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Expert perspectives on using mainstream mobile technology for school-age children who require augmentative and alternative communcation (AAC): a Policy Delphi study

Vinh-An Nguyen

Pepperdine University

Graduate School of Education & Psychology

EXPERT PERSPECTIVES ON USING MAINSTREAM MOBILE TECHNOLOGY FOR SCHOOL-AGE CHILDREN WHO REQUIRE AUGMENTATIVE AND ALTERNATIVE COMMUNICATION (AAC): A POLICY DELPHI STUDY

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Vinh-An Nguyen

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Paula Thompson, Ed.D. – Dissertation Chairperson

This dissertation, written by

Vinh-An Nguyen

under the guidance of a Faculty Committee and approved by its members, has been submitted to and accepted by the Graduate Faculty in partial fulfillment of the requirements for the degree of

DOCTOR OF EDUCATION

Doctoral Committee:

Paula Thompson, Ed.D., Chairperson

Kay Davis, Ed.D.

Heidi Sublette, Ed.D.

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DEDICATION

This work is dedicated to my family with whom I have been very blessed for their sacrifices over the past several years. They have also helped me to maintain and at times regain the sanity to complete this important work. For my wife Rosie—You lit the fire in me to accomplish this goal. You also made it a priority that our family dined together each night, although the past few weeks have seen me miss several meals. I look forward to sit-down dinners together again. For my children: Faith, Caleb, Rachel, Sarah, Matthew, Esther and Timothy—As much as you wanted to spend time with daddy, thanks for trying so hard not to enter my "cave" while I was working. I am looking forward to taking you out to the park, resuming our tennis lessons, and playing a lot of card and board games.

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VITA

Vinh-An Nguyen

1. Education

2011 – 2017, Pepperdine University, California
- Ed. D., Learning Technologies

1999-2000, Pepperdine University, California
- M.S., Education Administration

1989-1994, San Jose State University, California
- B.A., Social Science

2. Certification

- Texas Educator Certificates and School Administration Certificates
- California Administrative Credential
- California Multiple-Subjects Teaching Credential with Cross-Culture Certification

3. Experience

2013 – 2017, Educational Technology Consultant

2007 – 2013, Elementary School Principal

2005 – 2007, Professional Development Coordinator of Ed Tech

2002 – 2005, Ed Tech Resource Teacher, Title I Project Specialist

2000 – 2002, ESL Head of Dept., WASC Coordinator, Database Administrator

1994 – 2000, Elementary School Teacher

ABSTRACT

Despite legislation in the U.S.A requiring the use of assistive technology in special education, there remains an underutilization of technology-based speech intervention for young students who require augmentative and alternative communication (AAC). The purpose of this Policy Delphi study was to address three guiding research questions that relate to the feasibility of using mainstream mobile technology, facilitative actions, and stakeholder roles for implementation and utilization of AAC in elementary school settings. Data were collected in two rounds of questionnaires given to experts in special education, assistive technology and speech and language pathology, with experience in AAC. Round 1 included 19 participants, 14 of whom also completed the Round 2 questionnaire. The results indicated that a very strong case can be made that mainstream mobile devices have several advantages over traditional AAC systems, not only in their affordability, but also transparency and social acceptance by providing an ideal medium for inclusion in mainstream settings. A challenge that confronts AAC innovations is the tendency to focus on the technology instead of pedagogical, social and therapeutic goals. Until a perfect AAC system becomes available for mainstream mobile devices that meet individuals' communicative, educational and physical needs and personal preferences, it is apparent that multimodality will continue to be the model. The utilization of mainstream mobile technology for AAC necessitates certain facilitative actions and stakeholder responsibilities. Team collaboration is essential in supporting AAC use and, when applicable, facilitating the inclusion and mainstreaming of students who use AAC in the general education setting.

Chapter 1: Study Background and Purpose

> The silence of speechlessness is never golden. We all need to communicate and connect with each other--not just in one way, but also in as many ways as possible. It is a basic human need, a basic human right. And much more than this; it is a basic human power (Williams, 2000, as cited in Light & McNaughton, 2014).

Introduction

The astronomical advancements of technology in the last several decades have significantly improved overall quality of life. Regard less of abilities, we all use technology for assistance at one point or another (Robitaille, 2010). For many of us, high-tech devices simplify, such as by mediating social communication and instant access to information; for those with special needs, they enable, for instance by augmenting loss of hearing through cochlear implants (Edyburn, Higgins, & Boone, 2005). Of particular interest to educators is the widening array of innovative systems available to assist learners with special needs. While communication is essential to quality of life and everyone has the right to access it, regardless of age and ability level (American Speech-Language-Hearing Association [ASHA], 2005; Deruyter, McNaughton, Caves, Bryen & Williams, 2007), there exists an underutilization of technology in special education settings for students with complex communication needs (Bouck et al., 2006; Edyburn, 2004, 2009; McMillan & Renzaglia, 2014a). Thus, it is critical to ensure that children with speech impairment, currently the most common disability in U.S. schools, have the assistive technology required to support communication in the classroom (Kolipinski, 2006).

Special education background. Despite conflicting data on overall population trends of special education enrollment, the number of students with speech impairment has been growing

steadily. A 2011 study sponsored by the Fordham institute (Scull & Winkler, 2011) reported a decline in special education enrollment starting in 2005-2006, falling from 2.8 million to 2.4 million students, or from 6.1% to 4.9% of all students nationwide; while the population of students with autism quadrupled from 93,000 to 378,000. In contrast, a study sponsored by the National Institutes of Health (Houtrow, Larson, Olson, Newacheck, & Halfon, 2014) showed a 21% rise nationwide in the number of children with neurodevelopmental conditions, with speech impairment being the number one condition. Based on data from the National Health Interview Survey of 2008-2009, one in five parents cited speech problems as contributing to their child's difficulty (Halfon, Houtrow, Larson & Newacheck, 2012).

The growing number of students with speech impairment presents opportunities for systemic reforms in speech service delivery (Aron & Loprest, 2012; Banks, Frawley, & McCoy, 2015; Edyburn, 2003, 2004, 2009, 2013; Halfon et al., 2012; Scull & Winkler, 2011) and the need for a revolutionary new approach in the application of assistive technology (Foley & Ferri, 2012; Wise, 2012). A growing number of high-tech systems for augmentative and alternative communication (AAC) have been developed to add to the ever increasing selection of technological innovations (McMillan & Renzaglia, 2014a), offering a great deal of options for students with communication disorders. The recent development of mobile applications for AAC presents a revolutionary opportunity by improving accessibility, increasing options and lowering cost (Edyburn, 2013).

Policy and Practice Background

The effort of ensuring equal opportunities in education benefited as a result of a series of revolutionary governmental policies and legislation that mandated improved access to resources

for students with special needs. According to the 2012 report on assistive technology from the United Kingdom Foundation for Assistive Technology, "The United States is the only country in the world with statutory legislation relating to the acquisition of assistive technology and a definition of assistive technology with legal standing" (as cited in Dove, 2012, p. 26). A major shift in the education of all children came with the passage of the Rehabilitation Act of 1973, especially section 504 of the act, which made it illegal for schools that receive government funding to discriminate against children with disabilities (Aron & Loprest, 2012). Prior to this shift in policy, more than 3.5 million children with disabilities were segregated in special institutions, often without access to proper instruction (Esteves & Rao, 2008; Halfon et al., 2012). In 1975 a law now known as the Individuals with Disabilities Education Act (IDEA) was passed. A decade later the Technology-Related Assistance for Individuals with Disabilities Act (The Tech Act) of 1988 was passed and replaced with the Assistance Technology Act of 1998, which set the formal, legal definition of assistive technology that still stands today (Dove, 2012). In 1990 the Americans with Disabilities Act was passed, further prohibiting discrimination against the disabled. The IDEA was amended in 2004, recommending Response to Intervention (RTI) as an alternative method to the traditional IQ/ability-achievement discrepancy model for identifying children with learning disabilities (Estevez & Rao, 2008; Fuchs & Fuchs, 2006). As a result of these legislations, by 2009 an estimated 6.5 million children, representing more than 13 % of public school students, received services in special education settings (Halfon et al., 2012).

Assistive Technology. Assistive Technology (AT) is defined by the IDEA of 1988 as any item, equipment, device or system, from any origin, natural or created, that can be used to remove barriers or improve the capabilities of individuals with impairments. Edyburn (2013)

defined AT as technology used by individuals with disabilities; such as, technology used in a special education setting. Therefore, by definition, technology-based AAC can be considered an assistive technology.

There is a plethora of academic literature on the success of assistive technology (AT) on the special needs population in the U.S. (Allgood, Heller, Easterbrooks & Fredrick, 2009; Okoro, Strine, Balluz, Crews & Mokdad, 2010), yet there exists few research on their usage among elementary-age students (Bouck et al., 2006; Light & Drager, 2007). Edyburn (2004) reviewed literature from the early 2000's on assistive technology and found that there were more than twice as many research articles addressing post-secondary subjects compared to elementary, middle and high school age students. Nearly a decade later Edyburn (2013) called for a disruptive change and urged innovative educators of young children to view assistive technology as a "cure for historical limitations imposed by a disability" (p. 18). Therefore, there is an urgent need to gather new data on strategies for the utilization of innovative AAC systems for young students with speech impairments.

A number of studies have shown a lack of training in assistive technology, leaving educators unprepared to implement efficaciously and with fidelity, appropriate technology devices to assist special needs students with communication needs. Judge, Sharon, Simms and Kathryn (2009) explored causes for lack of assistive technology (AT) use by students in special education and found problems with pre-service training that was lacking in AT methodology. Bouck et al. (2006) reported that when asked about AT devices, most teachers implemented low-tech options such as pencil grips. The researchers also discovered that a majority of teachers desired more knowledge and training on AT use. Results of survey of Pediatric Physical

Therapists' perceptions of their training in AT, revealed a lack in adequate training in AT and lack of confidence in delivering AT services, and desired desire for more training (Long & Perry, 2008).

In an in depth analysis of educators' understanding of assistive technology, Edyburn (2003) called for a deep reexamination of current services to children with special needs. He cited a list of insufficiencies in providing interventions. The list included (a) leadership, (b) referral/evaluation systems, (c) device referral and service delivery in the Individual Education Plan (IEP) process, (d) staff and IEP team training, (e) specific intervention procedures, (f) data on utilization, (g) system for monitoring and analyzing usage and performance data, and (h) coordination of technology support and IT infrastructure. A common thread in Edyburn's recommendations was the need for more clearly defined, concrete strategies for AT implementation.

The technology used to assist learning and living are most inclusive when they take a transparent form. Foley and Ferri (2012) posit that when devices used to assist those with different abilities are not transparent, they have the potential to promote social exclusion. Foley and Ferri (2012) even take issue with the term *assistive*; that all technology should be inclusive and accessible; and that the use of technology should not be earned by a label of disability, but should be transparent and enabled for all abilities. Therefore, mainstream mobile devices, such as tablets and smartphones, are seen as ideal examples of transparency, affordability and looking "cooler", and less likely to be stigmatizing and abandoned than traditional, dedicated AAC devices (Foley & Ferri, 2012).

Augmentative and alternative communication. Augmentative and alternative communication (AAC) systems, a type of assistive technology, have been in use for at least three decades to facilitate short- or long-term communication between those with speech impairment and their social network (Granlund, Bjorck-AKesson, Wilder & Ylven, 2008). AAC is a very broad field with extensive research relating to treatment of speech impairment in older children and adults, and the development of a wide array of systems (Beukelman & Mirenda, 2013; Calculator, 2013; Deruyter et al., 2007; Dicarlo & Banajee, 2000). Most of the research, however, has been focused on effectiveness of use in family settings (Granlund et al., 2008) and very few studies on classroom usage (Kent-Walsh & Light, 2003).

AAC users employ a variety of methods to communicate, including facial expressions, gestures and sign language (Binger & Light, 2006). The visual nature of most AAC systems reduces memory load, thereby supporting comprehension and receptive language and increasing communication (Harding, Lindsay, O'Brien, Dipper, & Wright, 2011). More recently, high-tech systems provide not only access to social media and email, but also open the door for access to education and employment (Beukelman & Mirenda, 2013; Deruyter et al., 2007).

Young learners were historically overlooked as beneficiaries of AAC, even though evidence of its effectiveness have been observed in numerous studies that will be discussed in Chapter 2. Until recently, speech and language pathologists have viewed children as being too young to benefit from AAC (Cress & Marvin, 2003). Binger and Light (2006) gathered data reported on a survey by speech and language pathologists (SLP) on pre-school children and AAC usage. A significant finding was that only 24% of students receiving speech services *required* AAC. The study employed the term *require* to include students who used AAC and those who

were identified as needing AAC, with no distinction drawn between the two groups in the data for *require*; therefore the percentage of students who actually used AAC was likely lower than 24%.

Research by Cress and Marvin (2003) demonstrated that AAC is applicable at all ages for facilitating communication and developing speaking skills. A study by Dicarlo and Banajee (2000) showed that AAC voice output devices are effective in promoting communication among two two-year-old boys who were developmentally delayed and non-verbal. Successful use of AAC has been observed in young children and there are benefits for all age groups, socioeconomic status and ethnicities (Beukelman & Mirenda, 2013). Despite variances in communication needs, AAC strategies and methods have been effective across a range of conditions and speech impairments (Beukelman & Mirenda, 2013).

In recent years rapid technological innovations have resulted in greater impact and effectiveness of AAC systems, from electronic speech generating devices (SGDs) that provide synthesized and digitized voice, to mobile apps allowing more portability (van der Meer et al., 2011). A notable user of AAC is Dr. Stephen Hawking, a prominent Physicist who has ALS and uses a synthesized voice as an alternative to speaking. This innovative system allows him to continue actively conducting research, collaborating and lecturing around the world. Another innovation that was introduced in 2009, the Proloquó2Go™, a mobile app that turns any iPod touch into an AAC device using SGD technology, brought the price of a high-tech AAC system to $200 sans device, down from $7,000 for a dedicated AAC system (van der Meer et al., 2011). A year later, with the availability of the iPhone and iPad, there were 72 speech applications in the Apple store for the iPhone and 13 for the iPad, many of the apps being free (Heasley, 2010).

As of this writing, there are over 100 AAC apps for Apple devices, with dozens offered as free downloads, and several costing up to $200. Android apps are catching up with a few dozen offerings available.

Van der Meer et al. (2011) posit that while there are still too few research studies on AAC mobile applications to give conclusive evidence to their effectiveness, the researchers do recognize potential in mobile technology's affordances for special education, due to their adaptability, cost-effectiveness, portability, ubiquitousness, and *cool factor* (See also Foley & Ferri, 2012). Furthermore, personalized educational software via mobile applications have the power to enable students to learn in ways that are customized and catered to their learning speed and style (Christensen, Horn, & Johnson, 2008). Undoubtedly, the innovation of AAC mobile applications provide an important opportunity to explore the potential impact of this innovation as an assistive technology intervention for school-age learners with speech and communication challenges.

Although well intended, the lack of clarity in the Tech Act of 1998 legislation caused confusion among educators in special education regarding the difference between *wants* and *needs*, an issue that may have complicated the implementation of communication technology (Edyburn, 2003). Light and Drager (2007) appeal to the urgency of future research to address the needs of young students with speech impairments. Furthermore, Schlosser and Lee's (2000) 20-year meta-analysis of research on generalization and maintenance of AAC skills, showed that AAC interventions tended to be haphazard and lacked systematic implementation strategies, rather than employ evidence-based practices (EBP). Opportunity exists to gather and analyze expert perspectives on AAC implementation in order to provide updated recommendations for

the implementation of mainstream mobile technology as AAC devices for elementary school students with complex communication needs.

Theoretical Framework: Social Constructionist Worldview

Only three decades ago did a modern period of enlightenment give rise to the disability rights movement. According to Finkelstein (2001), Thomas (2004) and Anastasiou and Kauffman (2011) the definition of disability was rewritten and formulated in the UK in 1976 by the Union of the Physically Impaired Against Segregation (UPIAS, 1976). The new definition called disability a "socially constructed category" (Oliver, 1986, p. 11) that created the perception of the disabled as broken and needing to be fixed. Instead, this new worldview proclaimed that the disabled were not victims of individual impairments, but were victims of society's oppression and hostility; they were an oppressed social and minority group due to the label of disability. This newly inspired social constructionist model viewed that the disabled did not need to be fixed; rather, society's perception and treatment of the disabled needed to be reformed through the alleviation of oppression (Anastasiou & Kauffman, 2011). That oppression was an environment that was hostile to their physical differences. A changed society would be responsive to their needs and remove social and physical limitations, not as an expression of pity or an act of compensation, but as an earnest effort to remove society's inherent barriers toward those who were physically different. Hallahan, Kauffman, and Pullen (2009) explained this view further:

> Accepting the limitations imposed by physical disabilities without trying to see how much people can learn or how the environment can be changed to allow them to respond

more effectively is an insulting and dehumanizing way of responding to physical differences. (p. 513)

The disability rights movement called for the removal of barriers imposed by social structures and attitudes. The movement advocated for people with impairments through four aims:

1. Removing discrimination and oppression.
2. Promoting social inclusion.
3. Creating a barrier-free society.
4. Developing a positive identity.

(Finkelstein, 1980; Oliver, 1986, 1996)

Advocates for disability rights argue that the case for accommodating for the disabled was similar in importance to the civil rights movement, and view the ADA as an emancipation proclamation for people with disabilities (Finkelstein, 2001; Stein, 2004). The social constructionist position on disability was not without criticism. Critics cited its oversimplification of disability (Thomas, 2004) and major contradiction: While they objected to the term disability, they advocated for the removal of barriers for the disabled (Anastasiou & Kauffman, 2011; Shakespeare, 2004). Social constructionists believed that social and physical restrictions needed to be removed even though doing so would challenge the "inherency of established societal norms" (Stein, 2004, p. 581). Assistive technology was therefore considered a necessary accommodation in the removal of obstacles to learning, notwithstanding resistance by critics who objected to the added resources incurring expenditures and thereby elevating the disabled to a higher position. It stands to reason that this worldview supported high-tech AAC as

an effort at removing society's oppression by enabling children with speech impairment equal access to education and fulfillment of a meaningful role in society (Blackstone, Williams, & Wilkins, 2007); whereas the lack of technology in special education settings reinforced society's hostility toward the impaired. Furthermore, in the social constructionist worldview, it was not enough to ensure that learners have access to AAC; but rather, all speech impaired learners must have all barriers removed in order to become autonomous and independent and contributing members of society.

Definition of Terms

Complex communication needs (CCN) is described as the compromised development of speech due to impairments of skills in cognition, language, motor development, and/or sensory perception. This condition may affect a heterogeneous group of children who have Angelman syndrome, autism, cerebral palsy, Down syndrome and other developmental disabilities (Beukelman & Mirenda, 2013; Binger & Light, 2006; Light & Drager, 2007).

Impairment is defined by International Classification of Functioning, Disability and Health (ICF), developed by the World Health Organization (WHO) in 2001 as significant challenges in body structure or function. This includes activity limitations that hinder individuals from performing a task, and participation restrictions that restrict involvement in social situations (as cited in Halfon et al., 2012, p. 15).

Disability is a general, abstract, complex, and oftentimes controversial concept (Anastasiou & Kauffman, 2011) that attempts to encompass a wide range of impairments and conditions from behavioral to emotional, intellectual, mental, and physical; from short- to long-term challenges that require individuals to deal with barriers that may hinder their full

participation in society (Halfon et al., 2012). When appropriate, *different ability* has been used by the researcher as a substitute term for disability.

Within augmentative and alternative (AAC) systems are the classifications of unaided and aided methods (Beukelman & Mirenda, 2013; Calculator, 2013). Unaided methods include facial expressions, gestures, manual signs, natural speech and vocalizations, since there is no use of an aid. Aided methods utilize varying degrees of assistance along the technology spectrum. For instance, a no-tech system may use real objects and drawings; while a low-tech system may employ symbol sets such as picture exchange communication system (PECS; American Speech-Language-Hearing Association [ASHA], 2002).

High-tech AAC systems include speech generating devices (SGDs, formerly known as voice output communication aids [VOCA]) that primarily served as single-function, dedicated hand-held devices. There are also computer programs that will turn a desktop and laptop system into an SGD. These communication systems use either synthesized or digitized voice output. Newer devices may be touch screen-enabled and feature a visual scene display (VSD) which allows the use of natural images and on-the-spot photo capture. These images can be programmed to enable *hotspots* that deliver a programmable message when the touch points are selected by the user.

The term *mobile app* is short for mobile application. An app is a simplified or specific software program that usually performs a small function or provides a particular purpose (Campbell, 2011). A mobile app is generally designed to be used on a multifunction mobile device such as a tablet or smartphone. An AAC mobile app is therefore a speech generating program that enables a mobile device to be used as an AAC system. The term *mobile app(s)* was

used in this study to refer to high-tech AAC systems that utilize mainstream mobile devices, such as tablets and smartphones that run on Apple (iOS) or Android operating system.

Ethical Considerations for AAC Intervention using Mobile Apps

With the proliferation of technology, there is a new risk of excluding the special needs population from fully participating in the digital world. In order to ensure the right of every individual to communicate, AAC professionals and communication partners have a role in advocating for digital inclusion by increasing public awareness of and ensuring greater access to high-tech AAC tools. The prevalence of technology is seen in everyday activities such as shopping, health management and banking (Brandenburg, Worrall, Rodriguez, & Copland, 2013). Furthermore, the easy access to internet-connected devices is becoming commonplace, enabled by mobile applications that mediate participation in social media and management of business, educational, financial and personal tasks, all of which require the ability to communicate. However, individuals with speech impairment often experience digital exclusion due to limits imposed by the lack of accommodating features in the functions of current technology that prevent them from experiencing an independent and socially involving lifestyle (Dolic, Pibernik, & Bota, 2012).

Technology has always held the potential to empower those fortunate enough to have access. Innovations in the past decade provide those with speech disabilities a pathway to digital inclusion by overcoming barriers and achieving equal access to communication tools through online social interactions via email, online discussion forums, and social network websites. Public policies, such as the one started by the European Union in 2005, have aimed to provide such access through the *i2010* initiative which promotes *e-Accessibility* for people with

disabilities (Dolic et al., 2012). Individuals with disabilities need access to the digital world for two primary reasons: First, they have the human right to benefit from technology for all. Second, technology provides the opportunity to overcome barriers to digital inclusion (Deruyter et al., 2007). Elman (2001) posit that participation in the digital world is equal in importance to engagement in the physical world.

The concept of *digital participation* has been used to describe an individual's engagement in the technology environment, and includes descriptors by the World Health Organization as: communication, mobility, domestic life, interpersonal relationships, and major life areas (work, school and economic life; Brandenburg et al., 2013). These activities are fundamental to communication in the twenty-first century and are needed for those with speech disabilities to fully participate in the community, schools and the workplace (Deruyter et al., 2007).

Unfortunately, technology also has the power of exclusion that creates a digital divide when those with speech disabilities cannot access or use technology (Brandenburg et al., 2013). There has been a history of technology underutilization for the special needs community, including those who have speech disabilities (Schlosser & Blischak, 2001). Light and Drager (2007) lamented that many students who can benefit from AAC methods do not receive services until later and as a result, do not receive the benefits that early intervention using communication technology provides. Deruyter et al. (2007) reported that while there were an estimated 11,000 speech generating devices sold annually in the U.S., only 2-3% of individuals with speech impairment receive services using such devices. Mirenda (2003) offered a reminder that it is unethical to remove access to communication tools from the reach of those with different

abilities. Schlosser and Blischak (2001) cited the success of technology used in diverse special education settings for promoting communicative and educational skills and advised against withholding technology-based support and interventions.

Problem Statement

Despite the many technological advances in assistive technology and efforts to increase their implementation, there remains an underutilization of high-tech AAC systems for elementary school students with complex communication needs (Bouck et al., 2006; DeCoste, 2013; McMillan & Renzaglia, 2014a). As technological innovations have produced an abundance of supportive systems, greater burden is placed on educators to provide these cutting-edge resources to all children with special needs (Bouck et al., 2006; DeCoste, 2013; McMillan & Renzaglia; 2014a; Wise, 2012). The opportunity exists to examine expert opinions on the feasibility of using mainstream mobile technology for students who require AAC.

Purpose Statement

The purpose of this mixed-methods Policy Delphi research study was to gather expert opinions in order to inform the implementation of AAC mobile technology in elementary school settings for children with complex communication needs.

Research Questions

Data were collected from the following guiding questions using the Policy Delphi method in two rounds of questionnaires given to experts in special education, assistive technology and speech and language pathology, who have experience with AAC:

1. What are expert opinions on the feasibility of providing young learners who require AAC with mainstream mobile devices for communication?

2. What facilitative actions are important in the utilization of AAC mobile apps in elementary school settings by students with complex communication needs?
3. What are the roles of stakeholders in the implementation of AAC mobile apps in elementary school settings by students with complex communication needs?

Importance of Study

There has never been a time when greater utilization of technology in special education has been more important and conducive. With a rise in the number of children enrolled in school with speech impairment, modern advances have provided high-tech and affordable systems to address the communication needs of students with speech impairments. Numerous studies have shown the effectiveness of assistive technology in improving social and academic skills of learners in special education settings (Allgood et al., 2009). Despite government policies and legislation over the past 40 years increasingly mandating the provision of assistive technology for children with special needs, there exists an underutilization of high-tech systems for young learners with speech impairment (Bouck et al., 2006; Edyburn, 2004, 2009; Kent-Walsh & Light, 2003; McMillan & Renzaglia, 2014b). The communication needs of young students with speech impairment will benefit greatly from increased resources and support for innovative AAC interventions (Cress & Marvin, 2003). Furthermore, this data may prove to be valuable to decision-makers in special education settings who set policy and practice regarding the provision, implementation, support, and utilization of technology-based AAC for young students.

Limitations

Due to time and access restrictions, a small sampling of experts was taken from educators who were connected to the researcher. This limitation may cause sampling bias as survey

participants were confined to the researcher's network of teachers and specialists in special education. Additionally, the small sample size limited the generalization of results and prohibited the sub-analysis of experts by profession, in order to preserve study participants' anonymity and confidentiality. Lastly, although the role of communication partners (i.e., caretakers and parents) is essential to AAC research, their participation was not addressed within the scope of this study. This study will conclude with recommendations for further research to address some of these limitations.

Organization of Study

Chapter 1 included an introduction, research background, theoretical framework, definition of terms, purpose, importance, and an overview of the study. Chapter 2 presents an in-depth discussion of research on the effectiveness of a wide variety of aided AAC systems and their implementation and teaching strategies. Chapter 3 provides a description of the Policy Delphi research method, study design, and data collection procedures. Chapter 4 delves into the presentation of results and summary of findings. Chapter 5 presents a substantive discussion of the findings and conclusions, implications for policy and practice, and recommendations for further study.

Chapter 2: Literature Review of Factors that Affect the Utilization of AAC

The ultimate goal of AAC intervention is not to find the best communication technology, but to support student engagement in unprompted, intentional and appropriate, spontaneous communication across a range of settings, and using a variety of modalities (Beukelman & Mirenda, 2013; Trottier, Kamp, & Mirenda, 2011). Chapter 2 discusses the implications of peer-reviewed research on factors that affect the implementation and utilization a wide range of AAC methods and systems, from no- to high-technology. More specifically, the researcher presents a review of literature addressing the effectiveness of AAC interventions, evidence-based practices and professional development, and key stakeholders and their facilitation of AAC implementation.

Effectiveness of AAC interventions

The effectiveness of AAC systems are demonstrated in individuals' ability to effectively and efficiently participate in their environment through social interactions and independent choice making (Beukelman & Mirenda, 2013). Numerous anecdotal reports support the use of AAC and empirical data exist that show evidence for AAC intervention effectiveness in developing communicative competence in children (Millar, Light, & Schlosser, 2006; Mirenda, 2003). A majority of studies were based on single-case studies and small sample sizes (Ganz et al., 2011; Schlosser & Blischak, 2001). The following eight studies evaluated the effectiveness of aided AAC systems ranging from no-tech and low-tech methods (objects, pictures, symbols, and PECS) to high-tech devices (SGDs and AAC mobile apps).

Research on no-tech and low-tech AAC systems. One of the earliest research on using pictures to augment speech in children with complex communication needs was a seminal study conducted in Holland by Lancioni (1983) that explored the effectiveness of using a pictorial system with three children ages 8-12 with autism, who had intellectual deficits and were non-verbal. Using an experimental design, the baseline and post-treatment data were collected on the following behaviors (a) discrimination of objects, (b) discrimination of body positions, (c) discrimination of body positions related to objects, (d) discrimination of simple activities, (e) discrimination of activities involving two children, (f) selection of objects and role, and (g) selection of activities. The treatment involved training the children to perform actions that corresponded to the desired behavior (i.e., for discrimination of objects, children were trained to touch objects that correlated to the pictures depicting the objects). This study provided promising data supporting the use of pictorial representations to train subjects with severe developmental deficits to distinguish between objects and body positions and to make selections of objects and activities.

Another experimental study aimed to examine effective AAC methods for teaching young children with Down syndrome to learn object names. Foreman and Crews (1998) enlisted 19 children ages 2 to 4 years with Down syndrome to participate in the study, in which they had to learn 12 vocabulary words through four instructional phases (Verbal instruction, Sign language, Symbol [COMPIC], and Multimodal which uses all three methods). Results showed that the Verbal instruction method did not yield any successful trial. However, the scores of the other three methods (Sign, Symbol, and Multimodal method) yielded positive results, with the effect of the Sign and Multimodal instruction being superior to Symbol in promoting the learning

of object names. Scores of the Multimodal method were analyzed, revealing that Sign and Symbol instruction were preferred equally.

Harding et al. (2011) examined the process of implementing an intervention plan to provide services to support two 6-year-olds with complex communication needs and profound and multiple disabilities (PMLD), which include severe cognitive impairment coupled with comorbidities of physical, visual, sensory and other health-related challenges. The researchers explored the effectiveness of multimodal AAC interventions on supporting the children's ability to initiate communication in choice making in relation to physical prompting by an adult. It was determined that the children would benefit from AAC interventions due to (a) the children showing interest in communicating via non-verbal means, (b) both child having had very little AAC support, and (c) both displayed instances of challenging behavior due to their inability to communicate effectively. Unaided, low-tech, multimodal AAC interventions were used, consisting of visual stimuli (photographs and symbols), touching (familiar objects), manual signing and gestures. Baseline data were collected during pre-treatment and compared with data from 10 sessions during the 5-week treatment in the areas of (a) expression, (b) comprehension, (c) social interaction, and (d) behavior. Target settings were during music, lunch time, and play time. As a result of using multimodal AAC interventions, both children showed significant improvement overall in unprompted choice making and their expressive language, receptive language, social development and behavior.

Research on high-tech AAC systems. Dicarlo and Banajee (2000) conducted a small scale study designed to determine the effectiveness of SGDs on the intentional communication (illocution) of two young children who had developmental delays and were nonverbal. The

results during AAC intervention for the two boys were to be compared to the illocution of a normally developing peer in the same setting. Participants were two non-verbal 2-year-old boys with developmental delays, one with a chromosomal abnormality and the other with a diagnosis of Angelman syndrome. The participants were given initial assessments by an SLP and early intervention teacher to determine appropriate AAC device. Based on their assessed motor and visual skills, one boy who could use a single finger to press a button was given the Alpha Talker, a device with a small switch; the other boy who needed to use his whole hand to activate a button, was given a Dual Rocker Lever Switch, which had a larger surface to make selections. Both voice output devices used Picture Communication Symbols, which were colored pictures on a white background. The control participant, an 18-month old boy was chosen because he was typically developing and was able use two-word utterances to communicate. An experimental design using a multiple baseline method was used in which data were collected from the two participants over a 4-month period. The targeted activity was the snack routine. Baseline data were collected in the first phase using the boys' natural communication attempts, and the second phase using AAC devices as interventions. Both boys showed a significant increase in illocution as a result of using the AAC devices. For the boy who had the higher motor and visual skills, his specific initiations increased to 41% compared to the baseline of 16%, while the other boy increased to 27% from 4%; compared to the typically developing peer, who performed at 45%.

Soto, Hartmann and Wilkins' (2006) single-case study evaluated the narrative discourse of an AAC user to determine how AAC use may impact narrative abilities. The participant in this case study was an 8-year-old girl with muscular dystrophy, without cognitive impairment, who was using a switch-activated SGD (Dynavox 3100) to communicate. She was also able to

communicate through a variety of modes, including eye-gaze, one- to two-word utterances and word approximations. Narrative discourses were generated from elicitation tasks through the following exercises conducted by her teacher (a) personal photo description, (b) familiar book reading and story comprehension, (c) conversational map, (d) story stem, and (e) wordless picture book. Data were collected using the Narrative Assessment Profile to assess narrative ability. Throughout the elicitation tasks, the student's vocalizations were limited to single-word utterances generated by her use of the AAC device. Overall, the student's narrative discourse abilities were significantly limited.

In two-part study on the effectiveness of high-tech AAC, Franco et al. (2009) conducted an experimental trial that aimed to extend research on Functional Communication Training (FCT) and SGD by evaluating the effects of an SGD on reducing persistent inappropriate vocalization on Brent, a 7-year-old child with a diagnosis of autism and who is nonspeaking. This study was conducted using an experimental design, with data collected prior to treatment and post treatment in four phases using functional analysis to determine best treatment. Brent was given an SGD (Go Talk; DysphagiaPlus LLC, Shreveport, LA) that used photographs from Brent's environment and programed with messages that when the corresponding images were selected would provide him a method of communicating his requests. In both studies, using the SGD supported the reduction of inappropriate vocalizations. In the first study, the level of inappropriate vocalizations declined by almost 70%; while in the second study, there was nearly a 50% decline.

Sampath, Indurkhya and Sivaswamy (2012) had two goals in a study on the effectiveness of AAC mobile apps: (a) Design an AAC mobile app (AutVisComm) for the Android operating

system, with stakeholder input gathered from a parent survey, a participatory design experience with a student, and a usability study with a larger group; and (b) evaluate the effectiveness of the AAC mobile app intervention on a group of young students with severe communication deficits. Twenty-four children (unreported age) with autism who had no functional or severely limited speech were selected to participate in the study. They received training on using the AutVisComm mobile app to make requests for preferred snack items. Encompassing 10 sessions, the subjects' responses (when asked "What do you want?") were recorded as either independent response (IN), Verbally Prompted (VP) and Physically Assisted (PA). In the early sessions, the children relied more on physical assistance (PA) and gradually progressed to verbal prompting (VP) before using the mobile app to make their selections. By the sixth session, there was a significant shift to independent response (IN).

Lastly, Roche et al.'s (2014) study on AAC mobile apps had three goals (a) validate the effectiveness of using an instructional protocol to teach students with complex communication needs to use a tablet-based SGD for pragmatic communication purposes, (b) evaluate the effectiveness of using a mainstream mobile device as an AAC intervention for communication support, and (c) determine the extent in which natural speech production can increase after the AAC treatment has been removed after a period of intervention. Two boys, ages 3 and 9, with neurodevelopmental disorders and severe communication impairment were selected for this study. The material used was an iPad-based SGD with the Proloquo2Go®2 mobile app installed which provided graphic icons and synthesized speech output. After initial assessments, each child was given their own iPads which were configured with icons that represented their preferred stimuli (i.e., coloring books and crayons). The single-case experimental designs study

was conducted in three phases: (a) baseline, (b) SGD intervention (student received initial guidance to use the SGD), and (c) no SGD intervention. During each of the three phases data were gathered from student responses in the form of the following independent variables: reaching, correct SGD-based requests, and relevant natural speech, to indicate their choice for the preferred stimuli. Both students made significant progress in their intentional communication behavior by using the SGD and natural speech to make selections. When compared to baseline data, during the SGD intervention phase, both students' use of the SGD to indicate choice increased after each trial. During the No SGD phase, both students' use of natural speech also increased after each trial.

Summary. The progression of studies reflects the changing technology landscape, with the most recent ones evaluating the effectiveness of AAC mobile apps, the latest innovation in speech technology. Evidence from these studies supports the overall effectiveness of AAC intervention across all aided systems for not only promoting intentional communication in individuals with complex communication needs, but also reducing inappropriate vocalizations (Franco et al., 2009), and facilitating choice making (McMillan & Renzaglia, 2014a; Sampath et al., 2012). Evidence also show that the use of more symbolic over verbal methods for developing communication yielded positive results (Foreman & Crews, 1998). However, AAC use did not seem to have a positive effect on the narrative abilities of the individual in the case study reviewed (Soto et al., 2006).

Evidence-Based Practices and Professional Development

As we have seen in the previous section, empirical evidence supports the benefits of AAC in promoting unprompted speech; However, AAC interventions require rigorous

instruction (*learning costs*; Rackensperger, Krezman, Mcnaughton, Williams & D'silva, 2005) and support structures in order to achieve efficacious results (Mirenda, 2003). There are also learning demands on AAC users who are faced with a duality of stress factors of learning how to use a sophisticated device and using it successfully in communicative and social interactions (Light, 1997; McNaughton et al., 2008). One of the primary challenges in implementing AAC is in applying strategies that facilitate the use of interventions in settings that are as natural as possible for the learner (Koegel, 2000; McMillan & Renzaglia, 2014a; Mechling & Cronin, 2006; Ninio & Bruner, 1978). The other challenge is in planning communication interventions that support multimodality (i.e., a variety of unaided and aided AAC methods; Soto, Belfiore, Schlosser, & Haynes, 1993).

In their 20-year meta-analysis of studies on generalization and maintenance of language skills of AAC users, Schlosser and Lee (2000) observed that AAC interventions tended to be haphazard and lacked systematic implementation strategies, rather than employ evidence-based practices (EBP). Schlosser and Blischak (2001) point out that "there appear to be as many different approaches to treatment as there are individuals with autism (p. 170)." The primary role of the teacher in facilitating the effectiveness of AAC cannot be overstated (Dada & Alant, 2006; McMillan & Renzaglia, 2014a); therefore, it is critical that teachers are proactive in the early identification and intervention process (Light & Drager, 2007). Measuring student outcomes toward IEP goals is also essential in assessing student progress and making decisions regarding justification for continuance of AAC intervention (McMillan & Renzaglia, 2014b; Millar et al., 2006). This three-part section deals with research studies on (a) implementation strategies for promoting the utilization of AAC and inclusion of AAC users, (b) instructional practices that

enhance the effectiveness of AAC to promote academic, language and communicative skills, and (c) professional development for general education teachers and special education teachers and professionals to support students who require AAC**.**

Implementation strategies. Mechling and Cronin (2006) conducted a study to explore the potential of using computer-based video instruction (CBVI) in supporting generalized use of AAC in real-life community settings. Three students, ages 17 to 21 years, with Down syndrome and mild to severe intellectual disabilities, participated in this study. A laptop was used to deliver video instruction and a dedicated SGD used was a 7 Level Communicator. In the instructional procedure, participants received training on using the SGD in the classroom. During the generalization probe, participants were taken to three fast food restaurants to establish baseline data. During CBVI intervention, criteria was reached when the student used the SGD without prompting 100% of the time to order at the counter. Follow up procedure to assess generalization of learned behavior occurred several weeks later. During the generalization probe, neither student used the AAC device (0%) to order food. Following CBVI intervention, both students made significant progress in using the AAC device without prompting (100% and 75%). During the follow up procedures, both students demonstrated skills maintenance in continuing to use the AAC device without prompting.

The purpose of Binger and Light's (2007) investigation was to examine the effect of using aided AAC modeling (e.g., adults modeling a spoken phrase while demonstrating how to use an AAC device) on the production of multi-symbol messages by children with CCN. Five children between 3 and 5 years of age, with severe, congenital speech impairment requiring AAC intervention participated in this study. The participants were given aided AAC models using

communication boards and dedicated SGDs during seven creative role playing sessions (e.g., washing a baby, playing with vehicles, eating food, and cleaning the kitchen). The independent variable was the instructor's use of aided AAC models (e.g., The instructor touched the symbols *cat* and *milk* on child's SGD screen and spoke, "The cat drank milk."), while engaged in the play sessions during the intervention phase. The criterion behavior (dependent variable) was the frequency of AAC use by the participants to communicate multi-symbol messages. The study followed five phases (a) baseline, (b) instruction (AAC intervention), (c) generalization without aided AAC, (d) generalization with aided AAC, and (e) maintenance. Four of five subjects met the criterion (used symbol combinations and produced multi symbol messages) as a result of receiving aided AAC modeling by instructors.

Finke, McNaughton and Drager (2009) investigated the experiences of general education teachers in their use of strategies for the inclusion of students with ASD who use AAC. A qualitative focus group design was used to explore teacher views via an online discussion forum with five elementary school teachers who volunteered for the study. Some of the criteria for participation include (a) being a general education teacher, and (b) having had at least one child with ASD who requires AAC included in their classroom. The researchers served as moderators and posted discussion topics. Participants were encouraged to actively engage in discussions over a span of 15 weeks. Data from the online discussions were coded and grouped according to themes related to teachers' experience with AAC inclusion and implementation. Positive teacher feedback related to students who used AAC included the following: (a) increased social interactions resulting in increase in academic, social and language skills; (b) communication and language modeling from peers; (c) using visual schedules and PECs; (d) benefits of a *push-in*

model of service delivery, allowing for continuity and limited disruptions; and € administrative support in providing training and allowing time during the school day to meet with AAC team members for open communication, collaboration and lesson planning. Feedback on the challenges of inclusion include (a) students feeling overwhelmed and overstimulated by increased environmental noise and activity, (b) students being distracted by new and irregular schedules and activities (c) need for increased social and communication skills for students, (d) teachers frequently interrupted to provide support and services for children who use AAC (e.g., the SLP comes to observe the student weekly, causing the teacher to refocus the class), (e) more time required for teachers to prepare lesson plans to include modifications, and (f) and parental expectations for teachers to give more time and attention to their child.

Banda, Copple , Koul, Sancibrian and Bogschutz's (2010) primary goal was to examine the effectiveness of using Video Modeling (VM) to train individuals to use SGDs for conveying information (i.e., requesting objects). The secondary goal of this study was to examine the generalization effect of learned requesting behavior during post intervention sessions. The participants were students ages 17 to 21 and diagnosed with autism and speech impairment. The dependent variable was the target behavior of spontaneous requesting for preferred objects by using the Tech/Talk SGD. The independent variable was the intervention of using VM to model the use of the SGD. The study followed a multiple baseline, across-subjects design which included baseline, intervention, and generalization probes. Following the establishment of a stable baseline, the students were shown video vignettes of adults modeling how to use the SGD to request desired objects. If the students gave no response, the trainer replayed the video. Intervention was followed by generalization sessions in which students were evaluated on their

unprompted use of the SGD. During the baseline probe, neither students used the SGD to make requests. Results during the intervention and generalization were mixed. The first student used the SGD four times, thus not meeting the target of 8 of 10 responses per session. The second student met the criterion for all sessions. However, neither students used the SGD during the generalization probe. Overall, the results showed that VM intervention had promising results; however, generalization of learning did not transfer in the absence of the intervention.

In an effort to address two common shortcomings from earlier studies on the utilization of AAC mobile apps, Achmadi et al. (2012) evaluated the impact of the following implementation strategies (a) train students to use an iPod-based SGD to deliver multi-step responses, and (b) train students to start and operate the device from the off status. The researcher noted that the lack of training on fully operating the SGD (turning on the device, unlocking it, and opening up the correct application) limits individuals' ability to use the device in independent settings. The participants were two boys, ages 17 and 13, who were diagnosed with ASD and had severe speech impairment, although both could operate the SGD with sufficient motor skills. The device used was an iPod Touch using the Proloquo2Go application. The device was placed inside a speaker case for increased sound amplification. To provide multiple-part responses, the subjects had to perform the operations of turning the device on, unlocking, opening to the initial screen and touching several icons in sequence. Corresponding to the two goals above, the study was conducted in the following sequence: Baseline 1: Independent two-step requests for snacks; Intervention 1: Trainer gives prompt and guidance if no response; Baseline 2: Independent operation of device; Intervention 2: Trainer turns on device if no response, and ending with follow-up sessions. Results show that during both baseline

sessions the students performed few independent actions of selecting multi-level responses and high-level device operation. However, both intervention phases provided support for students to demonstrate significant success in performing target actions. Furthermore, after the first intervention session, the students were able to carry over their newly acquired skills into Baseline 2, Intervention 2 and the follow-up sessions.

Instructional practice. The goal of Myers' (2007) mixed-methods study was to examine the effect of AAC usage on the language and literacy development and curricular inclusion of children with CCN, through the following elements (a) an integrated approach and curricula, (b) constant modeling of AAC usage, (c) family involvement, and (d) follow-up visits to schools. The participants were four elementary school children who used AAC and had developmental disabilities and severe speech impairments. The students already had exposure to using SGDs. The students were given pre- and post-intervention evaluations in the following three categories: (a) language, (b) adapted literacy, and (c) computer technology use. The intervention process included language and communication skills development through individual and group activities, direct instruction, and workshop style activities built around the themes of *conversations, feelings, ourselves* and *others*. Post-intervention data showed that all four students made progress during the intervention procedure. The review of formal and informal observations demonstrated an increase in participation and unprompted communication for all students, although follow-up visits showed some waning of skills maintenance.

Solomon-Rice and Soto (2014) examined the viability of two language intervention methods, focused stimulation (modeling of target vocabulary multiple times) and augmented input (aided AAC modeling), to increase the expressive vocabulary of young learners who were

just beginning to use AAC. Three children with severe communication and speech challenges between 2 and 3 years of age participated in this preliminary study. Four adults, comprising of three SLPs and one special education teacher, provided both language interventions (focused stimulation and augmented input) to all three children and collected data probes (vocabulary assessments) during baseline, intervention and maintenance periods. The subjects achieved the learning criterion when they successfully spoke the target vocabulary independently at 80% for two consecutive sessions. Results showed that two out of three subjects made significant gains in expressive vocabulary as a result of both language interventions, were able to retain their new vocabulary during maintenance, and successfully generalized across different communication partners.

Binger, Maguire-Marshall and Kent-Walsh (2011) evaluated the viability of AAC modeling and recasting on the use of grammatical morphemes by children who use AAC. Data were taken intermittently during baseline (multiple-probe) on three participants who were 6, 9 and 11 years of age and who use SGDs to communicate. Criterion behavior for the subjects was three grammatical morphemes (e.g., flying, jogged, horse's). Probe data were collected from students' response to prompts with correct expression of grammatical morphemes. During the intervention phase, the instructor provided modeling and recasting to support the children's use of their aided AAC device. Results show that all three children demonstrated mastery of grammatical morphemes by the end of intervention, with an average improvement score of 94% over baseline performance.

Professional development. This study from the UK by Magiati and Howlin (2003) was designed to investigate the impact of teacher training on the use of the Picture-Exchange

Communication System (PECS) by children with autism. Selected to participate in this study were children from eight special education schools. All 34 children were diagnosed with ASD, and included 29 boys and 5 girls between the ages of 5 and 12 years old, all of whom had either limited or no speaking ability. Teachers gave students a pretest on communicative ability for baseline data that was later compared to post-intervention data from the same assessment. PECS training was given as the intervention to all teaching staff, which included 14 teachers, 22 teaching assistants, 10 care staff and one speech-language therapist. Perception data were also captured in a brief questionnaire completed by teachers during the implementation of PECS after training. Analysis of post-intervention data revealed that children's use of PECS increased significantly, with the average increase in PECS usage growing from 1 to 4.6 times daily. Results also showed that children's communicative skills (use of signs/gestures, words and phrases) increased slightly. Overall, teachers were highly positive about receiving PECS training and implementing it with their students. Many teachers saw the advantages of using this communication system in their classroom.

Lebel, Olshtain and Weiss' (2005) two-fold study from Israel aimed to provide an overview of an online course for special education teachers on AAC, and to investigate teachers' response to the web-based curriculum and instruction. Participants included 23 special education teachers in Israel, ranging in age from 24 to 52 years old, who worked with children having complex communication needs. Lasting five months, the web-based course offered synchronous (real-time chat and classroom meetings) and asynchronous (discussion forums, emails and surveys) learning opportunities. Course goals include topics surrounding AAC issues that included appropriate AAC terminology, recognition of obstacles to children with speech

impairment, descriptions of aided and unaided AAC systems, and AAC intervention plans. At the conclusion of the course, teachers were asked to complete a questionnaire that sought their subjective feedback of their online learning experience. Participation measures included log-in count, postings in discussion forums, and assignment completion. Overall findings showed a moderate degree of teacher interest high degree of task completion. Nearly all of the teachers (22) completed all of the coursework. The authors noted that this demonstrated a recognition of the value of the course. Course value was measured by the participants' rate of usage of the online learning activities (discussion forums, assignments, and study units) and level of assignment completion. Teachers' interests in course topics varied: There was great interest in topics that addressed strategies to enhance positive attitudes and motivation in their students' use of AAC. However, there was less satisfaction with discussion forums, as there were only a moderate number of postings.

Citing a lack of research in teacher perception (particularly that of general education teachers) on AAC devices and usage, Dada and Alant (2006), in a study from the University of Pretoria, South Africa, compared the attitudes of general education and special education teachers on their perception of low-tech versus high-tech AAC system (SGD and communication board [CB]). Perception data were sampled from 28 teachers (93% female and 7% male) at each of the four selected schools (conveniently samples) in the Pretoria area with special education and general education schools. Two videos were shown to two randomly divided groups of teachers at each school. Each video showed a student using one of the AAC methods (communication board and SGD AlphaTalker) to engage in conversations with an adult. Twenty-eight teachers were randomly separated into two equal groups at each school, with the only rule

that each group consists of seven special education teachers and seven regular education teachers, thus creating 2 groups (Group 1 and Group 2) in each of the 4 schools. Each group viewed two videos. Group 1 viewed the video of the student using the low-tech communication board, and a week later watched the same video. Group 2 viewed the video of the student using the low-tech communication board, and a week later watched a video of the student using the high-tech SGD. At the conclusion of each video viewing session, educators were asked to complete the Teacher Attitude Scale (TAS) that measured teachers' perceptions toward issues related to children with speech impairment and AAC device. Results from the TAS show a generally positive perception toward the use of AAC, regardless of the type of device. However, the mean scores of general education teachers were the lowest in the area of teacher's self-perception of their abilities. The authors noted that this signifies the need for more teacher training in AAC use.

Ratcliff, Koul and Lloyd (2008) reported on the findings of a survey that collected information about the academic training and clinical education in AAC in the United States and compared the findings with data from earlier surveys. The survey tool was presented for feedback to a group of faculty and doctoral students who were either experts in AAC or were studying aspects of AAC; all were associated with AAC training programs across the United States and could give insight into the curriculum of an AAC training program. The final iteration of the survey was administered via email across the United Sates to a group of 290 professionals from institutions that provide pre-professional training in speech-language pathology programs. (Ratcliff et al., 2008) A total of 168 completed surveys were received, for an overall 57.93% return rate. United State regional return rates were between 70% (Southwest region) and 100%

(Northwest region). Highlights of survey results include the following: 73% of respondents offered one or more AAC courses; 77% of the courses were offered at the undergraduate and graduate levels, and only 3% were offered only to undergraduate students; 11% of the courses were conducted online; 48% were elective courses and 52% were required; 14% of the courses were required for students enrolled in special education programs; and 80% reported that their programs infused AAC content into other courses. In terms of preparedness of pre-professional students, 33% of respondents felt that 76% to 100% of their students were prepared to work with clients requiring AAC. In contrast, 13% of respondents felt that none of their students were prepared for the task.

In this two-fold study by McMillan and Renzaglia (2014a) the first goal was to examine a multiphase teacher training program to support students' use of SGDs. The second goal was to investigate the effect of teacher professional development on SGD usage of students. In this multi-probe design study, four elementary school teachers were provided training intervention. The multiphase teacher training program provided the following (a) training on how to program student SGDs, (b) training on embedding opportunities for students to use SGDs during classroom activities, and (c) training on using time delay milieu teaching to support students in using SGDs without prompting. Teacher target behaviors were (a) to create opportunities for students to communicate via their SGD, and (b) to apply correctly at least 80% of the time-delay protocol when giving students communication instruction. Results show that device training (Phase 1 of the training) had little or no impact on teacher's providing opportunities for students to use SGDs (Phase 2 of training). Results from Phase 2 was shown to be effective, as mean frequencies of device embedding and integration increased to 27.3, 33.2, 25.8 and 44.3, from a

baseline of zero across all four teachers. The use of time-delay procedures also had a significant positive effect on two of the teachers in creating communication opportunities, with increases from 33.2 to 44.17 for Teacher 3, and 27.25 to 40.33 for Teacher 4.

The aim of this second of 2-part study by McMillan and Renzaglia (2014b) was to evaluate the effects of teacher professional development on SGD usage of four students ages 8 to 12 years who were diagnosed with autism and had significant communication deficits. The SGDs were dedicated devices with synthesized and digitized voice outputs. The target behavior for students is to activate their SGDs without prompting to use the device. Baseline data were collected and compared to data collected during the intervention period. Results showed that teacher training on creating opportunities for SGD use and time delay milieu teaching increased unprompted device use. Phase 1 (SGD programing) yielded insignificant improvement in students' unprompted SGD use. Phase 2 (embedding SGD use opportunities) and Phase 3 (time delay milieu teaching) resulted in all four students increasing unprompted device use.

Facilitators of AAC Utilization

AAC intervention is a complex, long term process that incurs not only learning costs for the user (McNaughton et al., 2008) and general and special education teachers (Rackensperger et al., 2005), but also demands team collaboration (Batorowicz & Shepherd, 2011). The successful implementation of AAC has been observed to benefit from the following facilitative actions: (a) team collaboration and support from all stakeholders, particularly, special education professionals such as speech-language pathologists; (b), communication partners (caretakers and family members of the AAC user; and (c) school leadership and administration (Caron, Light & Drager, 2016; Costantino & Bonati, 2014; Soto, Müller, Hunt, & Goetz, 2001).

In their comprehensive and systematic review of AAC literature, van der Meer et al. (2011) explained the need for all stakeholders to gain technical literacy and competence in maintaining and programming software in response to technological advancements. As Zaretsky, Moreau and Faircloth (2008) reported in their survey of leaders in special education, school principals value the importance of furthering the technology skills of the staff due to the increase in high-tech devices in schools. Furthermore, in a review of the school leader's roles and responsibilities in special education, Dyal, Carpenter and Wright (2009) recommended that the school leader must have clear understanding in the following areas regarding assistive technology: (a) AT laws and legislation (i.e., NCLB of 2001 and IDEIA of 2004); (b) Individualized Education Program (IEP); (c) AT devices and services; (d) Resources and funding for AT; and (e) AT and Professional Development.

The proceeding section presents research studies that address the impact of the following facilitators of AAC utilization (a) team collaboration, (b) communication partners, and (c) administrative and leadership support. Some of the studies provided results that encompass one, two or all three facilitators. For instance, the Finke et al. (2009) study provided results that show the importance of all three facilitators in supporting the general education inclusion of ASD students who use AAC.

Soto et al. (2001) explored stakeholders' perceptions surrounding the critical issues of inclusive education for students who require AAC. Participants in this study were key stakeholders in the implementation of AAC at their educational sites. They include parents, classroom teachers, speech-language pathologists, inclusion support teachers, and instructional assistants, coming from a variety of school districts, and all residing in the San Francisco Bay

Area. This qualitative study employed the focus group method to capture the perceptions of the group members in discussions led by a facilitator. Five focus groups were created based on the participants' roles. Overarching themes of the discussion topics included (a) experiences of successful inclusion of AAC users, (b) barriers to inclusion, (c) important skills for team members, and (d) examples of positive outcomes of successful inclusion. The authors coded the data under the following themes (a) indicators of success, (b) barriers to successful implementation, (c) necessary skills to support inclusion, and (d) positive outcomes of inclusion. Three major themes emerged across all focus groups for the successful inclusion of students who used AAC (a) administrative support, (b) AAC training, and (c) team collaboration.

Indicators of success included the following (a) teachers' ownership of educating included students, (b) collaborative teaming, (c) appropriate training of those involved, (d) presence of an effective teacher's' assistant, (e) acceptance and support from typically developing classmates, (f) positive social interactions between focus students and classmates, (g) successful AAC use, (h) reliable services and support, and (i) supportive classroom physical and social environment. Participants mentioned several barriers to successful inclusion, most of which were the inverse of recommended practices, such as, lack of training for all stakeholders, staff turnover, lack of leadership and administrative support, lack of team planning and collaboration, unmanageable caseloads, lack of opportunities for student's academic success, marginalization of focus students due to restrictive classroom environments, and lack of planning for transitions.

Some barriers to the use of tech-based AAC include (a) some team members' uneasiness with technology, (b) equipment constantly breaking down, (c) insufficient funding for devices, (d) lack of available of *loaners* if equipment breaks down; and (e) inability of AAC devices to

convey social/emotional expressions (e.g., humor, anger). Speech-language pathologists cited a barrier to success was the general expectation that AAC support services need to take place in the therapist's office, rather than in the classroom. They felt that their support would be more effective if carried out in the student's natural learning environment, being the classroom. Participants recognized the need for adequate training of all professionals, not only with the technical aspect of operating AAC devices, but also with strategies to implement AAC effectively. A common barrier identified by participants is the lack of administrative support which they felt was essential for successful inclusion. All focus groups emphasized the need for administrators to provide teachers with planning and collaboration time, and opportunities for training. Every focus group recognized the importance of team collaboration and having regular team meetings to develop mutual goals and implementation strategies.

Kent-Walsh and Light (2003) explored the experiences of general education teachers who taught students with AAC. Participants in this study were 11 teachers 32 to 49 years of age, with 6 to 28 years of teaching experience, all of whom had recently taught students who used AAC. All participants were individually interviewed by the researchers. Interviews were recorded, transcribed and coded into the following themes as they relate to the inclusion of students who require AAC (a) benefits, (b) negative impacts, (c) barriers, (d) supports, (e) recommendations, (f) description information about students, teachers, class or school, and (g) miscellaneous elements. The following teacher recommendations related to the theme of leadership and administrative support for AAC utilization that were derived from the interviews (a) ensuring school and classroom facilities can accommodate all students with severe disabilities, and (b) working to secure small class sizes to support students adequately.

In the area of team collaboration as it relates to AAC use, the teachers recommended (a) providing information in a timely manner and coordinating effective team collaboration, (b) offering individualized and team trainings, (c) providing on-going support for teachers (e.g., including adaptations in lesson plans), (d) securing additional time for teachers to plan and collaborate, (e) ensuring students have access to appropriate AAC tools for all learning tasks, (f) helping to facilitate interactions between AAC users and their typically developing peers, (g) providing an accessible classroom environment, (h) ensuring clear communication between team members prior to the inclusion of a new student, (i) developing effective goals for students, and (j) ensuring that student inclusion placements are done appropriately.

Sonnenmeier, McSheehan and Jorgensen (2005) investigated a model (Beyond Access) for student and team planning in supporting included student's access to mainstream curriculum and enhancing communication. One of the main foci of this study was to examine the changes in team members' team collaboration practices as a result of the implementation of the Beyond Access model. The participant in this case study was a 10-year old boy diagnosed with autism. The student had been introduced to using an SGD (Go Talk) which he used only occasionally. The boy's educational team consisted of his parents, classroom teacher, speech-language pathologist, occupational therapist, special educator, instructional assistant, and district AAC consultant. The intervention used in this study was the Beyond Access model, which was a planning tool that provided a framework for teams to plan, implement and evaluate team supports for the included student. Data were collected from observations, interviews, and document reviews during the implementation of the model. Prior to intervention, there was a lack of communication between parents and the school staff and among the school staff themselves.

In contract, post-intervention data showed that the team scheduled weekly meetings for all stakeholders (including parents) involved in AAC intervention, and that the meetings were more efficient and productive than the ones held in the past. Prior to intervention, the staff prioritized functional and living skills goals for the student. After intervention, the staff included IEP goals for academic skills, removing the prior requirement that the student had prerequisite skills before accessing the curriculum. Additional results of the intervention included the following (a) increased involvement of focus student in classroom activities, (b) increased (60% from baseline of zero) team meeting time devoted to discussing or designing supports, (c) integration of AAC best practices into virtually all aspects of AAC planning meetings and discussions, and (d) decision-making on device selection was based more on observations of student needs, rather than what is currently available or convenient for the adults.

Due to the key role of the speech-language pathologist (SLP) in AAC implementation, their opinions and experiences were collected and analyzed by Johnson, Inglebret, Jones and Ray (2006). In this investigation an AAC survey was sent throughout the United States to members of the American Speech-Language-Hearing Association (ASHA) Special Interest Division which had members who were likely to have experience in AAC. The survey contained 103 closed-ended and three open-ended questions; 41 questions addressed factors of long-term AAC success and 62 questions addressed AAC device abandonment. Analysis of the 275 (27.5% of surveys sent) returned surveys revealed the following results, with corresponding mean percentages, as related to team collaboration as being a factor of long-term success in AAC implementation, (a) There was team support among professionals (85.45%; e.g., teachers, SLPs, aides), (b) Time was given for family and team members to maintain the communication system (85.41%), (c) The

team (including family) received on-going training and support (83.52%), (d) The family members and the user are supportive of using the system (83.16%). Of the factors associated with device abandonment, the one related to team collaboration was identified as a lack of support from team members, evaluators, technology specialists, and family members.

Bailey, Stoner, Parette Jr. and Angell (2006) reported results from a collective case study on an AAC team members' perceptions of communication device use with students in junior and high school settings. One of the themes discussed were participants' views on factors that affect the facilitation of AAC use. Participants in this study were six special education teachers and one speech-language pathologist (SLP), working together as an inclusion team for individuals who use AAC. Case-studies were conducted to collect data qualitative data from interviews, observations, and a review of documents. Interview questions aligned with the following topics (a) AAC training and the process of device selection, (b) perceptions and expectations of AAC use, (c) provisions of AAC supports to device users and families, (d) time management and stress issues related to AAC use, and (e) potential barriers and benefits to AAC use. One of the important facilitators of AAC use identified by participants included consistent parent/guardian involvement. Parents were identified as being part of the AAC team and played an active role in ensuring that the device was used at home. Participants also expressed the desire for more active parental involvement. One strategy discussed was to increase parental involvement by using the student's AAC device to communicate messages about the student's progress (e.g., "Hi, Mom. I learned how to count to 100 today at school.") The primary factor that facilitated AAC use was identified as effective team collaboration, which was described as including frequent and consistent intra-team communication, having administrative support at team meetings and to

ensure adequate time for meetings, and having the willingness to learn and to teach others. The SLP was seen as the informal team leader, promoting the use of AAC in the classroom, empowering teachers to promote device use, modeling device use with students, and having a positive and supportive relationship with teachers.

Gallagher, Vail and Monda-Amaya (2008) analyzed university students' journals in a special education program to investigate perceptions of team collaboration. Journals came from students who were enrolled in a master's level special education course on team collaboration with professionals and parents. The researchers randomly selected 41 student journals to analyze. Students wrote journal entries that reflected their experiences while collaborating with teaching professionals when working with children with disabilities. Analysis and coding of the journal entries yielded 10 categories. The following are some of the categories, with the percentage of overall occurrence across all journal entries, from highest to lowest, self-evaluation (37.5%), communication skills (35.2%), personal evaluation of team (30.9%), components of teaming (30.5%), conflict (16.2%), relationships with other professionals (15.6%), para-educators (12.2%), mentoring (9.2%), logistical issues (8.3%), problem solving (4.5%), and evaluation of team process (1.9%). The authors noted that entries coded as Self-evaluation were almost always coded as Communication skills as well. Another observation was that entries identified as conflicts were more likely to come from journals of practicing teachers. Additionally, for male participants, conflicts were usually linked to challenges in their working relationships with para-educators.

The purpose of the following study by Batorowicz and Shepherd (2011) was to evaluate the effectiveness of Prescription Review (PR) a model of team collaboration used in AAC

centers in Ontario, Canada. The primary purpose of PR was to guide teams in the decision-making process for selecting appropriate AAC systems. Participants in this study were clinical staff members invited from 21 AAC centers in Ontario. The researchers invited participants to complete two background questionnaires: (a) the 20-question Team Process Tool (TPT), which assessed the quality of team collaboration process within each participants' organization; and (b) the 19-question Team Decision Making Questionnaire (TDMQ), which was designed to measure participants' perceptions on team collaboration and decision-making processes. Out of 141 invitations, there were 92 respondents to the questionnaire, yielding a response rate of 65%. On the TPT questionnaire, participants indicated the following, on a scale of 1 ("not at all") to 5 ("to a great extent"), (a) moderate involvement in the PR decision-making process (3.7), (b) moderate satisfaction with PR results from their team's decision-making process (3.9), and (c) moderate satisfaction with the PR model itself (3.9). On the TDMQ questionnaire, the participants shared the following, on a scale of 1 ("not at all"), to 7 ("to a vast extent"), (a) moderate help from PR with decision-making (4.7), (b) moderate help with team support (5.0), and (c) moderate benefit in learning about AAC technology and practice (4.6). The authors observed that there was a corresponding relationship between levels of satisfaction about the participants' team collaboration experience as indicated on the TPT and the level of satisfaction indicated on the TDMQ. Overall, participants who reported more satisfaction on the TPT also indicated that the PR was more helpful ($r = .49$, $p < .01$).

Comparisons of AAC Systems

According to Binger, Berens, Kent-Walsh and Taylor (2008), the focus of AAC methods is to support the receptive and expressive communication of young children with significant

speech, language and intellectual impairments. Research literature has seen an increase in the variety of AAC interventions that aim to improve students' language and communication skills (Binger et al., 2008). High-tech AAC aims to augment or replace the speech of individuals who have communication impairment in everyday life (Brandenburg et al., 2013). Binger et al. (2008) also indicated that an effective AAC system includes the following essential components (a) graphic symbols that are relevant and customizable, (b) used within natural communication and social contexts, (c) daily practice with communication partners, and (d) capable of progress monitoring.

AAC technology can range from unaided methods, in which no external material is required (e.g., manual sign language, hand gestures, facial expressions), to aided systems, which can vary from low-technology (e.g., letter boards, picture boards, communication books) and high-technology systems (e.g., computers, laptops and mobile devices; Costantino & Bonati, 2014). The most recognized AAC technique is the Picture Exchange Communication System (PECS; Beukelman & Mirenda, 2013; Sampath et al., 2012). PECS is a symbol-based program, designed by Bondy and Frost (1994) for children with ASD who have limited or no communication functions.

With the rise of technology developments, a key aspect of an effective AAC system has included portable devices capable of generating speech (Binger et al., 2008), which have become the most established form of high-tech AAC (Brandenburg et al., 2013). Also known as Voice Output Communication Aids (VOCAs), speech generating devices are electronic systems that provide synthesized or digital voice output (Mirenda, 2003). The user activates the device by pressing with one or more fingers to select a message, resulting in the production of an audible

voice (McMillan & Renzaglia, 2014b). More recent technological innovations have seen AAC systems used on mainstream mobile devices such as handheld electronics and tablets (Schlosser & Koul, 2015).

According to Philips and Zhoa (as cited in Caron et al., 2016) having a poorly-designed AAC device may result in under-utilization or abandonment and impede the development of the user's communicative competence. On the other hand, a well-designed AAC device for school-age children offer the following features (a) appealing to children and easy for them to learn (Light, Page, Curran, & Pitkin, 2007), (b) enabling rapidity of request messages (fewest steps for operation as possible; a critical feature for beginning communicators; Schlosser and Koul, 2015; van der Meer et al., 2012a), (c) uses pictures of real people and images (based on eye tracking research; Wilkinson & Light, 2014), (d) capable of producing speech output (synthesized preferred over digitized voice; Mirenda, 2001; Schlosser & Blischak, 2001), and (e) having high intelligibility of voice output (Mirenda, 2003).

The following section addresses designs and features, comparisons of effectiveness, and user needs and preferences as they relate to a range of AAC systems spanning from no-tech to high-tech. There will be a presentation of research literature that addresses each topic.

Designs and features. In order to gather data to inform AAC systems' visual and graphical design, this study by Fallon, Light and Achenbach (2003) aimed to determine the semantic organizations that young children use when given a list of abstract and concrete vocabulary words. This study involved the participation of 20 children ages of 4 and 5 who had cognitive and language disabilities. The low-tech materials used were sheets of paper with gridlines and small picture cards with line drawings of target vocabulary, from different parts of

speech (nouns, verbs, prepositions, etc.). The vocabulary included concrete and abstract words that can be sorted into a variety of categories (e.g., schematic and taxonomic). The children were tasked with sorting 42 picture cards (referred herein as vocabulary cards) and asked to explain the rationales for their organization during and after the sorting task. Results showed that 90% of the children used purposeful organization in sorting the vocabulary cards, meaning that they were able to provide meaningful explanation for their arrangements. The children organized more concrete (65%) than abstract (35%) vocabulary cards (representing target vocabulary words). A further analysis of the sorting revealed that 68% of the arrangements were pairs of words (e.g., *cookies* and *juice*), and 32% of the sorting were three to five word groups. Regarding schematic vs taxonomic arrangements, 92% were of the former (e.g., Cup and Juice go together), while only 7% were of the latter (e.g., *what* and *why* go together because both represented question words.

The following study explored design strategies that could support the use of a handheld personal data assistant (PDA) as an AAC device. Hine, Arnott and Smith (2003) discussed key features of an effective AAC system and design issues that may pose a challenge in replicating user experience on a small display screen versus a desktop computer's larger display platform. The authors described the development and testing of an interface system for the PDA. A usability study case was presented on a user's experience with a new AAC interface on a PDA compared to a desktop computer. The PDA selected was an HP Jornado Pocket PC with a dynamic monochrome display and touch screen capability. User testing was conducted to deal with three issues of a small display area, (a) composition of the presentation of images, (b) thumbnail image sizing, and (c) user input method (stylus vs finger touch). After optimizing the

design of the new AAC interface, usability testing was conducted with a non-speaking user interacting with both devices (PDA and desktop computer). Based on preliminary testing, the following designs were chosen (a) selected full page displays, rather than long scrollable pages, (b) 1.0 cm wide thumbnail image size, and (c) five finger touch input. Device comparison results revealed that the PDA provided the user with significantly quicker access to retrieving information and allowed for slighter fewer errors than offered by the desktop-based system. The authors attributed the quickness of information retrieval on the PDA-based system to the user being able to make selections directly on the handheld device's display, in contrast to a desktop system's requirement of using a mouse.

Drager, Clark-Serpentine, Johnson and Roeser (2006) investigated and compared the intelligibility of synthesized and digitized speech as received by children. Participants in this study were 90 typically developing children ages 3 through 5, with no identified speech, physical or sensory impairment. The children were divided into three groups, and tasked with repeating 20 words and 10 short sentences (some in context and some out of context) from one of three digitized speech output (digitized, MacinTalk synthesized and DECTalk synthesized). The digitized output was the recorded voice of an 11-year-old girl, and the voice was played on a CD player. *Junior* was the voice used on the MacinTalk system and the voice was played on a computer. The DECTalk voice used *Kit the Kid*, a commonly used voice on communication systems used for children. This voice was played on a DeltaTalker SGD. It appears, with some exceptions that words spoken in context increased intelligibility and that sentences were easier to repeat than words. Age was a significant factor in the children's ability to repeat words and sentences. ANOVA results showed that the successful repeating of words and sentences for 3-

year-olds was 73.7%, 4-year-olds was 83.2%, and 5-year-olds was 83.8%. There was no overall significant difference between digitized and synthesized speech. When words were spoken out of context, the children performed slightly better with digitized speech than synthesized output. The findings also indicate that single word intelligibility was overall low, particularly for 3-year-old children.

Light et al. (2007) participatory design study explored children's ideas for the design of communication technology for children with speech impairment. This study selected six typically developing 10-year-old children, 3 boys and 3 girls, none with experience in using an AAC system. They were divided into gender-separate teams and provided materials and tasked with imagining innovative designs to support the communication needs of children with speech or motor impairments. Multi-media data were collected and coded, including analysis of each child's inventions and ideas, notes of conversations during the design process, and video recordings of the children at work on their ideas. Each team designed five inventions. One idea from the girls' team was an interactive tray divided in half, with buttons that deliver messages when pressed. Buttons on the right side represent *important* tasks (basic needs, emotions, preferences), while buttons on the other side were for *regular* activities (playing and socializing). The boys' team invented a robot they called Mind O'Matic 2000, designed with the ability to read the user's thoughts when placed on top of the users head. The robot would scan the user's brain to read thoughts, which would be communicated through a video, text or drawings. The authors organized the children's combined ideas into three primary themes (a) Function, (b) Physical appearance, and (c) Components. The children's ideas touched on topics that expanded the designs of current AAC system, and included innovative ideas on the following features:

communication and social interaction, telecommunications, companionship, humor, artistic expressions, play and entertainment, motor tasks, cognitive supports, environmental controls, and self-esteem/social image.

The following study on digitized speech examined the single word recordings from typically developing children to determine intelligibility (for adult listeners) and optimal children's age for voice recording intelligibility. Drager and Finke (2012) selected as speakers for this study 16 children ages 4, 5, 6 and 7, with 2 girls and 2 boys in each age. According to the authors, this age range was selected because voice recordings used for AAC systems for young learners often use children between 4 and 7 years of age. Listeners selected were 40 adults, between 18 and 26 years of age, who were all native English speakers without (a) speech or language impairment, (b) history of emotional disability, and (c) hearing impairment. These adult listeners were divided into four groups and assigned to one of the children's age groups upon arrival to the testing session. They listened to 30 words from each child within the age group, for a total of 120 words, which the listeners were asked to identify at the end of the listening session. Intelligibility was determined by the percentage of words the adult listener correctly identified. The result of a one-way ANOVA to determine the effect of the children's age, showed that age was a statistically significant factor on intelligibility. The performance percentage of the adult listeners in successfully identifying the digitized spoken words of each age group follows: 4-year-old children, 69.2%; 5-year-old children, 71.8%; 6-year-old children, 82.9%; and 7-year-old children, 76.9%. To determine the age at which children’s voice was optimally intelligible, further data analysis revealed that the voices of 6-year-old children were more intelligible than that of 4-year-old and 5-year-old children.

Wilkinson and Light (2014) conducted research to explore eye tracking (gaze fixation) of individuals with moderate to severe intellectual disabilities while they viewed photographs containing human figures. Participants in this study consisted of four groups of pre-adolescents and adolescents, two groups (pre-adolescents and adolescents) having no disabilities, and the other two groups (pre-adolescents and adolescents) having significant language impairment as a result of intellectual disabilities, autism or Down syndrome. There were seven females and 11 males, with ages ranging from 11 to 20 years old. The eight photographs used in this study showed a human figure that covered less than 20% of the space in the picture. The rest of the space on the photographs contained at least one other image that may attract attention (e.g., a chair, a Christmas tree, a fountain, etc.). The participants' eye gazes were tracked by a technology called Tobii, which recorded the viewer's point of focus or gaze as they looked at the pictures. Results show that there was an overall similarity in eye tracking patterns across all four groups. In the two groups without disabilities, 98% of the participants maintained eye gaze on the human image in the eight photographs. In the group with Down syndrome, 88% of the participants fixated on the human figure. In the group with autism, the result was 90%. The group with other intellectual disabilities performed at 92%.

Comparisons of effectiveness. Tincani (2004) compared the effects of Picture Exchange Communication System (PECS) and sign language on the acquisition of requesting for preferred items (*mands*) for students with limited functional speech. Two children, ages 5 and 6, diagnosed with autism were participants in this experimental study which used an alternating treatments design. Data were collected from baseline and final *best-treatment* phase to compare the viability of both AAC methods. Generalization probes were conducted to support learning from different

adults. The intervention phase consisted of alternating training in both treatments (sign language and PECS). Baseline probe was conducted to assess preexisting requesting abilities. Both children emitted no mands (correct requests for preferred items) during baseline. Intervention results were mixed, as both children achieved different results with each AAC method. One child had an average performance of 38.9% independent mands using sign language, while decreasing to 7.6% with PECS. The other child had an average performance of 59.6% with PECS training while averaging 25% with sign language.

Bruno and Trembath (2006) evaluated the effectiveness of using a communication board vs. an SGD in implementing aided language stimulation to improve students' syntactic performance. Participants in this study were nine children ages 4 to 14 with CCN, and diagnosed with a variety of conditions, including apraxia, Down syndrome and cerebral palsy. In the 5-day intervention period the instructor provided aided language stimulation activities in both conditions, using the communication board and SGD. Pre- and post-intervention data showed that overall performance of the group improved with the use of aided language stimulation. When comparing the two AAC systems, post-treatment data showed that students who used the communication board performed better than those who used the SGD.

As one of the first studies comparing the viability of using VOCAs (SGDs) and picture-exchange (PE) systems, the researchers (Son, Sigafoos, O'Reilly, & Lancioni, 2006) had two goals (a) to investigate efficacy for language acquisition, and (b) to assess AAC preferences. This section reviews the methodology and results of the former goal, while the latter is discussed in the next section. In the first study, two pre-school children, 3 and 5 years old, were selected to participate based on the criteria of having a diagnosis of autism and lack of speech production.

Using an alternating treatments design, the intervention materials were a picture exchange (PE) system using black and white drawings representing preferred snacks, and the VOCA was a Tech/Talk 6X80 with relevant recorded messages (e.g., "I want some cereal"). Data were collected from baseline probe, intervention, and final assessment phase. During the intervention phase, the participants were cued or prompted as needed to express a request for a snack using the available system which was alternated in each session.

None of the three children initially used the AAC systems to make correct requests for snacks during baseline. Results showed that all three children made significant progress with both AAC systems across intervention sessions. Representing percentages correct for the three students, with VOCA performance first, followed by PE performance, the results were: Student 1 scored 75-85%/75%; Student 2 scored 87%/100%; Student 3: 100%/87.5%.

Procedures in the second study on preference were identical to the one on language acquisition, except that in every session, both AAC systems were available for children to choose when performing a request. The following results represent percentages and number of occurrences. The students' preferences for PE, followed by VOCA, were as follows: Student 1: 2/30 or 6%/94%; Student 2: 86/2 or 98%/2%; Student 3: 52/20 or 72%/28%. These results showed that regardless of their consistent performance with both AAC systems, each student had a strong preference of one system over the other.

In this study from New Zealand, the authors (Sigafoos et al., 2009) conducted twin studies comparing picture exchange (PE) system to SGDs. The first study investigated efficacy based on acquisition of requesting responses. The second study evaluated systems preferences, which is discussed in the next section. The single subject in this study was a 15-year-old boy

with Down syndrome, selected for his speech deficits and need for AAC. The two AAC intervention systems were a PE system and a dedicated SGD (Tech/Talk 6). The study followed the order of: baseline phase, intervention training, and post-training phase. During intervention training, the student received instruction on both AAC intervention systems and time to practice making requests for preferred snacks ("Can I have a snack please") using both systems. Results showed significant success in the students' use of both AAC interventions, with SGD having a slight advantage. Acquisition mastery was equally rapid as the subject achieved criterion for both AAC systems in the sixth training trial.

Sigafoos et al.'s (2009) second study, which was on system preferences, followed the same format as their first study, which compared the efficacy of two AAC intervention systems. The only difference in procedure was that during all sessions, both AAC systems (PE and SGD) were available for the student to choose during each requesting task.

Across 62 opportunities to make a correct request for a snack, the student showed a slight preference for PE (56% or 35 selections) over the SGD (44% or 27 selections). The authors noted that the student's preference was influenced by the position of the AAC system (he preferred the one that was placed to the left) as well as whichever one was closer to him. The authors therefore altered the placement of the devices to ensure there was an equal balance of right-left/far-near placements van der Meer et al. (2012a) compared the effectiveness of using an aided AAC (a mobile app-based speech-generating device [SGD]) and unaided (manual signing [MS]) in language acquisition and preference for method. Selected for this study were four children, ages 5 to 10, who met the criteria of having a diagnosis of ASD, very limited or no communication skills, no auditory or visual impairment, and sufficient motor skills to manipulate

the AAC system. The intervention systems used were an iPod installed with the Proloquo2Go mobile app and sign language from the Makaton method. Preferred snacks and toys were identified for use as stimuli during intervention. Procedures followed the order of a multiple-probe across participants design: baseline, intervention, preference assessment, post-intervention, and follow up. For goal of comparing the speed of language acquisition between the two AAC systems, students received training using a discrete trial format and alternating treatment design on using both methods (MS and SGD) during the intervention phase. Criterion was set at 80% manding across three consecutive sessions. The overall results from the device comparison showed that all four students made progress with both AAC methods. While all four students achieved criterion mastery with the SGD, only three boys achieved criterion with both methods. In terms of device preference, three students expressed a preference for using the SGD, while one student preferred to use MS.

The primary goal of the next experimental research study was to compare the efficacy of using PECS and SGDs in supporting requesting skills for three children with severely limited speech. Boesch, Wendt, Subramanian and Hsu (2013) selected three elementary-age children with ASD and limited communication skills to participate in this study. The pre- and post-intervention evaluation of the children's language and speech skills were scored using the MacArthur–Bates Communicative Development Inventories (CDI; Fenson et al., 2007, as cited in Boesch, et al., 2013). Interventions used were a ProTalker dedicated SGD and a standard-sized PECS communication book. Requesting for preferred snacks was the dependent variable. All three children achieved mastery of criterion across three intervention phases. The Rate of acquisition showed a comparative pace at which the children achieved target mastery after each

intervention session, as follows: Phase 1: PECS = 4.3 sessions, SGD = 3.7 sessions; Phase 2: PECS = 8 sessions, SGD = 9.7 sessions; Phase 3: PECS = 5.7 sessions, SGD = 6.1 sessions.

User preferences. There were two primary purposes of this seminal three-fold study by Soto et al. (1993). The first goal was to investigate whether a person with profound intellectual impairment could effectively learn manding (correctly requesting for preferred items) using two different communication methods (communication board [CB] and VOCA [SGD]). The second goal was to test whether the participant showed a preference for one method over the other. Despite its small scale, this was first known study to apply the choice-making paradigm to compare SGDs and CBs that has been replicated in numerous subsequent studies. This single-subject study enlisted the participation of a 22-year-old male with severe to profound diagnosis of intellectual impairment. The subject was able to communicate approximately 50 manual signs. No instruction for device use was given during baseline. During the intervention phase, the researcher alternately gave training on the two AAC modes (CB and SGD [Wolf]). The criterion (dependent variable) was manding with 85% accuracy. Preference assessment was conducted by presenting both devices concurrently for the participant to choose in each trial. The generalization phase took place in a nearby fast food restaurant. Results indicate that the subject met target behavior for both AAC devices during intervention and generalization, showing preference for the SGD 100% of the time during the preference assessment sessions.

Sigafoos, O'Reilly, Ganz, Lancioni and Schlosser (2005) extended the work of Soto et al. (1993) by refining the preference assessment procedures that evaluated user preference for SGDs. Selected to participate in this study were two boys ages 12 and 16, one having a diagnosis of intellectual disability and the other, autism. In addition to the communication board (CB),

three SGDs were used in the device choice assessment: (a) the BIGmack switch, (b) Tech/Talk 6x8, and (c) Mini-MessageMate, each costing less than $400. Device preference was determined by the subjects retrieving the device from the storage area, returning to the table with it, turning it on, and then making a request using the device. Results from the choice assessment showed one boy always (100%) preferred to Mini-messageMate, and using it with a proficiency rate of 83-100% correct. The second boy preferred the Tech/Talk device 70% of the time over the other devices

Cannella-Malone, Debar and Sigafoos (2009) extended the work of Sigafoos et al. (2005) by replicating the preference assessment procedure with one different AAC device and two different participants. Participants in this study were two boys, ages 11 and 13, diagnosed with severe intellectual disabilities; one boy did not speak; the other, had speech that was very difficult to understand. Two of the AAC systems in previous research (communication board [CB] and Mini-MessageMate) were used, with the addition of a more advanced device, the Cyrano Communicator. Both boys received training on using the three devices. When criterion mastery was met for all three devices, a choice assessment was conducted to determine preferred device, using the protocol outlined by Sigafoos et al. (2005). Only one boy achieved mastery of all three devices and was selected to advance to the choice assessment phase. During this phase, the student consistently preferred the Cyrano Communicator over the other two devices. It may be worth noting that there were significant differences between the two high-tech AAC devices: the Cyrano Communicator cost $1400, while the Mini-MessageMate cost $350; the former had a display described by the author as "dynamic", whereas that descriptor was not used for the latter device. The former was also described as a "handheld personal data assistant" (Cannella-Malone

et al., 2009, p. 264). It may be safe to assume that the former device was more appealing than the latter.

Clarke, McConachie, Price and Wood (2001) reported one of the earlier findings from focus group and individual discussions with young people on their experience with high-tech AAC systems (dedicated SGDs), in addition to other issues around speech services. Focus groups and individual interviews were conducted with the 23 children and young adult participants, whose median age was 12 years. Data were coded using the four categories of communicative competence by Light (linguistic, operational, social, and strategic competence; 1989). Regarding AAC system preferences, the participants had the following negative feedback on operational difficulties and issues with self-image: "uncool…boring…I'm the only one (using AAC)…It's not my voice". Positive feedback were as follows: "Lets me say anything…helps me make friends…It's my voice" (Clarke et al., 2001, p. 112). Ideas for improving speech services included preferred focus of therapy on using the AAC device, as follows, "learning where the words are stored…teaching strategies for using the machine" (Clark et al., 2001, p. 113).

Von Berg, Panorska, Uken and Qeadan (2009) compared the preference, intelligibility and speech rates of two popular speech synthesis systems, VeriVox and DECtalk, across a wide age group. There were 39 Participants in this study, 20 women and 19 men, aged 6 to 65 years. They had no known physical, speech or auditory disabilities and no extensive prior exposure to synthesized voice. They were divided into four age groups. Three synthesized voices (two adult voices and one child voice) were selected from each system to be played on the selected SGD, the DynaVox MT4. The participants were presented with three tasks as they interacted with the two options of synthesized voices, as follows, (a) intelligibility (ability to verify and repeat

words), (b) likeability, and (c) speech presentation rate (optimal speech rate). Results for intelligibility show that the VeriVox Male voice (75%) was the most intelligible, followed by the DECtalk male voice (67%). There was no significant difference in the gender factor. There was a 29% variance in the age factor. The lowest intelligibility scores were earned by the DECtalk child (36%) and female voice (50%). The likeability task revealed that, independent of gender and age, the preferred voice type was VeriVox female (46%), followed by VeriVox Male (31%). None of the participants preferred the DECtalk child voice. The speech rate task showed a difference in preference according to age, with the younger groups favoring an average word-per-minute (wpm) rate of 127, compared to 157 wpm for the older group.

Van der Meer et al. (2012b) extended the work of their previous study (van der Meer et al., 2012a) by comparing the effectiveness of three AAC modes in language acquisition, maintenance of skills and device preference in children with speech and language disabilities. Four new students, ages 6 through 13, were recruited for this study which compared three AAC methods (SGD, picture-exchange [PE], and manual signing [MS]). This study replicated the participant criteria and methodology of the previous study with the exception of including one more AAC method (PE). Criterion mastery was also set at 80% correct in requesting for preferred stimuli (snacks and toys). During intervention, the three AAC options were presented alternately for students to use for requesting. To determine preferences, the researcher randomly displayed all three AAC devices at different positions on the table. Results show that during baseline, none of the four students used MS or PE to make requests correctly, while two students correctly used the SGD to make a total of three requests. Post-intervention results show that two students achieved criterion with all three methods, while the other two students reached the

target for PE and SGD, but not MS. Three of the four students preferred using the SGD (56%, 61% and 100%), while the remaining student showed a slight preference toward using PE (56%).

Harding et al. (2011) explored essential strategies in implementing multi-modal, low-tech AAC with young students who have profound and multiple disabilities (PMLD). Both participants were aged six, diagnosed with PMLD, having severe motor deficits and requiring wheelchair access. Baseline data were established through assessing the children's communication and cognitive skills in the areas of expression, comprehension, social interaction and behavior. This data informed the selection of AAC systems and vocabulary options, with the aim of choosing materials based on each child's strengths and needs. AAC intervention strategies to support unprompted choice making were implemented in three sessions (a) using objects, (b) using photographs and symbols, and (c) using manual signing. Time-delay was also included as a teaching strategy to allow students time to process information. As a result of using multimodal AAC interventions, both children showed significant improvement overall in unprompted choice making in all three sessions (symbols & photographs, objects, and manual signing). Results further supported the implementation strategy of making decisions on AAC intervention based on the child's communication ability and level of cognition.

The two-fold focus of this study by Lorah et al. (2013) was to (a) compare the effectiveness of language acquisition using picture-exchange (PE) versus an iPad-based AAC mobile app, and (b) investigate children's preference for either method. Participants were five boys, ages 3, 4 and 5, who were diagnosed with autism and received individual speech and occupational therapies on a weekly basis. The SGD was an iPad II with the Poloquo2Go app installed. After receiving training on both devices (PE and SGD) for manding, the children were

given the device preference assessment. Four of the five students preferred the iPad-based SGD in the preference assessment, with percentages of choosing the SGD over the PE as follows: 98%, 93%, 86%, 78% and 12%.

The focus of this study from New Zealand by Couper et al. (2014) was to compare acquisition, generalization, maintenance, and preference for three AAC methods Participants in this study were four children, ages 5 through 7, with a diagnosis of ASD, with severe expressive language delays, although having sufficient motor and sensory skills to use the three AAC options. The children were taught using an alternating treatment design to use manual sign (MS), a picture exchange card (PEC, a speech-generating device (SGD; Apple iPad mini loaded with the Proloquo2Go mobile app) to request toys. Probes for generalization were collected during baseline and post-intervention phase. Device reference assessment was conducted in each study phase. All four children achieved criterion mastery in the generalization phase, with one meeting target for all three devices; three students meeting target for two devices (SGD and PE), and one student achieving target for one device (PE). The result for device preference showed that the SGD was chosen most often across all four participants, with percentages of choosing the SGD over the other options as follows: 83%, 83%, 76%, and 71%.

Achmadi et al. (2014) extended Couper et al.'s (2014) findings by evaluating the degree to which device preference affects performance during skills maintenance assessments that were conducted post-intervention. The other two methods used were a picture exchange (PE) board and manual signing (MS). The target behavior was the unprompted, independent correct request using any one of the three AAC methods. The study followed the order of baseline, intervention, post-intervention and follow-up phase. Intervention consisted of an alternating-treatment design

across four participants. The participants in this study were four boys, aged 4 and 5 years, who had a diagnosis of global developmental delay and severe expressive communication deficits. The SGD used in this study was an iPod Touch loaded with the Proloquo2Go mobile app and placed inside an iMainGo2 speaker case for sound amplification. Preference assessments were conducted in all phases except intervention. Maintenance probe occurred during intervention and follow-up sessions. Baseline data showed that all four students had no prior experience using any of the AAC options. Preference assessment results showed that three of the boys chose the SGD most often over the other systems, with the following percentages for SGD selection: 35%, 7%, 55%, and 47%; compared to PE: 32%, 31%, 5%, and 5%.

AAC Mobile Apps: Potential Benefits and Challenges

Innovations in mobile AAC technology have many advantages over traditional, dedicated AAC devices. A comprehensive review of literature revealed the following support factors for the use of mobile technology for AAC: (a) Convenience, (b) *Curb cut* ability, (c) Coolness, (d) Cost, and (e) Computing power and Customization.

The convenience of having a portable device is, without question, the obvious advantage that mobile technology has over traditional dedicated SGDs, thanks to its relative unobtrusiveness (AAC-RERC [Rehabilitation Engineering Research Center], 2011). Mobile technology offers the potential to have the convenience of multiple functions in one device (AAC-RERC, 2011; Schlosser & Koul, 2015). With the growing number of applications becoming available each day, they offer unlimited possibilities (Stuart, 2012). In their research article on efforts of building an open framework for AAC applications using Concept Coding Framework (CCF), Lundälv et al. (2014) argue that mobile devices (smart-phones and tablets)

are ideal for AAC needs, due to their portability, multi-functionality and larger displays, as compared to traditional SGDs.

Perhaps the most important aspect of this technological innovation is its ability to remove barriers. Deruyter et al. (2007) applied the *curb cut* analogy to the way mobile technology has cleared the path for those with speech impairment to access other mainstream technologies. They argued that the risk of not taking advantage of this technology may result in the danger of "digital exclusion" (see also social network; Raghavendra, Olsson, Sampson, Mcinerney, & Connell, 2012, p. 260), which would restrict those with complex communication needs from accessing social, educational and vocational opportunities. This equalization of access to AAC technology is seen as a transformation that enables consumers to have direct access to therapeutic speech devices and information via mobile apps, once restricted to the realm of only service providers (AAC-RERC, 2011; McNaughton & Light, 2013).

Due to its ubiquitousness among the general public, the use of a mobile device is not stigmatizing, but rather socially accepted (Allen & Shane, 2014). With the iPad tablet being very visible in the mainstream, many individuals with CCN have benefited from the confidence of using mainstream mobile devices for communication (McNaughton & Light, 2013). Another benefit resulting from the coolness factor is the potential to achieve truer and richer communication. Mobile AAC technologies enable interactive communication; whereas, traditional AAC devices primarily serve as "speech prostheses" (Light et al., 2007, p. 283) and allow for limited social interaction. While traditional, dedicated SGDs only serve one purpose, one of the major advantages of mobile technology is the ability to perform multiple functions. Allen and Shane (2014) found that, despite the proliferation of mobile technology, individuals

who have CCN spend little time using technology socially, neither through playing video games nor using social media. The ability to support numerous apps allows mobile devices to offer other functions besides communication (AAC-RERC, 2011), and support the integration of the device into daily activities (Light et al., 2007).

Cost has traditionally been a major obstacle in the provision of tech-based AAC intervention, and mobile technologies have made AAC more accessible for individuals and families, while offering similar functionalities as their counterpart (AAC-RERC, 2011; McNaughton & Light, 2013). Mobile systems are relatively much more affordable than traditional devices which can range from $2000 to as much as $8000 (Moffatt, Pourshahid, & Baecker, 2017). The cost of mobile devices can range from as low as $50 for a small Kindle Fire tablet running Android OS, to as high as $500 for an iPad (Stuart, 2012); while many AAC mobile apps are inexpensive and some are free (Stuart, 2012); and some AAC mobile apps can run as high as $250 for the Proloquo2Go.

The computing power and customization potential of current mainstream mobile devices to run AAC apps far surpass most dedicated SGDs. While costing less than their counterpart, some higher-end mobile devices have the ability to offer graphical processing unit (GPU) for high-definition photos and video, and dual-core and quad-core central processing units (CPU) (Dolic et al., 2012). Because they run on more sophisticated operating systems like Android and iOS, these mainstream systems are optimized for mobile devices and touch screen interface (Dolic et al., 2012). These efficient devices also offer support for faster vocabulary upgrades through features like software updating (Deruyter et al., 2007), and just-in-time programming (Caron et al., 2016) for adding new photos and touch-activation hotspots.

Challenges. There will always be a place for dedicated AAC devices that offer customized features catering to the needs of AAC users, features which mainstream mobile devices currently do not offer, nor will likely offer in the future (Hemsley, 2012). By their very nature, mainstream mobile devices cater to the needs of the mainstream, and thereby lack the specific features that some AAC users require. Perhaps it can be said of designers of dedicated AAC devices, "They only do one thing, and they do it right." Some of the unique features that dedicated AAC devices offer are: switches, enhanced speakers, built-in drop cases, mounts, and other enhanced communication interfaces (AAC-RERC, 2011). Furthermore, because of their experience in the niche market, traditional AAC manufacturers are better equipped to provide technical support, training and support in securing funding (AAC-RERC, 2011). Deruyter et al. (2007), while recognizing the potential benefits of using AAC apps on mainstream mobile devices, identified the following three disadvantages of going this route (a) AAC mobile apps are at the mercy of hardware changes in the mainstream mobile devices, (b) mainstream mobile devices will likely require peripherals (extra batteries, switch interface, amplified speakers, extra damage protection, and carrying case) to function fully as AAC systems, and (c) the lack of clear distinction in responsibility between the device manufacturer and the application software designer will be problematic when technical support is required.

Additional inherent features in current mobile technology that may impede AAC functionality are the Graphical User Interface (GUI) and touch screen display. The GUI could be problematic for users because they may be required to perform several steps before activating the AAC program (Dolic et al., 2012). The touchscreen interface requires fine motor control to operate settings and functions with a degree of finesse (lightly touching the icon, rather than

firmly pressing it), and may challenge and frustrate individuals lacking the required manual dexterity (van der Meer et al., 2011, 2012a).

Lastly, a challenge that confronts all technological innovations is also faced by mainstream mobile innovations, and that is the tendency to focus on the technology instead of pedagogical, social and therapeutic goals (Allen & Shane, 2014). In a white paper on mobile technology and communication, the Rehabilitation Engineering Research Center on Communication Enhancement (AAC-RERC, 2011) recognized the likelihood of AAC users or family members to choose communication systems based on information from social circles, rather than professional advice. The authors also noted that this may lead to service delivery being driven by new mobile technology. This poses a challenge for AAC professionals to keep abreast of technological innovations and to ensure that interventions match communication goals (AAC-RERC, 2011).

The recognition of the benefits of AAC has led to a large body of research on its impact, with recent studies beginning to examine the implications of mobile AAC apps (Brandenburg et al., 2013). In a narrative review of literature on mobile technology's impact on caregivers, Allen and Shane (2014) reported primarily anecdotal support for the great potential of AAC mobile apps. While there was general agreement in the potential benefit of mainstream mobile technology in supporting communication, leading experts in the field call for more empirical evidence to evaluate the effectiveness and efficacy of mobile-based AAC systems (Brandenburg et al., 2013; van der Meer et al., 2011). Mirenda (2014) posit that although there has been some evidence that such technologies are effective in teaching unprompted requesting, new research need to investigate the development of mobile technology in instructional methods that support a

wider range of communication functions (social interactions, conversations, social etiquette, and information sharing). The following section provides a review of several empirical studies on the educational and therapeutic use of AAC mobile apps.

Research studies. In Kagohara et al.'s (2010) case study of AAC mobile device use, behavioral intervention was applied to the retraining of a student who had difficulty using his iPod-based SGD, rather than abandoning the device and selecting a new one. A 17-year-old student with autism was taught to use an iPod SGD due to severely limited speech. The student had very limited success in operating the touch screen device due to motor control problems. After the student's continued difficulties using the iPod for requesting, the decision was made not to select a different device for the student, but to record the student's errant icon selections on the device. After studying patterns of the students' icon selections, the researchers applied behavioral interventions consisting of differential reinforcement and 10-second time delayed prompting. As a result of the interventions, the student achieved 100% success in using the iPod-based SGD for making requests. The authors noted that this study demonstrates the important role that, aside from the requisite ability to visually identify icons, fine motor skills play in the user's successful experience with touch-sensitive mobile devices. Another important aspect of this study was that reinforcing effective procedures (extinction of errant icon selection) for device usage may reduce the occurrences of device underutilization or abandonment, and that it helps to avoid the costly and time consuming alternative of device replacement.

Flores et al. (2012) compared the effectiveness of using an iPad-based SGD (AAC mobile app) to a picture-based system for making requests. The participants were five elementary school boys with severe speech deficits, who have used a picture-based system. The

iPad-based intervention used an AAC app called *Pick a Word*, which used photographs of preferred snacks and a digitized voice of a 10-year-old girl. Students received training on using the iPad and were given time to practice on the AAC mobile app for making requests. The intervention sessions followed the ABAB order, starting with picture-based condition, followed by iPad-based condition. There were mixed results: Three of the five students showed moderate success in using the iPad over the picture-based system; one student made noticeable gains in the iPad condition.

Researchers in Croatia (Dolic et al., 2012) explored issues in the potential of using mainstream mobile technology for AAC systems. The authors introduced a model for AAC mobile applications that can adapt its AAC features according to the technical specifications of specialized and mainstream mobile devices. In this model the AAC application was able to automatically optimize the size of symbol displays according to the screen size requirements of all devices offered by an operating system. Users were also able to customize settings according to their individual needs. These settings and preferences would be stored either online or locally on the device. In order to gain more insight into AAC users' technology needs, they distributed an online questionnaire to the parents of current and potential AAC users, 15 of whom responded. Results from the questionnaire indicated the following primary issues with AAC devices: (a) Letters and symbols were too small (63% and 54%, respectively), (b) The devices used a foreign language (45%), and (c) Pictures and symbols were hard to understand (27%). The parents also expressed that although none of them owned a tablet, they wanted the potential for their child to use a mobile device-based AAC system (50%).

Sampath et al. (2012) explored two goals in their study of AAC mobile technology: (a) design an AAC mobile app (AutVisComm) for the Android operating system, with stakeholder input gathered from a parent survey, a participatory design experience with a student, and a usability study with a larger group; and (b) evaluate the effectiveness of the AAC mobile app intervention on a group of young students with severe communication deficits. Twenty-four children (unreported age) with autism who had no functional or severely limited speech were selected to participate in the study. They received training on using the AutVisComm mobile app to make requests for preferred snack items. Encompassing 10 sessions, the subjects' responses (when asked "What do you want?") were recorded as either independent response (IN), Verbally Prompted (VP) and Physically Assisted (PA). In the early sessions, the children relied more on physical assistance (PA) and gradually progressed to verbal prompting (VP) before using the mobile app to make their selections. By the sixth session, there was a significant shift to independent response (IN).

In an exploratory study based on Toronto area schools Campigotto, McEwen and Epp (2013) evaluated the viability of using an AAC mobile app (MyVoice) on an iOS device (iPod touch and iPhone). This study used action research methodology to collect mixed data (stakeholder interviews, user profiles, student demographics, and device usage data). The iOS devices were deployed over a 5-month period to be used in special education classrooms in two schools in the Toronto area for grades 7 through 12. Staff were given training on the device, sample lesson plans and guidelines to align usage with the curriculum, but were encouraged to use explore other potential uses. Teacher and student experiences were analyzed and data were organized under the following themes: (a) attention and motivation, (b) curriculum design and

technology, (c) practical issues and technical issues, (d) timing and technology integration, (e) confidence and peer-assisted learning, and (f). student voices. The corresponding summary of findings include: (a) students being motivated to use the device for its familiarity and experiencing that it was a relevant classroom tool, although few students actually using the MyVoice app, which needed more scaffolding and improved user interface; (b) teachers having difficulty with the concept of using a mobile device as a learning tool and integrating the device into their classroom activities; (c) logistical challenges of charging the devices, syncing to a computer for programming and customizing vocabulary, storing them for security, and managing risk of damage; (d) server and internet issues limiting the ability to access online resources, impeding just-in-time performance (There was no way to reconfigure the rate of the synthesized voice, which students felt was too fast. Students with motor skill deficits such as one with Cerebral Palsy had difficulty holding the small device and manipulating input on the tiny screen.); (e) devices having been introduced toward the end of the school year, posing a challenge to teachers who would have preferred more time to work with the devices; (f) Because of the device's familiarity, students' social interactions increasing through collective problem solving and peer-assisted learning; and (g) Overall, students being positive about the devices and appreciating that the devices provided another source of speech modeling through its speaking and reading aloud features.

Moffatt et al. (2017) explored perspectives on the viability of clinical and therapeutic use of mobile technology for patients who have aphasia, an acquired speech impairment that typically affects adults. An online survey was administered to a broad group of professionals in the aphasia field, including communicative disorder assistants (CDAs), occupational therapists

(OT), and speech-language pathologists (SLPs). In addition, observations were recorded from group therapy sessions with patients using AAC devices. Lastly, data were also collected from discussions and observations during focus group sessions with clinicians. The Web-based survey received 67 viable responses, of which 49 were from Canada, and 18 in the United States. Survey results showed that the most used AAC devices were as follows, (figures represent number of respondents): Dynavox (34), iPad (21), iPod Touch (16), Tellus Smart (7), Vantage Lite (7), ChatPC (4), LightWriter (3), and Zygo Macaw (2). Respondents provided the following recommendations for devices: iPad (30), iPod Touch (26), DynaVox (18), iPhone 9), and Vantage Lite (7). The following were identified as advantages of mainstream mobile devices over traditional dedicated SGDs: Less stigma (12), more portable (8), lighter (5), and cheaper (4). The list of mobile device disadvantages included: screen harder to read (16), limited software options (8), screen hard to use (5), lower volume (4), and less durable (3). Observations from the therapy sessions and focus group discussions revealed that none of the clients used their assigned AAC device, except for giving self-introductions to strangers. The complaint was that the devices lacked sufficient vocabulary. Another key factor in underutilization and abandonment was the stigmatization that devices used childish pictures. Another important finding was that although there was enthusiasm among the clinicians for the positive potential of mobile devices, they were more excited about productivity apps such as the calendar and voice recording, then they were about AAC apps. The clinicians felt that apps such as Proloquo2Go still required more improvement.

Summary. The affordances of technology not only have enhanced our daily lives, but also have increased the potential for freedom in communication for individuals with CCN (Dolic

et al., 2012). Mainstream mobile devices, which primarily run on Apple (iOS) and Google (Android) operating systems, offer specialized applications that have increased the accessibility of communication solutions by essentially turning smartphones and iPads into sophisticated AAC devices (McMillan & Renzaglia, 2014a). However, despite technological advances and policies and legislation such as the IDEA of 1975 and the ADA in 1990, there exists an underutilization of high-tech communication resources for children who require AAC (Kent-Walsh & Light, 2003; McMillan & Renzaglia, 2014b). Communication professionals have an opportunity to work toward narrowing the digital divide and advocating for greater participation in the information society (Deruyter et al., 2007). There exists a need to ensure that children with speech impairment who require innovative AAC methods have the needed resources (Costantino & Bonati, 2014). Factors that affect the utilization of AAC were as follows, (a) effectiveness of AAC interventions, (b) evidence-based practices and professional development, (c) facilitators of AAC utilization, and (d) innovative system design.

Chapter 3: Methodology

Introduction

The purpose of this chapter is to present a detailed description of the Policy Delphi methodology that was employed to perform a study on issues that impact the utilization of AAC mobile applications by young students with speech impairment. There will be a description of the research methodology and rationale, and procedures for data collection, management and analysis. Data were collected from the following guiding research questions using the Policy Delphi method for two rounds of questionnaires given to experts in special education who have experience with AAC:

1. What are expert opinions on the feasibility of providing young learners who have complex communication needs with AAC using mainstream mobile devices?
2. What facilitative actions are important to the utilization of AAC mobile apps in elementary school settings by students with complex communication needs?
3. What are the roles of stakeholders in the implementation of AAC mobile apps in elementary school settings by students with complex communication needs?

Research Methodology and Rationale

The Delphi concept began as a spinoff of defense research by the Rand Corporation in the 1950's at the beginning of the Cold War with Russia. The main objective of Project Delphi was to gather input from military experts to formulate a consensus of opinions, solutions and forecasts (Skulmoski, Hartman, & Krahn, 2007). This research process involves the facilitated exchange of information, summarization of opinions and judgements and revision of individual responses. This *structured communication* process (Linstone & Turoff, 2002, p. 499) would

continue for a predetermined number of rounds, usually between three to five, or until a desirable result is achieved (Cho & Turoff, 2001). The premise is that structured, facilitated communication and answer revisions provide more value than individual responses (Linstone & Turoff, 2002). Alternative research methods would have been a costly effort to collect and process a massive amount of data. According to Linstone and Turoff (2002), Delphi continues to be a valid research method whenever there is a need to obtain accurate information in a cost-effective manner.

While there are alternative methods for decision-making and gathering information that are more linear and less involving, Linstone and Turoff (2002) suggest decisions to employ the Delphi method are made with consideration of the following situations:

- The problem does not lend itself to precise analytical techniques but benefits from subjective judgments on a collective basis.
- The individuals needed to contribute to the examination of a broad or complex problem have no history of adequate communication and may represent diverse backgrounds with respect to experience or expertise.
- More individuals are needed than can effectively interact in a face-to-face exchange.
- Time and cost make frequent group meetings infeasible.
- The efficiency of face-to-face meetings can be increased by a supplemental group communication process.
- Disagreements among individuals are so severe or politically unpalatable that the communication process must be refereed and/or anonymity assured.

- The heterogeneity (or individuality) of the participants must be preserved to assure validity of the results, i.e., avoidance of domination by quantity or by strength of personality ("bandwagon effect"; p. 6).

One important aspect contributing to the validity of the Delphi is the assurance of confidentiality, in which group interactions are carefully structured through individual communication. This identity concealment affords the private expression of opinions, judgements, individuality and freedom of expression (Linstone & Turoff, 2002). According to Cramer (1991) confidentiality also disinhibits effective panelists (or participants) and deters persuasion of opinion and thought. Thus, the essence of the Delphi process is that it facilitates individuals working together without having to meet face-to-face, which has been shown to be substantially inferior to private and remote opinion (Clayton, 1997). Delphi is not a substitute for committee work or focus group; rather, it enhances and extends them by allowing a homogeneous group of experts to problem-solve without hindrances from some of the following pitfalls that are characteristic of group meetings:

- The domineering personality, or outspoken individual that takes over.
- The unwillingness of individuals to take a position on an issue before all the facts are in or before it is known which way the majority is headed.
- The difficulty of publicly contradicting individuals in higher positions.
- The unwillingness to abandon a position once it is publicly taken.
- The fear of bringing up an uncertain idea that might turn out to be idiotic and result in a loss of face (Linstone & Turoff, 2002).

Despite the appearance of simplicity, the Delphi method can be a complex, demanding, and intensive process owing to its fluidity, adaptiveness and suitability for both qualitative and quantitative research (Linstone & Turoff, 2002; Skulmoski et al., 2007). Delphi studies can include as little as five and up to several hundred participants, with expert groups formed by panelists from homogeneous backgrounds. Due to this flexible nature, Delphi has received numerous adaptations and augmentations to match a variety of study settings and objectives to add to the researcher's options (Skulmoski et al., 2007).

Introduction to Policy Delphi Method

While the Delphi method aims to achieve consensus among expert groups, the Policy Delphi, introduced in 1969, is receptive to alternate and opposing views (Cramer, 1991). Not only is disagreement welcomed, the communication structure of Policy Delphi may inhibit consensus intentionally. The choice to employ Policy Delphi rests not on the interest to arrive at a group decision; but rather, to elicit diverse ideas and opinions for consideration on a complex issue with expected opposing viewpoints (Linstone & Turoff, 2002). According to Linstone and Turoff (2002) a Policy Delphi can involve as few as 10 and up to 50 panelists, and once its work is accomplished, a committee may utilize study results to develop the organization's policy. The goal of this researcher is for the results to benefit decision-makers who develop policies on the provision, implementation and use of high-tech AAC systems.

Another departure from traditional Delphi is that Policy Delphi favors a heterogeneous group of panelists, who are not necessarily experts on the topic being studied. In fact, Linstone and Turoff (2002) posit that Policy Delphi benefits from having diverse panelists of informed advocates, facilitators and other stakeholders who can contribute diverse perspectives for

consideration. Therefore, the strength and effectiveness of the Policy Delphi rest in its ability to serve the following objectives:

- To ensure that all possible options have been put on the table for consideration
- To estimate the impact and consequences of any particular option
- To examine and estimate the acceptability of any particular option (Linstone & Turoff, 2002)

With the complexities of AAC mobile apps implementation being the subject of study, the researcher has determined that the Policy Delphi is the most suitable research method by which to gather data in the form of viewpoints and opinions from a diverse group of educators who have experience with AAC. This data can prove to be valuable to decision-makers in special education settings who set policy regarding the provision and implementation of AAC mobile technology.

According to Skulmoski et al. (2007) the number of rounds depends on the focus of the study, and if consensus is not the goal, then only two rounds may be needed to undertake a Policy Delphi study. For this reason, a two-round Policy Delphi was conducted using a panel of experts from a variety of areas in education who have experience with and knowledge of AAC.

Phases of the Policy Delphi Method

To ensure construct validity, authoritative guidelines were incorporated into this study's methodology. Linstone and Turoff (2002) provided the following process exemplifying a two-round Delphi study. As adapted from the sample study, the following outline provides a preview of phases employed in this study's procedure:

- Phase 1. Assemble panel of experts.
- Phase 2. Draft questionnaire and seek validation by academics.
- Phase 3. Pilot questionnaire.
- Phase 4. Distribute Round 1 questionnaire.
- Phase 5. Prepare quantitative analysis of 1st-Round answers.
- Phase 6. Examine areas of consensus and highlight areas of dissensus to guide the construction of follow-up questions for Round 2.
- Phase 7. Design, pilot and distribute Round 2 questionnaire to include the following: (a) Round 1 quantitative results, (b) Round 1 areas of dissensus, (c) Request for comment and feedback in light of summarized data results, and (d) request for additional variables.
- Phase 8. Prepare final qualitative data analysis.

As indicated in the procedural outline above, this Policy Delphi study involved recursive management and analysis of data through two iterative rounds of questionnaires. Therefore, a more detailed description of this Policy Delphi study's specialized handing of data will be provided in the subsequent Data Management section.

Population, Sample and Sampling Procedures

The goal was to recruit a group of 20 participants via a purposive sampling of speech and language pathologists (SLPs), assistive technology specialists, and special education professionals from the United States. Experts in the field were recruited based on the following

three criteria: (a) knowledge and experience with AAC, (b) willingness and ability to participate, and (c) sufficient time to participate (Kurubacak, 2007; Skulmoski et al., 2007).

A list of potential participants were elicited from the researcher's network consisting of the following professionals: educational technologists, school psychologists, speech and language pathologists, and special education teachers and administrators. This initial request for referrals took the form of emails and phone calls with the researcher's network of professionals. Snowball effect sampling, also known as key-informant sampling (Biernacki & Waldorf, 1981; Dane, 2010; Emerson, 2015; Goodman, 1961; Skulmoski et al., 2007) was used to recruit experts by taking advantage of strong social networks among special education professionals. To remedy the inherent nature of anonymous surveys usually producing low response rates (Dane, 2010), the researcher sought recommendations for participants through introductions and referrals. Social capital as demonstrated through informant referrals may also play a strong role in increasing participation rates resulting in essential data (Noy, 2008). The goal was to achieve a quota of five to seven participants from each of the following groups of experts: (a) speech and language therapist, (b) special education teacher or administrator, and (c) assistive technology specialist. Individuals who were referred as a result of snowball effect sampling were contacted via an emailed invitation to participate in the study (See Appendix A). This personalized correspondence is intended to avoid the annoyance of unsolicited emails and to promote a connection and relationship with respondents that may lead to higher completion rates. According to Cramer (1991), participants who are nominated by peers may be flattered and more motivated to participate in the study.

Human Subjects Protection

The researcher ensured the best interest of participants through the preservation of privacy and anonymity, and maximizing of benefits while minimizing potential risks. Every effort was made to avoid researcher- and respondent-bias; the former through the inherent characteristic of the Delphi method using confidential questionnaires; the second through providing individualized emailed invitations and instructions. The researcher preserved panelists' privacy when reporting questionnaire results (i.e., each panelist's name and email address were not be associated with responses). Data collections were confidential and anonymous; participants answered questions individually using an anonymous survey link and were not asked for their name (See informed consent, Appendix B). As a critical component of a Delphi study, only the researcher saw responses and any identifiable information remained confidential. Because this study aimed to ensure the anonymity of subjects, the researcher requested that the IRB waive the requirement of a signature on the informed consent. Furthermore, the researcher requested expedited review due to the absence of children subjects in this study.

Once a list of participants was finalized, Round 1 of the study commenced with a personalized emailed invitation letter. Each email included a brief review of the study purpose and process, intended application of data, assurance of confidentiality and a web link to the landing page of the online questionnaire using Qualtrics, an online survey development tool (Qualtrics.com). Potential participants were informed that this study sought education professionals who have knowledge and experience with AAC. Individuals were informed that participation involved the completion of two rounds of questionnaires in a Policy Delphi Study. Additionally, the introduction letter encouraged participation by emphasizing the significance of

this study, and potential benefits of the results to decision-makers who develop policies on the use and provision of AAC technology.

The online questionnaire commenced with an informed consent (Appendix B) that included an opt-in/opt-out check box. Additional information were provided in the informed consent on the completion window and contact information for requests for clarifications (Dillman, Smyth, & Christian, 2014). Furthermore, participants were made aware that participation was voluntary and informed of the foreseeable risks and potential benefits associated with participation in this study. Minimal risks include possible discomforts in spending 15-30 minutes completing an online questionnaire for two rounds and navigating with a mouse and keyboard or touch-screen display. Although participants did not receive material or monetary incentive for their participation in the study, they were likely to reap intangible benefits in the form of added self-knowledge and increased understanding of the subject matter (Linstone & Turoff, 2002). Research has shown that the promise of material incentives for participation yielded modest results (Dillman et al., 2014). However, response rates increased when the facilitator made "respondents feel as though they are doing something worthwhile" (Dane, 2010, p. 234), which was more effective than offering incentives such as gifts. According to Frankl (1985), people are driven not so much by the search for rewards, but for meaning and significance in the work they do. Furthermore, participants had direct involvement in offering feedback on the formulation of questionnaire priorities and contributing to a joint body of knowledge as a result of the study. Lastly, results from this study may be beneficial to decision-makers who develop policies on the use and provision of AAC technology.

Instrumentation

The AAC questionnaires contained items that prompted the panelists to respond via rating scales and prioritize items, and offered experts opportunities to provide additional responses on open-ended questions. Based on guidelines gleaned from Cramer (1991), Dane (2010), Dillman et al. (2014), and Linstone and Turoff (2002), the following features were included in the questionnaire design:

1. Study background and purpose and directions for completing the questionnaire.
2. Check-boxes for acknowledging the receipt of informed consent and for confirming participation.
3. Definition of terms to ensure understanding of terminology and common use of language (adapted from Binger & Light, 2006).
4. Beginning with questions that elicit background information, which are easier to answer and not as time consuming (items on job title, years of experience in position, years of experience with AAC were followed by close- and open-ended questions about attitudes and perceptions).
5. Questionnaire items are focused on study purpose and guided by research questions.
6. Each item addresses only one domain that can be measured with a single question.
7. Questions using rating scales, but allowing no neutral position.
8. All open-ended questions allowing for *Not Applicable* and all rating scale questions offering *No Judgement* for opting-out of responses.

The researcher developed the Round 1 questionnaire based on a review of literature on AAC presented in Chapter 2. All questions were paraphrased from research literature. The

questionnaire was designed to survey attitudes, opinions and perceptions of AAC experts on factors that affect the implementation of AAC mobile applications. Respondents were asked to respond using the following rating scale: Highly Agree, Agree, Slightly Agree, and Completely Disagree. Individuals were asked to respond to statements gleaned from research studies about factors and variables that affect the implementation of high-tech AAC systems, and facilitative actions and roles of stakeholders in the implementation of AAC mobile applications by young learners with CCN. The questionnaire was organized according to the major themes of: Designs and Features, Social Inclusion, Training and Professional Development, Affordability, Challenges and Effectiveness, Facilitative Actions and Stakeholder Roles.

Questions in Round 1 were primarily quantitative, with only three concluding, open-ended questions that offer participants an opportunity to suggest additional variables associated with AAC implementation. At the end of the Round 1 questionnaire, there was a final question requesting participation in the Round 2 (Appendix D) of the study. Respondents who answered affirmatively were included in the second round. To further preserve anonymity, the data from this final question were recorded independently of the questionnaire data.

The Round 2 questionnaire was designed to contain exclusively open-ended questions based on summarized results from Round 1. Once Round 1 questionnaire was completed, results were organized according to the major themes of from Round 1 as outlined above. The second questionnaire prompted individuals to reflect and give feedback on synthesized data results and concluded with a final opportunity for participants to suggest additional variables and topics.

Total Design Method, also known as Tailored-Design Method (TDM) was applied to increase response rates by ensuring that the questionnaire is purposeful, well organized and easy

to complete (Dillman et al., 2014). As part of TDM, clear instructions were provided at the beginning of the questionnaire and in each section to assist respondents in answering questions without having to refer back to the beginning. Intelligent survey design also called for brevity and using simple and consistent formatting. Additionally, validity was promoted through the construction of questions that allowed respondents to opt out by selecting *No Judgement* due to non-familiarity with questions that do not apply to their situation (Linstone & Turoff, 2002).

Method Validity and Reliability

Validity and reliability were incorporated into several stages during instrumentation development. There were three levels of validation in constructing the questionnaire: (a) content, (b) online functionality, and (c) pilot testing. The first level of validity was sought by asking academics or practitioners with expertise in AAC research to provide feedback on the content of the questionnaire. Participants were emailed the research questions and the core content of the questionnaire. They were asked to provide feedback on the effectiveness in which the questionnaire contents address the research questions. In the second level of validity, an emailed solicitation were sent to request participation from education professionals in a functionality study to provide feedback on the questionnaire developed using Qualtrics. Online survey functionality testing was performed to ensure directions and question formats are easily understandable and functional (Linstone & Turoff, 2002; Skulmoski et al., 2007). Furthermore, the testers were asked to provide feedback on browser compatibility to ensure that the online questionnaire can be taken in all mainstream internet environments. Finally, in the third stage of validation, a pilot study was conducted with several members of the target population to test overall effectiveness of the online questionnaire. Pilot testers took the survey as if they were

participants on the study. Feedback from each of the validation procedures were incorporated into the questionnaire design prior to Round 1 of the study. The three-step validity process was repeated in the development of Round 2 questionnaire.

As recommended by Skulmoski et al. (2007) to demonstrate methodological rigor, the researcher kept an audit trail by using a journal to record notes on research procedures, data collection tasks, and correspondence with the committee chair and emails to study participants. This record of events was referred to by the researcher throughout the course of the study.

Data Management and Analysis

The two-round Policy Delphi data management process in this study was iterative and involved two rounds of questionnaires, structured group communication and facilitated feedback. These activities are described in detail in the following section. At the end of Round 1 the researcher performed statistical analysis of results from the rating scales on the quantitative questions (Creswell, 2009). The online survey results from Qualtrics were reported to the researcher as data tables, graphs and charts. The results were downloaded as a database for further descriptive analysis to reveal the means and range of scores. Coding of qualitative items, which primarily took place in the Round 2 questionnaire, were done using the Holistic Coding method (Saldana, 2013) in order to identify general themes. The researcher enlisted the help of a 2nd-rater to provide reliability of the coding process. Prior to commencing the second round, the researcher constructed new questions based on responses from Round 1. The Round 2 questionnaire provided summarized responses to the panel, while preserving confidentiality. In Round 2 all items in the questionnaire were open-ended to provide participants with an opportunity to provide feedback on the filtered summary (facilitated feedback). These qualitative

questions prompted panelists to respond to summarized responses from Round 1 (structured group communication). At the end of the second round, participant responses were summarized and analyzed to determine study findings. At the end of both rounds common and conflicting viewpoints were identified and analyzed. These findings will be shared with participants at the end of the study.

Following descriptive data analysis and coding, the researcher performed data interpretation. Based on Linstone and Turoff's (2002) six phases of a Policy Delphi exercise, the following communication process and associated questions guided data interpretation:

1. Formulation of the issues. What is the issue that really should be under consideration? How should it be stated?
2. Exposing the options. Given the issue, what are the policy options available?
3. Determining initial positions on the issues. Which are the ones everyone already agrees upon and which are the unimportant ones to be discarded? Which are the one exhibiting disagreement among the respondents?
4. Exploring and obtaining the reasons for disagreements. What underlying assumptions, views, or facts are being used by the individuals to support their respective positions?
5. Evaluating the underlying reasons. How does the group view the separate arguments used to defend various positions and how do they compare to one another on a relative basis?
6. Reevaluating the options. Reevaluation is based upon the views of the underlying evidence and the assessment of its relevance to each position taken.

Lastly, while the Policy Delphi method values dissensus, this study examined and discussed consensus of opinions where they exist. The researcher determined areas to explore further in Round 2 by examining Round 1 results that show a consensus of below 70%, as a measurement of agreement and disagreement to questionnaire prompts (Diamond et al., 2014). Furthermore, there was a discussion of findings and presentation of direct quotations in Chapter 4 that include both consensus and dissensus of perspectives.

Summary

Chapter 3 presented the methodology to undertake a study on expert perceptions on factors that affect the use of AAC mobile apps by young students with CCN. Due to this study's aim of exploring differing expert viewpoints, rather than reaching a consensus, a two-round Policy Delphi method was employed. The research method involved the following procedures: (a) setting population sampling criteria and recruiting participants, using purposive sampling, with snowball effect and quota sampling; (b) pilot testing the questionnaire; (c) administering two rounds of questionnaires; (d) summarizing the questionnaire after Round 1; (e) providing opportunities for participants to respond to Round 1 results; and (f) managing and analyzing data after each round. The goal was to enlist the participation of 20 experts in special education, speech and language therapy, and assistive technology who have experience with AAC. Pilot testing of the questionnaire was provided by experts who were asked to give feedback on content, formatting and usability of the online questionnaire. Lastly, panelists were given an opportunity after Round 1 to review and respond to a summary of survey results.

Chapter 4: Results and Key Findings

Introduction

This research study gathered expert opinions on the feasibility of utilizing mainstream mobile technology and mobile applications for young children who require augmentative and alternative communication (AAC). The Policy Delphi method was employed in this study to encourage and explore diversity in expert perspectives, rather than to achieve consensus of opinions. In this chapter, there will be a review the study purpose, research questions, methodology, and questionnaire; presentation of results; and summary of key findings.

Data were collected via two-rounds of online questionnaires using Qualtrics (Qualtrics.com) given to professionals in special education who have experience or expertise with AAC. The researcher recruited participants through snowball effect sampling by requesting referrals from his professional network of educators. Round 1 included 19 participants, 14 of whom also participated in Round 2. Each of the rounds was conducted during a two-week window of data collections, in November of 2016 (Round 1) and January of 2017 (Round 2).

Restatement of Research Questions

This study was designed and organized to elicit expert opinions on the implementation of mobile mainstream devices for use as AAC systems. The following three research questions guided the development of the iterative questionnaires:

1. What are expert opinions on the feasibility of providing young learners who require AAC with mainstream mobile devices for communication?
2. What facilitative actions are important to the utilization of AAC mobile apps in elementary school settings by students with complex communication needs?

3. What are the roles of stakeholders in the implementation of AAC mobile apps in elementary school settings by students with complex communication needs?

Design Overview

Round 1 of the Policy Delphi study consisted of a 29-item online questionnaire of rating scales and item rankings. All questions on the Round 1 were paraphrased from research literature on AAC as presented in Chapter 2. The questionnaire was aligned to the research questions, organized into four parts and designed to survey attitudes, opinions and perceptions of AAC experts on the feasibility of utilizing mainstream mobile devices and applications for communication intervention, as well as factors that affect the utilization of AAC mobile applications.

Round 2 questions were developed to explore areas that showed dissensus (Steinert, 2009) in the previous round. Eleven open-ended questions prompted participants to reflect and give feedback on synthesized data results from the previous round. The questionnaire was arranged in sections that aligned to the research questions.

Round 1 Results

The proceeding presentation of findings from Round 1 is organized in the following four parts: (a) participant background information; (b) research question 1, feasibility of using mainstream mobile devices for AAC; (c) research question 2, facilitative actions; and (d) research question 3, roles of stakeholders. These guiding questions have been abbreviated and the questionnaire prompts shortened in figures 1-8 to provide brevity. The complete prompts are provided in the Round 1 Questionnaire (Appendix E). Percentages will be used to present data results. The researcher has established consensus when at least ≥70% of the experts' responses

agreed or disagreed, and similarly for dissensus at ≤70%. This section will conclude with the presentation of responses from three open-ended questions that encouraged participants to offer their opinions and to suggest topics for the follow-up questionnaire.

Participant background information. Background information was collected on the demographics of study participants. The demographic information presented in this section represents the 19 AAC experts who participated in Round 1. Table 1 shows that experts came with a variety of professional experience, serving primarily in the west coast of the U.S.A., as well as, urban and suburban school districts. A majority of experts were Speech and Language Pathologists, and Special Education teachers/administrators. Professional experiences ranged from one to 11 or more years. Experience in AAC ranged from one to six or more years.

Table 1

Participant Demographics

Job Title		*n* = 19
	Speech/Lang Pathologist	7
	Special Ed	7
	Assistive Technologist	3
	Other (BCBA, OT)	2
Geographical Region		*n* = 19
	West	18
	Midwest	0
	South	1
	Northeast	0
Employment Setting		*n* = 18
	Urban School District	10
	Suburban School District	8
	Rural School District	0

(continued)

Years of Experience in Profession	*n* = 19
1-5 years	6
6-10 years	4
11 or more years	9
Years of experience in AAC	*n* = 19
None	0
1-2 years	5
3-5 years	4
6 or more years	10

Note. BCBA= Board Certified Behavior Analyst; OT= Occupational Therapist

Research Question 1: feasibility of using mainstream mobile devices for AAC.

Participants were prompted to respond to questions regarding the feasibility of using high-tech mobile devices in terms of the following five characteristics, as follows, (a) design and features, (b) social inclusion, (c) training and professional development, (d) affordability, and (e) challenges. Figures 1-6 show an aggregation of responses on a 4 point Likert scale that ranged from "Agree" to "Disagree". Responses for "Highly Agree" and "Agree" were combined into "Agree," and responses for "Slightly Disagree" and "Completely Disagree" were combined into "Disagree." For each question, participants were also given the option to choose "No Judgement," if they were unsure or did not want to take a position.

Design and features. Figure 1 shows results from the five questions related to the effects of design and features on the usability of mainstream mobile devices (MMDs). Overall, there was a consensus among respondents about the design and features of AAC mainstream mobile technology in four out of five questions. A majority disagreed (84%) with the statement that MMDs, which have touch screens, may impede AAC usage in students with low fine motor skills, and therefore should not be utilized. A majority disagreed (74%) that the lack of switch input to provide alternative input sources on MMDs makes them inferior as an AAC system

compared to dedicated devices (DDs). Worthy of note is that this question had the second highest percentage of no judgement selections (21%). A majority agreed (79%) that there will always be a place for DDs that offer customized features catering to the needs of AAC users, features which MMDs currently do not offer, nor will likely offer in the future. A majority agreed (79%) that it is feasible for a school to provide specialized behavioral and motor skills intervention for some students to help them be able to use AAC applications on MMDs. There was no consensus on the statement that overall, students will have more success in communicating effectively when using AAC on mainstream mobile devices than they will on dedicated AAC devices. For this question, disagreement was reported by 53% of experts, while only 32% agreed.

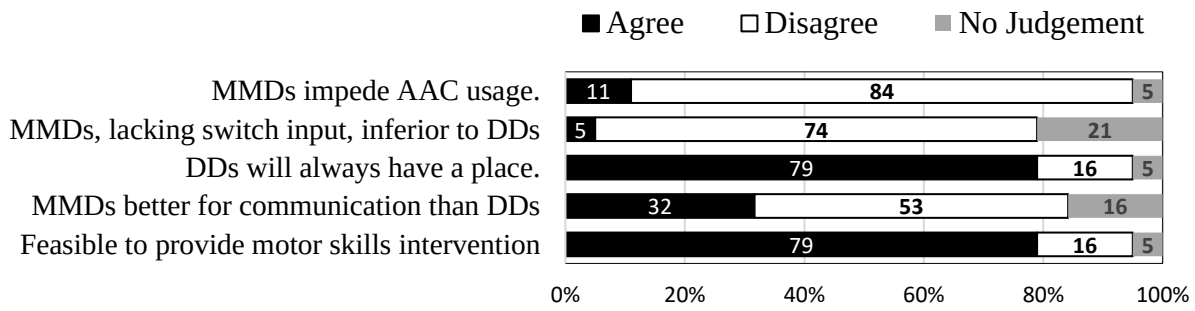

Figure 1. Design and features. MMDs = mainstream mobile devices, DDs = dedicated devices

Social inclusion. Figure 2 shows results from questions on the impact of social inclusion on the usability of MMDs. Overall, there was a diversity of opinions among respondents about the impact of AAC mainstream mobile technology on social inclusion, or how mainstream mobile devices are seen as socially acceptable and *cool*. There was a consensus on only two out of four questions. A majority disagreed (84%) that dedicated AAC devices primarily serve as *speech prostheses* that allow for limited social interaction. A majority agreed (89%) that access

to AAC through mainstream mobile technologies has provided increased visibility of AAC in society makes them socially acceptable.

There was no consensus with the statement that that AAC technologies on mainstream mobile devices enable unlimited, interactive communication. 58% disagreed with this statement while 42% agreed. In response to the statement that individuals with speech impairment who do not have access to mainstream mobile devices for AAC will be restricted from full participation in educational, vocational, and community opportunities 63% disagreed and 37% agreed.

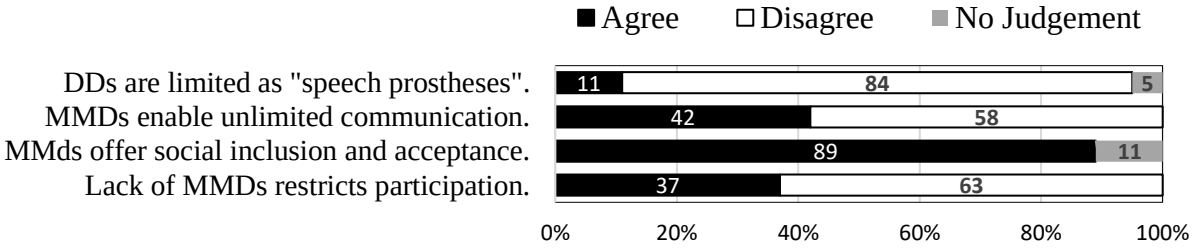

Figure 2. Social inclusion. MMDs = mainstream mobile devices, DDs = dedicated devices

Training and professional development. There was a consensus of opinions among respondents on all three questions about the importance of training and professional development in the implementation of AAC mainstream mobile technology, as seen in Figure 3. There was 100% agreement that insufficient training and knowledge for service providers leads to underutilization and potential abandonment of AAC technologies. There was overwhelming

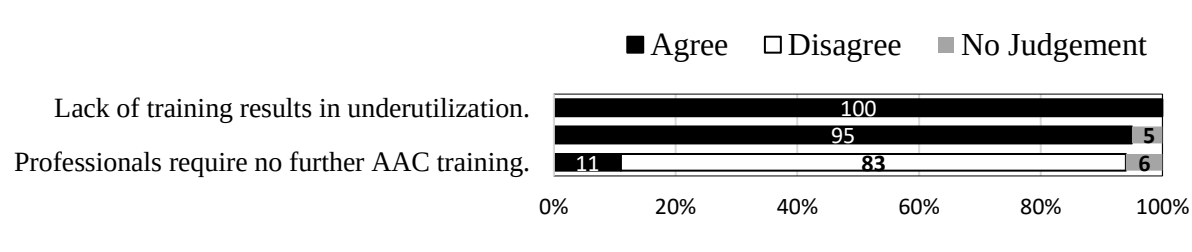

Figure 3. Training and professional development.

agreement (95%) with the statement that with the use of evidence-based practices and the systems established for AAC technologies to support teacher professional development in educational settings, communicative spontaneity of students who use AAC will likely be achieved. A majority disagreed (83%) with the statement that as an education professional, she/he was very comfortable with service delivery in the area of AAC and requires no further training.

Affordability. As seen in Figure 4, there was a consensus of opinions among respondents in three of five questions relating to the importance of affordability on the acquisition of AAC mainstream mobile technology. A majority agreed (74%) that cost has been a major obstacle in the provision of tech-based AAC intervention. A majority agreed (79%) that the relatively low cost of mainstream mobile devices means that more school districts, and other agencies are able to consider the purchase of AAC technologies on their own. A majority agreed (74%) that the affordability of mainstream mobile technology will likely result in the increased utilization of AAC mainstream mobile technology in young learners.

There was no consensus that school districts should prioritize funding for affordable AAC mobile apps over traditional AAC devices, with 42% experts disagreeing with this statement and 32% agreeing. Also noteworthy was the fact that this item had the highest percentage of no judgement selections (26%). In response to the statement that parents who were unsure if AAC was the right step now have an affordable option to provide an AAC device for their child, 53% agreed and 37% disagreed.

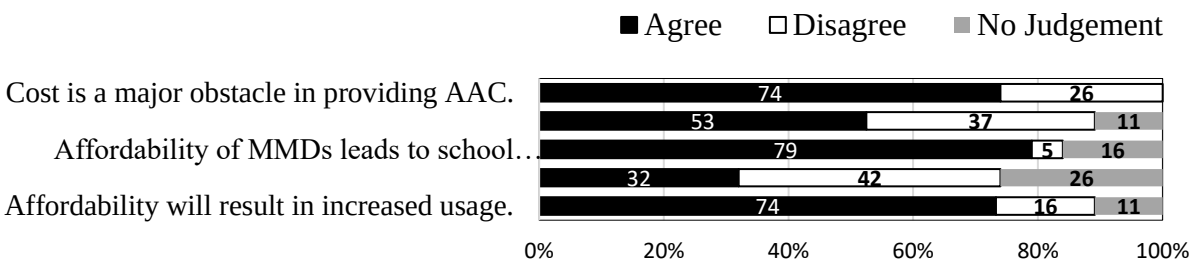

Figure 4. Affordability of mainstream mobile devices.

Challenges and effectiveness. Experts did not have a consensus on the two questions relating to the challenges and effectiveness of AAC mainstream mobile technology. As seen in Figure 5, 68% agreed and 32% disagreed that overall, the boom in mobile device availability and use raise many challenges, including the tendency to focus on the technology instead of on communication. Sixty-three percent agreed and 26% disagreed that a mainstream mobile technology such as a tablet, functioning as an AAC device, produces higher rates of independent responding than a picture exchange system.

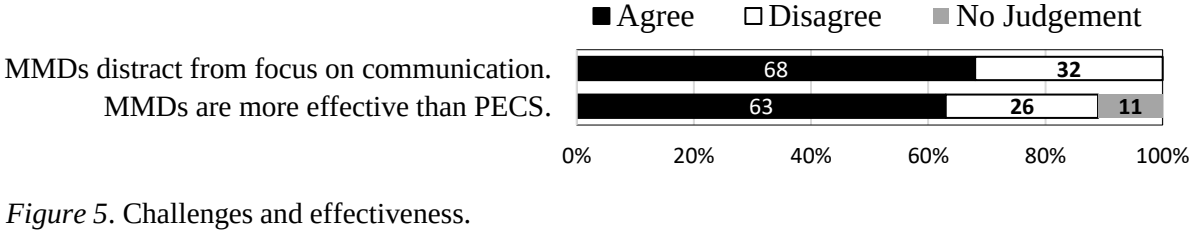

Figure 5. Challenges and effectiveness.

Research Question 2: Facilitative actions. Figure 6 shows the results when experts were asked to select the top three facilitative actions (in terms of priority and relevance) from a given list of actions for improving AAC mobile applications utilization in elementary school settings. The results showed that providing professional development for special education

teachers and training for communication partners (i.e., caretakers and parents) were selected by the participants as the most important tasks.

When asked to list any additional facilitative actions not represented in the question, the following were offered by study participants: “training peers”, “one size does not fit all”, “there needs to be assessment to determine appropriate recommendations”, and “getting buy in from student and training student users”. One expert gave this recommendation: “training to include emphasis on augmented input procedures being used across environments with multiple trained communication partners across the day prior to and while expecting the student to initiate, and integrating the use of AAC devices throughout the school day not just in speech therapy sessions.”

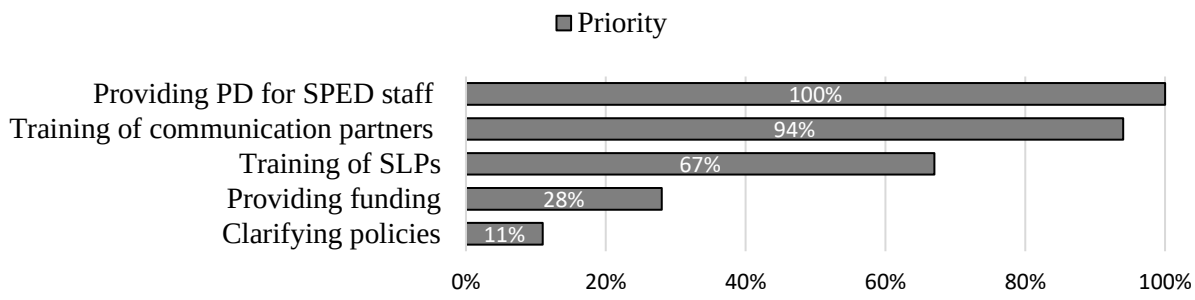

Figure 6. Facilitative actions. PD = professional development, SPED = Special Education, SLPs = Speech and Language Pathologists

Research Question 3: roles of stakeholders. Experts were also asked to select the top three stakeholder roles (in terms of priority or relevance) required to implement AAC mobile apps in elementary school settings. The results in Figure 7 revealed that Special Education staff, Speech and Language Pathologists and Communication Partners were the most important stakeholder groups, whereas administrators and general staff played limited roles.

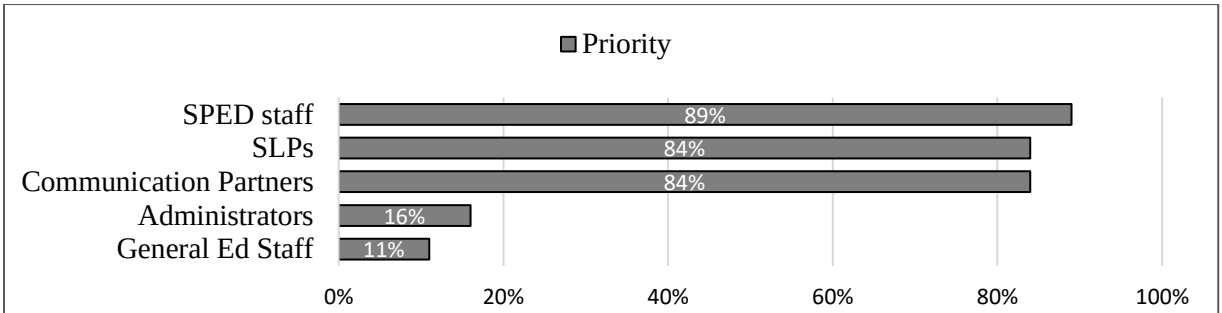

Figure 7. Roles of stakeholders.

Experts were also prompted at the end of the questionnaire to respond to two open-ended questions that solicited additional information. When asked to list any additional stakeholder roles not represented in the question above, only one response was offered: "Board of Education members". When asked to describe any additional issues that play a role in AAC mobile apps implementation that have not been represented in this questionnaire, one expert recommended that there should be a "Trial and implementation plan for student users, data collection." Another expert suggested that "Lower cost and common use today by students in general may result in over-selection of mobile apps when a dedicated device or low tech choice may be more appropriate." Lastly, this expert expressed that "because mobile devices are so commonly used by students and adults in general, they appear much more typical in any setting, are less intimidating and more user friendly for staff and communication partners compared with many dedicated devices."

Summary of Round 1 results. Results from Round 1 show that there were both consensus and diversity of perspectives within the five feasibility categories (design and features, social inclusion, affordability, training and professional development, and challenges and effectiveness). Experts were divided over the question of whether or not mainstream mobile

devices (MMDs) are superior to dedicated devices (DDs). While the benefits of MMDs are recognized by many experts, a majority agreed that DDs offer the design and features that are desirable to AAC users. In terms of social inclusion, a large majority of experts agreed that the prevalence of MMDs served to remove the stigma of using communication devices in public by offering the *cool* factor. However, experts were divided on the question of whether or not MMDs offer unlimited, interactive communication. Although MMDs are more affordable than their counterpart, many experts reasoned that parent wealth also play a role in device provision.

Since one of the aims of this study was to encourage and explore diversity of perspectives, the researcher made note of the following two items that stood out as having the greatest percentage of No Judgement selections. Nearly a quarter of experts (26%) held no position on whether or not schools should choose one system over the other, and whether or not lacking alternative input makes mainstream mobile devices inferior to dedicated devices (21%). In an effort to investigate divergent viewpoints, all Round 1 responses that showed dissensus were the subject of follow-up questions in Round 2.

In terms of facilitative actions to improve the implementation of AAC mobile technology, experts overwhelming agreed that professional development for special education staff and communication partners should take priority. Additionally, experts were overwhelmingly in agreement that they desire additional support and training on AAC.

Relating to roles of stakeholders in the implementation of AAC mobile technology, a consensus of experts agreed that the three critical players were Special Education staff, Speech and Language Pathologists and Communication Partners. Lastly, experts were clear in their position that general education staff, including teachers and administrators, played minor roles in

AAC implementation due to no or very little inclusion and mainstreaming of students who require AAC.

Round 2 Results

The results from the Round 2 questionnaire that consisted of 11 open-ended prompts, are presented in this section and also organized by the research questions, with the prompts abbreviated for brevity. The complete prompts can be found in the Round 2 Questionnaire (Appendix F). The coding process occurred in two phases. The initial phase involved the interpretation of responses for each item to determine the overall attitudes of experts on items that provided an opportunity to take a position. Eight of the 11 items in Round 2 (questions 1, 2, 4, 5, 7, 8, 9, and 10) lent themselves to coding for value-laden responses (i.e., yes or no; superiority of mainstream mobile device or dedicated devices). This coding served to provide an overall sense of expert attitudes for questions where applicable. The supporting data for this phase of coding can be found in Appendix G. After the discussion of the overall attitude of responses, the second step involved coding tallies for each question. The presentation of data in Tables 2-12 includes a discussion of significant themes and highly occurring codes for each of the questions; however, not all of the codes will be presented. The complete list of codes, tallies and corresponding code definitions are provided in Appendix G.

Research Question 1: feasibility of using mainstream mobile devices for AAC. In this section, results will be presented in terms of the following themes (a) designs and features, (b) social inclusion, (c) training and professional development, (d) affordability, and (e) challenges and effectiveness. Code results in tables 2-8 provide insight into expert perspectives on how these themes relate to the question of mainstream mobile technology feasibility.

Design and features. In reviewing the responses for the pros and cons of mainstream mobile devices (MMDs), only four out of 14 experts believed that items such as iPads, are superior to dedicated devices, while one supported the latter, and nine did not take a position (neutral). Based on Table 2, the advantage that participants cited most often in using MMDs for AAC was their prevalence or ease of access (15). One expert expressed that "mainstream mobile devices have advantages in the sense that is considered 'normal'", and that "there would be less stigma against the AAC vs. a dedicated device." Another expert reported, "mobile devices are so prevalent in today's society that students tend to be quiet savvy with them compared to low-tech or dedicated AAC devices"

Experts also mentioned other design and features that are important to consider when selecting the appropriate device. These include: functionality, portability, single-use/multi-use, support, affordability, limitations and student needs.

Table 2

Design and Features: Pros and Cons of MMDs

Codes	Representative Text	Tally
prevalence	currently used/easy access/social acceptance/coolness/less stigma/familiarity to neurotypical students (NT), savvy students	15
functionality	features that provide additional help in communication such as text-to-speech	4
portability	easy to carry around, convenient, lightweight	4
single-use/multi-use	distractions, setting aside device for communication use only, and having a separate device for other activities. Locking the device to only allow for communication activities and blocking out/install all other apps	4

(continued)

Codes	Representative Text	Tally
support	training for staff/team; parents/peers/technical support, hardware, app usage	4
affordability	relatively inexpensive compared to dedicated devices	3
limitations	characteristics of a device that may impede communication of not addressed	3
student needs	individual needs, which AAC system gives students a voice? Often requires assessment to determine specific communicative needs and ideal device	3

Note. Additional codes can be found in Appendix G.

Social inclusion. Overall, six experts believed that mainstream mobile devices (MMDs) can offer unlimited, interactive communication for children who require AAC, while five expressed disagreement, and three took a neutral position. Based on Table 3, the number one factor in the ability of any AAC system to support unlimited communication is basing the device selection on student needs (9 responses). In expressing how meeting students' needs for communication should be the criteria in device selection, on expert explained, "It is not uncommon for AAC users to use more than one form of AAC--iPad and PECS or picture supported communication for example, depending on the situation and setting." Another expert offered, "I believe children should have access to any means of communication that increases the likely hood of their expressive growth."

Additionally, experts mentioned several other factors to consider in terms of how to promote unlimited communication in students. These include the ability of the AAC to promote social inclusion and to offer support to adults.

Table 3

Social Inclusion: Ability of MMDs to Offer Unlimited, Interactive Communication

Codes	Representative Text	Tally
student needs	individual needs, which AAC system gives students a voice? Often requires assessment to determine specific communicative needs and ideal device	9
social inclusion	MMD can have a socially inclusive effect	3
support	training for staff/team; parents/peers/technical support, hardware, app usage	3

Note. MMD = mainstream mobile device. Additional codes can be found in Appendix G.

Training and professional development. As seen in Table 4, the number one factor in what educators and specialists need in providing service delivery for students who require AAC was hands-on experience in device utilization (13 responses). In support of the need for experience and device utilization among educators and specialists, one expert explained, "Many educators are not comfortable with AAC and do not/cannot take the time to become comfortable or even familiar with the system given to the student." Another expert suggested that educators and specialists "…need to make the time to feel comfortable with the device so as to be the best models they can be when demonstrating its use to the student."

Additional responses showed that there were other important considerations in terms of what educators and specialists need in order to deliver AAC services effectively. These responses include support, implementation and knowing students' needs.

Table 4

Training and PD: Needs of Educators and Specialists to Deliver AAC Services

Codes	Representative Text	Tally
experience/device utilization	use of a variety of devices in order for teachers to feel comfortable with and be able to support their students; hands-on experience	13
support	training for staff/team; parents/peers/technical support, hardware, app usage	7
implementation	MMD's effectiveness relies on proper implementation strategies	5
students' needs	individual needs, which AAC system gives students a voice? Often requires assessment to determine specific communicative needs and ideal device	5

Note. MMDs = mainstream mobile device; Additional codes can be found in Appendix G.

***Affordability*.** There were two questions relating to the theme of affordability. In looking at the overall responses in the first item (Table 5), five experts believed that AAC mobile technology was an affordable option for parents, while two expressed disagreement, and seven took a neutral position. According to codes tallied, the number one factor in the ability of parents to provide a mobile AAC device for their children was parents' wealth (9 responses). Several experts implied that affordability was a relative term regarding parents' ability to provide the mainstream mobile device for their child. On expert explained, "in my location, there are plenty of people who could not afford a mobile device and communication app." Another expert indicated that "for most parents without insurance coverage for AAC it is not affordable". Another important consideration around affordability includes questions regarding responsibility for device provision (5 responses). Additionally, due to the accessibility of mobile devices, there

was a concern (2 responses) that some parents may not have enough knowledge of AAC to make informed purchases.

Table 5

Affordability: AAC Mobile Technology As an Affordable Option for Parents

Codes	Representative Text	Tally
parents' wealth	for some families, cost isn't a factor in providing the device; for others, they cannot afford even a low cost device or application	9
provision	schools/Medicaid/insurance: How are devices provided?, who provides them?, and what is the expectation for their provision?	5
concern	without information, some parents may make uninformed purchases and more likely to purchase a device or app that is not suitable for their child	2
varies	cost of apps and devices vary	2

Note. Additional codes can be found in Appendix G.

In the second question, five experts believed that schools should prioritize the provision of mobile devices for AAC versus traditional and dedicated AAC devices, while nine took a neutral position. Table 6 shows that the number one factor in the provision of AAC was student needs (12 responses). Other factors suggested for consideration regarding device provision by schools include prevalence, affordability and portability.

In terms of device provision based on students' needs, one expert explained, "The priority should be what will be the most useful for each individual child and will result in successful communication." Another expert offered, "I don't think there should be a battle of mobile device vs dedicated device. It is about what is appropriate for the student, not more convenient or inexpensive for the district"

Table 6

Affordability: The Provision of MMDs by Schools

Codes	Representative Text	Tally
student needs	individual needs, which AAC system gives students a voice? Often requires assessment to determine specific communicative needs and ideal device	12
prevalence	currently used/easy access/social acceptance/coolness/less stigma/familiarity to neurotypical students (NT), savvy students	5
Affordability	relatively inexpensive compared to dedicated devices	2
Portability	easy to carry around, convenient, lightweight	1

Note. Additional codes can be found in Appendix G.

Challenges and effectiveness. There were two questions on Challenges and Effectiveness. Based on Table 7, the number one strategy to support educators and specialists in addressing the issue of technology distraction for students who use mobile devices for communication, was ensuring that AAC devices are used solely for communication (single-use, 6). This involved setting aside separate devices to be used solely for one purpose.

Device setting (4 responses) was also seen as being important in terms of taking measures to lock the device so that only the communication application is used. Lastly, students (student behavior, 4 responses) can be taught to stay focused on using the device solely for communication. In support of these strategies, one expert advised, “Use of guided access on an iDevice, only using the mobile device for communication and not having anything else on the device that could distract the student.” Another expert suggested, “Students who use

mobile devices for communication should have a separate device solely dedicated for communication and another for games, social media."

Table 7

Challenges and Effectiveness: Addressing the Issue of Technology Distraction

Codes	Representative Text	Tally
Single-use/multi-use	Distractions, setting aside device for communication use only, and having a separate device for other activities. Locking the device to only allow for communication activities and blocking out/install all other apps	6
device setting	turning off options for other uses by switching off Wi-Fi, and locking one app only	4
student behavior	teaching students to stay focused on communication task, ignore distractions, and value the benefits of the device for communicating. Helping students to focus on using the device solely for communication, not games or other apps.	4

Note. Additional codes can be found in Appendix G.

The results of the second question related to challenges and effectiveness showed that overall six experts believed that new technologies like AAC mobile apps were more effective than traditional systems, while two expressed disagreement, and six took a neutral position. Based on Table 8, the number one criterion cited for the selection of appropriate device is that it meets student needs (5 responses). One expert explained student needs as being "Whatever means we need to increase communication is what should be used." Another expert explained, "I think traditional systems and newer technologies both have their place, and dependent upon the individual, are equally as effective when appropriately recommended."

Almost as important as meeting student needs, another significant criterion for device selection was prevalence (3 responses). Lastly, several experts pointed out that both MMDs and DDs have similarities (both similar systems, 2 responses) and do not need to be distinguished.

Table 8

Challenges and Effectiveness: Comparing Effectiveness of MMDs and Traditional Systems

Codes	Representative Text	Tally
student needs	student needs (individual needs, which AAC system gives students a voice? Often requires assessment to determine specific communicative needs and ideal device)	5
prevalence	prevalence (currently used/easy access/social acceptance/coolness/less stigma/familiarity to neurotypical students (NT), savvy students)	3
both similar systems	both similar systems (the perception that MMD and DD having the same qualities and features)	2

Note. MMD – mainstream mobile device, DD = dedicated device; additional codes can be found in Appendix G.

Research Question 2: Facilitative actions. Thirteen participants believed that staff training and professional development are more important than funding and clarifying policies on AAC using mainstream mobile technology, while one expressed disagreement. While in the minority, it is important to mention that the dissenting voice expressed that "…funding is just important, however staff has to be trained to know how to implement as well."

Based on Table 9, the number one reason for prioritizing staff training and professional development was that it ensured utilization of resources (6 responses). One expert explained, "Research has shown that the majority of AAC equipment purchased is not used. Training in use will make more efficient use of what is currently available."

Experts suggested that another aspect to consider was provision (3 responses), in that since schools have the legal obligation to provide devices, little attention should be placed on funding and clarifying policies. Staff knowledge (2 responses) was also mentioned by several experts to express the belief that without training and professional development, the staff would not have the necessary knowledge to support their students with AAC.

Table 9

Facilitative Actions: Why Are Staff Training And PD More Important Than Funding And Policy?

Codes	Representative Text	Tally
utilization of resources	not abandoning resources; improves through training, support and professional development	6
provision	schools/Medicaid/insurance: How are devices provided?, who provides them?, and what is the expectation for their provision?	3
staff knowledge	knowledge of SLPs and SPED teachers regarding device usage and policies on FAPE and the provision of appropriate devices based on students' needs	2

Note. Additional codes can be found in Appendix G.

Research Question 3: Roles of stakeholders. Each of the three questions in this section will be represented in Tables 10-12. In response to the first question, thirteen participants believed that general education staff and school and district administrators do not need AAC training in implementing mainstream mobile technology, while one expressed that all staff needed training. As seen in Table 10, the number one reason given was that these stakeholder groups experience non- or limited inclusion and mainstreaming (9 responses) of students who require AAC. One expert explained that this was “Because kids who need AAC devices are in SDC classes, and they are rarely in general education.” Another reason offered by experts for the

limited roles and responsibilities (7 responses) of general education staff and administrators was due to the expectation that SPED and SLP staff are the ones who have the responsibility of providing support for students who require AAC.

Table 10

Roles of Stakeholders: Why Do General Education Staff And Admin Play Limited Roles in AAC?

Codes	Representative Text	Tally
limited inclusion/mainstr.	none, rarely or limited; the inclusion and mainstreaming of students who require AAC never occurs, rarely occurs or is limited	9
role/responsibility	special ed staff/specialists; it is primarily the role of special ed staff and specialists to provide support for AAC? For the most part, general education staff and school administrators are not involved due to limited interaction with these students, due to limited inclusion and mainstreaming	7

Note. Additional codes can be found in Appendix G.

For the second question in this section, as seen in Table 11, the overall sentiments expressed by experts showed that the role of general education and administrators are very limited in supporting AAC. The main reason included lack of training (4 responses), expectations for SPED and specialists (3 responses) and limited time (2 responses). In providing the reasons why general education staff and administrators have limited involvement in AAC, one expert explained, “Currently, they don't play a big role. And if they have a student who mainstreams to their classes, they would not have the appropriate training to work with them.”

Table 11

Roles of Stakeholders: What Roles Do General Education Staff and Admin Play in Inclusion?

Codes	Representative Text	Tally
gen ed lack training	in AAC to support mainstreamed students	4
role of sped staff/specialists	general education staff often rely on specialists to provide AAC services to mainstreamed students	3
limited time	general education staff lack sufficient time for training and supporting mainstreamed students	2

Note. Additional codes can be found in Appendix G.

In response to the third question of planning for the inclusion of students who require AAC using mainstream mobile technology, Table 12 shows that the most important factor to consider in the general education classroom was to focus on strategies that support the special needs students (6 responses). In describing strategies to support the inclusion of students who use AAC, one expert offered this suggestion, “Selecting a few peer support students to sit near the student and offer help when needed.” Several experts suggested that there is a tendency for general education staff to rely on SPED and Specialist (3 responses) staff to provide support for AAC. Lastly, it was explained by several experts that general education staff do not have the time to undergo the needed training to offer support to students who use AAC.

Table 12

Roles of Stakeholders: What Factors Are Important for Inclusion of Students Who Use AAC?

Codes	Representative Text	Tally
special needs student	play an important role in the success of AAC use by receiving training and orientation on how to use the device. They also need to be provided ample support, encouragement and opportunities to practice using the device.	6

(continued)

Codes	Representative Text	Tally
support	training for staff/team; parents/peers/technical support, hardware, app usage	5
NT peers	mainstreamed students need their neurotypical (NT) peers' understanding and support	4
team collaboration	general education staff, speech specialists, family, peers, student	3
logistics	the necessary steps to ensure that devices have internet access and power, well-function sound amplification and are that devices are functioning properly	3

Note. Additional codes can be found in Appendix G.

Summary of Round 2 results. Relating to designs and features, while only four out of 14 experts believed that mainstream mobile technology (MMDs) were superior to dedicated devices (DDs), many experts cited the main advantage of MMDs was their ubiquity, which in turn was reflected in their social acceptance and being a *cool* device. Although a slight majority of experts believed that MMDs have the potential to offer unlimited, interactive communication, the most important criterion in selecting and providing the appropriate device was whether or not it meets individual students' communication needs. Relating to affordability, experts disagreed on whether or not devices are attainable for all families. Several experts were concerned that despite the relative affordability of MMDs, parents' wealth plays an important role in device provision. Similarly, respondents advocated for school districts not to base provision on cost alone, but on selecting the best device that meets students' communication needs. Device distraction was a concern for many experts who suggested that the most important strategy to address this issue was to take steps to ensure that AAC devices are to be used solely for communication.

In terms of facilitative actions, an overwhelming majority of experts agreed that staff training and professional development were more important than funding and clarifying policies on AAC use. In order to ensure appropriate use of technology resources it was critical to support staff with training and professional development.

When considering the inclusion of students, the most important factor cited was to focus on strategies that support students. One suggestion was to provide students with more attention than their neurotypical peers (NT). Another strategy was to orient peers and prepare them to provide support for their special education peer as needed. Some concern was expressed about the distracting nature of mobile technology. In addressing technology distraction, the consensus was to guide students (*guided access*) to use AAC devices solely for communication. There were several suggestions to have devices dedicated for single use, one exclusively for communication and another for play or other activities. Another concern was that prevalence and availability of MMDs may result in the devaluing of no-tech (e.g., sign language) and low-tech systems (e.g., PECs).

Relating to roles of stakeholders, a large majority of experts believed that general education staff and school and district administrators play a very small role in supporting AAC, and therefore do not need AAC training. This was due to their non- or limited involvement in inclusion and mainstreaming of students who require AAC.

Overall Summary of Key Findings.

This section provides a summary of the overall key findings from Round 1 and Round 2. Results are organized according to the three research questions.

Research Question 1: feasibility of using mainstream mobile devices for AAC. What are expert opinions on the feasibility of providing young learners who require AAC with mainstream mobile devices for communication?

When comparing the effectiveness of AAC systems, there was dissensus of expert opinions regarding the superiority of mainstream mobile devices (MMDs) over dedicated devices (DDs) and other traditional systems. The most common recommendation when selecting and providing appropriate AAC technology was to base decisions on the extent to which the device meets students' communication needs and personal preferences. The strongest case for prioritizing MMDs over DDs was the former's social acceptance due to their ubiquity, coded as prevalence in this study. Although less expensive than dedicated AAC devices, the affordability of MMDs is relative and provision depends on parent's level of wealth. Lastly, there was concern regarding the potential of mainstream mobile technology to distract students from using communication devices in the classroom for their intended purpose.

Research Question 2: Facilitative actions. What facilitative actions are important in the utilization of AAC mobile apps in elementary school settings by students with complex communication needs?

There was an overall consensus that providing training and professional development for special education staff and communication partners are critical in facilitating the implementation of AAC mobile apps in order to support optimal utilization of technology resources. Training and professional development were seen as being much more important than the logistics of providing funding and clarifying policies.

Research Question 3: Roles of stakeholders. What are the roles of stakeholders in the implementation of AAC mobile apps in elementary school settings by students with complex communication needs?

A significant number of respondents reported that there was no or very limited inclusion and mainstreaming of students who require AAC, and therefore, general education staff and administrators play a minor role and do not need training in AAC implementation and support. Similarly, there was wide agreement that the three most important stakeholder roles in the implementation of AAC mobile technology were special education staff, speech and language pathologists, and communication partners, respectively.

Altogether there were seven key findings that were derived from the two rounds of this study. These findings will be explored in Chapter 5 in relation to the guiding research questions and connections will be drawn to the guiding theoretical framework and research literature. In addition, the following chapter will include a discussion of implications for policy and practice, study limitations, and recommendations for further study.

Chapter 5: Research Implications and Recommendations

Introduction

Despite policy mandates in the U.S. for the provision of assistive technology such as speech generating devices (SGDs) for children who require AAC, and the proliferation and affordability of mainstream mobile technology, there exists an underutilization of high-technology communication systems for elementary-aged students (Bouck et al., 2006; DeCoste, 2013; McMillan & Renzaglia, 2014b; Mirenda, 2003). Numerous studies have shown the success of communication technologies such as SGDs in teaching individuals with speech impairment to make requests (Kagohara et al., 2010; Mirenda, 2003; Schlosser & Koul, 2015; Wilkinson & Light, 2014). Yet, various studies have shown that up to 25% of students with autism do not have the skills to communicate effectively in the classroom (Schlosser & Blischak, 2001).

This research study was designed to gather expert opinions on the feasibility of using mainstream mobile technology and mobile applications to provide AAC for young children with speech impairment. The goal was to address three guiding research questions that relate to the feasibility of using mainstream mobile technology, facilitative actions and stakeholder roles for implementation and utilization of AAC in elementary school settings.

Design overview. A two-round, mixed-methods Policy Delphi study was conducted using online questionnaires completed by experts in AAC who work with students in special education. Questions in Round 1 were primarily quantitative and organized according to the major themes of: designs and features, social inclusion, training and professional development, affordability, challenges and effectiveness, facilitative actions and stakeholder roles. The Round 2 questionnaire was designed to contain exclusively open-ended prompts based on summarized

results from Round 1. Experts were asked to reflect on synthesized data from Round 1 and encouraged to offer their professional opinions. The iterative questionnaires were designed to gather diverse viewpoints, in keeping with the Policy Delphi method.

The participants were recruited via purposive sampling of education professionals from the United States. Snowball effect sampling was utilized through requests for referrals from the researcher's network of education professionals, consisting of education technology specialists, school psychologists, speech and language pathologists, and special education teachers and administrators. As a result, study participants came from the following professions: speech and language therapist, special education teacher or administrator, and assistive technology specialist. Data were collected and analyzed from 19 experts in Round 1 and 14 in Round 2.

Overview of Chapter 5. This chapter discusses the seven key findings from the data presented and summarized in Chapter 4. There will be a presentation of conclusions from findings as they relate to themes from research literature. This leads to a description of implications for policy and practice on the provision, implementation and utilization of mainstream mobile technology for AAC. Lastly, recommendations will be made for future studies that will address study limitations and extend the knowledge base in relation to the implementation and utilization of innovative AAC systems.

Discussion of Key Findings

The following sections address key findings from the Policy Delphi study in relation to the three guiding research questions. Each of the seven key finding will reference research data from both study rounds, as well as literature and theoretical frameworks from Chapter 2.

Research Question 1: feasibility of using mainstream mobile devices for AAC. What are expert opinions on the feasibility of providing young learners who require AAC with mainstream mobile devices for communication?

Finding 1. When comparing the effectiveness of AAC systems, there was dissensus of expert opinions regarding the superiority of mainstream mobile devices (MMDs) over dedicated devices (DDs) and other traditional systems.

The debate between dedicated devices and mainstream mobile devices (MMDs) for AAC was reflected in the sometimes contradictory opinions of experts in this study. This diversity of expert opinions supported the old adage that "one size does not fit all" when it comes to the superiority of one AAC system over another (AAC-RERC, 2011). Despite acknowledging the benefits of mainstream mobile technology, 79% of experts agreed with the statement that there will always be a place for dedicated AAC devices that offer customized features catering to the needs of AAC users, features which mainstream mobile devices currently do not offer, nor will likely offer in the future. Similar to prior research by Deruyter et al. (2007), Round 1 data also showed that 84% of experts in this study agreed that MMDs, which have exclusively touch screens, may impede AAC usage in students with low fine motor skills; and therefore should not be utilized. On the other hand, 74% disagreed that the lack of switch input to provide alternative input sources on MMDs makes them inferior as an AAC system compared to dedicated AAC devices. Experts generally were divided almost equally in Round 1 on the benefits of both AAC systems, as there was a near balance (47% agree, 53% disagree) of opinions on the statement regarding the superiority of MMDs over DDs for communication.

Finding 2. The most common recommendation when selecting and providing appropriate AAC technology was to base decisions on the extent to which the device meets students' communication needs and personal preferences.

Experts in Round 2 overwhelmingly agreed that the communication needs of AAC users should be the primary consideration when deciding on an AAC option. As one expert explained, "Schools should provide an AAC system that is appropriate for the students and that can be either a mobile device or a dedicated device." Another expert advised, "It's an individual decision depending on the students' need. We have to be open and not pre-determine what might give a student a voice." These findings were consistent with those of van der Meer et al. (2011) in their synthesis of studies on AAC preferences, which found that incorporating individual choice in the selection of modalities as a way to support self-determination. This student-centered selection process meets individual needs and improves device utilization (Newell, Langer, & Hickey, 1998).

Round 2 data also showed a diversity of expert opinions regarding the question of superiority of MMDs over DDs. As reported in Chapter 4, six experts indicated that new technologies like AAC mobile apps were more effective than traditional systems, while two expressed disagreement, and six took a neutral position. Furthermore, experts in Round 2 reported that effectiveness in facilitating communication was exhibited by a variety of modalities, which was supported by research literature indicating that users preferred a wide range of systems that met their communication needs and individual preferences (Achmadi et al., 2014; Sigafoos et al., 2005; Soto et al., 1993). One expert shared, "I think traditional systems and

newer technologies both have their place, and dependent upon the individual, are equally as effective when appropriately recommended."

Finding 3. The strongest case for prioritizing mainstream mobile devices over dedicated devices was the former's social acceptance due to their ubiquity.

In Round 1, 89% of experts agreed that MMDs provide increased visibility of AAC in society and are effective in promoting social inclusion and acceptance. As one expert suggested, "…mobile devices are [so] heavily prevalent in society that they are seen without stigma or question." There was also recognition that the ubiquity of mainstream mobile technology may play an important role in mediating the use of AAC technology in mainstream settings by taking the stigma away from using AAC in public settings. Because of their widespread use, this technology is seen as being more user friendly and inclusive than dedicated devices. These findings are reflected in the social constructionist view of disability in which claims that traditional assistive technologies in the form of obtrusive devices are stigmatizing. Foley and Ferri (2012) expressed the concern that traditional AT may promote social exclusion due to the lack of transparency. However, the modern offering of AT systems through mobile mainstream devices offer transparency due to their proliferation, leading to the perception of being *cool* and therefore socially acceptable. Not only does this perception help to remove the stigma and the barriers associated with using AT in public, it also promotes confidence in the user to fully participate in communication (McNaughton & Light, 2013) and to engage in social media (Brandenburg et al., 2013).

Finding 4. Although less expensive than their high-tech counterparts, the affordability of mainstream mobile devices is relative and provision depends on parent's level of wealth.

There was a consensus of opinions about the importance of affordability on the acquisition of AAC mainstream mobile technology. A majority of experts agreed (74%) that cost has been a major obstacle in the provision of tech-based AAC intervention. Undoubtedly, mainstream mobile devices (MMDs) have steadily become more affordable and accessible relative to traditional AAC devices (AAC-RERC, 2011; Moffatt et al., 2017; Stuart, 2012). This affordability has helped to reduce the traditional barrier in the provision of high-tech AAC, as more families, schools and agencies are able to consider providing these devices, without having to secure funding through insurance or special grants (McNaughton & Light, 2013).

Although new technology has become more affordable, experts in this study overwhelmingly cited parents' wealth as being the major factor in device provision. As two experts explained, "Affordability depends on the parents' incomes," and "…it depends on the family's situation, but I know that my students' parents would have a difficult time acquiring some devices due to financial situations." Due to its newness, mobile technology may not yet receive coverage by private medical insurance companies and Medicare, even though they have given reimbursement for dedicated AAC devices, which tend to be expensive and bulky (Stuart, 2012). Therefore, when schools and insurance do not cover the cost of device provision, parents are still left with the expense if they wish to provide their children with a high-tech AAC device.

Finding 5. There was concern regarding the potential of mainstream mobile technology to distract students from using communication devices in the classroom for their intended purpose.

The implication of this finding is that due to the design of mainstream mobile technology, students using these devices for communication in the classroom may be distracted by the device

having multiple functions and a variety of applications. Several experts in this study suggested locking down the device so that only the AAC application functions. Another recommendation was to have two sets of devices, one dedicated to communication, and another for other uses such subject matter learning or educational games. From the researcher's perspective, both options have impractical implications. The first strategy limits the full potential of the device and does not allow students to use other educational tools on the device when appropriate. Furthermore, toggling the lock feature can become cumbersome. The second approach is cost-prohibitive as it requires the provision of a second device.

Another expert suggested teaching students through "guided access to use only the communication application, while allowing students to have access to other technology for different purposes." While not addressing the issue of distraction per se, research literature provided strategies for teaching students how to use AAC effectively. A study by Achmadi et al. (2012) showed success in training students who had difficulty operating an iPod-based speech generating device (switching it on and off, and selecting applications). Allen and Shane (2014) successfully used applied behavior analysis in conjunction with video modeling for teaching students how to use high-tech AAC. While recognizing the potential of mainstream mobile technology to distract students from focusing on communication goals, experts urged that students receive "specific behavior interventions" and be provided with opportunities to practice appropriate use of devices. As one expert recommended, "…the world is filled with distractions and students need to learn to work past or around them. A closed door/quiet world does not prepare students."

Research Question 2: facilitative actions. What facilitative actions are important in the utilization of AAC mobile apps in elementary school settings by students with complex communication needs?

Finding 6. There was an overall consensus that providing training and professional development for special education staff, communication professionals and communication partners were critical in facilitating the implementation of AAC mobile apps in order to support optimal utilization of technology resources.

Experts in Round 1 agreed that providing professional development for special education staff (100%), training of communication partners (caretakers and parents; 94%), and training of speech and language pathologists (67%) were the top three facilitative actions to support the implementation of mainstream mobile technology for AAC. Similarly, extensive research literature also recognized the importance of training and professional development, not only in the implementation and support of AAC utilization, but also in the deterrence of technology resource abandonment (McMillan & Renzaglia, 2014a; Rackensperger et al., 2005). Teacher training has been shown in numerous studies to increase unprompted device use and response by students (Lebel et al., 2005; Magiati & Howlin, 2003; McMillan & Renzaglia, 2014a, 2014b). Although there is recognition that high-tech AAC devices can promote independent speech, almost one-third of all purchased AAC devices remain unused due to lack of teacher training and support (McMillan & Renzaglia, 2014a). Rackensperger et al. (2005) reported that teachers participating in their study revealed that they received AAC systems with no training and only minimal support.

While training and professional development of all stakeholders (staff, professionals and communication partners/parents) were seen as being critical to the facilitation of AAC utilization, experts in this study indicated low support for the importance of the facilitative actions of providing funding (28%) and clarifying policies (11%). However, research literature indicated the lack of funding as being one of the main barriers limiting access to AAC technology (Costantino & Bonati, 2014). Similarly, Light and Drager (2007) pointed out that the traditional policy of withholding AAC services for young children until they are older have denied children the opportunities for speech intervention.

Research Question 3: Roles of stakeholders. What are the roles of stakeholders in the implementation of AAC mobile apps in elementary school settings by students with complex communication needs?

Finding 7. General education staff and administrators play minor roles in AAC implementation and support due to non- or very limited inclusion and mainstreaming of students who require AAC.

Round 1 data showed that experts ranked special education staff (89%), speech and language pathologists (84%) and communication partners (84%) as being the top three stakeholder groups, while minimizing the roles of administrators (16%) and general education staff (11%). As a result, based on the premise in this finding, 13 of the 14 experts expressed that administrators and general education staff do not need AAC training, while only one expert insisted that all staff would benefit from training.

Would providing training to general education staff help to increase their involvement in inclusion and supporting students who use AAC in the mainstream classroom? In explaining that

the reason for the perceived minor roles of general education staff is due to lack of information and training, one expert in this study suggested the following: “It is a lack of education and professional training that may be responsible. Being supportive to all team members and educating them on how to utilize student devices in the classroom would support both teachers and students.” Research literature in AAC emphasized the importance of team collaboration as a recommended practice model in supporting the inclusion of students who use AAC (Batorowicz & Shepherd, 2011; Beukleman & Mirenda, 2005; Finke et al., 2009).

Of great importance is for all staff, including general education teachers and administrators, to have the necessary training and technical capability of operating AAC devices in order to support students who use high-tech AAC (van der Meer et al., 2012c). One expert in this study had the following to share about the importance of involving all stakeholders and on the essential role that team collaboration plays in supporting students who use AAC:

> …it seems there is such a turnover is special education…As such, some students lacked trained professionals in their development and may have not been provided access to communication devices at all. It does take a team to collaborate in order to support students and the responsibility is a team effort.

While data from this study showed the limited role of school administrators in AAC support, research literature highlighted the critical role that school principals and administrators play in allocating teachers with resources and time needed to support AAC usage by students in inclusive classrooms. Another important component of administrative support is facilitating team collaboration and planning (Calculator, 2009; Kent-Walsh & Light, 2003).

Based on research literature, this reported lack of inclusion and mainstreaming in this study is an exception, not the rule. Recent studies have shown a growing awareness of the issue of digital exclusion (Dolic et al., 2012), and emphasis on the importance of including students who use high-tech AAC in the general education classroom (Dada & Alant, 2006; Deruyter et al., 2007). Mainstream mobile technology holds the potential to bridge the education gap by helping individuals with speech impairment to overcome their disabilities in order to access the mainstream curriculum (Deruyter et al., 2007; Dyal et al., 2009; Sonnenmeier et al., 2005). The importance of inclusion and mainstreaming of students who use AAC in the general education classroom is critical to their speech development and cannot be overstated.

Conclusions

The significant findings from this study lend themselves to certain conclusions about AAC utilization for school-age children. While the goal of AAC utilization should be functionality, not device oriented, a very strong case can be made that mainstream mobile devices have several advantages over their counterparts, not only in their affordability, but also transparency and social acceptance by providing an ideal medium for inclusion in mainstream settings. However, a challenge that confronts all technological innovations is the tendency to focus on the technology instead of pedagogical, social and therapeutic goals (Allen & Shane, 2014). Until a perfect AAC system becomes available using mainstream mobile devices that meet individuals' communicative, educational and physical needs, and personal preferences, it is apparent that multimodality will continue to be the model to provide inclusivity and to support individuals with options in a variety of settings (Lundälv et al., 2014).

The utilization of mainstream mobile technology for AAC necessitates certain facilitative actions and stakeholder responsibilities. The importance of training and support for key stakeholders such as special education teachers, communication professionals and communication partners cannot be overstated. However, all stakeholders working in collaboration are essential in supporting AAC use and, when applicable, facilitating the inclusion and mainstreaming of students who use AAC in the general education settings.

Implications for Policy and Practice

The seven findings in this Policy Delphi study lend themselves in providing a foundation for implications for policy and practice. These implications may prove valuable to policy-makers in special education and school district administrators in making decisions about the provision, implementation, support and utilization of technology-based AAC for young students.

The field of AAC has accumulated extensive literature on design and recommendations for the implementation high-tech AAC, as discussed in Chapter 2. Hemsley (2012) proposed a series of ethical guidelines of policy and practice for AAC professionals and communication partners when supporting AAC. The following three guidelines from Hemsley (2012) will serve as a framework in which to apply the implications for policy and practice from this study:

1. The fundamental right to communicate.
2. Ensuring that AAC authentically represents the voice of the person.
3. The imperative to maintain and expand clinical competence in AAC.

The fundamental right to communicate. Due to their social acceptance and prevalence, there is little doubt that mainstream mobile technology presents a viable alternative to traditional systems in providing communication options for students who require AAC. This high-tech

option enables the use of AAC devices in all settings without the stigmatization often associated with bulky and obtrusive dedicated devices. Experts in this study felt that the strongest case for prioritizing mainstream mobile devices over dedicated devices was the former's social acceptance due to their ubiquity.

U.S. legislation has been passed since the late 1980's regarding special education policies and practices requiring assistive technology intervention for children with different abilities. Therefore, it is incumbent on the decision-makers (special education directors, assistive technologists, communication professionals, etc.) to recognize the legal obligation of schools and to advocate for the provision of technology-based AAC for young students with speech impairments. Light and Drager (2007) advocated two crucial efforts in advocating for AAC: (a) ensure the early intervention of speech services by medical professionals and speech-language pathologists; and (b) reduce barriers for young children with complex communication needs. As an expert in this study declared, "…school districts are obligated to provide services/equipment that students need regardless of cost." Another expert also explained, "If the student has a need for AAC to access their education, then regardless of the funds, the district will have to provide the equipment"**.**

As discussed in Chapter 4, Round 1 results showed that there was an overwhelming consensus supporting the opinion that general education teachers and administrators play a small role in AAC support when compared to special education staff, speech-language pathologists, and communication partners. When experts were asked in Round 2 of the study to explain the low ranking of general education and administrative staff's roles, experts provided the rationale that inclusion and mainstreaming of AAC users ranged from non-existent to very limited levels

(see Chapter 4). However, when asked directly about factors important to consider in the general education classroom when planning for the inclusion of students who require AAC, eight of 14 experts indicated that there was a desire for general education teachers to receive training in order to support AAC. While in the minority, several experts insisted that all stakeholders were important to the success of AAC utilization and that all play a role in acquiring knowledge and skills in AAC technology. As one expert explained, "General education staff need orientation on special ed students' speech and language skills." Another expert suggested to have "regularly scheduled meetings with the general education teacher and special education staff and SLP for on-going education and training, problem solving and programming." These findings have great implications on the inclusion of students who use AAC in the mainstream setting. While inclusion and mainstreaming are dependent on the students' IEP goals and therefore seldom experienced by experts in this study, they voiced the need to provide all staff members with the skills necessary to support AAC use, which is consistent with recommendations by Johnson et al. (2006) and Costantino and Bonati (2014).

Ensuring that AAC authentically represents the voice of the person. As a key finding indicated, the selection and provision of appropriate AAC technology need to be based on the extent to which the device meets students' communication needs and personal preferences. An expert opined, "I think traditional systems and newer technologies both have their place, and dependent upon the individual, are equally as effective when appropriately recommended." The speech professional needs to be mindful of that fact that often times, the best approach to a speech intervention program is multi-modal, necessitating a variety of services the meet the needs of the individual (Beukelman & Mirenda, 2013).

The proliferation of technology can have the adverse effect of creating chaos and adding confusion to the already complex selection of AAC interventions. As one of the key findings indicated, when comparing the effectiveness of AAC systems, there was doubt regarding the superiority of mainstream mobile devices (MMDs) over dedicated devices (DDs) and other traditional systems. Despite their shortcomings, new mobile offerings are worthy of serious consideration, being mindful that "one size does not fit all". Consumer demand for new mobile devices are undoubtedly being fueled by technology companies (AAC-RERC, 2011). Communication professionals and communication partners are reminded that these new devices and software applications are in the early stages of development and therefore require scrutiny careful selection to ensure user compatibility. According to Hemsley (2012) communication systems should reflect the user's own voice and personal preferences.

Meeting the communication needs of young students often requires the school to allocate resources to provide students with the ACC equipment required to express their authentic voice. As experts in this study overwhelmingly agreed, although less expensive than their high-tech counterparts, the affordability of mainstream mobile devices depends on parent's level of wealth. Despite the prevalence of technology in society, there remains a digital divide that is widening for those whose access to mobile technology and communication applications is limited by lack of resources (AAC-RERC, 2011). Being a somewhat recent innovation, mobile technology for AAC is not yet covered by private medical insurance (Stuart, 2012). The result of this digital exclusion is seen in the continued neglect of the majority of children with speech impairment who require AAC interventions (Costantino & Bonati, 2014). Therefore, educators and speech-language pathologists have an ethical responsibility to advocate for the removal of financial

barriers preventing access to high-tech AAC systems (Hemsley, 2012). Furthermore, action is needed to ensure funding for young children to receive high-tech AAC equipment that take advantage of innovative communication methods (Light & Drager, 2007).

The imperative to maintain and expand clinical competence in AAC. Experts in this study overwhelmingly agreed that providing training and professional development for special education staff, communication professionals, and communication partners were critical in facilitating the implementation of AAC mobile apps in order to support optimal utilization of technology resources. This was due to their direct involvement in AAC support. When asked about key roles in implementing mainstream mobile technology for AAC, several experts voiced the expectation of communication professionals to provide AAC support. One expert cited, "it is the special ed people who are supposed to deal with this." Another expert expressed, "Generally when a student has a device a special ed staff member is responsible for supporting it."

These results support the importance placed on the role of the AAC professional which includes ethical and complex decision-making involving assessment findings, intervention options and the related risks and benefits, as well as considerations of the values and beliefs of those affected (Hemsley, 2012). Furthermore, Hemsley (2012) described the tension that may exist when having to decide on a course of action in light of available resources, risks and benefits, the learner's rights and preferences, and organizational policies. Mirenda (2003) suggested that oftentimes, the AAC professional has to make complex decisions when little research data exists to inform clinical practice in certain areas of AAC practice; nevertheless, decisions made should be based on the specific context of the individual, not in the abstract.

With the fast pace of technological innovations to augment and enhance speech and communication, all stakeholders are tasked with the evaluation of a wide range of AAC systems in relation to research studies on evidence of their effectiveness (Hemsley, 2012). In the case of choosing the right AAC technology which runs the gamut in the range of quality, all staff must have the training and knowledge to offer professional recommendations (Brandenburg et al., 2013). There is a need to be fully informed of the wide range of options in communication aids, from unaided methods (e.g., manual signing and gestures) to aided systems (e.g., low-tech and high-tech SGDs). With the introduction of mobile technology which widens the options for AAC, there is an ethical responsibility to provide unbiased and insightful recommendations regarding the effectiveness of innovative AAC systems (Hemsley, 2012), while recognizing the importance of multi-modal interventions (Beukelman & Mirenda, 2013).

Recommendations for Further Research

This Policy Delphi study aimed to gather diverse expert opinions on the feasibility of using mainstream mobile devices for AAC. While this study addressed a wide range of issues associated with high-tech AAC implementation and utilization, the key findings offer several implications for further investigation.

Design. It was clearly evident that AAC systems have improved with technological innovations; however, mobile mainstream devices (MMDs) do not yet hold the superior position when compared with dedicated devices. While MMDs have clear advantages over their counterparts (i.e., prevalence, affordability, convenience and familiarity), their shortcomings are also evident (i.e., lack of technical support, lack of powerful speakers), and in some cases do not meet the needs of students with severe impairments (i.e., lack of switch input). One expert said

about the advantages of DDs, “They come with speakers powerful enough to allow their users to be heard in a variety of settings (e.g. noisy restaurants, playgrounds, etc). Furthermore, dedicated devices allow for Keyguards and Touchguides to be added to help this with fine-motor limitations.” Further studies would help to bridge the gap between the design of MMDs and DDs, by addressing design features such as Bluetooth-enabled auxiliary components for alternative input methods. A worthwhile study would be to use participatory design to explore children’s ideas for the design of communication technology, as employed in a study by Light et al. (2007).

Mainstream mobile devices vs dedicated devices. The diversity of expert opinions on the comparison of mainstream mobile devices and dedicated devices offer an insightful research opportunity. A quasi-experimental study can be conducted to compare the effects on independent speech in two groups of students, each using one type of device. After a pre-determined period of perhaps one year, students can be assessed for their communication progress. Studies such as these might provide valuable insights into the comparison and prioritization of different types of devices.

Communication partners. While one of the main limitations of this study was in the role of communication partners (e.g., parents; CPs), the panel of experts saw that this stakeholder group as being among the most important in supporting AAC. Further investigation into the opinions and attitudes of CPs through a replication of this Policy Delphi study would have several benefits. Questions could be posed regarding their understanding of roles of communication partners, special education policy and practices for children who require AAC,

as well as meaningful insights into the comparison and selection of mainstream mobile technology vs. dedicated devices.

Further research with CPs may also provide insight into the historical withholding of AAC from young learners. Despite legislation requiring the use of assistive technology in special education, there remains the issue of their underutilization in speech intervention. Perhaps this has to do with communication partners' understanding of their voice in advocating for their child's communication needs? Another benefit is in exploring strategies in which to support CPs in facilitating their children's use of AAC devices in a variety of settings. Myers (2007) found that, while the communication professional's role is critical, parents often have to bear the burden of supporting their children's device use.

Inclusion and mainstreaming of students who require AAC. In light of the latest innovations in high-tech AAC, further investigation is recommended into barriers to inclusion of AAC users in mainstream classrooms. Would mobile mainstream technology's transparency more easily facilitate AAC usage in general education classrooms? A controlled or random sampling survey of policies and practices of school districts in various parts of the US would be insightful in helping to understand how different organizations address inclusion and mainstreaming of AAC users.

Summary

Results from this Policy Delphi study offer a valuable foundation for decision-makers to derive implications for policy and practice, as well as launching points for further investigations. The findings provide educators with the awareness of salient issues of design, social inclusion,

affordability, challenges, facilitative actions, and stakeholder roles pertaining to the support of AAC mainstream mobile technology.

Edyburn (2013) challenged those who provide support for AAC users, “As educators, we can passively wait until the future becomes the present, or we can work to actively influence the future” (p. 18). There exists an opportunity for educators and communication specialists to maintain professionalism during this period of proliferation of mobile technology and that working together collaboratively will be more productive than resisting change and innovation (AAC-RERC, 2011). It is hoped that educators and specialists continue to support young learners through advocating for their access to cutting-edge communication tools that facilitate the expression of their authentic voice.

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APPENDIX A

Snowball Sampling Referral Request

Hi _____,

This is An Nguyen, (indicate previous connection).

I am conducting a research study for my doctoral dissertation on augmentative and alternative communication (AAC) and the feasibility of using mainstream mobile technology devices, such as iPads, to facilitate communication for young children with speech impairment.

I am ready to collect data via an online questionnaire and hope that you will be willing to participate or help by recruiting participants for this study. I am seeking educators and specialists who have experience with AAC. I am hoping to collect data from 20 participants, so any referrals would be appreciated. Speech and Language Pathologists tend to have experience with this subject, so please connect me with any SLPs that you know.

Once I hear back regarding your interest and hopefully a list of referrals' emails, I will send out the official invitation to participate.

Would it be possible for you to reply within the next few days?

Please see the attached file for a sample of the recruitment email. This letter also includes a brief background of the study.

I'd love to hear back from you regardless, to let me know how you are doing.

Thank you,

An Nguyen

Sincerely,

Vinh-An (An) Nguyen

Doctoral Candidate in Learning Technologies
Graduate School of Education and Psychology
Pepperdine University

APPENDIX B

Invitation Letter—Round 1

Date

Dear ,

My name is Vinh-An (An) Nguyen, and I am a doctoral candidate in Learning Technologies at Pepperdine University. I was referred to you by _____ as someone with experience in augmentative and alternative communication (AAC). I am conducting a research study examining expert opinions on the feasibility of using mainstream mobile technology (i.e., iPads) for elementary school aged children who require AAC, and you are invited to participate in the study. Data will be collected from professionals who have experience with AAC, and will include special education teachers and administrators, assistive technology specialists and speech and language pathologists.

Please click on the following linked text to begin the survey: AAC Mobile Apps Questionnaire

Study Background:

Recent disruptive innovations in AAC technology have revolutionized the field and offer new opportunities for children with severe speech impairment. Due to a gap in research literature on the latest trends in AAC technology, results from this study may be critical to decision-makers who develop policies on the use and provision of high-tech AAC. This research study is guided by the following research questions:

1. What are expert opinions on the feasibility of providing young learners who require AAC with mainstream mobile devices for communication?
2. What facilitative actions are important to the utilization of AAC mobile apps in elementary school settings by students with complex communication needs?
3. What are the roles of stakeholders in the implementation of AAC mobile apps in elementary school settings by students with complex communication needs?

You are being asked to participate in a study that involves completing two rounds of questionnaires given to a select group of 15-20 educators with experience in AAC. The research method employed will be the Policy Delphi which gathers data in the form of perspectives from a diverse group of experts who have knowledge on a given topic. The two rounds of questionnaires will be administered using an online survey tool (Qualtrics.com). The first questionnaire will consist of 29 multiple-choice items, with opportunities for participants to suggest new variables for consideration in the second round. The second iteration of the questionnaire will be developed based on the results from the first questionnaire. Each of the two online questionnaires is anticipated to take between 15-30 minutes to complete. Data collection

is projected to take place in November, 2016. Lastly, the researcher will manage and analyze questionnaire data and will share the results with participants after each round.

Participation in this study is voluntary. Your identity as a participant will remain confidential during and after the study. Only the researcher will see responses and any identifiable information will remain private. Data reporting of responses will be coded using a generic identifier or pseudonym to assure confidentiality.

Again, please click on the following linked text to begin the survey: AAC Mobile Apps Questionnaire

If you have questions, please contact me at vinh-an.nguyen@pepperdine.edu or my dissertation chairperson, Dr. Paula Thompson at paula.thompson@peperdine.edu.

If you are willing to participate in this study, would it be possible for you to complete the questionnaire within one week?

Your participation is important to this study and I hope to have your consideration.

Sincerely,

Vinh-An (An) Nguyen

Doctoral Candidate in Learning Technologies
Graduate School of Education and Psychology
Pepperdine University

APPENDIX C

Invitation Letter—Round 2

Dear,

I appreciate your valuable input on the first questionnaire in November/December on the feasibility of using mainstream mobile technology for children who require AAC.

A total of 19 AAC experts responded, represented by seven Speech and Language Pathologists (SLP), seven Special Ed teachers and administrators (SPED), three Assistive Technology Specialists (AT), one Occupational Therapist (OT), and one Board Certified Behavior Analyst (BCBA).

Thank you for agreeing to complete the second AAC Questionnaire.

This Round 2 questionnaire of a two-round Policy Delphi study contains 11 open-ended follow-up questions based on the results from Round 1. This questionnaire is meant to capture the thoughts of participants after reflecting on a summary of responses from the previous questionnaire. The goal of this study is not to establish consensus, but rather, to gather a diversity of ideas on AAC mobile technology.

Please click on the link below to begin the questionnaire:
https://pepperdinegsep.az1.qualtrics.com/SE/?SID=SV_7WnDUG5wmfYm9ff

The deadline for completion is one week from today, Wednesday, February 1, 2017.

Your participation is important to this study and I hope to have your consideration.

If you have questions, please reply to this email, contact me at vinh-an.nguyen@pepperdine.edu or my dissertation chairperson, Dr. Paula Thompson at paula.thompson@peperdine.edu.

Sincerely,
Vinh-An (An) Nguyen
Doctoral Candidate in Learning Technologies
Graduate School of Education and Psychology
Pepperdine University

APPENDIX D

Informed Consent

Pepperdine University Graduate School of Education and Psychology

Doctor of Education in Learning Technologies Program

INFORMED CONSENT FOR PARTICIPATION IN RESEARCH ACTIVITIES

EXPERT PERSPECTIVES ON USING MAINSTREAM MOBILE TECHNOLOGY FOR SCHOOL-AGE CHILDREN WHO REQUIRE AUGMENTATIVE AND ALTERNATIVE COMMUNICATION (AAC): A MIXED-METHODS STUDY USING POLICY DELPHI

You are invited to participate in a research study conducted by Vinh-An (An) Nguyen, Principal Investigator, and Dr. Paula Thompson, Faculty Chair at Pepperdine University, because you are recommended by a mutual colleague as a professional with experience in augmentative and alternative communication (AAC). Your participation is voluntary. You should read the information below, and ask questions about anything that you do not understand, before deciding whether to participate. Please take as much time as you need to read the consent form. You may also decide to discuss participation with your family or friends. If you decide to participate, you will be asked to indicate your selection below. You may also print out a copy of this form for your records.

PURPOSE OF THE STUDY

The purpose of this mixed-methods research study is to gather expert opinions in order to inform the implementation of AAC mobile apps in elementary school settings for children with complex communication needs.

Data will be collected from the following guiding questions given to professionals in special education, assistive technology and speech and language pathologists who have experience with AAC:

1. What are expert opinions on the feasibility of providing young learners who have complex communication needs with AAC using mainstream mobile devices?
2. What facilitative actions are important in the utilization of AAC mobile apps in elementary school settings by students with complex communication needs?
3. What are the roles of stakeholders in the implementation of AAC mobile apps in elementary school settings by students with complex communication needs?

STUDY PROCEDURES

If you volunteer to participate in this study, you will be asked to complete questionnaires in two rounds of data collections, about two weeks apart. The method employed will be the Policy Delphi which involves two rounds of questionnaires given to a select group of 15-20 educators with experience in AAC.

The Policy Delphi is a research method that gathers data in the form of viewpoints and opinions from a diverse group of educators who have experience with AAC. This data can prove to be valuable to decision-makers in special education settings who set policy regarding the provision and implementation of AAC mobile technology.

The two rounds of questionnaires will be administered using an online survey tool using Qualtrics (Qualtrics.com). The first questionnaire will consist of 29 multiple-choice items, with opportunities for participants to suggest additional variables. The second iteration of the questionnaire will be developed based on the results from the first questionnaire. Panelists will

be given an opportunity after Round 1 to reflect and respond to the summarized group responses. Lastly, after the each round, the researcher will manage and analyze the data that will be shared with participants.

POTENTIAL RISKS AND DISCOMFORTS

The potential and foreseeable risks associated with participation in this study are minimal and include possible discomforts in spending 15-30 minutes completing an online questionnaire and navigating with a mouse and keyboard or touch-screen display.

POTENTIAL BENEFITS TO PARTICIPANTS AND/OR TO SOCIETY

Although participants will not receive material or monetary incentive for involvement in the study, they will likely reap intangible benefits in the form of added self-knowledge and increased knowledge of the subject matter. Furthermore, participants will have direct on the formulation of Round 2 questionnaire priorities and contributing to a joint body of knowledge as a result of the study. Results from this study may be beneficial to decision-makers who develop policies on the use and provision of AAC technology.

CONFIDENTIALITY

The researcher will keep your records for this study confidential as far as permitted by law. However, if required to do so by law, he may be required to disclose information collected about you. Examples of the types of issues that would require the researcher to break confidentiality are if you tell him about instances of child abuse and elder abuse. Pepperdine's University's Human Subjects Protection Program (HSPP) may also access the data collected. The HSPP occasionally reviews and monitors research studies to protect the rights and welfare of research subjects.

The data will be stored on a password protected computer in the principal investigators place of residence. The data will be stored for a minimum of three years.

Any identifiable information obtained in connection with this study will remain confidential. Your responses will be coded with a pseudonym and transcript data will be maintained separately.

PARTICIPATION AND WITHDRAWAL

Your participation is voluntary. Your refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study.

ALTERNATIVES TO FULL PARTICIPATION

The alternative to participation in the study is not participating or completing only the items which you feel comfortable.

EMERGENCY CARE AND COMPENSATION FOR INJURY

If you are injured as a direct result of research procedures you will receive medical treatment; however, you or your insurance will be responsible for the cost. Pepperdine University does not provide any monetary compensation for injury

INVESTIGATOR'S CONTACT INFORMATION

I understand that the investigator is willing to answer any inquiries I may have concerning the research herein described. I understand that I may contact Vinh-An (An) Nguyen at vinh-an.nguyen@pepperdin.edu and Dr. Thompson, Committee Chair, at paula.thompson@pepperdine.edu. if I have any other questions or concerns about this research.

RIGHTS OF RESEARCH PARTICIPANT – IRB CONTACT INFORMATION

If you have questions, concerns or complaints about your rights as a research participant or research in general please contact Dr. Judy Ho, Chairperson of the Graduate & Professional Schools Institutional Review Board at Pepperdine University 6100 Center Drive Suite 500 Los Angeles, CA 90045, 310-568-5753 or gpsirb@pepperdine.edu.

ACKNOWLEDGEMENT OF RESEARCHER

The researcher has explained the research to the participants and was available to answer all of his/her questions. In the researcher's judgment the participants are knowingly, willingly and intelligently making their selection regarding participation in this study. They also have been informed participation is voluntarily and that they may discontinue their participation in the study at any time, for any reason.

OPT-IN/OPT-OUT SELECTION OF PARTICIPANTS

I have read the information provided above. I have been given a chance to ask questions. Any questions I may have had have been answered to my satisfaction.

- ☐ I agree to participate in this study.
- ☐ I decline to participate in this study.

APPENDIX E

AAC Mainstream Mobile Technology Questionnaire—Round 1

This 29-item questionnaire aims to explore expert opinions on issues impacting the implementation of augmentative and alternative communication (AAC) apps on mainstream mobile devices for elementary school aged children with speech impairment. Specifically, the first part of this questionnaire asks for participants' background information. All answers will remain anonymous and confidential. The second part aims to gather expert opinions via rating scales on paraphrased statements taken from research studies about the feasibility of using mainstream mobile technology for AAC. The third part prompts participants to rank items on facilitative actions and stakeholder roles in order of importance.

Directions: Please read the information and definition of terms below. Not all questions require a response. You may select "No Judgement" or type "NA" if you do not wish to respond to an item. If you do not provide an answer to a question, you will receive a reminder message before moving on to the next section.

Definition of augmentative and alternative communication (AAC): AAC involves using any method in addition to or in place of speech to communicate (e.g., pictures, gestures). Elementary school aged children with a wide variety of disabilities that compromise communication may need AAC in order to share their needs, wants, feelings, and thoughts with others.

Mobile apps is short for mobile applications. An app is a shortened or specific software program that usually performs a small function or provides a particular purpose. A mobile app is generally designed to be used on a multifunction mobile device such as a tablet or smartphone. An AAC mobile app is, therefore, a speech generating program that enables a mainstream mobile device to be used as an AAC system.

Mainstream mobile devices such as iPads run on Apple (iOS) or Android operating systems.

Types of AAC that children might use: Children may use any or all of the following forms of AAC: eye pointing, gestures, signs, objects, communication books or boards, PECS, speech generating devices (SGDs) and AAC mobile apps on mainstream mobile devices (i.e., iPad, iPod, Android tablets).

Example AAC mobile apps usage: Tony has severe apraxia of speech, making his speech very difficult to understand. He communicates by using an AAC app on his iPad to indicate choices (for snacks and play activities) and to make requests.

Part 1. Participant Background Information.

(1) Select one of the following job titles that you identify with the most in your current role:

- ❍ Speech and language pathologist
- ❍ Special education teacher or administrator
- ❍ Assistive technology specialist
- ❍ Other

(2) What region of the country do you work in?

- ❍ West (Mountain and Pacific regions)
- ❍ Midwest (East North Central and West North Central regions)

- ❍ South (South Atlantic, East South Central and West South Central regions)
- ❍ Northeast (New England and Mid-Atlantic regions)

(3) What employment setting do you work in?

- ❍ Urban school district
- ❍ Suburban school district
- ❍ Rural school district

(4) Years of experience in current position:

- ❍ 1-5 years
- ❍ 6-10 years
- ❍ 11 or more years

(5) Years of experience using AAC mobile applications, whether as a clinical or education practitioner or trainer (of parents and/or practitioners).

- ❍ None
- ❍ 1-2 years
- ❍ 3-5 years
- ❍ 6 or more years

Part 2: Feasibility of using AAC Mainstream Mobile Technology for AAC

Innovations in AAC apps using mainstream mobile devices present many advantages as well as challenges when compared to traditional, dedicated AAC devices. Special education practitioners and administrators are confronted with important decisions concerning the provision of effective communication systems for children who require AAC. The statements below were derived from research literature on AAC technology and grouped in the following categories: Design & Features, Social Inclusion, Professional Development, Affordability and Challenges and Effectiveness. You are being asked to indicate your level of agreement with each of the following statements:

Category: Design and Features

(6) Mainstream mobile devices, which have touch screens, may impede AAC usage in students with low fine motor skills; and therefore should not be utilized.

- ❍ Highly Agree
- ❍ Agree
- ❍ Slightly Disagree
- ❍ Completely Disagree
- ❍ No Judgement

(7) The lack of switch input to provide alternative input sources on mainstream mobile devices makes them inferior as an AAC system compared to dedicated AAC devices.

- ❍ Highly Agree
- ❍ Agree
- ❍ Slightly Disagree

- Completely Disagree
- No Judgement

(8) There will always be a place for dedicated AAC devices that offer customized features catering to the needs of AAC users, features which mainstream mobile devices currently do not offer, nor will likely offer in the future.

- Highly Agree
- Agree
- Slightly Disagree
- Completely Disagree
- No Judgement

(9) Overall, students will have more success in communicating effectively when using AAC on mainstream mobile devices than they will on dedicated AAC devices.

- Highly Agree
- Agree
- Slightly Disagree
- Completely Disagree
- No Judgement

(10) It is feasible for a school to provide specialized behavioral and motor skills intervention for some students to help them be able to use AAC apps on mainstream mobile devices.

- Highly Agree
- Agree
- Slightly Disagree

- ❍ Completely Disagree
- ❍ No Judgement

Category: Social Inclusion

(11) Dedicated AAC devices primarily serve as “speech prostheses” that allow for limited social interaction.

- ❍ Highly Agree
- ❍ Agree
- ❍ Slightly Disagree
- ❍ Completely Disagree
- ❍ No Judgement

(12) AAC technologies on mainstream mobile devices enable unlimited, interactive communication.

- ❍ Highly Agree
- ❍ Agree
- ❍ Slightly Disagree
- ❍ Completely Disagree
- ❍ No Judgement

(13) Access to AAC through mainstream mobile technologies has provided increased visibility of AAC in society and is effective in promoting social inclusion and acceptance.

- ❍ Highly Agree
- ❍ Agree
- ❍ Slightly Disagree

- Completely Disagree
- No Judgement

(14) Individuals with speech impairment who do not have access to mainstream mobile devices for AAC will be restricted from full participation in educational, vocational, and community opportunities.

- Highly Agree
- Agree
- Slightly Disagree
- Completely Disagree
- No Judgement

Category: Training and Professional Development

(15) Insufficient training and knowledge for service providers leads to underutilization and potential abandonment of AAC technologies.

- Highly Agree
- Agree
- Slightly Disagree
- Completely Disagree
- No Judgement

(16) With the use of evidence-based practices and the systems established for AAC technologies to support teacher professional development in educational settings, communicative spontaneity of students who use AAC will likely be achieved.

- Highly Agree

- ❍ Agree
- ❍ Slightly Disagree
- ❍ Completely Disagree
- ❍ No Judgement

(17) As an education professional, I am very comfortable with service delivery in the area of AAC and require no further training.

- ❍ Highly Agree
- ❍ Agree
- ❍ Slightly Disagree
- ❍ Completely Disagree
- ❍ No Judgement

Category: Affordability

(18) Cost has traditionally been a major obstacle in the provision of tech-based AAC intervention.

- ❍ Highly Agree
- ❍ Agree
- ❍ Slightly Disagree
- ❍ Completely Disagree
- ❍ No Judgement

(19) Parents who were unsure if AAC is the right step now have an affordable option to provide an AAC device for their child.

- ❍ Highly Agree

- ❍ Agree
- ❍ Slightly Disagree
- ❍ Completely Disagree
- ❍ No Judgement

(20) The relatively low cost of mainstream mobile devices means that more school districts, and other agencies are able to consider the purchase of AAC technologies on their own.

- ❍ Highly Agree
- ❍ Agree
- ❍ Slightly Disagree
- ❍ Completely Disagree
- ❍ No Judgement

(21) School districts should prioritize funding for affordable AAC mobile apps over traditional AAC devices.

- ❍ Highly Agree
- ❍ Agree
- ❍ Slightly Disagree
- ❍ Completely Disagree
- ❍ No Judgement

(22) This affordability will likely result in the increased utilization of AAC mainstream mobile technology in young learners.

- ❍ Highly Agree
- ❍ Agree

- ❍ Slightly Disagree
- ❍ Completely Disagree
- ❍ No Judgement

Category: Challenges and Effectiveness

(23) Overall, the boom in mobile device availability and use raise many challenges, including the tendency to focus on the technology instead of on communication.

- ❍ Highly Agree
- ❍ Agree
- ❍ Slightly Disagree
- ❍ Completely Disagree
- ❍ No Judgement

(24) A mainstream mobile technology such as a tablet, functioning as an AAC device, produces higher rates of independent responding than a picture exchange system.

- ❍ Highly Agree
- ❍ Agree
- ❍ Slightly Disagree
- ❍ Completely Disagree
- ❍ No Judgement

Part 3: Prioritizing Facilitative Actions and Stakeholder Roles

The following three items relate to the scenario below:

Your school district is evaluating the feasibility of providing AAC using mainstream mobile devices. Input is gathered from stakeholders on prioritizing facilitative actions and stakeholder roles.

(25) As a member of the special education task force, you are asked to select the top three (3) facilitative actions (in terms of priority and relevance) from the list below for improving AAC mobile apps utilization in elementary school settings.

- ❍ Providing professional development for special education staff
- ❍ Clarifying special education policies regarding AAC service
- ❍ Training of speech and language pathologists
- ❍ Providing funding at the school and district level for high-tech AAC
- ❍ Training of communication partners (caretakers and parents)

(26) Please list any additional facilitative actions not represented in the question above:

_____.

(27) You are asked to select the top three (3) stakeholder roles (in terms of priority or relevance) required to implement AAC mobile apps in elementary school settings.

- ❍ Speech and language pathologists
- ❍ Communication partners (caretakers and parents)
- ❍ General education staff
- ❍ Special education staff
- ❍ Administrators (school site and district level)

(28) Please list any additional stakeholder roles not represented in the question above:

_____

(29) Please describe any additional issues that play a role in AAC mobile apps implementation that have not been represented in this questionnaire:

_____

The second round of this study consists of a follow-up questionnaire that will commence in two weeks. Please indicate your interest in completing the second and final round of this study. The second iteration of the questionnaire will be developed based on the results from the first questionnaire. Panelists will be given an opportunity in Round 2 to reflect and respond to the summarized group responses from Round 1.

- ❍ Yes, include me in the second round of the study. An invitation can be sent to my email address as follows: _____
- ❍ No, remove me from the second round of the study. (Please provide a reason for opting out of the second round.) _____

Thank you for your participation in this two-round Policy Delphi Study on AAC Mobile Apps. The researcher will contact you in approximately three months to share the results of this study. If you have any questions, please do not hesitate to contact Vinh-An Nguyen at vinh-an.nguyen@pepperdine.edu or the dissertation chairperson Dr. Paula Thompson at paula.thompson@pepperdine.edu.

APPENDIX F

AAC Mainstream Mobile Technology Questionnaire—Round 2

Thank you for your valuable input on the Round 1 questionnaire several weeks ago on the feasibility of using mainstream mobile technology for children who require AAC. A total of 19 AAC experts responded, represented by seven Speech and Language Pathologists (SLP), seven Special Ed teachers and administrators (SPED), three Assistive Technology Specialists (AT), one Occupational Therapist (OT), and one Board Certified Behavior Analyst (BCBA).

This Round 2 questionnaire of a two-round Policy Delphi study contains 11 open-ended follow-up questions based on the results from Round 1. This questionnaire is meant to capture the thoughts of participants after reflecting on a summary of responses from the previous questionnaire. The goal of this study is not to establish consensus, but rather, to gather a diversity of ideas.

Directions: After reviewing each summary of group responses, you will be asked to reflect and give feedback from your experience. Please provide a response for all 11 items.

Part 1: Feasibility of using mainstream mobile technology for AAC

Design and Features

Overall, there was a consensus (≥70%) among respondents about the design and features of AAC mainstream mobile technology in four out of five questions from Round 1.

- A majority disagreed (84%) that mainstream mobile devices, which have touch screens, may impede AAC usage in students with low fine motor skills; and therefore should not be utilized.
- A majority disagreed (74%) that the lack of switch input to provide alternative input sources on mainstream mobile devices makes them inferior as an AAC system compared to dedicated AAC devices
- A majority agreed (79%) that there will always be a place for dedicated AAC devices that offer customized features catering to the needs of AAC users, features which mainstream mobile devices currently do not offer, nor will likely offer in the future.
- A majority agreed (79%) that it is feasible for a school to provide specialized behavioral and motor skills intervention for some students to help them be able to use AAC apps on mainstream mobile devices.

There was not consensus on the statement that overall, students will have more success in communicating effectively when using AAC on mainstream mobile devices than they will on dedicated AAC devices. 53% disagreed with this statement and 47% agreed.

Q1. As you reflect on the results above, please explain your thoughts on the pros and cons of mainstream mobile devices, such as iPads, for AAC as compared to dedicated AAC devices, keeping in mind aspects of design and features:

A. Social Inclusion

Overall, there was a diversity of opinions among respondents about the impact of AAC mainstream mobile technology on social inclusion. There was a consensus on only two out of four questions from Round 1.

- A majority disagreed (84%) that dedicated AAC devices primarily serve as "speech prostheses" that allow for limited social interaction.
- A majority agreed (89%) that access to AAC through mainstream mobile technologies has provided increased visibility of AAC in society and is effective in promoting social inclusion and acceptance.

There was not consensus with the statement that that AAC technologies on mainstream mobile devices enable unlimited, interactive communication. 58% disagreed with this statement and 42% agreed. In response to the statement that individuals with speech impairment who do not have access to mainstream mobile devices for AAC will be restricted from full participation in educational, vocational, and community opportunities 63% disagreed and 37% agreed.

Q2. Please share your thoughts on whether mainstream mobile devices can or cannot offer unlimited, interactive communication for children who require AAC:

Training and Professional Development

There was a consensus of opinions among respondents about the importance of training and professional development in the implementation of AAC mainstream mobile technology in all three questions from Round 1.

- There was 100% agreement that insufficient training and knowledge for service providers leads to underutilization and potential abandonment of AAC technologies.

- There was overwhelming agreement (95%) with the statement that with the use of evidence-based practices and the systems established for AAC technologies to support teacher professional development in educational settings, communicative spontaneity of students who use AAC will likely be achieved.

- A majority disagreed (83%) with the statement that as an education professional, she/he is very comfortable with service delivery in the area of AAC and requires no further training.

Q3. Please explain your thoughts on what educators and specialists need in providing service delivery for students who require AAC, keeping in mind training and professional development: _____

D. Affordability

Background Information: Dedicated AAC devices range from $1000-$7000, while mainstream mobile devices range from $50-$1000, and AAC mobile apps range from free to $200.

There was a consensus of opinions among respondents about the importance of affordability on the acquisition of AAC mainstream mobile technology in three of five questions from Round 1.

A majority agreed (74%) that cost has been a major obstacle in the provision of tech-based AAC intervention.

- A majority agreed (79%) that the relatively low cost of mainstream mobile devices means that more school districts, and other agencies are able to consider the purchase of AAC technologies on their own.

- A majority agreed (74%) that the affordability of mainstream mobile technology will likely result in the increased utilization of AAC mainstream mobile technology in young learners.

There was not consensus that school districts should prioritize funding for affordable AAC mobile apps over traditional AAC devices. 42% disagreed with this statement and 32% agreed. In response to the statement that parents who were unsure if AAC is the right step now have an affordable option to provide an AAC device for their child, 53% agreed and 37% disagreed.

Q4. Please provide your thoughts on whether or not AAC mobile technology is an affordable option for parents: _____

Q5. Please explain your beliefs on whether or not schools should prioritize the provision of mobile devices for AAC versus traditional and dedicated AAC devices: _____.

E. Challenges and Effectiveness

There was no consensus among respondents on the challenges and effectiveness of AAC mainstream mobile technology in the two questions in Round 1.

- 68% agreed and 32% disagreed that overall, the boom in mobile device availability and use raise many challenges, including the tendency to focus on the technology instead of on communication.
- 63% agreed and 26% disagreed that a mainstream mobile technology such as a tablet, functioning as an AAC device, produces higher rates of independent responding than a picture exchange system.

Q6. Please provide your feedback on how educators and specialists can address the issue of technology distraction for students who use mobile devices for communication:

_____

Q7. Please offer your thoughts on whether or not new technologies like AAC mobile apps are more effective than traditional systems: _____

Part 2: Facilitative Actions

In Round 1 you were asked to select the top three (3) facilitative actions (in terms of priority and relevance) from the list below for improving AAC mobile apps utilization in elementary school settings.

Results, in descending order:

- Providing professional development for special education staff (100%)
- Training of communication partners (caretakers and parents) (94%)
- Training of speech and language pathologists (67%)
- Providing funding at the school and district level for high-tech AAC devices (28%)
- Clarifying special education policies regarding AAC devices (11%)

Q8. As you reflect on the results above, please provide your feedback on the reasons why staff training and professional development may be more important than funding and clarifying policies on AAC using mainstream mobile technology:

_____

Part 3: Roles of Stakeholders

In Round 1 you were asked to select the top three (3) stakeholder roles (in terms of priority or relevance) required to implement AAC mobile apps in elementary school settings.

Results in descending order:

- Special education staff (89%)

- Speech and language pathologist (84%)
- Communication partners (caretakers and parents) (84%)
- Administrators (school site and district level) (16%)
- General education staff (11%)

As you reflect on the results above, please provide your feedback on the following questions:

Q9. What are your thoughts on why general education staff and school and district administrators received the fewest selections concerning stakeholder roles in implementing mainstream mobile technology? _____

Q10. What do the results say about the roles that general education staff play in the inclusion of students with speech impairments in general education classrooms?
_____

Q11. When planning for the inclusion of students who require AAC using mainstream mobile technology, what factors are important to consider in the general education classroom?
_____

Thank you for your participation in this two-round Policy Delphi Study on AAC Mobile Apps.

The researcher will contact you in the coming months to share the results of this study. If you have any questions, please do not hesitate to contact Vinh-An Nguyen at vinh-an.nguyen@pepperdine.edu or an1995@gmail.com, or the dissertation chairperson Dr. Paula Thompson at paula.thompson@pepperdine.edu.

APPENDIX G

Round 2 Data

Round 2: Codebook

Question	Codes
1	affordability (relatively inexpensive compared to dedicated devices)
1	design features (include elements of function, customization, durability, portability, and limitations)
1	misc (MMDs that are appropriate & valuable)
1	portability (easy to carry around, convenient, lightweight)
1	prevalence (currently used/easy access/social acceptance/coolness/less stigma/familiarity to neurotypical students (NT), savvy students)
1	provision (schools/Medicaid/insurance: How are devices provided?, who provides them?, and what is the expectation for their provision?)
1	student needs (individual needs, which AAC systems gives students a voice? Often requires assessment to determine specific communicative needs and ideal device)
1	support (training for staff/team; parents/peers/technical support, hardware, app usage)
1	team collaboration (gen ed staff, speech specialists, family, peers, student)
2	adaptations (although MMD can offer unlimited interactive communication, some adaptations are required)
2	all devices limited (interactive communication is not possible in MMD and DD systems--all systems are limited)
2	functionality (features that provide additional help in communication such as text-to-speech)
2	greater accessibility (MMD offer students greater access to communication)
2	implementation (MMD effectiveness relies on proper implementation strategies)
2	implementation (strategies for using in home, school, communication)
2	independence (MMD can offer independence if implemented correctly)
2	limitations (characteristics of a device that may impede communication of not addressed)
2	opportunities (students can reap benefits of MMD if they are provided same opportunities to communicate as NT peers.)
2	socially inclusive (MMD can have an socially inclusive effect)
2	unlimited (MMD offers unlimited interactive communication)
3	collaborating (working together as a team alongside all stakeholders)
3	experience/device utilization (use of a variety of devices in order for teachers to feel comfortable with and be able to support their students; hands-on experience)

3	hands-on training (on use of device)
3	implementation (strategies/best practices for ensuring that devices are utilized with integrity in the classroom or learning sessions)
3	model use (ability for adults to demonstrate effective use of the device)
3	on-going training/support (special educators/SLPs/students/parents/NT peers/all stakeholders on a variety of strategies to improve implementation of AAC)
3	open to learning (attitude of a life-long learner)
3	recognizing importance (of AAC devices and systems)
3	staying updated (keep abreast of latest development in AAC as well as technology innovations)
4	concern (Without information, some parents may make uninformed purchases and more likely to purchase a device or app that is not suitable for their child)
4	parents' wealth (for some families, cost isn't a factor in providing the device; for others, they cannot afford even a low cost device or app.)
4	school provision (because of its affordability, some school districts may chose to offer mainstream mobile technology over dedicated devices. FAPE is free appropriate public education.)
4	varies (cost of apps and devices vary)
6	device settings - distractions (turning off options for other uses by switching off wifi, and locking one app only)
6	single use/multi use-distractions (setting aside device for communication use only, and having a separate device for other activities. Locking the device to only allow for communication activities and blocking out/install all other apps)
6	student behavior -distractions (teaching students to stay focused on communication task, ignore distractions, and value the benefits of the device for communicating. Helping students to focus on using the device solely for communication, not games or other apps.)
6	training - distractions (Adults need training on how to guide students in using the device, and how to seek help for tech support.)
7	both similar systems (the perception that MMD and DD having the same qualities and features)
7	durability and capability (having robustness and offering additional features)
7	experience (based on subjective experience or feedback from other users)
7	more stimulating (features that motivate the user)
7	not easily adjustable (this is a design feature based on the perception that MMDs are not as easily customized for students as DDs.
8	PD and training (Professional development and training of educators and specialists on how to use and implement AAC. This positively affects the utilization of AAC devices.)
8	policy (refers to the guidelines for schools and districts to provide appropriate systems for students who require AAC)

8	staff knowledge (knowledge of SLPs and SPED teachers regarding device usage and policies on FAPE and the provision of appropriate devices based on students' needs)
8	yes -PD and training most important (This is the respondent's overall answer to the question of whether or not professional development and training of educators and specialists are more important than funding and setting policies for the provision of AAC.)
9	Gen Ed Staff & Admin - not need AAC training (This is the respondent's overall response to the question of why general education staff and school and district administrators may not be as important as special ed staff and speech specialists concerning stakeholder roles in implementing mainstream mobile technology?
9	limited inclusion/mainstreaming - none, rarely or limited (the inclusion or mainstreaming of students who require AAC never occurs, rarely occurs or is limited)
9	limited PD/training (There is a lack of time and often unavailable staff to provide training to general ed staff)
9	role/responsibility - special ed staff/specialists (it is primarily the role of special ed staff and specialists to provide support for AAC. For the most part, general education staff and school administrators are not involved due to limited interaction with these students, due to limited inclusion and mainstreaming of these students.)
10	gen ed lack/need training (in AAC to support mainstreamed students)
10	gen ed role (gen ed staff play an important role in being a part of the team that supports students who require AAC)
10	limited time (gen ed staff lack sufficient time for training and supporting mainstreamed students)
10	neutral response (The answer is vague and doesn't provide a position.)
10	role of sped staff/specialists (gen ed staff often rely on them to provide AAC services to mainstreamed students)
11	classroom environment (that is supportive and conducive for students to use their AAC system to communicate effectively)
11	inclusion strategies - gen ed staff (training, support, etc.)
11	inclusion strategies - logistics (ensuring internet connectivity and power source for device)
11	inclusion strategies - NT peers (Neuro-typical peers, meaning students who have typical abilities, general population)
11	inclusion strategies - special needs students (what these students need to be successful in using AAC in the general ed classroom, such as time to use device, appropriate device, instructional aide [support staff])
11	logistics (the necessary steps to ensure that devices have internet access and power, well-function sound amplification and are that devices are functioning properly)

11	NT peers (mainstreamed students need their neurotypical (NT) peers' understanding and support)
11	special needs students (play an important role in the success of AAC use by receiving training and orientation on how to use the device. They also need to be provided ample support, encouragement and opportunities to practice using the device.)
all	yes, no, neutral, DD, MMD - are overall coded responses to the question at hand. The idea is to capture the overall answer for each question posed.

Code Tallies per Question

Q1. Design & Features: Pros and cons of MMDs	
Codes	Tally
prevalence	15
functionality	4
portability	4
multi-use	4
support	4
affordability	3
limitations	3
student needs	3
durability	2
provision	2
customization	1
team collaboration	1
Q2. Social Inclusion: Can MMDs offer unlimited, interactive communication?	
Codes	Tally
student needs	9
socially inclusive	3
support	3
unlimited	3
limitations	2
adaptations	1
all devices limited	1
functionality	1
greater accessibility	1
implementation	1

independence	1
opportunities	1
Q3. Training and PD: Needs of educators and specialists to deliver AAC services	
Codes	Tally
experience/device utilization	13
support	7
implementation	5
meeting students' needs	5
model use	2
staying updated	2
collaborating	1
open to learning	1
recognizing importance	1
Q4. Affordability: Is AAC mobile technology is affordable option for parents	
Codes	Tally
parents' wealth	9
provision	5
concern	2
varies	2
Q5. Affordability: Should schools provide MMDs over DDs?	
Codes	Tally
student needs	12
prevalence	5
affordability	2
portability	1
Q6. Challenges and Effectiveness: How can educators and specialists address technology distraction of MMDs?	
Codes	Tally
single use	6
device setting	4
student behavior	4
training	2
Q7. Challenges and Effectiveness: Are MMDs more effective than traditional systems?	
Codes	Tally

student needs	5
prevalence	3
both similar systems	2
user friendly	2
affordability	1
durability and capability	1
faster	1
more stimulating	1
not easily adjustable	1
portability	1
robust vocabulary	1
Q8. Facilitative Actions: Why are staff training and PD more important than funding and policy?	
Codes	Tally
utilization of resources	6
provision	3
Staff knowledge	2
Q9. Roles of Stakeholders: Why do general education staff and admin play limited roles in AAC?	
Codes	Tally
limited inclusion/mainstr.	9
role/responsibility	7
limited PD/training	1
Q10. Roles of Stakeholders: What roles do general education staff and admin play in inclusion?	
Codes	Tally
gen ed lack training	4
role of sped staff/specialists	3
limited time	2
gen ed important role	1
gen ed need training	1
limited inclusion/mainstr.	1
no inclusion/mainstr.	1
vague response	1

Q11. Roles of Stakeholders: What factors are important for inclusion of students who use AAC?	
Codes	Tally
special needs student	6
support	5
NT peers	4
team collaboration	3
logistics	3
staff buy in, support	2
commitment	1
realistic expectations	1
classroom environment	1

Overall Attitudes for Questions 1, 2, 4, 5, 7, 8, and 9

Note: Codes of "neutral", "yes", "no", "MMD" (mainstream mobile technology), "DD" (dedicated devices) are the overall answers of each respondent in addressing the question at hand, based on the interpretation of the researcher.

Q1. As you reflect on the results above, please explain your thoughts on the pros and cons of mainstream mobile devices, such as iPads, for AAC as compared to dedicated AAC devices, keeping in mind aspects of design and features: mainstream mobile devices, such as iPads, for AAC as compared to dedicated AAC devices, keeping in mind aspects of design and features:
DDs are better than MMDs
MMDs are better than DDs
MMDs are better than DDs
MMDs are better than DDs
MMDs are better than DDs
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)

Q2. Please share your thoughts on whether mainstream mobile devices can or cannot offer unlimited, interactive communication for children who require AAC:
Yes, MMDs can offer unlimited, interactive communication for children who require AAC.
Yes, MMDs can offer unlimited, interactive communication for children who require AAC.
Yes, MMDs can offer unlimited, interactive communication for children who require AAC.
Yes, MMDs can offer unlimited, interactive communication for children who require AAC.
Yes, MMDs can offer unlimited, interactive communication for children who require AAC.
Yes, MMDs can offer unlimited, interactive communication for children who require AAC.
No, MMDs cannot offer unlimited, interactive communication for children who require AAC.
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No, MMDs cannot offer unlimited, interactive communication for children who require AAC.
No, MMDs cannot offer unlimited, interactive communication for children who require AAC.
No, MMDs cannot offer unlimited, interactive communication for children who require AAC.
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)

Q4. Please provide your thoughts on whether or not AAC mobile technology is an affordable option for parents:
Yes, AAC mobile technology is an affordable option for parents.
Yes, AAC mobile technology is an affordable option for parents.
Yes, AAC mobile technology is an affordable option for parents.
Yes, AAC mobile technology is an affordable option for parents.
Yes, AAC mobile technology is an affordable option for parents.
No, AAC mobile technology is not an affordable option for parents.
No, AAC mobile technology is not an affordable option for parents.
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)

Q5. Please explain your beliefs on whether or not schools should prioritize the provision of mobile devices for AAC versus traditional and dedicated AAC devices:
Yes, schools should prioritize the provision of mobile devices for AAC versus traditional and dedicated AAC devices.
schools should prioritize the provision of mobile devices for AAC versus traditional and dedicated AAC devices
schools should prioritize the provision of mobile devices for AAC versus traditional and dedicated AAC devices
schools should prioritize the provision of mobile devices for AAC versus traditional and dedicated AAC devices
schools should prioritize the provision of mobile devices for AAC versus traditional and dedicated AAC devices
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)

Q7. Please offer your thoughts on whether or not new technologies like AAC mobile apps are more effective than traditional systems:
yes, new technologies like AAC mobile apps are more effective than traditional systems.
yes, new technologies like AAC mobile apps are more effective than traditional systems.
yes, new technologies like AAC mobile apps are more effective than traditional systems.
yes, new technologies like AAC mobile apps are more effective than traditional systems.
yes, new technologies like AAC mobile apps are more effective than traditional systems.
yes, new technologies like AAC mobile apps are more effective than traditional systems.
No, new technologies like AAC mobile apps are not more effective than traditional systems.
No, new technologies like AAC mobile apps are not more effective than traditional systems.
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)
neutral (Expert did not take a position on which system is better.)

Q8. As you reflect on the results above, please provide your feedback on the reasons why staff training and professional development may be more important than funding and clarifying policies on AAC using mainstream mobile technology:
yes-PD and training most important
yes-PD and training most important
yes-PD and training most important
yes-PD and training most important
yes-PD and training most important
yes-PD and training most important
yes-PD and training most important
yes-PD and training most important
yes-PD and training most important
yes-PD and training most important
yes-PD and training most important
yes-PD and training most important
yes-PD and training most important
yes-PD and training most important
no-funding is just as important as training and PD
Q9. What are your thoughts on why general education staff and school and district administrators received the fewest selections concerning stakeholder roles in implementing mainstream mobile technology?
neutral - need team collaboration
Gen Ed Staff & Admin - not need AAC training
Gen Ed Staff & Admin - not need AAC training
Gen Ed Staff & Admin - not need AAC training
Gen Ed Staff & Admin - not need AAC training
Gen Ed Staff & Admin - not need AAC training
Gen Ed Staff & Admin - not need AAC training
Gen Ed Staff & Admin - not need AAC training
Gen Ed Staff & Admin - not need AAC training
Gen Ed Staff & Admin - not need AAC training
Gen Ed Staff & Admin - not need AAC training
Gen Ed Staff & Admin - not need AAC training
Gen Ed Staff & Admin - not need AAC training
Gen Ed Staff & Admin - not need AAC training
Gen Ed Staff & Admin - not need AAC training

APPENDIX H

IRB Approval Notice

PEPPERDINE

Pepperdine University
24255 Pacific Coast Highway
Malibu, CA 90263
TEL: 310-506-4000

NOTICE OF APPROVAL FOR HUMAN RESEARCH

Date: October 11, 2016

Protocol Investigator Name: Vinh-An Nguyen

Protocol #: 16-08-357

Project Title: EXPERT PERSPECTIVES ON USING MAINSTREAM MOBILE TECHNOLOGY FOR SCHOOL-AGE CHILDREN WHO REQUIRE AUGMENTATIVE AND ALTERNATIVE COMMUNICATION (AAC): A POLICY DELPHI STUDY

School: Graduate School of Education and Psychology

Dear Vinh-An Nguyen:

Thank you for submitting your application for exempt review to Pepperdine University's Institutional Review Board (IRB). We appreciate the work you have done on your proposal. The IRB has reviewed your submitted IRB application and all ancillary materials. Upon review, the IRB has determined that the above entitled project meets the requirements for exemption under the federal regulations 45 CFR 46.101 that govern the protections of human subjects.

Your research must be conducted according to the proposal that was submitted to the IRB. If changes to the approved protocol occur, a revised protocol must be reviewed and approved by the IRB before implementation. For any proposed changes in your research protocol, please submit an amendment to the IRB. Since your study falls under exemption, there is no requirement for continuing IRB review of your project. Please be aware that changes to your protocol may prevent the research from qualifying for exemption from 45 CFR 46.101 and require submission of a new IRB application or other materials to the IRB.

A goal of the IRB is to prevent negative occurrences during any research study. However, despite the best intent, unforeseen circumstances or events may arise during the research. If an unexpected situation or adverse event happens during your investigation, please notify the IRB as soon as possible. We will ask for a complete written explanation of the event and your written response. Other actions also may be required depending on the nature of the event. Details regarding the timeframe in which adverse events must be reported to the IRB and documenting the adverse event can be found in the *Pepperdine University Protection of Human Participants in Research: Policies and Procedures Manual* at community.pepperdine.edu/irb.

Please refer to the protocol number denoted above in all communication or correspondence related to your application and this approval. Should you have additional questions or require clarification of the contents of this letter, please contact the IRB Office. On behalf of the IRB, I wish you success in this scholarly pursuit.

Sincerely,

Judy Ho, Ph.D., IRB Chair