent five messages concerning well-being. Winston’s schedule indicated that he was scheduled to be at his day habilitation program for 23 of those days, but he only sent 10 messages indicating that he was at day hab. He was scheduled to be in attendance at his support group eight times during this phase of the intervention, and he sent at least one message indicating that he was at support group on each occasion while sending two messages that he was in support group on four out of eight of the sessions for a total of 12 messages sent in this category.

It is possible that the procedural nature of the messages can account for the number of messages sent in each category as well as frequency. On any given day the participants in experiment 1 might attend several classes, there are at least two
opportunities to indicate when one is going to or leaving campus, while participants go to work only once during a workday. The results of experiment one suggest that the messaging is contextual in nature, similar to text message usage in the general population (Porath, 2011). The content of text messages sent by teenagers and young adults are reflective of their locations throughout the day (Faulkner & Culwin, 2005; Thurlow, 2003). The participants in experiment 2 were accessing transportation multiple times a day, and were in support group more frequently than they were at work or day hab. It appears that opportunity and location do play a role in determining the types of messages that people send.

**Unsolicited Messages Sent by Contact**

When looking at messages sent by contact in experiment 1, the majority of messages were sent to familial contacts. Harrison and Gilmore (2012) found that 91.1% of college students in their study \((n = 102)\) utilized text messaging “to report to your family where/how you are?” However, the contact ‘Mom’ received almost twice as many messages as ‘Sibling,’ 101 messages versus 51 messages respectively. This is inconsistent with the findings of Crosswhite, Rice, and Asay (2014) who examined texting patterns of young adults aged 18-24 years old in the United States. Their research \((n = 127)\) found that young adults texted their parents and siblings with nearly the same frequency. The researcher received almost as many messages as the sibling contact with the PSE support staff receiving about half of that. It is possible that the PSE support staff and the researcher received the least amount of messages because they had daily
interaction with the participants. There was opportunity to discuss daily schedules and well being in person without the need for text messaging.

Conti-Ramsden, Durkin, and Simkin (2010) in examining language and social factors in use of mobile phones by adolescents with and without speech language impairment (SLI) speculate that those adolescents with SLI do have more frequent contact with their parents than their peers without SLI. The adolescents in the study were more likely to agree with the statement, “cell phones are important for my personal safety.” In this study, participants were more likely to send a message to a parent that other contacts.

In terms of messages sent to specific contacts for experiment 2, measure I, the majority of messages were sent to the primary researcher. When asked why this might be the case, the director of the support group stated that, “it’s the novelty factor, you are a new person and that’s interesting.” Making new friend and acquaintances is a motivating factor for sending text messages for young adults (Morrill, 2013). Social motivation and social factors do play an important role in the frequency of use of text messaging technologies. Also, social motivation factors do play a role in determining whom young adults do text (Conti-Ramsden, Durkin, & Simkin, 2010). A content analysis of 544 first-year college students categorized messages into one of nine categories (Thurlow, 2003) and found that the majority of messages, 23%, sent by these college students fell into the “Friendship maintenance” category.

In Battestini, Setlur, and Sohn (2010) participants made contact with 47 different individuals. However, those participants made regular and frequent contact with only five
contacts. In these two concurrent experiments, participants were limited in the numbers of contacts, four, that they could choose from to send a message. While further exploration of the idea that individuals maintain regular and/or frequent contact with a small number of contacts via text messaging when compared to their respective pools of contacts, it is difficult to corroborate that finding in this study given the limited number of contacts available to participants. Yet, even the limited data gather from the current experiments reveals that participants do seem to favor certain contacts.

**Messages by Category Time of Day**

Looking at the time of day the messages were sent, four and a half times more messages were sent while participants were on campus than after school or work and four times more that before school or work. This may be a limitation of the procedural nature of the messages. Given the content of the messages in experiment 1, there were more opportunities to send messages while participants were on campus. Kate, for example, sent 40 of a total of 56 messages while on campus; of those 40 messages, 29 related to employment or class status which were only relevant while she was on campus. She sent 11 messages before school, which were all “I’m going to campus” and only appropriate at that time. The only message programmed into her device that was appropriate for any time of day was “Everything is okay; I’m fine.” She sent this message 11 times while on campus and five times after school or work.

Similar findings were found for experiment 2, measure I. The majority of messages were sent while participants were either at work/day hab. or after work/day hab. when the majority of the participants’ daily activities were taking place. In addition
to the aforementioned procedural and contextual nature accounting for the bulk of messages being sent during the time when participants were either at work/day hab. or after work/day hab. the population of “young adults are the most likely to send and receive mobile text messages throughout the day” (Experian Marketing Services, 2013, p. 103).

**Major Findings, Experiment 2 (Measure II)**

For measure II, where a total of 230 of 292 messages were responded to by participants, frequency of responses and response time or latency were examined.

**Response Rate and Latency**

In experiment 2, measure II messages were analyzed by number of responses and latency. Participants did respond to the majority of messages sent to them with average latency time being 33.2 minutes. Rettie (2009) contends that SMS, or text messaging, is a near-synchronous medium, and as such quick responses are expected. Crosswhite, Rice, and Asay (2014) found that amongst their study’s participants, “the majority respond within five minutes” (p. 76). While these findings are at odds with findings in the current study, messages sent to participants during measure II were sent during the day while participants were at work/day hab. so it is possible that work related tasks in which they were engaged prevented them form responding immediately.

Porath (2011) contends “Few people send a text message without expecting a response, yet unlike face-to-face communication, the response may not be immediate” (p. 90). While the majority of messages were responded to during the intervention phase of experiment 2, measure II there were sessions where participants responded to few or none
of the messages sent to them on a particular day. In this experiment there was a 78.77% response rate to messages sent to elicit a response.

There are several factors that might account for this level of response. Individuals do not always maintain immediate access to their phones or mobile devices. People, young adults in particular, are adept at multitasking on their mobile devices (Porath). While carrying on a text messaging conversation, an individual might be engaged in other activities on the device, which might account for an increase in the response time of text messages. In this experiment, participants were in situations where they were, at times, not able to respond to text messages until later in the day. For example, if a participant was at work or attending support group, an immediate response to a text message would not be possible. Lack of interest in the message is also a possible factor that might account for the response rate and latency seen in this experiment.

**Literacy for Communicative Purposes and Socialization**

In the past, conceptions of literacy often excluded the modes of communication that can be most appropriate for individuals with moderate to severe ID and DD. As mentioned in chapter 2, the process of writing is defined as an action that “involves constructing meanings by choosing and arranging symbols and understanding how these meanings change as a result of audience, context, and purpose” (Van Kraayenoord, Moni, Jobling, & Ziebarth, 2002, p. 36). Using this definition of writing, the participants in both experiments were able to write by selecting and sending a message to a given contact. The baseline phase of experiment 1 and experiment 2, measure I, demonstrated that these individuals were minimally using their mobile devices to engage in writing. However,
after the introduction of an authentic digital literacy activity (Ruppar, 2013), modified
text messaging, participants did immediately increase instances of independent electronic
communication.

Cihak et al. (2015) surmised that individuals with disabilities need to learn how to
use pervasive technologies or risk the possibility of increased isolation. Increasing
literacy skills has the potential to increase social circles and thusly opportunities for
socialization (Forts & Luckasson, 2011). When discussing the app with participants after
the generalization and maintenance phases, they indicated that they would like to use the
app for socialization. Socialization is a motivating factor for using instant and text
messaging technologies due to ease of use and popularity of the modality; the 2014 works
of Shpigelman and Gill show that persons with disabilities on social media platforms
have the same motivations and perform in a manner consistent with the general
population.

The results of these experiments indicate that increasing access, via adaptations or
modifications, to traditional technologies enables persons with moderate to severe ID and
DD to increase opportunities to enhance digital literacy and rates of communicative
instances. All participants in both experiments were able to independently utilize the
EZPic2Txt app to send messages, and participants in experiment 2 were able to respond
to messages. This corroborates the earlier research considering the use of modified
messaging systems by individuals with more significant disabilities. The studies
conducted by Lancioni et al. (2010), Lancioni et al. (2011), Lancioni et al. (2012a),
Lancioni et al. (2012b), and Lancioni et al. (2013), and the current research study
demonstrate that individuals with moderate to severe ID and DD can gain the skills required to become fluent digital communicators. Reading and writing with the specific purpose of electronic communication are elements of authentic digital literacy (Ruppar, 2013). The abilities to communicate expressively and receptively have positive results and an increase in personal autonomy (Cohen, Allgood, Heller, & Castelle, 2001). “With the advancement of technology, accessibility features, and user-friendly design, people with ID can participate as active members of a digital society” (Cihak et al., 2015, p. 169).

**Participant Satisfaction, Both Experiments**

The data from the interviews indicated that all participants responded well to direct instruction in and use of the EZPic2Txt app. Additionally, All eight participants expressed ease of use of the EZPic2Txt app, and satisfaction with using the app. These results represent some of the first findings in regard to participant satisfaction and attitudes toward modified text-messaging and instant messaging technologies designed for use by persons with moderate to severe ID and DD. Participants’ family members and support staff also reported positively on outcomes of the intervention. Winston’s caregivers did mention that this current app might be a bit limiting for Winston as he could compose longer and more varied sentences on his iPad with his VOCA software. The app, once programmed with messages cannot be changed unless it is reprogrammed with new messages. This might be limiting to someone such as Winston who can type longer and varied phrases on his current device. Sandra wanted to add all of her friends as contacts. The messages used in this experiment were all procedural, so a future
experiment might center on using this app for messages that are more social in nature. While participant satisfaction is a major consideration as individuals are more apt to use the technologies when they deem them significant and have ease of use (Kagohara et al., 2012), the nature of communication being reciprocal and the procedural nature of the messages and contacts implies that both parties, in this case the participant and his/her family members or support staff, also find the intervention significant.

**Evidence Standards by Research Question**

The findings can be evaluated in accord to Kratochwill et al.’s (2010) evidence of effectiveness criteria since the study meets design standards, as discussed in chapter 3. In experiment 1 four out of four participants increased their level of frequency of independent expressive electronic communication, and in experiment 2, measure I four out of four participants increased their level of frequency of independent expressive electronic communication, this indicates that there is strong evidence that there is a functional relation between direct instruction in and use of the EZPic2Txt app and increasing instances of expressive electronic communication for persons with moderate to severe ID and DD. So, in regard to research question 1: is there a functional relation between use of the EZPic2Txt app, and an immediate increase in level of frequency of self-initiated text responses amongst young adults with moderate to severe ID and DD? It appears there is evidence of a strong functional relation. Participants were able to increase instances of independent electronic communication via use of the app.

In experiment 2, not only did four out of four participants increase their instances of expressive electronic communication via use of the EZPic2Txt app, but results show a
Immediate increase in the response rate to received messages as well. So, in regard to research question 2, is there a functional relation between use of the EZPic2Txt app, and an immediate increase in the response rate to received messages amongst young adults with moderate to severe ID and DD? This research shows that there is evidence of a strong functional relation. Participants did not readily respond to text messages before introduction of the independent variable, but did readily respond after introduction of the intervention.

In regard to research question 3, are the young adults who receive the intervention able to maintain and generalize the skills acquired through the intervention if there is a functional relation between use of the EZPic2Txt app, and an immediate increase in level of frequency of self-initiated text responses and a functional relation between direct instruction in the use of the EZPic2Txt app, and an immediate increase in the response rate to received messages amongst young adults with moderate to severe ID and DD? There is evidence that all eight of the participants were able to generalize and maintain the skills learned through the intervention.

**Limitations and Future Research**

While the results of the current study are promising, the findings need to be discussed while considering several limitations. The first limitation is that the current study only had eight participants, four for each experiment. This limits generalizability of the findings to a larger group (Gast, 2010; Kazdin, 2011). Additional research is needed to determine if the same results can be replicated across a larger pool of participants.
A second limitation of the study was that touch screen technology and voice output were embedded within the app itself. It was therefore difficult, if not impossible, to determine the effectiveness of these features independently. Indeed none of the features of the app can be examined independently as the app comes as a package with all features embedded.

A third limitation of the study was that no other studies have been conducted on using the using the EZPic2Txt app to increase instances of independent electronic communication and to increase the response rate of those participants that are sent solicited messages. While the results of this study are promising, further research is needed to determine if other teaching strategies could be used to deliver instruction in use of the app. A variety of teaching methodologies and strategies could be tried to find the most successful way of delivering direct instruction in use of the app.

A fourth limitation of the study is the age of participants. Participants in experiment 1 and experiment 2 were all relatively close in age. The potential of the EZPic2Txt app to aide in the communication skills of both younger and older individuals with moderate to severe ID and DD is warranted.

A fifth limitation for experiment 2, specifically, was that participants were only measured on their response rate to the primary researcher for measure II of the intervention and to one other individual for maintenance and generalization phases. Increasing the number of individuals who sent messages to participants to elicit a response would be a way to determine if the participants were able to fully distinguish
between contacts or if they were simply responding to messages received without regard to that sent them.

A sixth limitation of the study is that, while latency was calculated in experiment 2, measure II, no direct observation of participants was conducted to determine the cause of latency. Were participants receiving messages at inopportune times in their respective daily schedules, and thusly unable to respond to messages quickly? Direct observation would help answer this question. Additionally, it is not known if others were prompting participants to respond during measure II; it is possible their peers or other individuals were reminding or encouraging participants to respond.

A seventh limitation is that some of the participants used picture symbols with accompanying text, some used pictures with accompanying text, some used pictures without text, and some used picture symbols without text for the icons for messages and participants on their respective touch screen devices. A future study could standardize the icons used across participants to test if the format of the icon has any impact on results.

An eighth limitation is that the majority of the messages in both experiments were procedural in nature. Motivation to use the device and communicate about procedural aspects of ones’ day might be of limited interest to some participants. A study utilizing a majority of messages that were social in nature is worth exploring. While the procedural messages do address safety and pragmatic concerns, opportunities for socialization and leisure are limited.
Implications for Future Practice

According to the 2013 Digital Marketer published by Experian, 85% of all Americans over the age of six own a cellular phone. “During a typical month, smartphone owners ages 18 to 24 send 2,022 mobile text messages and receive another 1,831, for a combined total of 3,853 texts sent and received.” p. 99. The popularity of smart phones has permeated our culture and transformed the communicative landscape. As more and more young adults communicate via text/instant messaging on mobile devices, individuals without access and the skills to use the devices will miss opportunities for socialization with their same age, non-disabled peer group. According to Lenhart (2012) 75% of all teens text, in 2012 the typical teen (age 12-17) was sending 60 texts a day. Without access to text/instant messaging technologies that are modified to meet the needs of the population by including voice output and picture/picture symbol vocabularies, individuals with moderate to severe ID and DD are potentially, daily missing out on many opportunities for interaction and communication.

This current study has implications for practitioners who work with individuals with moderate to severe ID and DD in PSE settings, day habilitation programs, and assisted living facilities. Incorporating age appropriate and new technologies is a way to teach new and reinforce existing communicative skills. Results of this study corroborate earlier research that indicates that individuals with moderate to severe ID and DD can acquire new technology related and communication related skills that can be generalized and maintained over time (Collins, 2007; McDonnell, Hardman & McDonnell, 2003; Snell et al., 2010; Snell & Brown, 2011). Use of the EZPic2Txt app has the potential to
aid in increasing the independent electronic communication instances of participants. And, as discussed earlier, there are several positive outcomes that are correlated to increasing the communication skills of individuals with ID and DD. These include, but are not limited to increasing levels of personal safety, inclusion, socialization, and levels of independence (Cohen, Allgood, Heller, & Castelle, 2001; Collins, 2007).

Conclusions

Technological advances are enabling individuals with moderate to severe ID and DD the ability to access modes of communication to which they traditionally did not have access (Snell, Chen & Hoover, 2006). All individuals have the need and right to communicate (TASH, 2004). The EZPic2Txt app may indeed assist individuals with more significant disabilities in increasing their levels of independent electronic communication, and independent communication overall. Prior to this study there was no analysis of social validity and participant satisfaction in regard to modified text messaging systems and their use by individuals with moderate to severe intellectual, developmental, and multiple disabilities. This study provides evidence that these individuals can improve independent electronic expressive and receptive communication skills when given instruction in the use of and access to EZPic2Txt app. Participants were able to generalize and maintain the skills they learned. The present study adds to the limited literature on modified text messaging technologies for persons with moderate to severe ID and DD. However, more research is needed to examine how other age groups and individuals with a variety of other disabilities respond to use of the EZPic2Txt app.
Appendix A

IRB Approval

Office of Research Integrity and Assurance
George Mason University

DATE: September 11, 2013
TO: Michael Behrmann
FROM: George Mason University IRB
Project Title: [509373-1] Modified Text Messaging Study
SUBMISSION TYPE: New Project
ACTION: APPROVED
APPROVAL DATE: September 11, 2013
EXPIRATION DATE: September 10, 2014
REVIEW TYPE: Expedited Review
REVIEW TYPE: Expedited review category #7

Thank you for your submission of New Project materials for this project. The George Mason University IRB has APPROVED your submission. This submission has received Expedited Review based on applicable federal regulations.

Please remember that all research must be conducted as described in the submitted materials.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by the IRB prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to the Office of Research Integrity & Assurance (ORIA). Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed if applicable.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to the ORIA.

The anniversary date of this study is September 10, 2014. This project requires continuing review by this committee on an annual basis. You may not collect data beyond this date without prior IRB approval. A continuing review form must be completed and submitted to the ORIA at least 30 days prior to the anniversary date or upon completion of this project. Prior to the anniversary date, the ORIA will send you a reminder regarding continuing review procedures.
Appendix B

Participant Recruitment E-mail

Recruitment e-mail (participants):

Hello:

I am looking to conduct a study on an app designed to help people text and send messages. The reason for this research is to discover how a communication app, that helps people text, works. Participants shall be asked to have the app installed on their phones and shall be taught how to use the app. Researchers shall then look at the phones to record the number of messages sent using the app. This shall occur over a three-week period. Please respond to this e-mail if you are interested in participating. Thank you!

I am a Ph.D. student in the Graduate College of Education at George Mason University.

Thank you,

-David Lojkovic
Ph.D. Student, George Mason University
College of Education and Human Development
dlojkovi@gmu.edu

Approval for the use of this document
EXPIRES
SEP 10 2014
Protocol # 508273-1
George Mason University
Appendix C

Participant Consent Form

CONSENT FORM (Participants)

RESEARCH PROCEDURES

The reason for this research is to learn how an app, that helps people text, works. You will be asked to have the app put on your phones and learn how to use it. I will then look at the phones to record the number of messages sent using the app. This will happen over a three-week period. I shall only be reading/counting the text messages sent from your phone to your parent.

RISKS AND BENEFITS

Nothing bad will happen to you if you participate in this study. There are no rewards or money being paid for this study. You may choose not to continue to participate at any time. I hope that participation in the study shall help increase your communication skills.

CONFIDENTIALITY

Your name and identity will remain confidential. No one but me shall know who you are.

CONTACT

My name is David Lojkovic. I am a student at George Mason University who is working on my Ph.D. in Education. I may be reached at 646- for questions or to report any problems. You may also contact Dr. M. Behrman of the College of Education at (703). And, you may contact the George Mason University Office of Research Integrity & Assurance at 703-993-1121 if you have questions or comments regarding your rights as a participant in the research.

This research has been reviewed according to George Mason University procedures governing your participation in this research.

Consent:

I have read this form and agree to be part of the study, and to have the app added to my cell phone.

Yes ________

No ________

Signature: ___________________________________________ Approval for the use of this document EXPIRES SEP 10 2014

George Mason University

Protocol #2013-73-1
Appendix D

Parent/Legal Guardian Consent Form

INFORMED CONSENT FORM: Parent/Legal Guardian

RESEARCH PROCEDURES
The purpose of this project is to test the usability of a communication app (the app is a form of modified text messaging) for adults with disabilities. After obtaining consent, I shall have the app installed on the students' phones. The app can record the number of the messages sent. Your child shall receive direct instruction in the use of the app. Direct instruction shall occur over three days, one session per day of approximately 30 minutes. After instruction occurs, the students shall use the app independently, and researchers shall look at the phones to collect data on accuracy and number of messages sent. Researchers shall record the data daily over a period of approximately three weeks. I ask that you provide a picture of yourself. The picture can be programmed into your child's phone so that they can identify you as a contact to send you messages. I shall be only be reading/counting the text messages sent from your child to you.

RISKS
There are no foreseeable risks for participating in this research.

BENEFITS
There are no benefits to your child if he/she does or doesn't participate. However, the goal is to increase their levels of independent communication via the use of this app.

CONFIDENTIALITY
The data in this study will be confidential. No one but me shall have access to the data and student phones to check and record data. Once the researchers receive the participant consent forms the primary investigator will assign a code for each participant. The primary investigator will require that all data that is recorded correspond to the participant's research code instead of the participant's name. Data forms will contain the code and not names. Only the primary investigator will know the correlation between the research codes and the participants' names.

PARTICIPATION
Your child's participation is voluntary, and you may withdraw your child from the study at any time and for any reason. If you or your child decide not to participate or if you withdraw your child from the study, there is no penalty or loss of benefits to which you are otherwise entitled. There are no costs to you or any other person.

CONTACT
David Lejkovic, a Ph.D. student in the Graduate School of Education at George Mason University, is conducting this research. He may be reached at (616) 1 or dlejkovic@gmu.edu for questions or to report a research-related problem. You may also contact the faculty advisor, Dr. M. Behrman at mbehrman@gmu.edu or (703) 1. You may contact the George Mason University Office of Research Integrity & Assurance at (703) 993-4121 if you have questions or comments regarding your child's rights as a participant in this research.

This research has been reviewed according to George Mason University procedures governing your participation in this research.

CONSENT
I have read this form and agree to allow my child to participate in this study.

Name: __________________________

Date of Signature: _________________________

Version date: ____________________________

Approval for the use of this document
EXPIRES SEP 10 2014

Protocol # ____________________________

George Mason University
Appendix E

APPs Evaluation Checklist for Sandra

<table>
<thead>
<tr>
<th>Name of App</th>
<th>EZPicTalk</th>
<th>Rater</th>
<th>D. Lojkovic</th>
<th>Rating Date</th>
<th>10-10-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>App Developer</td>
<td>Keller Institute on Human Disabilities</td>
<td>Cost</td>
<td>N/A</td>
<td>Tablet Platform</td>
<td>Android and iOS</td>
</tr>
<tr>
<td>Programming Required?</td>
<td>☐</td>
<td>Subscription?</td>
<td>☐</td>
<td>Subscription Cost</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Grade Level Appropriate for App (check all that apply): ☐ Pre-K ☐ K-3 ☐ 4-6 ☐ MS ☐ HS

CONSIDERING SENSORY AND COGNITIVE FEATURES

a. Auditory

- Content is presented with auditory component
- Auditory feedback for responding is used
- Feedback for responding is paired with graphics/text
- Auditory component is adjustable

The auditory features of this app are appropriate for Sandra (student) ☐ Yes

Comments: The app will indicate auditory if a message has been successfully sent; it will also indicate if the messaging attempt has failed.

Features to Use with This Student: Auditory feedback.

b. Visual

- Visual information is presented with graphics and text
- Visual information is graphics alone
- Visual information is text alone
- Visual information is paired with auditory component
- Visual feedback for responding is immediate and clear
- Zoom to magnify screen is included
- Font size change capabilities
- Color contrast change capabilities

The visual features of this app are appropriate for Sandra (student) ☐ Yes

Comments: Contacts and messages can be represented with text, pictures/picturesymbols, and voice output. So, for one contact, her mother, the word mom can be written below a picture of her mother and who she represents that contact the app will verbally the word mom.

Features to Use with This Student: Text with pictures and voice output.
Apps Consideration Checklist

c. Cognitive

<table>
<thead>
<tr>
<th>Feature</th>
<th>Yes</th>
<th>Sometimes</th>
<th>No</th>
<th>Optional</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity levels are adjustable or a variety of levels can be selected</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student engagement with app is intuitive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student can understand feedback (feedback is at student's cognitive level)</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

The cognitive demands of this app are appropriate for Sandra ________ (student) ✔ Yes

Comments: Sandra understands how a touch screen works, she knows how to connect two items on the screen. Feedback lets her know if the message was sent, and she understands this.

Levels to Use with This Student: Voice output.

d. Sensory

<table>
<thead>
<tr>
<th>Feature</th>
<th>Yes</th>
<th>Sometimes</th>
<th>No</th>
<th>Optional</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colors can be changed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed of graphics can be changed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screen view is uncluttered</td>
<td>✔</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

The sensory features of this app are appropriate for Sandra ________ (student) ✔ Yes

Comments: Sandra does not present with any vision difficulties/challenges.

Features to Use with This Student: Uncluttered view important for all users.

CONSIDERING APP CHARACTERISTICS

a. Content

<table>
<thead>
<tr>
<th>Feature</th>
<th>Yes</th>
<th>Sometimes</th>
<th>No</th>
<th>Optional</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>App teaches what it claims to teach</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content is presented in a culturally inclusive manner, when appropriate</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

The content of this app is appropriate for Sandra ________ (student) ✔ Yes

Comments: This app is not for teaching content. And, since someone would be programming in contacts and messages, the programmer would have options to ensure messages were culturally appropriate and contacts were represented appropriately.

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continued on next page
### Apps Consideration Checklist

<table>
<thead>
<tr>
<th>b. Design</th>
<th>Yes</th>
<th>Sometimes</th>
<th>No</th>
<th>Optional</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help menu, settings, or instructions are easily available</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Settings are easily changed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Setting change options are appropriate and sufficient</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Option exists for data collection of responses</td>
<td></td>
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<td></td>
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<tr>
<td>Size of activation icon can be changed</td>
<td></td>
<td></td>
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</tbody>
</table>

The design features are appropriate for Sandra (student) Yes

Comments: An individual would need to program messages and contacts into the app for Sandra. Settings are easily changeable and accessible. There is an option to password protect settings so that a use cannot accidently alter settings.

Settings to Use with This Student: Data collection.

### BASIC ACCESS/INPUT FEATURES

<table>
<thead>
<tr>
<th>Yes</th>
<th>Sometimes</th>
<th>No</th>
<th>Optional</th>
<th>N/A</th>
</tr>
</thead>
</table>

| Swipe screen – anywhere                                                   |     |           |    |          |     |
| Swipe screen – specific location                                         |     |           |    |          |     |
| Tap/touch screen anywhere                                                |     |           |    |          |     |
| Tap specific screen location                                             |     |           |    |          |     |
| Screen pinch – to zoom in or out                                        |     |           |    |          |     |
| Slide (touch an icon and slide it across screen)                        |     |           |    |          |     |
| Screen tilt (app requires moving device in a tilt manner)                |     |           |    |          |     |
| Shake device                                                             |     |           |    |          |     |
| Voice control of app available                                          |     |           |    |          |     |

The access features are appropriate for Sandra (student) Yes

Comments: When the app is accessed anywhere on the screen a red line shows movements. This will enable her to see where she is making movements on the screen.

Access/Input Features to Use with This Student: Tap/touch screen anywhere

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### ADVANCED ACCESSIBILITY FEATURES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Yes</th>
<th>Sometimes</th>
<th>No</th>
<th>Optional</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen reader compatible</td>
<td></td>
<td></td>
<td>♦</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of VoiceOver screen reader is included</td>
<td></td>
<td></td>
<td>♦</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open wireless network is available for use with wireless Braille displays or switch</td>
<td>♦</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changing sound from stereo to mono is available</td>
<td></td>
<td></td>
<td>♦</td>
<td></td>
<td></td>
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<tr>
<td>Closed caption content/capabilities</td>
<td></td>
<td></td>
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<tr>
<td>Able to use app with AssistiveTouch</td>
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</tbody>
</table>

Accessibility Features to Use with This Student:
Sandra would not require the use of any of the advanced accessibility features.

### OTHER FEATURES (SPECIFY)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Yes</th>
<th>Sometimes</th>
<th>No</th>
<th>Optional</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other: Traditional messaging capabilities with voice output</td>
<td>♦</td>
<td></td>
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<tr>
<td>Other:</td>
<td></td>
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</table>

### COMMENTS

I think Sandra's parents would like to have devices installed with the app as well. They could send traditional text messages to Sandra through the app and the app would "translate" messages into voice output, so they could send her a variety of messages that wouldn't require reading.
Appendix F

Scripted Pre-baseline Lesson

Text Messaging on Apple Devices Lesson Plan

Text messaging from your mobile device or cell phone is an easy and fast way to send messages.

1. Select "Messages" from the main menu. On the Apple devices, iPad, iPod, and iPhone, this icon looks like a talk bubble from a cartoon.

2. Create a new message. On the iPhone, an icon appears in the top right corner of the Messages menu that looks like a pencil and paper. This will open the new message window.

3. To add a Contact to message. You can either message a contact from your Contacts List, or you can message a new phone number you haven't added into your contacts list yet. You can also select more than one person to message.

4. Write your message. When you select the blinking cursor in the messaging field, your keyboard should pop up. Use the keyboard to type out the message you'd like to send. You can also select the Microphone icon near the keyboard on the iPhone to send a voice-activated message. After you select this icon, speak the message you'd like to send as clearly as possible.

5. Check for error corrections. If you misspell something while you're typing, some phone models will try and guess what you were trying to type and provide an alternative. If you want to use the substitute word, add a space and the word will be added automatically. If you don't want to use the word, hit the X on the suggested alternative.

6. Send your message. When your message is finished, simply click send. Most smartphones will display your conversation with comic-book style "talk bubbles" that correspond to you and the person you're texting with.
Appendix G

Fidelity Checklists

Pre-baseline Lesson

Put a ‘+’ if you observe the step in the instruction process and ‘—’ for a step that was not followed during instruction.

Participant __________
Score ______________

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1) Select “Messages” from main menu</td>
<td></td>
</tr>
<tr>
<td>2) Create new message</td>
<td></td>
</tr>
<tr>
<td>3) Add contact to message</td>
<td></td>
</tr>
<tr>
<td>4) Write message</td>
<td></td>
</tr>
<tr>
<td>5) Check for error corrections</td>
<td></td>
</tr>
<tr>
<td>6) Send message</td>
<td></td>
</tr>
</tbody>
</table>

Teaching Phase of Intervention (Demonstration and Practice)

Put a ‘+’ if you observe the step in the instruction process and ‘—’ for a step that was not followed during instruction.

Participant __________
Score ______________

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Demonstration (Researcher)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1) Device powered down</td>
<td></td>
</tr>
<tr>
<td>2) Device turned on</td>
<td></td>
</tr>
<tr>
<td>3) App located and accessed</td>
<td></td>
</tr>
<tr>
<td>4) Identify contact</td>
<td></td>
</tr>
<tr>
<td>5) Identify message</td>
<td></td>
</tr>
<tr>
<td>6) Connect contact and message</td>
<td></td>
</tr>
<tr>
<td>7) Wait for confirmation of sent message</td>
<td></td>
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</tbody>
</table>

Practice (Participant)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1) Device powered down</td>
<td></td>
</tr>
<tr>
<td>2) Device turned on</td>
<td></td>
</tr>
<tr>
<td>3) App located and accessed</td>
<td></td>
</tr>
<tr>
<td>4) Identify contact</td>
<td></td>
</tr>
<tr>
<td>5) Identify message</td>
<td></td>
</tr>
<tr>
<td>6) Connect contact and message</td>
<td></td>
</tr>
<tr>
<td>7) Wait for confirmation of sent message</td>
<td></td>
</tr>
</tbody>
</table>
Appendix H

Interview Protocol

Interview protocol

Participants:

Validating Messages
1) What messages would you like to send?

After experiment
1) Did you like using the EZText2Pic app?
2) What did you like about using the app?
3) Was it easy or difficult to use the app?

Participant Contacts:

Validating messages
1) Which messages would be most useful to you?

After experiment
1) What, if any, changes did they notice in the ways the participants communicated?
2) Were the messages useful to you?
References


Chicago Public Schools (n.d.) iPad app assessment rubric for librarians. Retrieved from [https://docs.google.com/spreadsheet/viewform?key=0AnuDOzIVx_xDdEF6cHhXQ1p2VHjSzFVd2hiWHRPOWc](https://docs.google.com/spreadsheet/viewform?key=0AnuDOzIVx_xDdEF6cHhXQ1p2VHjSzFVd2hiWHRPOWc)


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McDougall, J., Evans, J., & Baldwin, P. (2010). The importance of self-determination to perceived quality of life for youth and young adults with chronic conditions and


Biography

David A. Lojkovic graduated from Oakville Senior High School, St. Louis, Missouri, in 1996. He received his Bachelor of Arts from the University of Chicago in 1999 and his Master of Arts from the Gallatin School at New York University in 2001. He received his Master of Education from Ohio University in 2004. He was then employed for six years as a teacher in the New York City public school system, District 75, where he taught students with moderate to severe and profound intellectual, developmental, and multiple disabilities. He was a full time doctoral student in the Ph.D. in Education and Human Development Program at the Graduate School of Education at George Mason University in Fairfax, Virginia from 2011 to 2014. He subsequently worked as the Project Coordinator for the Virginia Project for Children and Young Adults with Deaf-Blindness at the Partnership for People with Disabilities and at Virginia Commonwealth University. He is currently an adjunct faculty member at Trinity Washington University, George Mason University, North Carolina Central University, and Virginia Commonwealth University. Additionally, he serves on the Board of Directors for the Virginia chapter of TASH, was President of the District of Columbia unit of the Council for Exceptional Children (2014), and serves on the Elections Standing Committee of Council of Exceptional Children.