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A team approach to mobile device implementation for transition-age students with autism spectrum disorders (ASD)

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A TEAM APPROACH TO MOBILE DEVICE IMPLEMENTATION FOR TRANSITION-AGE STUDENTS WITH AUTISM SPECTRUM DISORDER (ASD)

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ABSTRACT

Adolescents with autism spectrum disorder (ASD) have poor outcomes related to education, employment and independent living as they transition out of the school system (Roux, Shattuck, Rast, Rava, & Anderson, 2015; Wei, Wagner, Hudson, Yu & Shattuck, 2015). Software applications on mobile devices, such as smartphones and tablets, are types of assistive technology (AT) that may help increase the ability of individuals with ASD to function independently and reduce their need for support from teachers, therapists, or job coaches (Gentry, Kriner, Sima, McDonough, & Wehman, 2015; Kim & Kimm, 2017; Odom et al., 2015; Walsh, Holloway, McCoy, & Lydon, 2017). However, there is a need for guidelines and implementation procedures to avoid misuse of the device, carryover of the device post-graduation, and address professional knowledge as it relates to this new technology. The Knowledge to Action (KTA) framework by Graham et al. (2006) suggests the creation of knowledge tools and products, such as guidelines and decision aids to increase access to knowledge for professionals. Using this framework, the Human Activity Assistive Technology (HAAT) model (Cook & Polger, 2015), as well as reviewing the available evidence on mobile devices, apps and assistive

technology, a set of guiding documents were developed. The documents consist of a variety of tools, such as flowcharts, checklists, and guiding questions that can assist school-based teams in implementing mobile devices with transition-age students with ASD. In addition, a funding plan, evaluation, and dissemination needs of a pilot implementation of these documents in a school-based setting are proposed.

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LIST OF ABBREVIATIONS

AAC ..... Augmentative and Alternative Communication

ADLs ..... Activities of Daily Living

AOTA ..... American Occupational Therapy Association

ASD ..... Autism Spectrum Disorder

AT ..... Assistive Technology

HAAT ..... Human Activity Assistive Technology

IADLs ..... Instrumental Activities of Daily Living

IDEA ..... Individuals with Disabilities Education Act

IEP ..... Individualized Education Plan

KTA ..... Knowledge to Action

NTACT ..... National Technical Assistance Center on Transition

QIAT ..... Quality Indicators for Assistive Technology

SETT ..... Student Environment Tasks and Tools

UDL ..... Universal Design for Learning

WATI ..... Wisconsin Assistive Technology Initiative

CHAPTER ONE - Introduction

Background

An estimated 50,000 American teenagers with autism spectrum disorder (ASD), a lifelong developmental disability, enter adulthood each year (Roux, Shattuck, Rast, Rava, & Anderson, 2015). Although there is a range of severity of symptoms that adolescents with ASD exhibit, many have difficulty with communication skills, specifically conversation skills, social skills, behavioral challenges, and functional skills such as completing activities of daily living (ADLs) and instrumental activities of daily living (IADLs) (Center on Secondary Education for Students with Autism Spectrum Disorder, 2013; Roux, et al., 2015). These challenges persist as they age and are compounded by decreased cognition and communications skills; as a result, adolescents and adults with ASD are less likely to enter post-secondary education, have gainful employment, live independently, and engage in social situations than their peers with other types of disabilities (Roux, et al., 2015; Wei, Wagner, Hudson, Yu & Shattuck, 2015).

Individuals with ASD are guaranteed a free, appropriate public education in the least restrictive environment from age 3 to 21 through the Individuals with Disabilities Education Act (IDEA) (Jackson, 2007). In 2015, 576,000 students with ASD were served under this federal law (U.S. Department of Education, 2016). Transition plans and transition services are intended to address potential barriers to participation for students with ASD as they leave high school and transition to employment, post-secondary education, day-habilitation centers, supported or independent living. IDEA mandates that transition plans and transition services, are incorporated into the Individualized Education

Program (IEP) by age 16, though it is recommended that transition planning begin earlier, and some states begin at age 14 (Crabtree, 2014; Wehmeyer & Zager, 2014). Many of these plans focus on establishing employment interests and goals related to job performance, such as endurance, social interaction and executive functioning skills, and if appropriate choosing a postsecondary education placement and fulfilling the steps and skills needed for that context (Bissell & Cermak, 2015; Crabtree, 2014; Wehmeyer & Zager, 2014). Other goals focus on independent living and community participation, such as increasing independence in ADLS, IADLs, sensory regulation, leisure skills, money management, social skills, executive functioning, travel training, and safety (Bissell & Cermak, 2015; Crabtree, 2014; Wehmeyer & Zager, 2014). In accordance with IDEA, the IEP team, commonly consisting of parents, teachers, school administrators, speech language pathologists, occupational therapists, behavioral consultants, representatives from outside vocational agencies, and the student when suitable (Bissell & Cermak, 2015; Wehmeyer & Zager, 2014), must consider the student's assistive technology (AT) needs to complete functional skills and when appropriate include assistive technology devices and related training within the transition plan (Bowser & Reed, 2012).

Use of Mobile Devices as Assistive Technology

Software applications on mobile devices, such as smartphones and tablets, are types of assistive technology (AT) that may help increase the ability of individuals with ASD to function independently in many of these transition activities and reduce their need for support from teachers, therapists, or job coaches (Gentry, Kriner, Sima, McDonough, & Wehman, 2015; Kim & Kimm, 2017; Odom et al., 2015; Walsh,

Holloway, McCoy, & Lydon, 2017). For the purpose of this project, mobile devices, sometimes referred to as "mobile technology," will be any computing device that can be held in one hand or worn on the body (Ayres, Shepley, Douglas, Shepley & Lane, 2016). Applications, commonly referred to as apps, are the software programs either built in or added to a mobile device that help a user perform functions or tasks. As a type of AT, mobile devices offer portability, customization, and social acceptability, which increases their appeal to users and may lower the risk of abandonment (Ayres et al., 2016; McKnight, 2014). In addition, mobile devices adhere to the principles of universal design for learning (UDL) by providing flexibility in the way information is presented with visual, auditory, and tactile options and how users can respond and interact with the information presented, furthering their value for students with ASD (McMahon & Walker, 2014).

Built in apps found on mobile devices, such as electronic calendars, notes, cameras, and maps, are current examples of apps commonly used for and by individuals with developmental disabilities. Electronic calendars, reminders, and to-do lists apps on Apple devices assist with the initiation, sequence, and termination of tasks by providing both text, picture and auditory cues and helped improve job performance for adults with ASD (Gentry et al., 2015; Gentry, 2015). Similarly, the built-in applications, notes and photo on an iPhone® were used to create electronic shopping lists for adolescents with moderate intellectual disabilities and improved their location of items in a grocery store (Douglas, Ayres & Langone, 2015). Cameras on mobile devices are another example of an app that has been used with young adults and adolescents with ASD and

developmental disabilities. With this app, mobile devices can record and display video models or video prompts which can be used as a visual tool where students can imitate the viewed skills or tasks. Video modeling and video prompting on mobile devices have been effectively used for teaching vocational skills such as those associated with custodial and office work, IADLs such as meal preparation, washing the table and windows, as well as participation in leisure skills, namely, listening to music (Bereznak, Ayres, Mechling, & Alexander, 2012; Kagohara, et al., 2011; Kellems & Morningstar, 2012; Smith, et al., 2016; Wu, Cannella-Malone, Wheaton, & Tullis, 2016). Maps and global positioning software (GPS) may help with community mobility and travel training, though there is limited evidence to support the effectiveness of these applications for individuals with ASD at this time (Gentry et al., 2015; Gentry, 2015; Leynse-Harpold, 2013).

In addition to the cues and functions built-in apps can provide, add-on apps also address AT needs for students with ASD. Add-on apps are software that is purchased from the mobile device provider's store and installed on the mobile device. Some add-on apps are also available for free. An example of an add-on app includes, Proloquo2go™, an alternative and augmentative communication (AAC) application that has been shown to increase the requests of preferred items like toys, books, or food by children and adolescents with ASD, offers additional features, and is cheaper than Dynavox® and other speech generating devices (Achmadi, et al., 2012; Alzrayer, Banda, & Koul, 2017; King et al., 2014). Choiceworks®, another add-on application, is a customizable visual schedule that includes the options of adding auditory prompts, video models, and the use

of a timer for both to-do lists and for specific situations such as waiting (Bruhn, Hirsch, & Vogelgesang, 2016). During a small pilot study, Choiceworks®, proved to be helpful when used for students with ASD as a self-monitoring tool (Xin, Shepard & Brown, 2017). The use of behavioral reinforcement systems and schedules on Choiceworks®, may foster increased autonomy and self-determination in students with ASD (Bruhn, et al., 2017). An alternative visual schedule application First-Then Visual Schedule© also allows users to customize prompting with the options of adding auditory, video, and visual timer prompts, and adults with developmental disabilities used it to accurately complete a series of whole-body exercises unassisted (Uphold, Douglas, Loseke, 2016).

Identified Problem

Although the use of these individual apps has begun to be documented, without clear guidelines for implementation of such AT or proper training for the student and particularly taking into consideration the need for interdisciplinary collaboration, their IEP team, it can lead to misuse of the device, lack of carryover, or an unawareness by the education team for its potential as a useful tool in the transition process (Bowser & Reed, 2012; Zabala et al., 2000). Survey results from teachers and related professionals who work with students with disabilities across one state in the Midwest, indicated educators do not have the necessary training or knowledge to use technology to improve their students' education (Okolo & Diedrich, 2014). A larger survey across the United States and a few international countries, noted that more than half of educators had not received training on applications on mobile devices (Ferdig, Pytash, Kosko, Gandolfi, & Matthews, 2016). Consequently, Odom et al. (2015) calls for an increase in professional

development and training that guides implementation of technology, like mobile devices, into common practice.

There is also little in the way of research on the use of applications that fully examine the combined use of multiple applications on one mobile device (Gentry, 2015) nor the navigation and usage within the chosen device (Cullen & Alber-Morgan 2015), though existing studies show promising results (Gentry et al., 2015; Gentry et al., 2012; Jones & Bucholz, 2014; Tomchek, Koenig, Arbesman & Lieberman, 2017). Indeed, customizing a mobile device with multiple applications is a form of AT that has the potential to support students with ASD as they work towards many of their IEP transition goals of employment, leisure, community living and daily living skills (Ayres et al., 2016; Gentry, 2015; Jones & Bucholz, 2014; McKnight, 2014; Odom et al., 2015; Tomchek, et al., 2017).

Occupational Therapy's Role

Under the reauthorization of IDEA in 2004, occupational therapists are expected to prepare students and develop skills that support positive outcomes for students in their next stage whether that is, employment, further education, and/or supported or independent living (Jackson, 2007). Occupational therapists can do this by educating students and their families about their changing roles and routines; evaluating students' needs within the home, educational, and community settings including assessing aspects of the environmental contexts, client factors, and participation in ADLs, IADLs, community mobility, work, social, and leisure pursuits; and facilitating the development of the cognitive, motor and social interaction skills in these occupational areas (AOTA,

2014; AOTA, 2018; Crabtree, 2014). Assistive technology is one area occupational therapists can address in order to help support successful transitions (AOTA, 2018).

Occupational therapists have the activity analysis, observation and client matching skills, as well as the educational background and clinical experience to evaluate, provide and recommend AT, such as mobile devices, to improve functional ability (AOTA, 2015). Using a mobile device, as with many forms of AT, requires multiple interactions between the person, the device, and the environment. Specifically, accessing and utilizing various functions and applications on the mobile device, requires extensive knowledge of all facets of the individual's capabilities and the environment in which they are performing those activities (Gentry, 2015). Occupational therapists have the unique lens in which to observe the client factors, performance skills, performance patterns, and the environment and context and then analyze and synthesize the information to be able to apply it to this form of AT (AOTA, 2014). Although occupational therapists have a distinctive and valuable viewpoint, it is important to note that in both transition planning and in providing AT, occupational therapists are often part of a team of professionals. Therefore, decisions made in this area should be done in a collaborative manner, although the nature of that collaboration may range from multidisciplinary to interdisciplinary (AOTA, 2018; AOTA, 2015).

Project Overview

In order to be successful, as with any AT, mobile devices must be included within the transition plan and guidelines for training and proper use of this technology must be implemented (Bowser & Reed, 2012; Zabala, 2000). The interaction between the

individual and the multiple applications on the device affects the decision-making process for what applications to choose, how many applications to install on a device, and how to implement the device for transition-age students with ASD. An assessment tool that can inform the IEP team on how to customize a device with multiple applications for a transition-age student, specific guidelines for including the device within the transition plan and strategies for implementation of the device would help facilitate this process.

To address this problem, the proposed program will establish procedures and guiding documents or knowledge products and tools to assist an education team in customizing a mobile device for a transition-age student with ASD by using a flowchart, app suggestions, and questions that will assist the members of the team in matching the apps to the student's post-secondary goals and identified needs. The second component will be an observation checklist and examples for designing a task analysis that will assist the transition education team in measuring the student's progress with operational competence and assess any additional hardware needs when navigating and using the device across contexts and settings. This checklist will assist the team in setting measurable goals for the transition plan to increase students' independence using a mobile device with multiple forms of AT installed.

CHAPTER TWO – Project Theoretical and Evidence Base

Theoretical Base for Project

The Knowledge to Action framework by Graham et al. (2006) suggests the creation of knowledge tools and products, such as guidelines and decision aids to increase access to knowledge for professionals by making the information more user-friendly. In order to design the knowledge products and tools, the Human Activity Assistive Technology (HAAT) model by Cook and Hussey will be used (Cook & Polger, 2015). The HAAT model recommends teams use a collaborative process that considers the human (student), the activities (transition goals), the context where they will be performing these activities (post-secondary environments), and the interaction of the assistive technology (applications, mobile device) with all of these factors, in order to avoid misuse or abandonment of the device (Cook & Polger, 2015).

KTA Framework

The knowledge to action (KTA) framework from the nursing field was proposed as a way to address the need to translate research findings into professional practice (Graham et al., 2006). Decreased rate of knowledge translation can lead to professionals not utilizing evidence-based research to inform practice, as well as implementing practices before sufficient research is available (Graham et al., 2006). Due to the high quantity of research or new techniques, professionals often have difficulty locating relevant findings and integrating the evidence into practice. Mobile devices are an example of a novel technique in school practice that professionals have had difficulty translating into practice (Ferdig et al., 2016). To assist with the implementation of new

concepts like mobile devices from the research literature and from practice, the KTA framework suggests a non-linear, dynamic model that has two phases, knowledge creation and knowledge action (Graham et al., 2006). For the purpose of this doctoral project, the focus will be on the first phase, knowledge creation (see Figure 2.1).

Knowledge creation is described as a funnel where knowledge becomes more useful to practitioners as it moves from knowledge inquiry, such as pilot studies, to knowledge synthesis, such as systemic reviews and controlled trials, to knowledge tools and products (Graham et al., 2006). Knowledge tools and products are defined as practice guidelines, decision tools, toolkits, and/or care pathways that present information in user-friendly formats and can be tailored for potential users (Graham et al., 2006). An example of a knowledge tool and product is the AOTA's *Occupational Therapy Practice Guidelines for Individuals with Autism Spectrum Disorders* (Tomchek & Koenig, 2016). Knowledge products and tools can also help stimulate more research on a topic and begin the groundwork for the second phase in the KTA framework, knowledge action (Graham et al., 2006).

Knowledge action is envisioned as a cycle that encircles the funnel, and represents the activities needed for implementation of the knowledge in a specific context (Graham et al., 2006). It consists of identifying the problem, reviewing the relevant knowledge, adapting the knowledge to the local context, assessing barriers to using the knowledge, selecting and implementing interventions to promote the use of knowledge, monitoring knowledge use, evaluating the outcomes of using the knowledge, and sustaining ongoing knowledge use (Graham et al., 2006). In the same way that

knowledge creation influences knowledge action, each phase of the action cycle can influence aspects of knowledge creation, causing changes in knowledge inquiry, synthesis, or product and tools.

Review of the literature on the use of mobile devices with transition age students with ASD revealed that there are studies within the knowledge inquiry and synthesis phases. However, there are gaps regarding empirical studies that use a combination of multiple applications on one device, and there is a need for knowledge products and decision-making tools and guidelines on implementing mobile devices for school teams to use. By addressing this aspect of the knowledge to action framework and disseminating the knowledge products, it will increase stakeholders' awareness and draw attention to research gaps (Graham et al., 2006). It will also lay the groundwork for the following phase, knowledge action, where the tools and products can be adapted and implemented within a specific school context leading to more knowledge creation through the process.

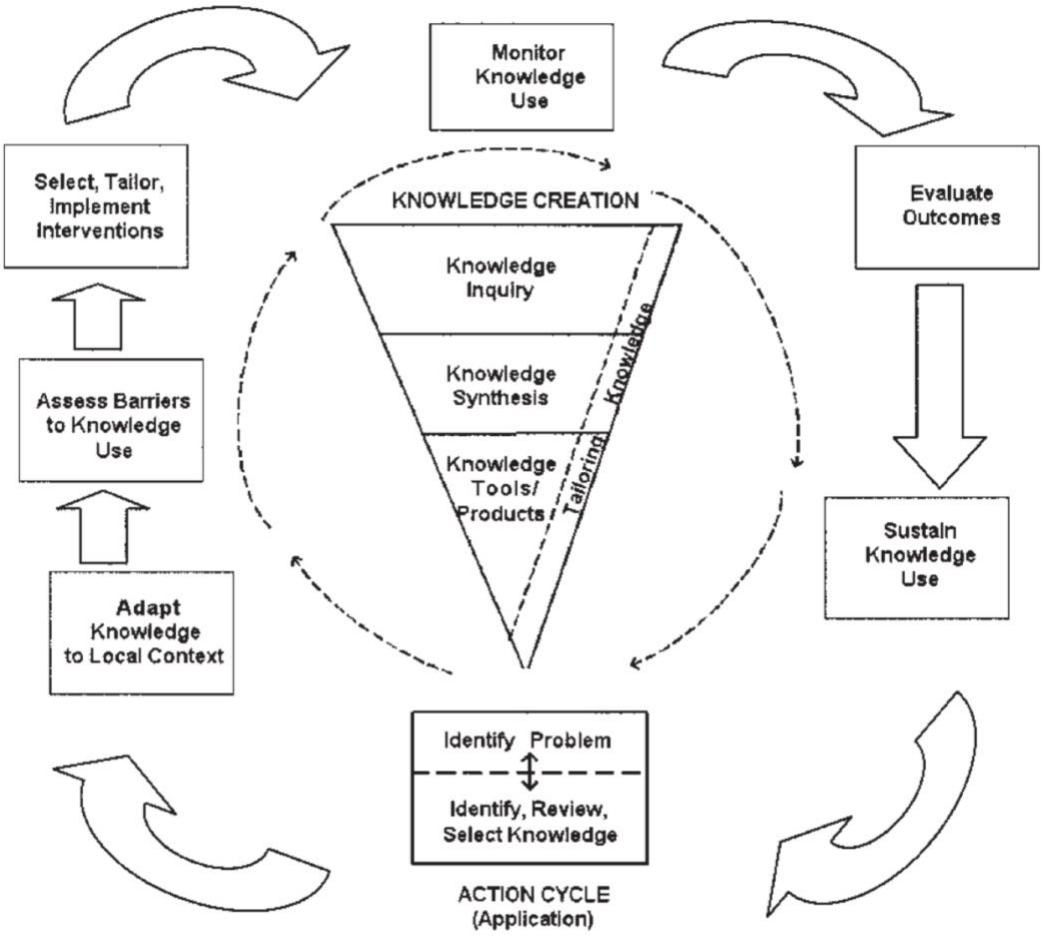


***Figure 2.1*. Pictorial representation of the knowledge to action framework illustrating both knowledge creation and knowledge action and their dynamic relationship. Reprinted from "Lost in Knowledge Translation: Time for a Map?" by I.D. Graham et al., 2006, *The Journal of Continuing Education in the Health Professions, 26*, p. 19. Copyright 2006 by Wolters Kluwer Health Inc. Reprinted with permission.**

HAAT Model

In order to guide the design of the decision-making tool and guidelines, an assistive technology model, the Human Activity Assistive Technology (HAAT) model by Cook and Hussey will be used (Cook & Polger, 2015). The HAAT model "describes someone (Human) doing something (Activity) in a context using assistive technology" (Cook & Polger, 2015, p. 20). The HAAT model is a dynamic framework that can be

applied to product research and development, product usability, assistive technology (AT) design, assessment, and outcome evaluation (Cook & Polger, 2015). The four main components of the model are activity, human, context, and assistive technology and the interaction between these components creates the AT system (Cook & Polger, 2015). Given the complex and varied base of knowledge required to understand all of these components, the authors' stress an interdisciplinary collaborative approach is needed to properly execute a systematic evaluation and to avoid abandonment or rejection of the device (Cook & Polger, 2015).

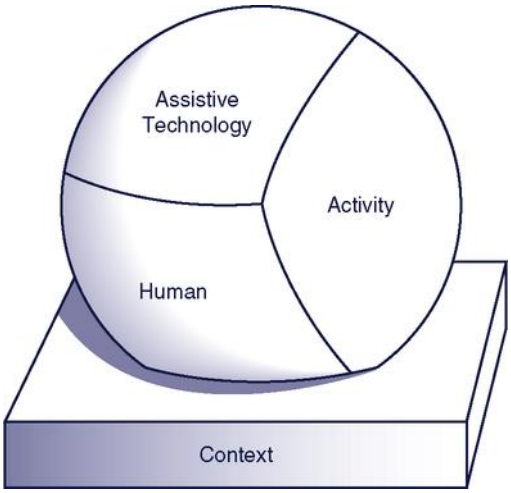


Figure 2.2. **Representation of the HAAT model showing the relationship between human, activity, and assistive technology resting and dependent on context. Reprinted from *Assistive technologies: Principles and practices* by A.M. Cook & J.M. Polger, 2015, St. Louis, MO: Elsevier. Reprinted with permission.**

This framework is helpful when considering mobile devices as a form of AT for transition-age students, as it can aid in both designing a decision-making tool for the selection and customization of the mobile device, and the assessment of the device in order to reduce its abandonment or misuse. Furthermore, the HAAT model's emphasis on a collaborative team approach for the assessment and service delivery process addresses

the issue indicated in research that there is a lack of collaboration, team involvement, and professional knowledge when implementing AT interventions like mobile devices for adolescents with ASD (Ferdig et al., 2016; Kucharcyzk et al., 2015; Okolo, & Diedrich 2014). A knowledge product tool that uses the HAAT model will make the implementation of mobile devices as a form of AT more accessible to professionals by helping them to design and assess mobile devices use with transition age students with ASD.

Factors Contributing to the Need for Knowledge Tools

Need for Effective Interventions for Transition-Age Students with ASD

Outcomes for adolescents and adults with ASD are poor when compared to their peers with other disabilities, as they are less likely to attend post-secondary education, be employed, live independently, and engage in social situations (Roux, et al., 2015; Wei, et al., 2015). Decreased cognition and communications skills, as well as low income and race, specifically within the African-American and Hispanic populations, often further impact students' with ASD poor outcomes (Roux, et al., 2015; Shattuck et al., 2012; Wei, et al., 2015). Research related to the post-secondary outcomes of students with ASD (Roux et al., 2015; Shattuck et al., Wei et al., 2015) draws on data collected from the National Transition Longitudinal Study-2 (NTLS-2), a study that surveyed parents and/or their youth with disabilities who were identified by school districts every two years from 2001 to 2009 (Wei et al., 2015). NTLS-2 is the largest data set examining the challenges that students with ASD face after graduation; however, the sample of participants may not be representative of all students with ASD, as some students may not be accurately

identified or may not have received special education services (Shattuck et al, 2012; Wei et al., 2015).

Researchers examining these poor outcomes call for more effective transition planning that addresses communication and cognitive challenges, individualized interventions, and increased support and training for parents specifically related to independent living (Hendricks & Wehman, 2009; Shattuck, et al., 2012; Wei et al., 2015). Software apps on mobile devices are one type of intervention that can help support individuals with ASD, address deficit areas, and increase their independence (Gentry, et al., 2015; Kim & Kimm, 2017; Stephenson & Limbrick, 2015). For example, augmentative and alternative communication (AAC) apps have been used to address communication challenges (Alzrayer, et al., 2017; Lorah, Parnell, Whitby, & Hantula, 2015) and task reminders on a mobile device have increased independence in a job setting (Gentry et al, 2015). The prompts provided by these mobile devices suggest that mobile devices should be used as a form of AT rather than a one-time instructional tool. For example, research designs that removed the device found that participants' levels of independence decreased and then increased upon re-implementation of the device, indicating these devices are needed to maintain and/or improve the functional capabilities for some individuals (Bereznak et al., 2012; Burke et al., 2010).

In accordance with the Individuals with Disabilities Education Improvement Act (IDEA) of 2004, the IEP team must include AT devices and services within the IEP, and for students ages 16 or above within the transition plan section of their IEP (Bowser & Reed, 2012). Despite this law, AT and AT services are often underutilized (Bouck,

2016). Some of the factors contributing to underutilization and poor implementation of AT that have been identified are lack of professional training, evaluations of students in functional contexts, staff time and allocation to AT, and decreased funding and availability of AT equipment in the school (Bausch, Ault, Evemenova, & Behrmann, 2008; Copley & Ziviani, 2004; Okolo & Diedrich, 2014). Similarly, barriers for implementing transition plans and interventions for adolescents with ASD include lack of stakeholder involvement, and decreased information and training for school professionals (Anderson, Sosnowy, Kuo, Shattuck, 2018; Kurcharczyk et al., 2015: Lubbers, Repetto & McGorray, 2008). These barriers indicate a need for interventions that can provide knowledge to school-based professionals and increase their involvement when implementing mobile devices with transition-age students with ASD.

Research Gaps

A review of the research on mobile devices and apps and transition age students with ASD revealed gaps in the literature that limit knowledge informing implementation effectiveness for this type of technology. The majority of the research reviewed by this author on mobile devices and apps was dominated by single subject research designs, which affects generalizability to the larger population. However, a few studies that combined the smaller population studies found mobile devices to be effective, lending support for this type of intervention. For example, a meta-analysis by Kim and Kimm (2017) found mobile device-based interventions were effective at improving communication, academic skills, leisure skills and vocational skills for individuals with intellectual and developmental disabilities, with a 91.8 percentage of non-overlapping

data points, lending more support for the efficacy of this approach. Similarly, Stephenson and Limbrick (2015) in a review of smaller studies found touch screen mobile devices to be effective for communication, self-prompting and leisure with calculations of percentage of non-overlapping data to be between 79.7 and 92.8 percent in the studies reviewed.

One of the most transformative ways apps have been used as AT with individuals with developmental disabilities was by expanding the speech generating device options for individuals who require AT to communicate. These apps, such as GoTalk NOW and ProLoQuo2Go® are cheaper than speech generating devices, such as Dynavox®, less stigmatizing, and portable (Lorah, et al, 2015). There is evidence for using Proloquo2Go® to increase children with ASD and developmental disorders ability to request preferred items and games (Alzrayer, et al., 2017). Lorah et al. found in a larger review that speech generating apps like Proloquo2Go®, increased communication skills for individuals ranging in age from 3 to 23 years with developmental disabilities, where over half of the participants had ASD. Randomized controlled trials were not found in this research review on communication apps, and the studies that were reviewed primarily focused on requesting skills in participants (Lorah et al., 2015).

In addition to the limitation of small population sizes found in the literature on mobile devices, the majority of research studies only examine one application. However, mobile devices are designed to hold a variety of applications, and the combination of these applications can address multiple areas of functioning for students with ASD. For example, the mobile devices could contain the electronic shopping list as described by

Douglas et al., (2015), as well as a speech generating device, such as ProLoQuo2Go™ as described by Lorah et al., (2015).

One study by Gentry et al. (2015) used a delayed randomized control trial and found that adult workers with ASD who received an iPod® touch, customized with applications for task reminders, video-modeling, behavioral self-management, communication, and way finding tools, required fewer hours of support from a job coach. The remaining studies that examined multiple applications on one mobile device are case studies with promising results, but limited generalizability. Participants for these case studies, who were transition-age students with developmental disabilities, demonstrated improvements in transition activities, such as employment (Jones & Bucholz, 2014); time management and cooking tasks (Tomchek et al., 2017); and behavior management and filling out a job application (Bruegger, Dorrough, & Hughes & Klein, 2017).

Within this limited research, there is little guidance on best practices for teaching students to navigate between different multifunctioning apps on their mobile devices. Cullen and Alber-Morgan (2015) reviewed the use of technology as a self-prompting technique for daily living skills in adolescents and adults with ASD and found that only 6 out of the 36 articles reviewed had a procedure in place to teach the technology to the participants. There is a need for more research and guidelines for professionals on teaching mobile devices to students, specifically on navigating between apps on the mobile device and using the device in a variety of settings (Cullen & Alber-Morgan, 2015; Jones & Bucholz, 2014; Stephenson & Limbrick, 2015).

Lack of Professional Knowledge

One of the barriers to implementing AT cited by numerous studies is lack of professional education. A survey of school professionals across a Midwestern state indicated low levels of knowledge regarding how to use AT with students with disabilities (Okolo & Diedrich, 2014). Ferdig et al. (2016) found similar results from professionals surveyed across a larger geographic area. Over half of the respondents had not received any training on mobile devices or software apps, and close to half of the respondents reported not using mobile devices for instructional purposes (Ferdig et al., 2016). One of the factors contributing to the gap in professional knowledge for mobile devices and apps is that this is a new, rapidly changing, and proliferating technology. The changes and number of applications available poses challenges for professionals as they are tasked with sifting and evaluating applications for their potential benefits for students (Schmidt, Lin, Paek, Macsuga-Gage, & Gage., 2017). This lack of knowledge may lead to poor team member involvement in the mobile device implementation process thus not addressing one of the key components of the HAAT model (Cook & Polger, 2015)

Poor Implementation Procedures

In addition to gaps in professional knowledge, implementation procedures are often lacking when AT is provided or used by a student in the school system (Bausch et al., 2008). Assistive technology services include a functional evaluation of the student in their environment, selecting, designing, and customizing the device, using intervention therapies with the device, and providing training (Bausch et al., 2008). In a survey across 9 states and 43 school districts, only 40 percent of the assistive technology services

reported by respondents met the federal definition (Bausch et al., 2008). The results of this survey echoes what Copley and Ziviani (2004) found in a literature review that school teams experience difficulties implementing AT with students with disabilities. Contributing impediments to AT implementation include staff training, staff knowledge, implementation plans, collaboration, lack of assessments, equipment maintenance and time constraints (Copley & Ziviani, 2004; Okolo & Diedrich, 2017).

When implementing AT for transition-age students it is important to consider their transition activities, current and post-school environments, as well as document the AT services within the IEP (Bowser & Reed, 2012; Cook & Polger, 2015). Yet transition plans, a component of the IEP for students ages 16 and above, or 14 and above in some states, have similar barriers to implementation of AT. A survey across teachers in 67 school districts in Florida reported that limited resources, poor stakeholder involvement, system and policy issues, and lack of training affected their ability to create and implement transition plans (Lubbers, et al., 2008). Similarly, Kurcharczyk et al. (2015) found from conducting focus groups with students, parents, and school processionals that there is a lack of effective interventions for adolescents with ASD and highlighted the need to establish pathways to ensure collaboration among the stakeholders involved in transition planning for students with ASD. Information sharing and interdisciplinary collaboration were also needs identified in a literature review of research related to services for transition-age youth with ASD (Anderson et al., 2018). Clearly, there is a need for interventions that incorporate collaboration and involvement among stakeholders.

Survey

Although the literature reviewed identified some barriers to AT implementation and transition planning, many of the articles used data from the NTLS-2, a broader definition of AT, and their populations often encompassed more disabilities than ASD. In addition, due to the recent introduction of mobile devices as AT, there is a lack of current research examining specifically how professionals are implementing this type of technology with transition-age youth with ASD and what barriers currently exist. Therefore, in order to gain a better understanding of how school-based professionals were using mobile devices with transition-age students with ASD, this author created and conducted a survey with this population of professionals.

Survey design. Survey construction was based on discovering current trends in school-based practitioners use of mobile devices. Surveys and questionnaires related to AT and mobile devices (Bausch et al., 2008; Ferdig et al., 2016; Okolo & Deidrich, 2014) were used to help guide the construction and terminology used for some of the questions. A pilot survey was dispersed to a small pool consisting of a speech language pathologist, an occupational therapist, a special education teacher, an assistant transition coordinator, and an assistive technology practitioner to gather feedback on the design of the survey, clarity of the questions, and length of time to take the survey. The feedback regarding length of the survey, response options, survey content and question phrasing from the small group was used to further revise the survey questions.

The final survey consisted of 32 questions, which were mixed between close-ended, open-ended, and likert-scale questions. The first nine questions focused on

demographic information regarding professionals' title, school setting, and state of practice. For demographic questions related to the practitioner's school and location, respondents were asked to report on the school where they presently worked the most. Three questions were focused on training and self-reported level of competency. There were eight questions related to using mobile devices with transition-age students. The next block of nine questions addressed the school's process in implementing mobile devices and incorporation of the devices on transition plans. The last two questions asked respondents to rate the usefulness of potential guidelines and procedures for their practice.

The survey was administered via an online survey platform, Qualtrics™ software (Qualtrics, Provo, UT). Institutional Review Board (IRB) approval was received from Boston University prior to dispersing the survey. The survey was open for six weeks and the link was posted on various list servs, online groups and forums related to school professionals and assistive technology. In addition, snowball recruitment was used, and professionals were asked to pass on the survey to colleagues working with transition-age students with ASD. Survey participants were offered the opportunity to put their name into a raffle for $25 Amazon Gift Card. Inclusion criteria consisted of school professionals working with transition-age students (ages 13-21) with ASD and professionals who worked in the United States.

Demographics of survey results. Thirty-nine individuals responded to the survey. Thirty four out of the 39 reported their level of education. Of the 34 responses, 76% had a Masters level of education (n=26), 11% had a Bachelors (n=4), 9% had a

clinical doctorate (n=3), and 3% had a research doctorate (n=1). Participants were asked to state their current position, 35 individuals responded to this question with the following positions: occupational therapist (n=9), speech language pathologist (n=6), transition coordinator (n=5), special education teacher (n=4), behavior therapist (n=1), occupational therapy assistant (n=1), assistive technology specialist (n=1), internship coordinator (n=1), social worker (n=1), paraprofessional(n=1), learning strategist (n=1), executive director (n=1), supervisor (n=1), professor (n=1), and staff therapist (n=1). Thirty-five people indicated the state where they practiced. Respondents were asked to indicate the state where they practice the majority of the time. The following states were represented in the survey: California, Connecticut, Florida, Illinois, Minnesota, New Hampshire, New Jersey, New York, Ohio, Oregon, South Carolina, South Dakota, Texas, Virginia, and Wisconsin. For most of the states, there was only one respondent, except for New York (n=15), New Jersey (n=3), Illinois (n=2), Florida (n=2), and California (n=2). Respondents were also asked about the demographics of their school (see Table 2.1).

Table 2.1

School Demographics

Question Category	Percentage (n = 34 or 35)
Area where school is located	**n = 34**
Urban	53%
Rural	15%
Suburban	32%
Type of School	n = 35
Private	46%
Public	34%
Charter	6%
Regional Collaborative	3%
Residential	3%
Other (special education consortium, private practice)	9%
Number of Students in School	n = 35
Less than 100	26%
100-200	37%
200-300	6%
300-400	3%
400-500	6%
500-600	0%
600-700	3%
700-800	3%
800-900	3%
900-1,000	0%
1,000-1,500	3%
1,500-2,000	6%
Over 2,000	9%

Use of mobile devices. Thirty-five participants responded to the question if they used mobile devices with transition-age students. Twenty-eight out of the 35 responses indicated yes to using mobile devices with transition-age students. Of the 24 responses, school-based professionals were using mobile devices with an average of 63.83% of their caseload. The apps used by professionals varied across different categories with the

majority noting apps for augmentative and alternative communication (AAC) (See Figure 2.3).

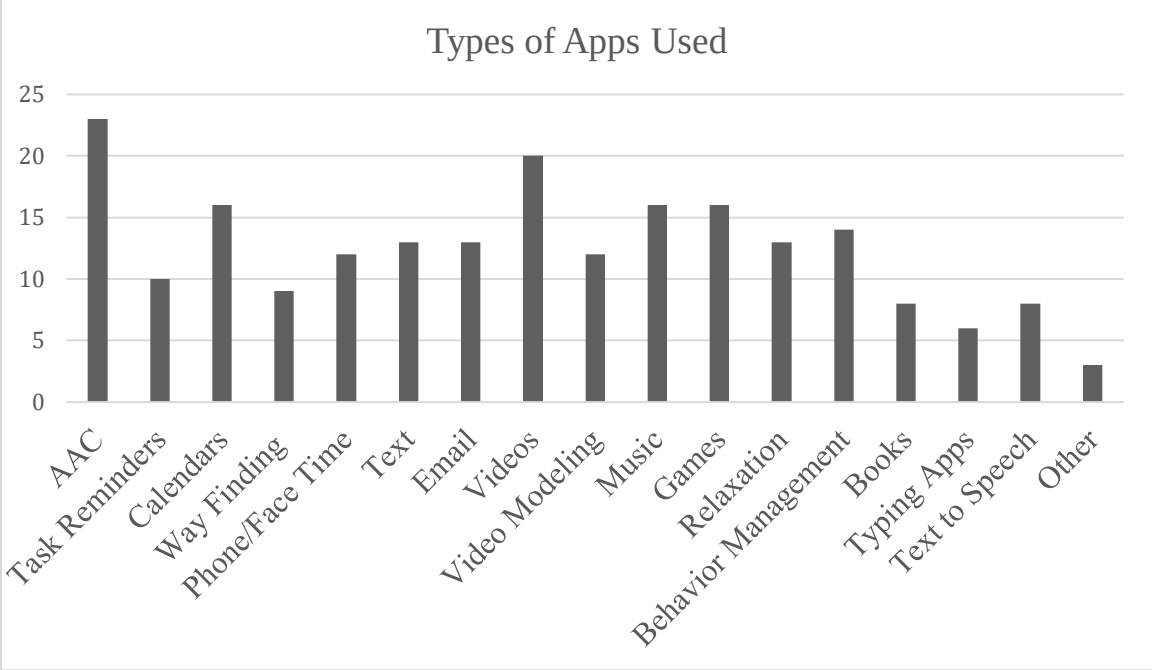


Figure 2.3. **Frequency of types of apps used for transition-age students with ASD as reported by school-based professionals.**

Mobile devices are currently being used for a variety of different transition areas and needs. The majority of professionals report the use of mobile devices for accessing education or curriculum and social participation, such as texting and contacting family and friends. Mobile devices are also being used for employment, activities of daily living (ADLs), household management, and leisure (see Figure 2.3). Despite the varied use of devices, the majority of respondents indicated that they are not currently using a formal assessment or evaluation to measure success and progress with the mobile device. Of the 27 professionals who responded to this question, 20 indicated that they did not have a formal assessment and seven indicated that they did.

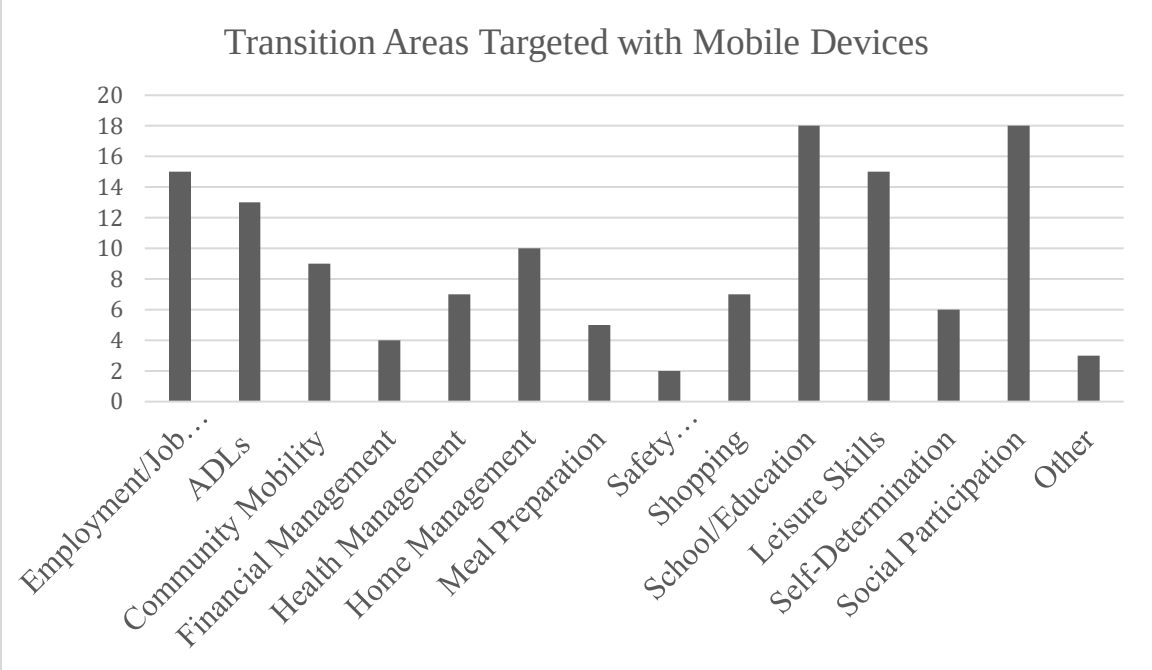


Figure 2.4. **Transition areas school-based professionals reported using mobile devices to target with transition-age students with ASD.**

Discussion of results. The number of responses for this survey was low and only represented a small population of professionals working with transition-age students from a limited number of areas in the United States. However, surveys on current school practices with using mobile devices with this age and diagnosis have not been found in the research literature. The survey results do begin to provide insight into how school-based professionals are using the devices. The responses to this survey indicate that school-based professionals are using mobile devices with transition-age students with ASD in a variety of ways and for different transition areas. However, these professionals who are using mobile devices do not have a set of procedures to assess and measure progress.

The survey collected additional information from respondents regarding types of

professional training received, members involved in the mobile device implementation and barriers and facilitators to using mobile devices with this population. The results of which were not represented or discussed due to the scope of this doctoral project but could be analyzed in the future to facilitate the next phase of this project, implementation of the knowledge tools. In addition, upon receiving results, the author noted some of the questions on the survey could be re-worded for improved clarity. To gain a better understanding of how school-based professionals across the United States are managing this novel form of technology, further research on this topic should include questions regarding number of apps that are currently installed on transition-age students' devices and the training procedures provided to students who use devices with multiple applications. In addition, wider dissemination of the survey, as well as surveys for parent and adults with ASD who have transitioned out of the school system can further illuminate areas to address when implementing these devices with transition-age youth.

Need for knowledge product tools

The results of the literature review indicated there is a need for procedures when working with school teams on interventions using AT for transition-age students, which includes the use of mobile devices. The provision of these procedures is crucial as adolescents with ASD are in need of interventions that assist them with the transition process and carry-over to their post-graduation life. Factors that contribute to this problem are lack of professional knowledge, team involvement, funding, and staff allocation. Due to the novelty of this technology, research often lags behind and influences professionals' ability to implement mobile devices as AT. Further examination

of the problem through a survey designed by this author indicated similar findings and strengthened the need for this project. School-based professionals are using mobile devices with transition-age students and they use it for a variety of transition areas; however, the majority do not have procedures in place to customize and implement this technology.

The results of these findings indicate a need for a knowledge product tool that can inform the school team on strategies for evaluation and implementation of the device with transition-age students. The knowledge product tool will need to increase interdisciplinary collaboration and involvement, include mobile devices as a form of AT on the transition plan, and increase school professionals' knowledge when implementing mobile devices. The aim of this product will be to avoid misuse of the device, lack of carryover, or an unawareness by the education team for a mobile device's potential as a tool in the transition process

Previous Use of Guidelines to Improve Professional Education and Collaboration

Limited professional education and knowledge regarding AT and specifically novel technology like mobile devices can lead to school professionals having difficulty making team-based decisions regarding AT for transition-age students with ASD. There is support for providing teams with guidelines and rubrics to increase their comfort, knowledge and ability to make decisions. Rubrics designed to help professionals select apps increased school-based professionals' comfort and knowledge level (Schmidt et al., 2017; Weng & Taber-Doughty, 2015). Copley & Ziviani (2007) found that when school-based teams were given a formal process for assessment, team-based goal making, and

the use of a team facilitator, there was an increase in in team members' satisfaction and involvement in the AT process. Although a different population, Malinowsky, Rosenberg, and Nygard (2014) found that providing a checklist and performance assessment that helped healthcare professionals implement everyday technology as AT, such as alarms on mobile phones for older adults with dementia increased the professionals' readiness to use technology and increased their collaboration with other professionals. Similarly, school professionals that attended a professional education course paired with utilizing a transition plan checklist, increased their self-reported competence, collaboration, and led to positive revisions in the transition planning process for students with disabilities (Finn & Kohler, 2010). Although preliminary, the results from the research indicate that a knowledge tool, such as a checklist and performance assessment could potentially improve school-based team's ability to implement mobile devices with transition age students.

As this is an emerging intervention area, recommendations for what to include in the checklist or performance assessment for selecting and implementing mobile devices are scarce. Rubrics for assessing and evaluating apps have been successfully used with professionals and have led to an increase in professionals' positive attitudes and comfort level with using mobile devices. Schmidt et al. (2017) designed a rubric for professionals to select apps, which involved conducting a needs assessment for the individual, reviewing the product, implementing the app, and evaluating the app. Special education teachers, who participated in a workshop and learned about the first two steps in this process, conducting a needs assessment and reviewing the product, felt more confident in

their use of mobile devices (Schmidt, et al., 2017). Similarly, Weng and Taber-Doughty (2015) developed a rubric for school-based professionals, including both special education teachers and related service professionals. The rubric evaluated apps based on the design, content, usability and individualization of the app. Both of these rubrics involved professionals identifying the individual needs of the student and matching the prompting involved in the app to the student needs. These studies lend support for using guidelines to assist school-based professionals, and the design of these guidelines should include a matching component between the user needs and the app.

Existing Assistive Technology Assessment and Frameworks for Assessment

Further exploration of assessments and procedures that have guided schools in implementing AT was conducted in order to determine their usability and application for a mobile device assessment. AT assessments, such as the Wisconsin Assistive Technology Initiative (WATI) have been adopted by the Wisconsin and other state school districts to help consider and assess AT needs for students (WATI, 2004). The WATI package provides an overview for school systems on how to consider AT, who to include in AT discussions, free forms for student information, environmental observation guides, AT checklist, and decision-making guides (WATI, 2004). Specific AT items on the WATI checklist can be helpful for school teams to identify technology for students such as voice recognition, hand-held scanners, and voice output, which can be found on mobile devices. However, WATI's suggestions for AT in their forms does not direct the professional to mobile devices specifically or the use of everyday technology that may be incorporated into a device for a transition-age student (WATI, 2004). For example, a

transition-age student may use a weather app on their smartphone and a visual chart to help determine appropriate clothing for the day. In addition, although these guidelines have been adopted by some school districts, no empirical studies have been found that link the implementation of these guidelines to better AT outcomes.

Education Tech Points are another set of guidelines used by school systems (Bower & Reed, 2001; WATI, 2004). The guidelines use questions to assist with the team decision making process and offers a whole section on the consideration of the transition needs of students who use AT. Other assessments or frameworks for considering the AT needs of students include the Student Environment Tasks and Tools (SETT), which is similar to the HAAT model (Cook & Polger, 2015; Zabala, 2005). Based on a literature review of various assistive technology models, there is limited evidence to support the SETT framework or Education Tech Points at this time (Desideri, Roentgen, Hoogerwerf, & de Witte, 2013). AT models and assessments like WATI and Education Tech Points lay a foundation for the mobile device guidelines as they advocate for team-based approaches, use of guiding questions to help school teams make decisions and provide a process for a school-based team. In addition, the WATI assessment (2004) provides forms for school teams to identify training and maintenance needs for the AT device, an important consideration when implementing mobile devices with transition-age students. However, many of these forms were developed prior to the launch of the first iPhone® in 2007 and the first iPad® in 2010, and the resulting proliferation of apps that were developed. Their questions and considerations do not directly address the specifics of using a mobile device. Nor do they consider how using multiple pieces of AT as well as

everyday technology like a phone on one device may affect the student's performance and thus the assessment process. Due to the nature of mobile devices and their ability to combine multiple AT in one device, there will need to be a tool that can be customized to each iteration of the mobile device, as well as to assess the student's performance when using multiple forms of AT, including the use of every day technology on one device within their chosen environments.

Strategies for Assessment and Implementing of Mobile Devices with Multiple Applications

Team-Based Approach

A team-based approach to assessment, customization and implementation of AT has been supported both by AT theoretical models and research (Cook & Polger, 2015; Copley & Ziviani, 2007; Watson, Ito, Smith, & Anderson, 2010). Both the HAAT model and the SETT framework advocate for the use of a team when assessing and implementing AT (Cook & Polger, 2015; Zabala, 2005). In addition, Quality Indicators for Assistive Technology Services (QIAT) also call for the use of multiple disciplines when assessing and implementing AT (Zabala, et al., 2000). QIAT is a set of descriptors that was developed by 14 AT providers across the United States. The recommendations are based on the Joint Committee for Standards for Educational Evaluation and feedback from additional AT providers (Zabala et al., 2000). The indicators are divided into different sections for administrative support, consideration of AT needs, assessment of AT needs, documentation in the IEP, and evaluation of effectiveness (Zabala et al., 2000). Although written broadly for AT, these recommendations specify what should be

included when considering, assessing, documenting and evaluating technology such as mobile devices that have been used as AT for transition-age students. For example, including training for the student and family, using a team approach with clearly delineated roles, gathering data on the effectiveness, evaluating across contexts and environments, and supporting carryover to these different environments (Zabala et al., 2000).

Copley and Ziviani (2007) found that the use of a team consisting of caregivers, teachers, and related service providers when implementing AT for children with disabilities, improved their goal attainment, but also improved team members' confidence, awareness and knowledge of AT assessment and implementation. This team-based approach was completed with the use of an external team facilitator that assisted the team in their decision-making process (Copley & Ziviani, 2007). The availability and ability of other schools to replicate this may be difficult due to staffing and financial concerns; however, the results from Copley and Ziviani suggest there are benefits to assigning and using a facilitator/leader for a team-based approach to AT.

Assessing Learning Preferences and Skills of the User

Pre-requisite skills that will need to be considered prior to implementation of a mobile device as a form of AT and self-instructional tool include the visual skills to see the screen, fine motor skills to operate the device, cognitive skills, such as attention to the device, and the ability to copy the movements of a model if using video modeling (Shepley, 2017). Due to some of the accessibility features of mobile devices, adaptations in the settings can be made to compensate for visual and fine motor deficits if appropriate

(Erickson, 2015). The assessment of these skills may help teams create a better match between the person and the technology and any supporting equipment they may need. For example, when the device matched the visual and fine motor skills of individuals with ASD they had a stronger preference for the device (Douglas & Uphold, 2014). Preference for a mobile device has been associated with improved outcomes and may indicate a better match between the person and technology. Laarhoven, Carreon, Bonneau, and Lagerhausen (2018) in their study of high school students with ASD examined the effect of both an iPad® and the HP slate to complete prevocational activities and although the association did not reach the significance level, the authors found that participants performed better on a preferred device. Spriggs, Knight and Sherrow (2015) also noted that adolescents with ASD who used an iPad® for leisure prior to participating in their study performed better when using video modeling on a mobile device to complete instrumental activities of daily living (IADLs) and vocational activities than the participants who did not have prior experience with an iPad®.

Much of the research literature that involves mobile devices as interventions for transition-age students with disabilities incorporate either video modeling or video prompting (Bereznak et al., 2012; Burkley, Tincani, & Fisher, 2015; Smith et al., 2016; Spriggs et al., 2015; Walser, Ayers, & Foote, 2012; Yakubova & Zeleke, 2016). Video modeling is a video of the whole task being recorded and video prompting involves smaller segments of the task being recorded to prompt an individual. Hong et al. (2016) found in a meta-analysis of single-case research studies that video modeling as an intervention had a moderate effect on improving the functional living skills of individuals

with ASD. Analyzing video modeling as an intervention further, Hong et al. found it to be effective for both individuals with high functioning ASD and individuals with ASD and an intellectual disability; as well as point-of -view video modeling and video modeling of a peer or an adult to be effective interventions. Although age as a moderator was also analyzed, there were only two studies that were compared. The results indicated that video modeling is most effective for 10 to 15-year old's with ASD (Hong et al., 2016).

Given the effectiveness of video modeling, as well as the frequency it is used as an intervention on mobile devices, it is important that the video modeling learning preference of the adolescent with ASD be analyzed as part of the assessment process. Shepley (2017) recommends that educators assess full video modeling versus video prompting, short clips of video cues or third person point of view versus first person for each student. For example, when the video was broken down into smaller segments for participants with shorter attention spans, they were able to increase independence in both an IADL and vocational task than when shown the video model in its entirety (Spriggs et al., 2015).

Matching Device and Apps to User

Matching the AT to the user is a concept that is echoed in theoretical models, such as the HAAT model (Cook & Polger, 2015). In addition, the rubrics that were used to help professionals increase their competence with app selection involved a matching component between the student's needs and the app function (Schmidt, et al., 2017; Weng & Taber-Doughty, 2015). In a randomized controlled trial, the employment skills

of adults with ASD improved when their needs were matched with apps on a mobile device using the HAAT model (Gentry et al., 2015). Following this randomized controlled trial, Gentry (2015) published an article for occupational therapy practitioners on how to assess and implement apps on mobile devices. Suggested questions to aid the app decision making process include: Can the individual successfully navigate a mobile device? What tasks do people have to remind the person to do? What complex tasks is the individual learning how to do? Can the individual communicate with others and seek help? Can the individual self-manage anxiety? Will the individual choose to use the device as a support? (Gentry, 2015). Erickson (2017) recommends that when implementing mobile devices as an occupational therapist, the *Occupational Therapy Practice Framework (3rd Edition)* should be incorporated as occupational therapists must examine the client performance skills, occupational performance and the context and environment. Erickson recommends that an occupational profile be conducted to identify the client's occupations and their performance skills, analysis of the app and device requirements, and the app's content in order to match the device to the user.

The HAAT model instructs teams to consider the activities the human is performing (Cook & Polger, 2015). In regard to activity, the transition-age student with ASD has specific transition activities that should be identified by the team, which include ADLs, IADLs, leisure, employment, and school activities (AOTA, 2014). At the same time, the team must also consider the student's strengths and their developmental stage. For example, the transition-age student is preparing for increased independence in their postsecondary life and they will need technology that can enable these activities.

Therefore, consideration should be made for what apps and mobile device will be needed to help support independence in these transition areas. The recommendations from researchers and theoretical models indicate that in order for school teams to implement mobile devices with adolescents, they must first assess the student's needs, assess the app content, and match the app to the individual.

Environmental Context

The environmental context where the individual will be performing these skills must be addressed during the assessment process as it can affect the individual's performance according to both the HAAT model, SETT Framework, *Occupational Therapy Practice Framework: Domain and Process 3rd Edition,* and QIAT (AOTA, 2014; Cook & Polger, 2015; Erickson, 2017; Zabala et al., 2000). The post-secondary settings of transition-age students with ASD vary by individual but can include college, vocational training programs, group homes, supported living, full or part-time employment, volunteer settings, or recreational environments, such as gyms. The student's ability to use the device in these types of environments should be evaluated and taught when implementing AT, such as mobile devices for transition-age students (Behnke & Bowser, 2010; Jackson, 2007).

Using a task analysis may be helpful for this portion of the assessment process for it can be individualized to the specific environment and context where the individual is using the device (Erickson, 2015; Shepley, 2017). Some of the skills that will need to be assessed include the operational and strategic competence skills indicated in Light's model of competence and adapted by Behnke and Bowser (2010) for transition age

students who use AT. These can include turning on and off the device, charging the device, wearing the device, holding the device to view the screen, adjusting the volume in the setting, using headphones to hear the auditory prompts, storing the device, accessing the correct app needed for the task, and moving between apps as needed to complete the task. Smith et al. (2016), found that when high school students with ASD were trained to turn on an iPhone®, open an app and self-operate video modeling they were able to participate in 20 to 30 different tasks using the self-instruction videos on their phone.

Teaching strategies, such as progressive time delay (Smith et al., 2016) and constant time delay (Douglas & Uphold, 2014) have been used to train individuals with ASD on how to use mobile devices to complete independent living skills. Strategies to use Augmentative and Alternative Communication (AAC) apps for requesting items, include least to most prompting, constant delayed prompting and differential reinforcement (Alzrayer et al., 2017). In addition, video modeling has also been used to help high school students with mild intellectual disabilities learn how to turn on and navigate to the correct icon for a task on an iPhone® (Walser, et al., 2012). There is also some evidence to suggest that high school students with ASD who were taught how to use a mobile device to access video models for functional activities were able to generalize this self-instruction tasks to other activities (Shepley,2017; Smith et al., 2016; Spriggs et al., 2016). Generalization of these skills across contexts and settings does not happen with all individuals and may depend on cognitive abilities (Smith et al., 2016). Therefore, teams should assess the student's ability to generalize the use of the device in different settings and determine if further instruction may be needed for how to use the

mobile device and apps in a specific context. It should be noted that there is limited research that included a training phase on the operational skills required to use a mobile device (Cullen & Alber-Morgan, 2016). Therefore, the teaching strategies cited are suggestions, teams will need to create procedures for ensuring that the student is learning the skills necessary for operating the mobile device across contexts.

Ergonomic considerations. Part of the environmental context observation should include how the individual is holding and using the device ergonomically. School teams should address student's alignment when using the device to reduce future musculoskeletal injuries. For example, a case and external keyboard has been found to reduce extreme wrist extension in adults who used tablets (Young, Trudeau, Odell, Marinelli, & Dennerlein, 2013). In addition to potential musculoskeletal problems, the screens on mobile devices may also contribute to other physical deficits. Adolescents who used their smartphones for two or more hours per day reported higher rates of symptoms related to visual fatigue, such as blurring, dry eyes, and redness (Kim, et al., 2016), and the artificial and blue light from screens on mobile devices have been associated with sleep disruptions in adults (Heo, et al., 2017). However, a study conducted in Japan on healthy adults found that using a blue-light reduction and color control product on a tablet device improved visual function and comfort (Ayaki, Hattori, Maruyama, Tsubota, & Negishi, 2017). Furthermore, a study of healthy male adults found that using the technology available on a Samsung smartphone that suppresses blue light led to decreased sleepiness (Heo et al., 2017). Although it did not reach a significant level, the use of the blue light suppressing technology was associated with higher and

earlier onset levels of melatonin, the hormone that regulates wakefulness (Heo et al., 2017). Although the participants in these studies were adults and adolescents without ASD, the physical impacts may be similar with adolescents with ASD who are using these same devices for prolonged periods of time. Therefore, educators should consider as part of their assessment how the adolescent is manipulating the mobile device throughout the day and also suggest protective measures, such as changing the light display to reduce the amount of blue light adolescents with ASD are being exposed to or consider using a case and strap when using mobile devices.

Social context. The HAAT model recommends that an AT assessment should consider not just the physical environment, but the social, cultural, and institutional contexts (Cook & Polger, 2015). Family norms is one aspect that should be considered as part of the social and cultural context. One survey of 64 parents or caregivers of children with communication-related disabilities, found that families like devices with multiple apps and often used the device with other family members (Meder & Wegner, 2015). In addition, parents often purchased mobile devices and apps without a formal assessment and then later approached the school team for help and support (Meder & Wegner, 2015). This may impact the flow and order of the assessment process, as well as implementation of the device but must be considered with mobile devices since they are mainstream.

Device considerations

In terms of types of device and app content, much of the research literature that utilized mobile devices as an intervention for individuals with ASD used Apple devices, such as Apple iPhones® (Bereznak, et al., 2012; Smith et al., 2016; Walser, et al., 2012),

iTouches® (Gentry et al., 2015; Douglas & Uphold, 2014), and iPads® (Bouck, Savage, Meyer, Taber-Doughty & Hunley, 2014; Douglas & Uphold, 2014; Laarhoven, et al., 2018; Spriggs, et al., 2015; Yakubova & Zeleke, 2016). No clear difference seems to emerge from the literature regarding a change in effectiveness when using different types of mobile devices. In a small study with a population sample of three adolescents with ASD, video modeling on an iPhone5® and an iPad2® were compared (Bennet, Gutierrez, & Loughrey, 2016). The author found similar results for two participants regardless of device size, and one participant made greater progress with the larger screen on the iPad2® (Bennet, et al. 2016). Since effectiveness appears to be similar regardless of the device used, the student's preference for the size of the screen on the device and ability to see and navigate the screen should be assessed by the team to determine a good match between the mobile device and the transition-age student with ASD. In addition, the environmental context may also impact the device size. For example, some researchers chose to use iPhones® or iTouches® as opposed to larger devices due to the convenience of placing the device in a pocket or on a lanyard while engaged in a work task (Gentry et al., 2015; Walser, et al.; 2012).

Icon size and the number of icons on the screen may affect users with ASD's ability to access and use mobile devices (Quezada, et al., 2017). Quezada et al. (2017) found that children 5 to 11 years of age with ASD had more difficulty with round versus square icons, icons with smaller images, and icons placed on the same colored background than their typically developing same age peers. When examining the content of apps, the icon size and shape should be considered in relationship to the adolescent's

fine motor and visual motor abilities.

Conclusion

There is a need for interventions for transition-age students that increase adolescents' with ASD ability to complete daily life and job tasks independently, as well as participate in leisure activities (Kurcharczyk et al., 2015: Roux, et al., 2015; Shattuck et al., 2012; Wei et al., 2015). Mobile devices and apps have been found in the research literature to support these areas and thus improve long-term outcomes for these individuals (Gentry, et al., 2015; Kim & Kimm, 2017; Stephenson & Limbrick, 2015). In addition, a small survey conducted by this author found school-based professionals are using mobile devices for these purposes with transition-age youth. However, research suggests that there are barriers to implementing AT and transition planning, which include limited professional knowledge and lack of stakeholder involvement. There is also a lack of professional knowledge for mobile device technology (Ferdig et al., 2016; Okolo & Diedrich, 2014) and the small survey conducted by this author revealed that most schools did not have procedures or guidelines available to assist with device implementation.

There is some evidence that knowledge products and tools, such as a rubrics, guidelines, and performance checklists can help educators and health professionals increase their comfort level with implementation of mobile devices (Copley & Ziviani, 2007; Malinowsky, et al., 2014; Schmidt et al., 2017; Weng & Taber-Doughty, 2015) and with transition planning (Finn & Kohler, 2010). Therefore, a knowledge tool that incorporates existing AT frameworks and assessments, research evidence on mobile

devices and AT implementation could potentially be beneficial in increasing school-based professionals' knowledge and involvement in mobile device implementation for transition-age students with ASD.

CHAPTER THREE – Description of the Program

The proposed program is a set of procedures and knowledge tools to assist school-based teams in implementing mobile devices with transition age students with ASD. The proposed procedures are intended to enable school-based teams to improve their competence and collaboration when implementing this novel technology. As a result, adolescents with ASD should achieve better outcomes related to their level of independence in functional activities when using mobile devices with multiple applications (apps). The procedures should also aid in carryover to the student's post-secondary environments in order to avoid abandonment of the mobile device.

The proposed knowledge tools and examples will be designed to be piloted in a private school in an urban area using Apple technology for students who have ASD and a co-morbidity of intellectual disabilities. Due to the nature of funding systems in different states, the availability and access to AT in rural versus urban areas, and level of involvement of school professionals in different school districts, aspects of these knowledge tools may need to be modified in order to be implemented in different school settings and districts. The process, questions and frameworks will lay the foundation for further research and adaptations as they enter an implementation phase.

Features of the Program

Team approach

The HAAT model, the QIAT indicators, and studies examining AT implementation indicate using a team approach (Bowser & Reed, 2012; Cook & Polger, 2015; Copley & Ziviani, 2007; Watson, Ito, Smith, & Andersen, 2010; Zabala et al.,

2000). The level of complexity of different apps available on mobile devices combined with the student's transition needs requires the expertise of multiple disciplines. The proposed procedures for using mobile devices with multiple apps recommend that schools utilize interdisciplinary collaboration when customizing the device and assessing the student. According to Choi and Pak (2006), interdisciplinary refers to the "reciprocal interaction between disciplines that are working on a problem in parallel or sequentially, and without challenging their disciplinary boundaries" (p.359). Interdisciplinary collaboration where each discipline can cooperatively contribute their unique perspective to the design of the mobile device for the student with ASD will be beneficial for implementation and carryover of the device. Members of the team should include the same members of the transition team: occupational therapist, speech language pathologist, special education teacher, parents, the student, and outside agencies as they become involved in the student's transition plan (Bissell & Cermak, 2015; Wehmeyer & Zager, 2014). These members will be able to identify the student's transition needs, their current skill level and thus be better able to match those criteria with the app features and the device.

Important factors for effective AT and transition planning practices include increasing team member collaboration and involvement (Anderson, et al., 2018; Copley & Ziviani, 2004; Lubbers & McGorray, 2015; Okolo & Diedrich 2014). Inadequate professional training and awareness on AT and lack of procedures can lead to challenges with AT team implementation, specifically lack of awareness and knowledge on mobile devices (Copley & Ziviani, 2004; Ferdig et al., 2016; Okolo & Diedrich, 2014; Schmidt

et al., 2017). In addition, team members who are not involved in the assessment process may not be as involved or invested in the implementation of AT (Copley & Ziviani, 2004). Similarly, there is a need for increased team member involvement and collaboration within transition planning, but a lack of ways to coordinate intervention efforts and limited professional training and knowledge (Kucharczyk et al, 2015).

The knowledge tools were created to increase team members' awareness of mobile devices and considerations for implementation with transition-age students with ASD. By making these tools available through online collaboration software, it is believed that it will allow more team members the ability to collaborate and access these tools. Online collaboration software allows team members to add their input asynchronously. Although team members will be able to input their ideas and see their colleagues' contributions on the online software, it is recommended that team members meet in a face-to-face meeting prior to implementation of a mobile device as effective AT implementation procedures have used face-to-face communication (Copley & Ziviani, 2007; Watson, et al., 2010). In addition, the team should appoint a point person or leader of the group to help facilitate discussions and gather information, as literature suggests that a facilitator of team-based AT decisions may improve goal attainment for children with disabilities (Copley & Ziviani, 2007).

Consideration of Apps that Match Student Needs

Knowledge tools, such as decision-making aids are part of the KTA framework and have been shown to increase professionals' competence with using technology (Graham et al., 2006; Malinowsky et al., 2014). In the nursing field, having guidelines, education

materials, and decision-making support tools helped improve evidence-based decision-making and thus patient outcomes (Yost, et al., 2014). In addition, the HAAT model recommends that when implementing AT, professionals consider the human, the activity, the AT, as well as the context (Cook & Polger, 2015).

In order to do this, a set of documents were developed to help the team make evidence-based decisions and consider the components of the HAAT model for transition-age students with ASD who are using mobile devices. These documents will be knowledge tools that allow the team to consider the student, transition activities, and mobile device and apps, and help match the apps and device to the student. Although team members initially using the tools may find them to be time-consuming, other knowledge tools have demonstrated a change in professionals' knowledge base and their decision-making, thus improving the outcomes of students. The tools will be focused on Apple devices as they are dominant in the research literature and offer a variety of apps (Bereznak, et al., 2012; Bouck et al., 2014; Douglas & Uphold, 2014; Gentry et al., 2015; Smith et al., 2016; Spriggs, et al., 2015; Walser, et al., 2012; Yakubova & Zeleke, 2016).

They consist of:

- A flowchart (See Appendix A)
- A worksheet with a set of guiding questions (See Appendix B)
- A chart of app suggestions (See Appendix C).

Flowchart. The headings of the flowchart are questions based on transition needs, such as employment, independent living, and education. Using these broad areas, combined with occupations listed in the *Occupational Therapy Practice Framework* and reviewing

assistive technology areas within the WATI assessment, a set of questions were developed (AOTA, 2014; WATI, 2004). These questions take the team through documenting what apps the student may already be using and help the team to consider additional apps that can be used to address these areas (see Appendix A).

Many students by the time they reach transition age may already be using apps for their transition needs and parents report they install multiple apps on students' devices (Meder & Wegner, 2015). According to recent data collected from an app data marketing company, mobile device users' access about 9 apps per day (App Annie, 2017). The apps that are most heavily accessed are built-in apps, such as Safari®, followed by social networking apps (App Annie, 2017).

Therefore, the team should consider what apps the student is already using on a mobile device. The flowchart (see Appendix A) asks if the student is already using an app to fulfill this need. To decide if an app should be considered, the flowchart asks additional questions regarding the student's transition needs. Some of these questions were developed based on suggestions by Gentry (2015) for using mobile devices to assist with individuals with cognitive impairments. The flowchart ends in categories of apps that may be useful for student. These categories correspond to the App Suggestion chart (see Appendix C).

App Suggestion Chart. To help teams begin to consider additional apps the transition-age student may need, a chart of possible apps is included in the guiding documents (see Appendix C). The chart consists of apps that would be considered both AT and everyday apps that transition-age students may still use to help with daily life (see Appendix C). The app chart are for Apple products and are based on research

examining cognitive aids by Cook & Polger (2015), research literature examining the effectiveness of scheduling apps (Bruhn, et al., 2016; Uphold et al., 2016), recent occupational therapy practice articles listing specific apps (Gentry, 2015; Leynse-Harpold, 2013), as well as apps presented on lists by Easter Seals (n.d.) and AOTA (Yamkovenko, n.d.). Due to changing technology, apps that are listed on the chart may not exist in the future or their developers may not update them to correspond to the latest iOS update. To address this, additional resources are also included on the app suggestion chart to assist teams in locating current apps. Apps that the team would attempt to trial are then recorded on the mobile device worksheet (see Appendix B).

This chart has been designed with a population of students with a co-morbidity of intellectual disabilities. Although the chart contains some examples of apps that can be used in a post-secondary education setting, a different population of students may require a chart that includes more education focused AT. This chart serves as a guide to help teams locate an app that they can trial with a student.

Mobile Device Worksheet. The mobile device worksheet (see Appendix B) is where the team will record the information for the student, including the apps the student is currently using and the apps the team will attempt to trial. This document will be available on online collaboration software in order to allow access to all team members. Since assistive technology theoretical models indicate matching the technology to the student and activities, the worksheet includes a section on considerations of student skill levels for using a mobile device. Items for this section were based off of the motor, sensory and visual skills and preferences indicated by Shepley (2017), Gentry (2015), Cook and

Polger (2015), and Wilkhomm's "App Analysis for Feature Mapping" (n.d). In addition, the worksheet asks the student's preference for device and history of device use since the literature suggested these may indicate increased success with mobile device use (Laarhoven et al., 2018; Spriggs et al. 2015). The worksheet provides a chart that lets the team place the app features and the student skills side-by-side (see Appendix B). In this way, the team can see if there is a good match between the two. In addition, the team considers the type of device in terms of transition activities, apps features and student considerations.

When introducing multiple pieces of AT on mobile devices, Cook and Polger (2015) and Gentry (2015) advise starting with the primary need and getting the individual comfortable with using that app or feature first. For some students, the primary need may be an app for an augmentative and alternative communication (AAC) speech generating device, and the student may need to gain competency with this app before adding additional apps. The team should develop a plan for primary needs, order of AT and everyday technology implementation, and consider the student's cognition when installing multiple apps. The proposed mobile device worksheet includes a section for the team to develop a timeline for app installation (see Appendix B). This record can also be used as a transition document to help professionals in the student's post-secondary environment with carrying over the AT.

Performance Assessment with a Mobile Device with Multiple Apps

One of the areas lacking in the research literature is the implementation of mobile devices with multiple apps installed (Gentry et al., 2015). Since no assessment currently

exist for this type of technology, guidelines for AT users and suggestions from research on mobile devices were used to create these guiding documents for the team to assess the student's performance when using mobile devices with multiple apps. Behnke and Bowser (2010) advise school teams to address operational, strategic, and social competence skills for transition-age students who use AT in order to make them more independent with the use of their technology. Operational competence for a mobile device with multiple applications includes how to operate the technology, such as turning on the device, ensuring the device is sufficiently charged for the setting, ability to control settings such as volume, and navigating between apps. Strategic competence refers to the AT user being able to determine when they need certain assistive technology (Behnke & Bowser, 2010). For mobile devices, this is when the student will need to select the appropriate app. Social competence skills refers to using the technology appropriately for the setting and people surrounding them. For example, adjusting the volume appropriately between different apps. In order to asses these types of skills, school teams should watch the student use the device in their natural context.

Task analyses have been recommended by Shepley (2016) and Erickson (2015) and environmental observations have been recommended by Gentry (2015) when implementing mobile devices with individuals with ASD. Malinowsky et al. (2014) used an observation checklist to help guide professionals' assessments of everyday technology like mobile devices for older individuals with mild cognitive impairments and dementia. Shepley recommended that teachers create task analysis specific to the task and that the steps involve included locating and navigating the device. However, in the task analysis

example provided, Shepley only considered students using one app or videos to self-instruct for a task. The proposed performance assessment will consist of a task analysis, similar to Shepley's recommendations of the steps required to complete the task, but considers the navigation between apps, an analysis of the environmental context where the task is being completed, and a checklist of competency skills. The results from this observation can help develop transition goals for the student. In addition, it can also be used to demonstrate progress and mastery of the mobile device.

Quality Indicators for Assistive Technology (QIAT) emphasize for transition-age students that AT requirements in the receiving environment are identified by representatives from both environments (Behnke & Bowser, 2010; Zabala et al., 2000). In addition, the HAAT model also emphasizes performance assessment during functional activities as part of the assessment process for AT (Cook & Polger, 2015). In order to understand the full context of the transition-age student and the skills they need to use the mobile device independently the assessment should be performed in at least three different settings where the transition-age student will potentially be using their mobile device. The decision for the location of these three different settings should be made by the interdisciplinary team.

Creating a standard task analysis is not possible for the different iterations of apps, device settings, and context settings. However, three examples of what a task analysis may look like for a student who uses multiple applications are included in the guiding documents (see Appendix D). These examples could be adapted and used as a guide to fit the needs of different students. The task analysis also considers the

environmental and social context including who the student is interacting with and the physical requirements of the space. Once the team has decided what apps are appropriate for each setting, the OT can create the task analysis. One additional team member should also review the task analysis in order to ensure all items and features of the different apps are accounted for. Although, this cross-reference is time consuming, it is important to gather the viewpoints of multiple disciplines. The responsibility for these tasks is designated on the mobile device worksheet and should be decided at the annual face-to-face meeting, which can also coincide with the student's IEP meeting.

The observation checklist consists of the operational, strategic and social competence skills needed for a mobile device (see Appendix E). With this document, team members can consider if the student has mastered the skills to be independent in using this piece of technology in their post-secondary settings. If not, they should consider transition goals that will need to be taught to the student or designate a person to be in charge of this aspect of using the device (Behenke & Bowser, 2010).

In addition, ergonomic considerations should be taken into account when the student is using the device across settings. Musculoskeletal impairments, vision issues, and sleep disruptions have all been associated with the use of mobile devices (Ayaki, et al., 2017; Kim, et al., 2016; Heo, et al., 2017; Young et al., 2013). Therefore, occupational therapists should also be observing how the student uses the device across contexts and make appropriate recommendations for additional hardware to be added to address these issues. The checklist helps teams to consider these ergonomic considerations (see Appendix E). The task analysis (see Appendix D) and the observation

checklist (see Appendix E) can be used in conjunction as a performance assessment to help assess the student using the mobile device installed with multiple apps and for the team to determine appropriate goals for using the device.

Transition Plan Incorporation

Once the observation checklist and task analyses have been conducted, the team will have some guidance on what the transition-age student will need to become an independent mobile device user. QIAT recommends that transition planning be individualized, and the team address specific equipment, maintenance, and funding issues (Behnke & Bower, 2010). The checklist and task analysis may reveal that the transition-age student requires assistance with the operational competence skills required for the device. These goals could be designated to their parent or a post-secondary agency member.

In addition, training needs should also be identified (Behnke & Bower, 2010; Cook & Polger, 2015). All the individuals who interact with the student should be familiar with the apps on the student's device and have received an in-service on the app and how the student should be using the app. In addition, training should be provided to staff and family on what activities may require multiple apps so they may assist the student as they are learning to navigate between multiple apps. Training may also involve teaching parents and post-secondary agency members the operational competence skills needed for a mobile device or providing resources on who to contact for maintenance of the device once the student has graduated. Training will be performed by the professional who takes the lead on each app. For example, the speech language pathologist may

provide the training to staff and families on AAC apps and the occupational therapist may lead the training on the visual schedule apps. It is important that a record is kept of when the trainings took place, who was trained, and what they were trained on. In addition, the team should plan for the training process when implementing an app. Therefore, there is specific charts for the team to fill in on the mobile device worksheet in order to ensure they have planned for this aspect of mobile device implementation (See Appendix B).

Due to changes in student abilities, rates of new technology, and transition needs, it is important that the team follow up on any mobile device plans and implementation. The HAAT model recommends follow up and follow along (Cook & Polger, 2015). Follow-up entails maintenance and repair of the device as needed and follow-along involves re-evaluating the AT (Cook & Polger, 2015). Gentry et al. (2015) emphasized the importance of follow-along when implementing mobile devices with multiple applications with adults with ASD in a vocational setting. For transition-age students with ASD, it will be important to re-evaluate every year to ensure the mobile device apps are still providing the needed assistance. Items to consider include additional or different apps to install, prompting or hardware modifications, and additional people to be trained. These changes should be documented in order to transition with the students each year and to their next setting. The facilitator of the team should be responsible for ensuring that follow up and follow along is documented and occurs for the student.

Process of Delivery

A visualization of the process of using the proposed knowledge tools and the team members responsible for different sections are presented in Figure 3.1. The process

follows the HAAT model addressing the components of the human (transition-age student with ASD), activity (transition activities), assistive technology (apps and device) and the context (assessment in post-secondary environments).

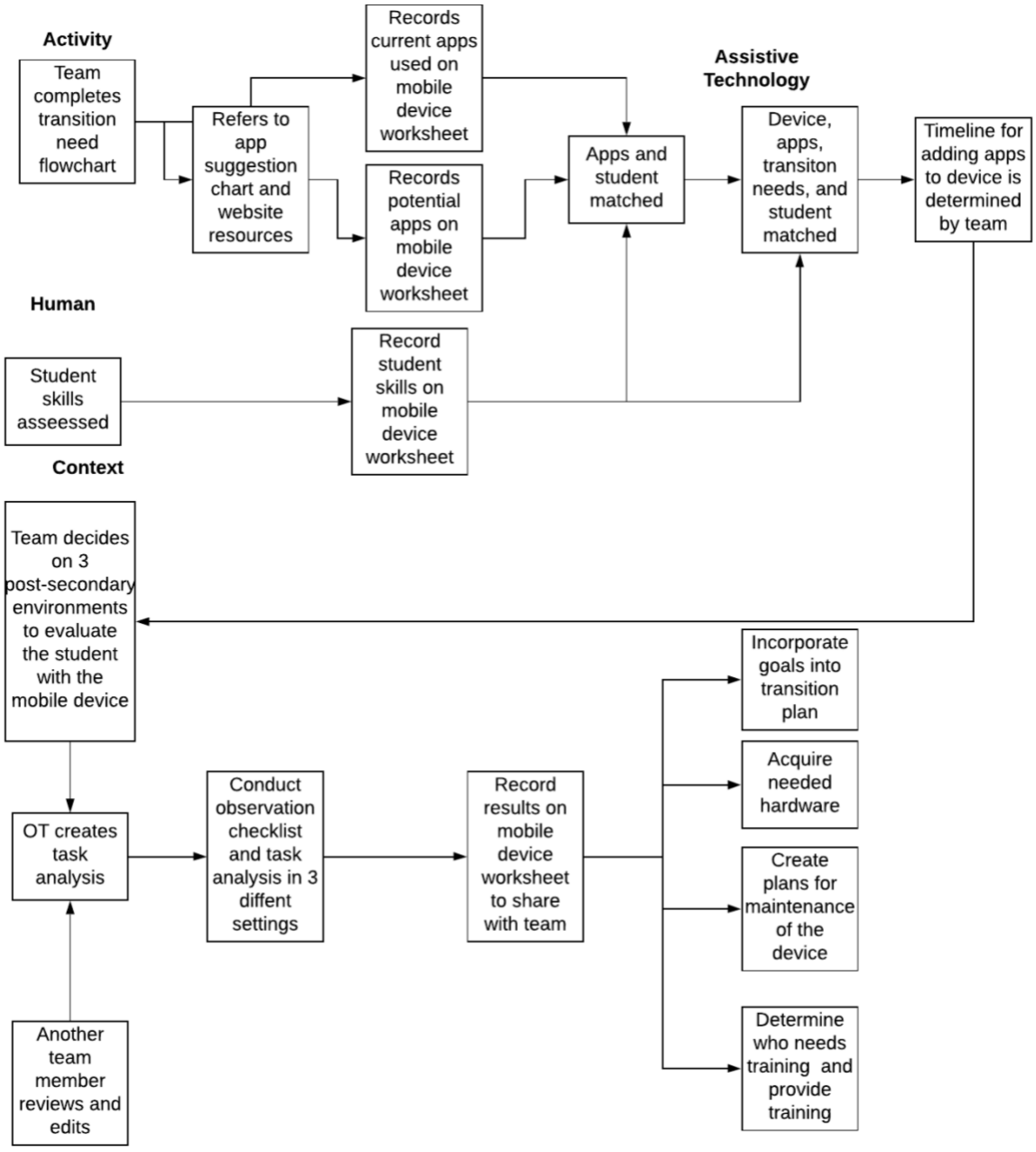


Figure 3.1. **Process of delivery for transition-age students with ASD who use mobile devices with multiple applications.**

Recipients

There are two different groups of intended recipients for these knowledge tools. The first are the school-based professionals. Using the flowchart (see Appendix A), the mobile device worksheet (see Appendix B), the app suggestion chart (see Appendix C), the task analyses examples (see Appendix D), and the observation checklist (see Appendix E) should improve their competency and level of collaboration when implementing mobile devices. Addressing these factors of implementation could potentially lead to better outcomes with using mobile devices with multiple apps in regard to carryover of the device for transition-age students with ASD, the other recipients of these knowledge tools. Use of mobile devices, are associated with increased independence and functioning in individuals with ASD and developmental disabilities (Gentry, et al., 2015; Kim & Kimm, 2017; Stephenson & Limbrick, 2015). It is hypothesized that improved implementation of these devices will lead to better post-secondary outcomes for transition-age students with ASD.

Outcomes

Increased perceived competence for school-based professionals

Knowledge tools and products are intended to help professionals translate knowledge from the literature into practice. The proposed tools are developed from the existing research literature on mobile devices. The flow chart, performance checklist, and examples of task analyses should facilitate team members' ability to implement mobile devices and to follow evidence-based suggestions that will help to improve functional outcomes for the students and increase carryover of the device. Following the use of

these knowledge tools, professionals should report a higher level of competence when using mobile devices.

Increased collaboration between school team members

It is hypothesized that the procedures will provide a framework and questions to facilitate collaboration between disciplines. In addition, these procedures propose specific roles for professionals in the process. Following using these knowledge tools, professionals may report an increase in members involved in the decision-making and implementation of mobile devices and an increase in the amount of time professionals were involved in the process.

Improved functional outcomes for students with ASD

Based on the research literature, adolescents and individuals with ASD who have used mobile device have demonstrated skill improvement (Gentry, et al, 2015; Kim & Kimm, 2017; Stephenson & Limbrick, 2015). In addition, lack of knowledge and poor implementation procedures has been identified as barriers to AT implementation (Bausch, et al., 2008; Copley & Ziviani, 2004; Okolo & Diedrich, 2014). Collaboration has also been associated with better outcomes for transition age students with ASD (Hendricks & Wehman,2009). It is hypothesized that a cohesive interdisciplinary team approach by knowledgeable practitioners when implementing mobile devices with multiple apps will also lead to improved functional outcomes for adolescents with ASD. This can be measured through transition plan goal attainment every year. Long term outcomes can include post-secondary rates of success across education, employment, and independent living domains.

Students' increased carryover to post-secondary environments

The knowledge tools provides a structure for the transition team to consider and incorporate goals related to operational and strategic competence and ergonomic concerns on the transition plan, provide training to the individuals who interact with the student, and establish back up plans for device maintenance and operational competence if the student is unable to manage these aspects of the mobile device themselves. It is hypothesized that incorporation of these goals and establishing plans for AT management on the transition plans will ultimately lead to carryover of the device and improve the student's ability to use the device in their post-secondary environments. In addition, by assessing the student in their proposed post-secondary environments, there is a greater likelihood that areas that require additional skill training will be identified and thus addressed prior to graduation.

Barriers

Changing Technology

There are a number of barriers related to implementation and use of the proposed knowledge tools in a school environment. Technology is rapidly changing, which means that device interfaces and app interfaces may shift and evolve. There is also no guarantee that specific apps will be available every year. It can be difficult for individuals with ASD with cognitive impairments to generalize, and professionals should keep this in mind when implementing mobile devices as AT. By working through the flow chart, school-based professionals should have gained a basic understanding of their student's transition needs and general mobile device software that might support them. In addition,

they will have assessed the student's capabilities and learning style, such as their video modeling preferences. This knowledge will allow professionals greater ability to find apps that meet the students transition and technology needs. Rubrics and professional development that includes this problem-solving component for professionals have been effective in increasing professionals' competence with locating and assessing apps (Schmidt et al., 2017).

Implementation

The proposed procedures require time from professionals in order to fill out the flow chart, collaborate on the flow chart, identify student priority needs, assess student characteristics, identify appropriate apps and choose an appropriate device. In addition, the assessment portion requires additional time to create the task analyses, utilize the task analyses in three separate environments and perform the checklist. Sharing the results with the team will also require time. Having the checklists available on a format like Google Forms on GSuite will allow users to easily upload results from iPads® or computers onto the shared platform. Gsuite is also HIPAA compliant which will make it easier to implement in a school-based setting (Google Cloud, n.d.).

This doctoral project lays out the groundwork for procedures that could be implemented in a school system. However, implementation may present with additional barriers. The proposed knowledge tools require decision-making input from a variety of team members and thus may increase professional expenses as they require additional non-treating time to engage in these discussions. Software that can facilitate collaboration like Gsuite, is another additional expense that may impact implementation. In order to

adopt new policies and techniques, there must be buy-in from stakeholders, such as school-based professionals, parents, and school administrators.

The KTA framework does provide some guidance on implementation that can help facilitate this process. Although this doctoral project focused on the first phase knowledge creation, the second phase in the model is the action cycle (Graham et al., 2006). The action cycle involves tailoring the knowledge tools to the practice setting, assessing barriers to the knowledge use, monitoring and evaluating knowledge use, and sustaining knowledge use (Graham et al., 2006). It is important to note that the specifics will need to be determined for each unique school setting, as barriers, modifications and evaluation procedures will vary according to funding systems, school location, professional roles, and team member availability.

CHAPTER FOUR – Evaluation Plan

Purpose of the Evaluation

Given the novelty of using mobile devices with multiple applications for transition-age students with ASD and the need for multiple disciplines to collaborate on their implementation, knowledge tools were created to assist school teams in this process. It is proposed that by improving implementation procedures for mobile devices, school-based professionals' competence and collaboration will increase, independence for the transition-age student with ASD will increase, and there will be a reduction in students' abandonment of the device post-graduation. The knowledge tools consist of proposed procedures for implementation: a flowchart (see Appendix A); a worksheet to match student's skill and needs to the device and apps (see Appendix B); a chart with app suggestions (see Appendix C); guidelines for a process of delivery (see Figure 3.1); examples of a task analysis (see Appendix D); and an observation checklist to assess the student's use of the device in their post-secondary environments (see Appendix E).

The purpose of evaluating the knowledge tools is to understand the barriers and facilitators to their implementation and the potential usefulness of these documents for school teams. The evaluation would take place in two phases. The first phase would use a formative approach to gather feedback from school-based practitioners, the potential users of the tools. The first phase would produce qualitative data and provide feedback to the author in order to revise the forms into a pilot version.

The second phase would use both formative and summative evaluation approaches to further improve the design of the knowledge tools and to gather initial data

regarding the effectiveness of this approach. This phase would consist of piloting the documents in a school with professionals, families, and students with ASD. The second phase would provide more specific descriptive information regarding the characteristics of the program, particularly therapist time and ability to utilize the tools. The second phase would also provide preliminary causative information regarding the changes in school professionals' perceived competence and collaboration as a result of the program's implementation. In addition, changes in transition plans as a result of the implementation will provide causative information about differences in the quantity and content of transition goals related to mobile devices. In this second phase the author would gather both quantitative and qualitative data, which would provide ideas for improving the knowledge tools, as well as initial outcomes of their implementation.

Evaluation Plan Design

Phase One

For phase one, a qualitative approach with focus group interviews will be used since the goal of this phase is to gather feedback on the components of the knowledge tools with experts and stakeholders. The focus group participants will be occupational therapists, speech language pathologists, general education teachers, special education teachers, assistive technology practitioners, transition coordinators, agents from vocational rehabilitation, job coaches, parents, students with ASD, and school administrators. Ideally, there should be a member from each professional category in order to get a variety of input for the guideline and enough participants to conduct three to four focus groups. Participants will be divided into smaller focus groups to ease discussion. The participants in the focus group should have a mixture of experience levels

with using mobile devices in practice, as well as a range of experience in working with transition-age students with ASD. Participants will be divided into groups to distribute disciplines and experience levels. An online meeting format via Zoom Video Communications© will be used for the focus groups in order to gather more participants from different geographic areas and accommodate a variety of schedules.

Review of the recording and transcripts of the focus groups would be thematically analyzed to provide qualitative data about the strengths, weaknesses, potential barriers, and further suggestions for development of the knowledge tools. Transcription and analysis will be completed by this author with the assistance of NVivo software, as well as by this author and potentially occupational therapy fieldwork students. It is anticipated that this phase will take one year. In this time frame, focus group members would be recruited, focus groups would be implemented, the results analyzed, and the knowledge tools would be revised as needed.

Phase Two

Phase two involves the proposed pilot implementation of the revised knowledge tools in a private school in an urban area. The following outcomes will be evaluated: 1) changes in school-based professionals perceived levels of collaboration 2) perceived competence when implementing mobile devices and 3) the incorporation of goals related to mobile devices into the transition plan. Phase two of the evaluation plan involves a mixed-methods approach, using a fixed effects quasi-experimental single group pretest and posttest design.

To gather the information needed for the evaluation, surveys will be dispersed to

school-based professionals and transition plans will be reviewed prior to and post implementation. In addition, minutes from the meetings with the team will be kept during implementation and will reviewed post-implementation. School-based professionals will also self-record the time spent on mobile device implementation on a Google Sheet that can be exported into data analysis software.

The pilot program participants in phase two will be five transition teams, consisting of an occupational therapist, speech therapist, transition coordinator, lead teacher, classroom supervisor/BCBA, transition-age student, and parents. The professionals on each of the student's teams may overlap due to the caseload distribution. Based on the potential pilot site's current organization of classroom and therapist caseload, there would be three lead teachers, three occupational therapists, three speech therapists, two classroom supervisor/BCBA, five transition-age students and their respective parents/guardians.

The pre- and post-surveys for the school-based professionals will allow the author to determine if the implementation of the knowledge tools in a school, the independent variable, led to changes in the school-based professionals perceived levels of competence and collaboration, the dependent variable. The use of a pre and post surveys would provide this preliminary causative information regarding changes in perceived collaboration and competence and either strengthen or weaken the theoretical model for the intervention. Both qualitative and quantitative information will be gathered from the surveys through likert-style questions and open and closed ended questions.

Surveys will also be distributed to parents to gather their feedback on using the

knowledge tools. Open and closed ended questions will focus on the amount of time it required from parents, their level of comfort with the technology, their willingness to carryover the technology at home, and overall satisfaction with the knowledge tools and process. This information will contribute to the social validity of using the knowledge tools and team approach. The knowledge tools are intended to be piloted with students with a co-morbidity of intellectual disabilities. Therefore, students may not have the cognitive skills to formally answer survey questions. Students' acceptability and satisfaction can be gained from observations and short interviews with students, if appropriate.

In addition to the survey results, review of the mobile device meeting minutes will provide descriptive qualitative information on how transition teams implemented the guidelines and checklist. The review of the transition team meeting minutes will also provide descriptive quantitative data regarding how much of team member's time was spent discussing and implementing the knowledge tools. In addition, team members will be asked to record any additional time they spent on implementing the knowledge tools in order to provide quantitative information on the productivity and cost of this type of program. Time commitment can be added by team members into an online data form, such as Google Sheets. This information will be important to stakeholders as they assess cost and barriers to implementation of this type of program

Analyzing the transition plans prior to and post intervention will provide preliminary causative information on the knowledge tools ability to assist teams in integrating mobile devices into the transition plans. The independent variable would be

the implementation of the knowledge tools and the dependent variable would be the number of goals related to mobile devices in student's transition plans.

The anticipated time frame for the pilot phase would be two years. The first year includes baseline data collection, such as reviewing previous transition plans, administering pre-intervention surveys and implementing the knowledge tools. At the conclusion of the 12-month school year (July to June), post-intervention surveys will be administered, and meeting minutes, time records, and transition plans will be collected. The second year of the evaluation plan would consist of analyzing the results, preparing the descriptive case report and presenting the report to various stakeholder groups.

Data Management Plan

Data will be collected from a variety of sources, such as participant responses from the focus group and survey, as well as document review of the team meeting minutes and the transition plans. This information will be collected through different platforms but should ultimately be downloaded to a single platform and backed up routinely to avoid loss of data.

Information via the survey and the additional time sheets can be collected in an online platform, such as Qualtrics™ that will export the ordinal and interval data into spreadsheets. The team meeting minutes can be collected on an online platform, to avoid errors related to the transfer of paper data to a computer spreadsheet. A format such as Google Forms will allow for teams to input data, such as time of meeting, members present, student discussed, and content of the meeting that will automatically be converted into a spreadsheet format. Once again, these spreadsheets should be uploaded

to a single platform for analysis.

Rog (2015) recommends NVivo as a software platform that can hold a variety of both quantitative and qualitative data and assist with organization of data for future analysis. Further exploration of the NVivo website, states the software is able to extract data directly from Qualtrics™, scanned documents like the transition plan, as well as the ability to upload video files from the focus group and assist with transcribing and coding the data (NVIVO, n.d). The NVivo software platform is a viable tool to assist the evaluator in managing the mixed methods research of this multiple phase evaluation.

Logic Model

A logic model was developed for the second phase of the program when the knowledge tools are implemented. This logic model assumes that the knowledge tools are in their revised format based on feedback gained from the results of the focus group. The logic model provides a vision for the implementation of these procedures (see Appendix F). It includes the resources needed for implementation, overview of the problem, theory of change, short-term outcomes, intermediate outcomes, and long-term outcomes. The logic model also addresses environmental factors that can impact the implementation of the knowledge tools and thus the evaluation plan. These include the changing technology that might arise during the implementation phase, staff adherence, team members' participation, and support from the school administration.

Next Steps

Phase two of the evaluation plan focusses on short-term outcomes listed in the logic model. Phase two is also a formative and summative evaluation, which may lead to

additional versions of the knowledge tools and revisions to the implementation procedures. To evaluate the intermediate outcomes of the knowledge tool implementation, transition plans could be reviewed to measure changes in goal attainment for students who used mobile devices with the use of the proposed procedures. Transition plan analysis on goal attainment could take place following a 12-month school year (June to July) of implementation.

Further follow-up of these student participants post-graduation would reveal outcomes related to post-secondary living, employment, and education and their rates of continued use of the device post-graduation. However, this would be a third phase and have to be conducted one to two years after the students have graduated in order to gather information on their employment and living status, as well as if they are still using the mobile devices and what barriers and facilitators factored into their use of the mobile devices.

CHAPTER FIVE – Funding Plan

The proposed program is a set of guiding documents or knowledge tools to help school-based teams with the assessment, customization and implementation of mobile devices with transition-age students with ASD. Lack of professional knowledge and collaboration may lead to poor implementation of mobile devices with transition-age students, especially when they are used as AT (Copley & Ziviani, 2004; Ferdig et al., 2016; Okolo & Diedrich, 2014). Current research literature, clinical documentation of mobile device use with individuals with developmental disabilities, and the Human Activity Assistive Technology (HAAT) model were used to develop the knowledge tools for school-based teams. The knowledge tools aim to address the lack of guidelines for implementing a mobile device with multiple applications and the need for collaboration and professional knowledge when implementing this type of technology. The tools are intended to be used by an interdisciplinary team and be made available using online software to make them accessible to professionals outside of face-to-face meetings.

The knowledge tools were developed to be piloted in a private school in an urban area with students with ASD and a co-morbidity of intellectual disabilities. The pilot implementation will gather information on the knowledge tools' potential usefulness and provide data to further revise the documents and set of procedures. The funding plan discusses the proposed budget and potential financial resources to assist with this pilot implementation.

Available Local Resources

The potential pilot site is a private school in an urban area that serves students 5 to 21 years old with developmental disabilities. The school has a 12-month academic program with an average of 9 weeks of vacation per academic school year. The target population for these knowledge tools are transition-aged students, 13 years and older and their transition teams. With the school administration's support, the available resources at the school will be used to implement the knowledge tools, including the facilities, professionals, and infrastructure. In terms of facilities, the school has the conference rooms for transition team meetings and staff training. Occupational therapists, speech language pathologists, transition coordinators, special educators, Board Certified Behavior Analysts (BCBAs), students with ASD, and their families are all available at the school and have the time allocated to pilot the knowledge tool implementation and provide feedback on the implementation process. The school facility also includes infrastructure, such as WiFi, computers, and iPads, which will be needed for team members to collaborate on the flowchart and worksheet. The school's WiFi will also be necessary to run some of the apps. Each professional listed on the pilot program has an iPad® and a computer provided by the school to access the knowledge tools both at their desks and in the community when assessing the student. If WiFi is required in the community, a WiFi hotspot can be used and is included in the anticipated costs.

Anticipated Costs

Evaluation Costs

Since this is a new set of procedures and tools, information will need to be gathered in order to evaluate the effectiveness and the potential to be used in other schools. The costs associated with evaluating the pilot program are addressed in the funding plan and include software tools to conduct surveys and to analyze the data. Qualtrics™ is an online survey software program that secures data, customizes displays, and can be used on mobile platforms (Qualtrics, n.d.). This would be an appropriate software program to disperse surveys and collect data pre and post implementation to evaluate changes in school-based professionals' perceived collaboration and competence, as well as the parent and student's perspectives. A sales representative stated the cost of this survey platform for a single user starts at $1,500 per year (T. Fetherolf, personal communication, May 21st, 2019). It is anticipated that the occupational therapist and author of the project might serve as the single Qualtrics user during year one and data will be exported for year two.

In addition, since the evaluation of the pilot implementation involves a review of multiple sources of quantitative and qualitative data, the software platform NVivo will be used to manage and organize the data. NVivo offers the ability to import multiple sources of data from various platforms, upload different types of data, and analyze the data (NVivo, n.d.). Evaluation of the program will occur in year two, once the pilot program has been implemented and the data has been collected. Software costs were calculated to determine evaluation costs (see Table 5.1).

Table 5.1

Anticipated Costs for Evaluation

Evaluation Expense	**Cost**
Qualtrics Software	$1500
NVivo 12 PLUS Software	$1599
Total	$3099

Implementation Costs

Although, the potential pilot site has a number of resources, there are additional professional, software, and hardware expenses that will need to be purchased to run the pilot program as intended. For example, the proposed procedures for implementing mobile devices with transition-age students recommend using a team facilitator. The facilitator can be any member of the team who has knowledge of assistive technology (AT) implementation. Their responsibilities include coordinating the meetings, gathering professional input on the worksheet, following-up on the team member evaluations and assessments, maintaining the meeting minutes, and leading the team discussions. The proposed facilitator for this program will be a therapist with AT knowledge, who will reduce their caseload to take on the additional administrative work associated with implementing and running this program. It is estimated that this will take an additional 5 hours per week for the pilot program. For the purpose of this funding proposal, an occupational therapist was chosen since they have the unique skill set to address both AT and transition planning (AOTA, 2015; AOTA, 2018; Crabtree, 2014). The contract hours needed are based on an occupational therapist's average hourly rate in the New York area, which was retrieved from Indeed (n.d) and reflect the weeks school is in session

(see Table 5.2).

In addition to the program facilitator, there will also be additional needs from the information technology (IT) department to coordinate and install the online software on the hardware such as iPads®, desktop computers, and if needed address technical issues that arise. This will incur additional time from the IT specialists in the department and should therefore be factored into costs for the pilot program. The support hours may vary across the academic school year, as the initial installation may require more hours than the daily support. An estimated one hour per week for the academic school year was calculated for the IT support. IT support makes an average of $64,516 per year in New York, according to Indeed salaries (n.d.). This salary was converted into an hourly wage to get an estimate of costs for their services (see Table 5.2).

The proposed knowledge tools recommend the use of online software to assist teams in collaboration. GSuite allows the user to collaborate on documents, forms, and spreadsheets. The software uses cloud-based storage and is HIPAA compliant (Google Cloud, n.d). This is a viable platform to allow team member's access to student's files and add information as needed. The cost for this software and features were calculated based on a pilot trial of 5 transition-age students and their families, and their respective transition-based school team, which will consist of 11 professionals and one team facilitator (see Table 5.2).

Although, the school has WiFi that can be used to run some of the apps and GSuite, professionals may need access to the internet to assist with running the student's app or with collaborating in real time with another professional while in the community.

In order to achieve this, a WiFi hot spot is included in the budget. Costs for an AT&T hotspot is based on a monthly subscription and the cost of the Netgear Hotspot from Amazon. For the pilot program, a 3GB data plan will be used for $25 per month (AT&T, n.d.). Usage during the pilot program will determine if additional data will be needed for an expansion of the program. Costs for the WiFi hot spot are included in Table 5.2

The knowledge tools indicate that school-based teams may need to trial certain apps and mobile devices. The pilot program should have the resources to lend equipment as needed for the participating transition-age students. The lending equipment should include, iPads®, mini iPads®, stands, external batteries, external keyboards, external speakers, cases, and styluses. This equipment can be found on the Apple Store website and through vendors, such as Best Buy, Amazon, and OtterBox. The hardware included in the funding plan is for up to 5 students in the pilot. However, individual prices are included in Table 5.2 in order to assist with calculating cost if the pilot program were to be expanded or reduced.

Additional software needs include apps that may need to be trialed with students. The apps presented in Table 5.2 are the suggested apps listed in the app suggestion chart (see Appendix C) that are not built-in to apple devices or free. Prices of apps may change, and different apps may be developed that are appropriate to trial for this population affecting the overall cost of the program. The prices reflected are from May 2019 from the App Store (n.d.). In addition, dissemination costs are listed in Table 5.2 and the details for this cost can be found in chapter 6.

Table 5.2

Anticipated Costs for Pilot Implementation

Item	Quantity	Price per item	Total Cost
Personnel			
Team Facilitator	5 hours per week for 43 weeks	$55.58/hr	$11,949.70
IT Support	1 hour per week for 43 weeks	$31.33/hr	$1, 347.19
		Total Personnel Cost	$13, 296.89
Software			
GSuite	17 users	$12/user per month	$2,448
AT&T 3GB Data Plan for WiFi Hot Spot	1	$25/month	$300
ChoiceWorks app	5	$6.99	$ 34.95
ChoiceWorks Calendar App	5	$4.99	$24.95
FirstThenVisualSchedule app	5	$9.99	$49.45
Proloquo2Go app	5	$249	$1,245
Go Talk NOW app	5	$79.99	$399.95
TouchChat app	5	$149.99	$749.95
Abilipad	5	$19.99	$99.95
Wayfinder 3	5	$349.99	$1,749.95
GoWorksheet app	5	$39.99	$199.95
SnapType	5	$4.99	$24.95
		Total Software Cost	$7,327.05
Hardware			
Computers	12	Existing Resource	N/A
Netgear Hotspot from Amazon	1	$59.99	$59.99
iPads from Apple Store	5	$329	$1645
iPad Air with True Tone Display from Apple Store	5	$499	$2,495
Mini iPads from Apple Store	5	$399	$4,490
External Bluetooth Speakers from Best Buy	5	$39.99	$199.95
iPad Stands from Amazon	5	$41.00	$205

Logitech – K480 Bluetooth Multidevice Keyboard from Best Buy	5	$29.99	$149.95
iPad Air/iPad Pro Defender Series Case from Otterbox	5	$89.95	$449.75
iPad Mini Defender Series Case from Otterbox	5	$69.95	$349.75
Otter Box Utility Series Latch II 7-8 inch From Otterbox	5	$27.96	$139.80
Otter Box Utility Series Latch II 10 inch From Ottebox	5	$39.95	$199.75
Cosmonaut Wide-Grip Stylus From Amazon	5	$24.99	$124.95
		Total Hardware Cost	$10,508.89
Facilities			
WiFi	n/a	Existing Resource	N/A
Computers	11	Existing Resource	N/A
Meeting Space	1	Existing Resource	N/A
		Total Facilities Cost	$0
		Dissemination Costs	**$3,858.81**
		Total Implementation Cost	**$3,4991.64**

Expansion of the Program

Following the evaluation of the pilot program, analysis of the results, and dissemination of those results, which will take place in year two, the knowledge tools and process will be refined. The revised format will be expanded to all students in the high school and eventually additional schools. The expansion will involve similar costs to the initial pilot program with increased quantities to address the additional students. In

addition, personnel costs will also be increased to accommodate for the extra time needed to manage and run the program. It is important to note that the prices may be different for the expansion of the program due to changing technology. Different apps and mobile device hardware may be available in three years and their prices are variable.

Potential Funding Sources

Grants

Although, the pilot site has existing resources that would lower the overall costs for implementing the program, there are still additional expensive items that could potentially make the pilot program and expansion inaccessible for the school. To assist with the cost of this implementation, potential grants were located, whose mission and purpose matched the components of the program. The first is the Alison Keller Education Technology Program, funded by the Doug Flutie Jr. Foundation. The grant is intended to fund innovative technology for schools serving individuals with ASD in the New York Area. Previously funded equipment has included tablets, apps, and technology training. The maximum grant request is up to $7,5000 (Doug Flutie Jr. Foundation for Autism, n.d.). Due to the potential for mobile devices with multiple applications to increase independence in adolescents with ASD, this pilot implementation could meet the requirements for this grant application.

Autism Speaks, a national organization offers Adult Transition Research Grants for research evaluating an intervention or service for transition-age students with ASD that could contribute to evidence-based practices (Autism Speaks, 2019). Four grant awardees will receive $250,000. In addition, the proposed evaluation and implementation

project includes people with cognitive impairments, the use of technology, and multi-sectoral collaboration, satisfying three of the eight priorities listed by Autism Speaks for grant awardees (Autism Speaks, 2019). This grant would be helpful to cover the personnel and the evaluation portion of the program.

The NEXT for AUTISM Grants program provides funds for innovative programs and organizations that have educational, vocational, social and community-based services. The 2018 grant cycle general requirements included a new model of delivery that could improve outcomes, programs that demonstrated sustainability, and that funds were used for program-specific requests rather than operating costs (NEXT for Autism, n.d.). This grant corresponds to the proposed program. However, it would only cover the hardware, such as the iPads® and the supporting software to run the program. Information on exact grant awards was not provided. In 2015, the organization gave $5 million to 50 organizations (NEXT for AUTISM, n.d.).

Two other potential grants, which have broader criteria that could encompass the goals and outcomes of this pilot program, were also identified as potential sources of funding. Sony offers a grant for education with a focus in art, culture, technology or the environment (Sony, n.d.). The grant application could highlight the role technology plays in the education for students with ASD and its potential to improve outcomes in their adult life. The OMRON Foundation also offers grants for non-profit organizations. One of their focus areas includes education and technology (OMRON Foundation, n.d.). The grant application involves explaining both short-term and long-term program outcomes that could be measured, which have been established through this doctoral project. Both

the SONY and the OMRON Foundation did not list how much money they provide to organizations through their grants.

School Fundraising

In addition to the potential external grants that could be secured to fund this pilot program, the potential pilot school has fundraising opportunities that may be used to supplement the costs. These include targeted fundraisers for specific projects which takes place through Giving Tuesday and during the larger annual fundraiser. During the annual fundraiser, a wish list is generated by the staff and often includes technology items, such as iPads®. These are then presented to attendees, who can choose to purchase them for the school. Hardware and software for the pilot program can be displayed on this wish list to help support the program. In addition, live appeals during the annual fundraiser often highlight the programmatic costs needed for the school, which would be an additional opportunity to raise funds for the personnel costs of this project.

Community Fundraising

Other potential fundraising opportunities may be available through posting the needed items, such as iPads® and supporting hardware, such as cases and straps on fundraising websites. An example is donorschoose.org, a website that allows schools to request specific items needed for classrooms. Donors have the option of choosing a classroom to give money towards the project (Donors Choose, n.d.). This could potentially raise additional funds for the pilot implementation, specifically the equipment lending library.

Conclusion

The costs for implementing a small pilot program in the school for one year are considerable when factoring in the anticipated costs for evaluating the program would be $3,099 and the anticipated costs for implementing the program would be, $31,132.83, totaling to $34,231.83. Dissemination costs would raise this total number even higher. Factors that may influence the projected costs for the implementation of pilot program should be considered. For example, the implementation design may be modified with the school's administration's partnership, leading to lower costs.

Since the pilot program is intended to be implemented in a school, there are benefits to purchasing items using a school account. For example, Apple partners with schools to provide technology plans and financing options that can assist with the costs for this type of program. There are discounts on apps when bought in bulk through education accounts. Schools also have the option of enrolling in leasing Apple hardware, such as iPads® (Apple Education, n.d.). These options may reduce both the projected hardware and software costs. In addition, with collaboration from the school administration and human resources, costs for personnel may be able to be factored into pre-established salaried positions with benefits thus reducing the hourly rate for both clinicians and the IT support specialist.

It is also important to note that the evaluation plan is for five students. The profile of these five students have not been determined or assessed. These students and their families may have already purchased hardware, such as smartphones or tablets that the team has decided are an appropriate match, thus reducing the overall costs for the pilot

program. The projected costs of the pilot program include up to five of each of the apps, mobile devices, and supporting hardware. However, following assessment of the student they may not need certain apps or supporting hardware, such as an external keyboard. In addition, refurbished or older models of Apple hardware are also available for reduced costs. The school may purchase these reduced cost options when trialing these devices. The actual costs for implementing and buying equipment for each of the five pilot students will likely be less than the proposed budget.

There are potential avenues to explore both with school fundraising and external grants that may help offset some of the costs to implement and evaluate the pilot program, as well as sustain the program for longer periods and with additional students. It will depend on effectively demonstrating to stakeholders, specifically school administration and funders, the importance of using these knowledge tools to implement mobile devices and the potential benefits to student outcomes. In addition, since the knowledge tools are in their beginning phases, the importance of evaluating the implementation process and the tools must be highlighted as this will help drive revisions and lead to better implementation and carryover of the device.

CHAPTER SIX – Dissemination Plan

There is a lack of guidelines for implementing a mobile device with multiple applications (apps) and a need for collaboration and professional knowledge when implementing this type of technology for transition-age users with ASD in a school setting. The knowledge tools were developed as part of a doctoral project and consist of a variety of online documents to assist educational teams in customizing and assessing transition-age students with ASD who use a mobile device with multiple apps through an interdisciplinary approach.

The knowledge tools were designed to be piloted in a private school in an urban area with students with ASD and a co-morbidity of intellectual disabilities. The plan to disseminate the results will take place upon the conclusion of the pilot program's evaluation, yielding positive outcomes and also the results and feedback leading to revisions of the knowledge tools. It is anticipated that the implementation of the knowledge tools will result in increased levels of collaboration and perceived competence for school-based professionals, the incorporation of goals related to mobile devices in the student's transition plans, increased rates of transition goals being met by transition-age students, and carryover of the device post-graduation. The results should be disseminated in order for the tools to be expanded to different schools and to change how practitioners are implementing mobile devices.

Approach to Dissemination

Dissemination Goals

Disseminating the knowledge tools and the results from the pilot program's evaluation have short term and long term aims. The short-term goal is to expand the implementation of the knowledge tools to different schools, both private and public. The long-term goal is to change how school-based practitioners are using mobile devices with the ASD population by influencing their knowledge and awareness about best practices. By achieving these goals through dissemination, there will be a wider population of transition-age students with ASD who achieve better outcomes post-graduation, as they are equipped with technology that serves them in performing their various daily occupations.

Target Audience

There are a number of stakeholders that would benefit from being informed about the usefulness of these tools and processes for implementing mobile devices with transition-age students with ASD. In order to focus dissemination, activities and materials will target school-based occupational therapy practitioners as the primary audience. School based occupational therapy practitioners are members of the transition team who can use these tools and guidelines to help establish similar practices in their school setting. Although, the knowledge tools promote the use of an interdisciplinary team approach, the components of the pilot program involve assistive technology, environmental assessment, and transition planning, which are areas of occupational therapy practice (AOTA, 2014; AOTA, 2015). In addition, the author of the tools is an

occupational therapist and successful dissemination with occupational therapy practitioners could lead them to becoming ambassadors of the program in a variety of school districts. Since the program does involve an interdisciplinary school team, the members of that team including classroom teachers, speech language pathologists, school administrators, outside adult agencies, students with ASD, and their parents, must be part of the dissemination plan. This diverse group will be considered the secondary target audience.

Key Messages

The goals of dissemination involve increasing the implementation of these procedures and ultimately, raising awareness of school-based practitioners and parents of students with ASD to change school-based practices when implementing mobile devices with transition age students. The targeted messages for the primary audience of occupational therapy practitioners will be for them to become advocates and ambassadors for change in their own school settings. The following are the key messages that the dissemination activities will highlight:

- Occupational therapy has an important role to play in using mobile devices as interventions with transition age students with ASD, both through direct intervention and by becoming ambassadors for establishing formal procedures when implementing mobile devices.
- Advocating for the use of collaborative interdisciplinary teams within your school district when implementing mobile devices with transition age students with ASD will lead to better outcomes, such as increased attainment of transition goals and

carry over of the device post-graduation.

- Establishing plans and assessments when implementing mobile devices with transition age students with ASD can be done by using the knowledge tools provided.

For the secondary audience, the messages are similar to occupational therapy practitioners for using these processes when implementing mobile devices, but messages should also emphasize the importance and benefits to their use. The following key messages will be conveyed to the secondary audience through dissemination materials and activities.

- The use of the outlined procedures can help school professionals use mobile devices with transition-age students with ASD, increasing their independent living and vocational skills, and thus improving their post-secondary outcomes related to employment and living.
- Implementing assessment and procedures for mobile devices will better prepare school-based team members, increasing their knowledge and ability to collaborate when using mobile devices with transition-age students with ASD.

Sources/Messengers

To assist with a wider and well-received dissemination, it will be important to enlist organizations and spokespersons who believe in the benefits of using the knowledge tools and procedures. The spokespersons should be credible sources who are able to reach a wide audience. Autism Speaks is a large nationwide organization that provides information to parents, educators and individuals with ASD (Autism Speaks,

n.d.). If Autism Speaks provided a resource to the knowledge tools or a resource guide on using mobile devices for transition age students with ASD, it would reach a wide audience and increase awareness. In addition, Autism Speaks has an Autism Response Team (ART) that is available to refer individuals to resources and information. If the ART were aware of the knowledge tools and best practices when implementing mobile devices, they could also disseminate the information.

Another important organization that would be helpful in dissemination of the knowledge tools and procedures is the National Technical Assistance Center on Transition (NTACT). NTACT provides resources, rates evidence-based practices, and offers webinars on transition planning for students with disabilities (NTACT, n.d.). Connecting with this organization in order to disseminate materials could raise awareness to the wider school transition community on the importance of implementing mobile devices using a team-based approach and components to include in assessment and implementation.

Dissemination Activities

Written Information

One of the most important steps in the dissemination process will be to publish the results of the pilot program in a peer reviewed journal. The following peer-reviewed publications will be able to reach both the primary and some members of the secondary targeted audiences: *American Journal of Occupational Therapy*, *Journal of Autism and Developmental Disorders*, *Focus on Autism and Other Developmental Disabilities*, *Journal of Special Education Technology*, and *Assistive Technology.* A non-peer

reviewed publication that will reach the primary audience is *OT Practice*.

The manuscripts prepared for these publication submissions will differ slightly based on the focus of the publication and the submission requirements. For example, the focus for *The American Journal of Occupational Therapy* and the *Journal of Autism and Developmental Disorders* involves a scholarly presentation of the results and statistical analysis of the pilot program. This will be used to highlight the positive outcomes of the program's implementation. Publications such as *Special Education Technology* and *OT Practice* may involve a case study and more practical applications for readers on the use and benefits of the approach to mobile device implementation. This will address the key goals of increasing the number of school-based practitioners implementing similar programs and potentially changing their practices.

To evaluate if the articles have been disseminated to a wide audience, citations of the article by other authors can be monitored through Google Scholar. In addition, Mendeley can also provide additional statistical information on citations, viewership of the article, and number of readers (Elsevier, n.d.). Qualitatively, feedback received from emails or messages to the author will also determine if the article has been received positively and if the article led to a change in the reader's view on mobile device implementation. Both the readership and citation data, as well as the qualitative communication can be used to generate material for additional articles, as well as to indicate to stakeholders the importance of this topic and continued need for research. Although publishing will be an important first step in disseminating this information, it cannot be the only method of translating this information into practice. Other methods of

conveying the importance and practicality of the procedures will be needed in order to spread the messages beyond the audience of readers of academic journals.

Electronic Media

One proposed method involves using the internet to spread the information about the knowledge tools. Articles could be posted on websites such as Autism Speaks, a national organization that provides information to educators, families and individuals with ASD (Autism Speaks, n.d.) and Understood, an organization that provides resources for individuals with learning and attention issues (Understood, n.d.). These articles will be written in lay terms and provide tips for mobile device implementation for parents and educators.

Creating blog and forum posts is another written dissemination format that will increase dialogue and awareness about this topic to both occupational therapy practitioners and other members of the school-based team. Posing questions and discussion topics on the AOTA CommunOT Forums (AOTA, n.d.) would involve some occupational therapy practitioners. In addition, Facebook posts on groups such as School-Based Occupational and Physical Therapists, The Special Ed Squad, Helping People with Autism Learn, Play & Thrive, Apps and AT for OT, can also increase awareness and networking opportunities with a wider audience.

Dissemination activities using an electronic media format include articles published on websites, Facebook posts, and CommunOT forum discussion posts. The impact of the articles on the website can be measured by how many hits the website received. This can be used in conjunction with the statistics on readership from the

scholarly articles to demonstrate to stakeholders the need for these procedures and could potentially assist with funding. Evaluation of the electronic media posts on social media and forums can be measured both qualitatively and quantitatively by the number of responses, likes, and comments to posts. In addition, the discussions the posts generate will be used to gear dissemination materials aimed at expanding the program to different school districts. For example, responses and comments by different school-based practitioners and parents will help to make the dissemination activities more relatable to different team members.

Person-to-Person Contact

Hearing from the people that have implemented and piloted the program will be an important component of inspiring school-based practitioners to evaluate and implement mobile devices with transition-age students with ASD using a planned team approach. Person-to-person contact through conference presentations and sharing of information in communities of practice work groups are ways to relate to this wide audience and help tailor the knowledge tools to different settings. Conferences and community of practice work groups will first target the primary audience of occupational therapy practitioners. Then, further dissemination to the wider secondary audience or other members of the school-based team will be completed with colleagues from the pilot program.

To address the primary audience of occupational therapy practitioners, presentations at the AOTA conference and the AOTA Children and Youth Specialty Conference either with a short course or a poster presentation will help to convey the key

messages to occupational therapy practitioners. Other person-to-person contact with occupational therapy practitioners can involve leading a call through the AOTA Communities of Practice Transition group, in which this author is a member. To reach the secondary audience, partnering with a colleague to present at different disciplines' national organization conferences will be helpful to disseminate to other school-based team members. Co-presenting with a member from that discipline can create a camaraderie and relatedness to the audience members. Proposals can be submitted to the following professional organization's conferences: American Speech-Language Hearing Association (ASHA), Center for Exceptional Children, and the National Association for Special Education Teachers. Person-to-person contact will primarily target the school-based practitioners of both the primary and secondary audiences as opposed to other members of the school team, such as parents and students.

Evaluation of the effectiveness of this dissemination format can be gathered during conference dialogue and follow up calls and emails from the community of practice work group. Conference attendance and an average number of people who visited a poster could provide details about the number of school-based practitioners the key messages may have reached. Dialogue during the poster session can be used to revise dissemination materials and to generate ideas for further research.

Timeline for Dissemination Activities

The priority for dissemination will first involve preparing materials for dissemination. This involves writing the manuscripts and submitting to publications, posting forum posts, and leading an AOTA Community of Practice Transition phone call.

The second level of priority will be to submit poster proposals for first, occupational therapy conferences and then, other professional organizations. These conversations will also lead to practical suggestions on how to implement these procedures in different school-based settings.

Budget

To disseminate the information, there will be a significant amount of volunteer hours from the author to prepare and write the journal articles, blog posts, and follow up with communication with people who comment, email or respond to postings and articles. In addition, presenting at conferences will also be done voluntarily to help spread this information. However, travel costs for these activities should be accounted for and could potentially be covered by the employer of the pilot site, as this will also serve as an advertisement for the school and continuing education opportunity for the presenter. Conference costs are based on the 2019, 2020, and 2021 conference locations, as some registration fees and locations have not been published yet. Travel costs are based on the flights or train trips from New York, where the author is based and local hotels at the conference location. The prices listed in Table 6.1 are from June 2019 and may change.

Table 6.1

Estimated Dissemination Budget

Item	**Cost**	
Personnel Costs		
Preparation of manuscripts, conference posters, slide presentations, blog posts, and discussion posts.	Donated time by Author	
Materials Costs		
8 x 4-foot Poster Printing from MakeSigns.com (n.d.)	$131.81	
Conferences and Related Travel Costs		
AOTA Conference 2021 San Diego CA *based on 2019 registration cost and April 2020 flights	Registration	$523.00
	Round Trip Flight on Alaska Airlines	$532.00
	3-night Hotel at Courtyard Marriott	$510.00
	Meals	$160
AOTA Youth and Specialty Conference *based on 2019 registration location TBD	Registration Fee	$325.00
	Flight	Location unknown for 2020 or 2021
	Hotel	Location unknown for 2020 or 2021
	Meals	$80
ASHA 2021 Convention, Washington D.C. *based on 2019 registration cost and April 2020 train costs.	Registration	$555.00
	Round trip Amtrak Saver Trip	$106.00
	1-night Marriott Marquis, Washington, D.C.	$119.00
	Meals	$40
Center for Exceptional Children 2021 Convention, Baltimore MD *based on 2020 registration fee, April 2020 train costs.	Registration	$535.00
	Round trip Amtrak Saver Trip	$108.00

	1-night Hampton Inn Baltimore Hotel	$94.00
	Meals	$40
Total Costs	**$3,858.81**	

Conclusion

The goal of dissemination is to raise awareness about a team-based approach to implementing mobile devices and inspire school-based practitioners to implement similar procedures in their school-based setting. The primary audience to be targeted for dissemination is occupational therapy practitioners in order to create advocates for practice change. The secondary audience involves other school-based team members, such as speech language pathologists, special education teachers, transition coordinators, school administrators, students with ASD, and their families. Ultimately, all of these members must be educated, aware, and willing to change practices in order to implement these procedures.

The plan to disseminate the information involves many means of increasing awareness and widening implementation. Publication of the results of the pilot program will lend credibility and validity to the key messages being conveyed. By presenting the results through conferences, both in the occupational therapy community and other disciplines, would widen the audience of school-based practitioners who have been educated on best practices for mobile device implementation. In addition, by using electronic media sources to open discussion about the barriers and importance of using an organized team-based approach to mobile device implementation, the key messages will be disseminated and refined. Although, this plan highlights some methods for

disseminating the material, such as written publications, online posts, and conference presentations, some members of the both the primary and secondary audience may require alternative methods in order to garner interest and become engaged with how to implement mobile devices. Methods, such as short videos and parent education nights at local schools might be additional dissemination activities that will need to be explored once the initial dissemination plan has been launched and evaluated.

The estimated costs for disseminating the information are based on the author volunteering time to create dissemination materials. In addition, the estimate costs for travel may change as taxes and fees for travel costs are added and locations are determined for conference proceedings. Funding for dissemination may be provided by the pilot site as part of continuing education tuition reimbursement and to increase the prestige of the school.

CHAPTER SEVEN - Conclusion

As adolescents with ASD age out of school, they often lose or do not have access to the same the supportive services, such as occupational therapy that they received through the age of 21 under IDEA (Roux et al., 2015). In relation to peers with other disabilities, outcomes for these adolescents as they reach adulthood are poor, as many young adults with ASD are unemployed, socially isolated, and not living independently (Roux et al., 2015). Considering these poor outcomes and dearth of services, it is critical that transition services prepare adolescents with ASD for independence, employment and secondary education, as effective transition planning is associated with better outcomes for these youth (Hendricks & Wehman, 2009). An area that shows tremendous promise for adolescents with ASD is the use of mobile devices with apps that can be used as AT and everyday technology to help support adolescents and lessen the need for adult assistance (Gentry et al., 2015; Kim & Kimm, 2017; Odom et al., 2015; Walsh et al., 2017). However, this technology is still in the nascent stages and is constantly changing, which affects the quantity and quality of research being conducted and often the ability of school-based professionals to implement this helpful, but perceived overwhelming technology (Gentry et al., 2015; Ferdig et al., 2016). In addition, mobile devices and the corresponding apps require the expertise of multiple school-based professionals involved with the student due to the areas addressed by different apps. Therefore, there needs to be collaboration and coordination among team members when implementing this technology.

In order to address this area of need in school-based practice, the knowledge to

action framework (KTA) and the Human Activity Assistive Technology (HAAT) model were used to structure an approach (Cook & Polger, 2015; Graham et al., 2006). The KTA framework suggest using pathways, guidelines and decision aids to help make information more user-friendly for clinicians (Graham et al., 2006). The HAAT model provides a structure to evaluate and implement AT, such as mobile devices for transition-age students with ASD, by considering their transition activities, environmental and social context, the student, and the device. In addition, the HAAT model as most AT evidence and frameworks suggest, uses a team-based approach to AT evaluation and implementation (Cook & Polger, 2015).

This doctoral project involves the use of the following components: interdisciplinary collaboration, matching device and app to user, and a performance assessment that involves the student's ability to navigate the device and ergonomic considerations It is comprised of documents, such as worksheets, flowcharts and checklists that can be made available on online collaboration software, such as GSuite, which is HIPPA compliant (Google Cloud, n.d.). These documents make it easier for professionals to use the available research on mobile devices to make informed decisions regarding the evaluation and implementation of this technology with transition-age students with ASD, as well as provide information for what to address within the transition plan, for example training needs of the students, school staff, and parents. In addition, the online software component will allow for increased collaboration with team members, whose time may be limited thus impeding successful AT implementation and transition planning.

The aims of using the proposed approach is to increase school-based professionals' perceived competence and collaboration when implementing mobile devices with this population and improve the use and carry over of these devices post-graduation. Mobile devices have been associated with greater levels of independence in a variety of activities that are needed once students have graduated out of the school system. Therefore, the proper implementation of mobile devices is important, as it will hopefully increase independence, attainment of transition goals, and long-term outcomes for students with ASD.

As students with ASD transition out of school, it is beneficial if they become as independent with their AT systems as soon as possible. An independent AT user has the competencies needed to operate, navigate, problem solve, maintain, and adjust the device as needed for the social situation, as well as over time (Behnke & Bower, 2010). If the student has difficulty mastering these competencies, a designated person, usually a family member should be appointed and trained. The guides and checklists created for this doctoral project propose that school teams consider and assess each student's ability to perform these competencies in order to determine what training needs to take place and who needs to be trained during the transition years.

As members of the transition team, occupational therapists play a vital role in this proposed process for implementing and evaluating mobile devices with transition-age students with ASD. Occupational therapists have the skills needed for task analysis, environmental assessment, and consideration of client centered factors, all of which are essential for the proposed mobile device implementation and evaluation procedures

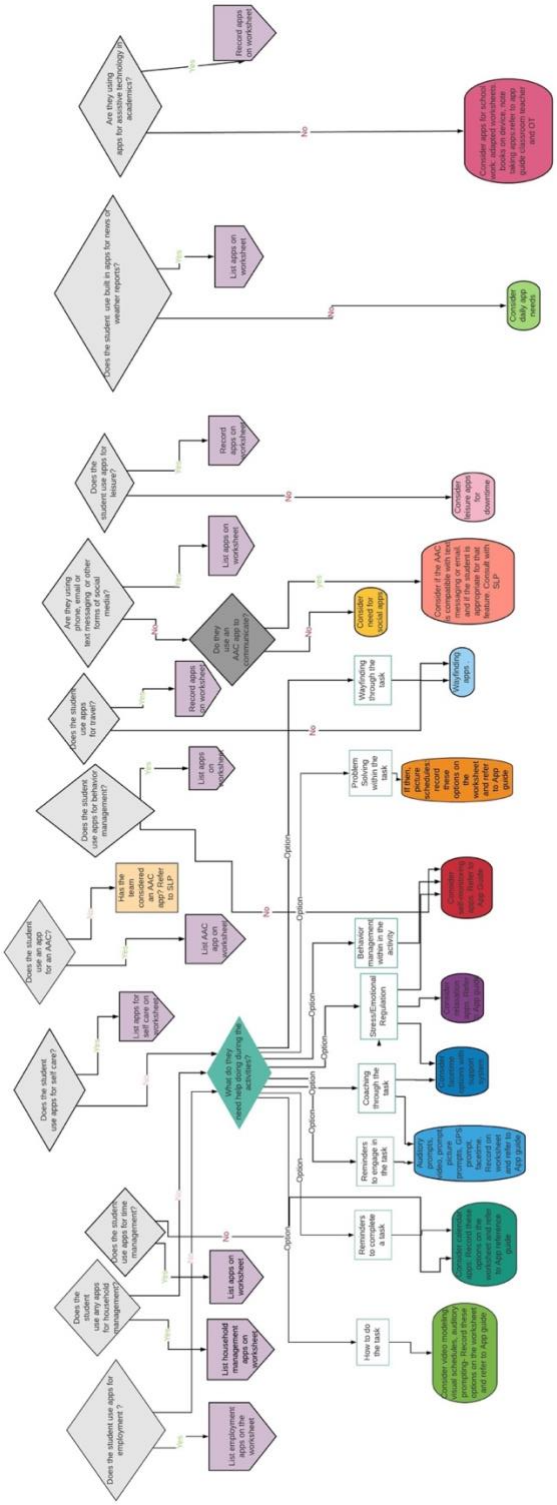
(AOTA, 2014; AOTA, 2015; AOTA 2018; Crabtree, 2014). In addition, learning to navigate and operate the device in order to be an independent AT user would fall under occupational therapy's domain as part of AT management, according to the *Occupational Therapy Practice Framework* (AOTA, 2014). Therefore, occupational therapists will be targeted as the primary audience when these knowledge tools are disseminated. Occupational therapists can become ambassadors and advocates to implement better practices and procedures in schools for transition age students with ASD who use mobile devices.

Recommended procedures include involving all team members in the customization, evaluation and implementation of mobile devices, in order to adhere to best practices of AT implementation (Cook & Polger, 2015; Zabala et al., 2000). The proposed knowledge tools will provide teams with a method to collaborate, conduct evaluations, and implement mobile devices. However, these knowledge tools are still in their initial stages of development and must undergo program evaluations that will measure their perceived usefulness and effectiveness with producing the expected outcomes. The process to pilot the implementation in a private school in an urban area will require time and money. It is expected that the pilot implementation and evaluation could cost $34,231.83 in the first two years. Although, the cost is high, the potential benefits for students with ASD who are leaving the school system are great. Additionally, trialing these knowledge tools will provide professionals with more information about best approaches to using this new technology, allow them to adhere to federal law by integrating AT into student's IEPs and transition plans, and lay the groundwork for future

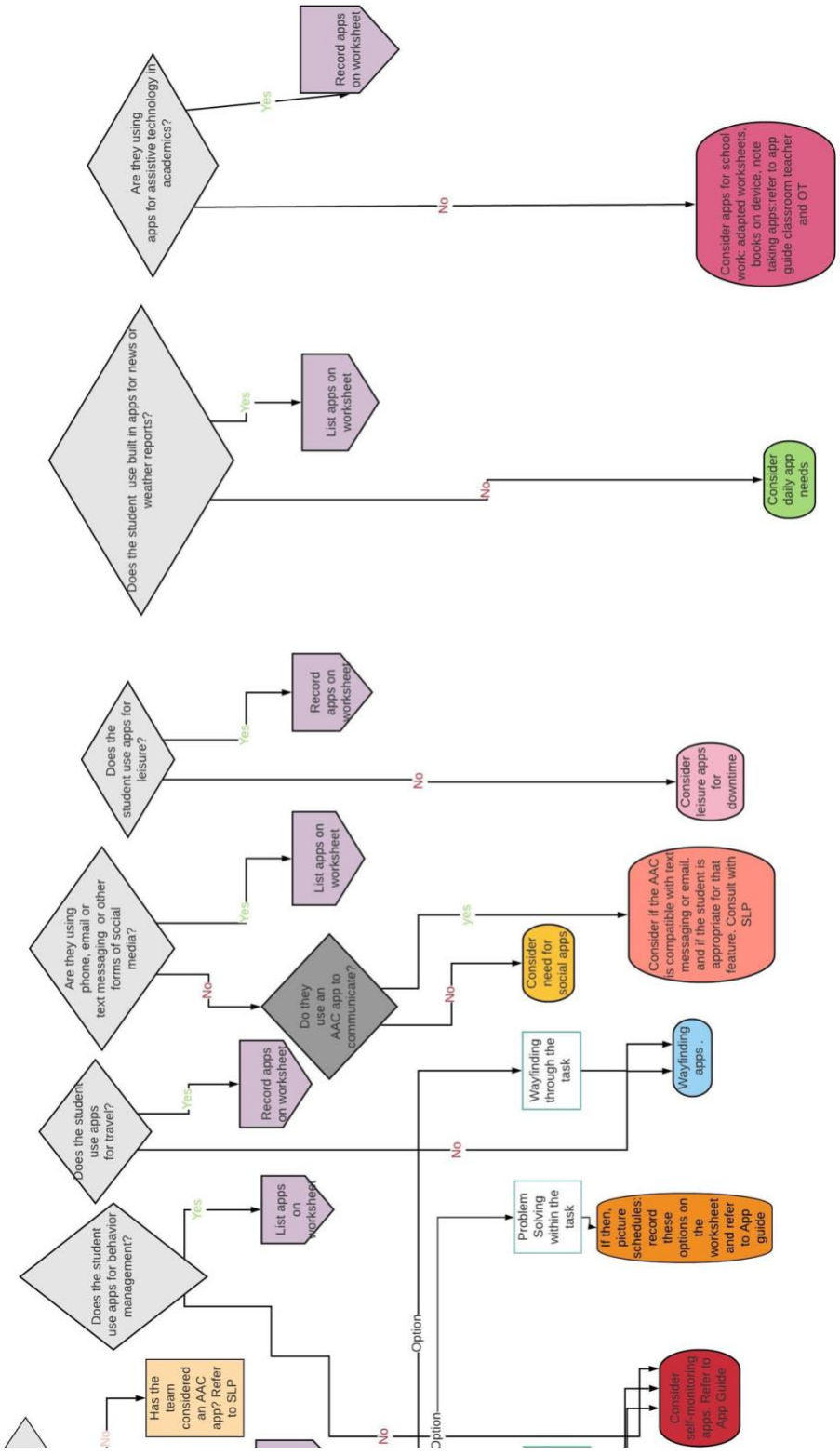
research and program implementation that will further improve outcomes for students with autism spectrum disorder.

APPENDIX A: Flow Chart

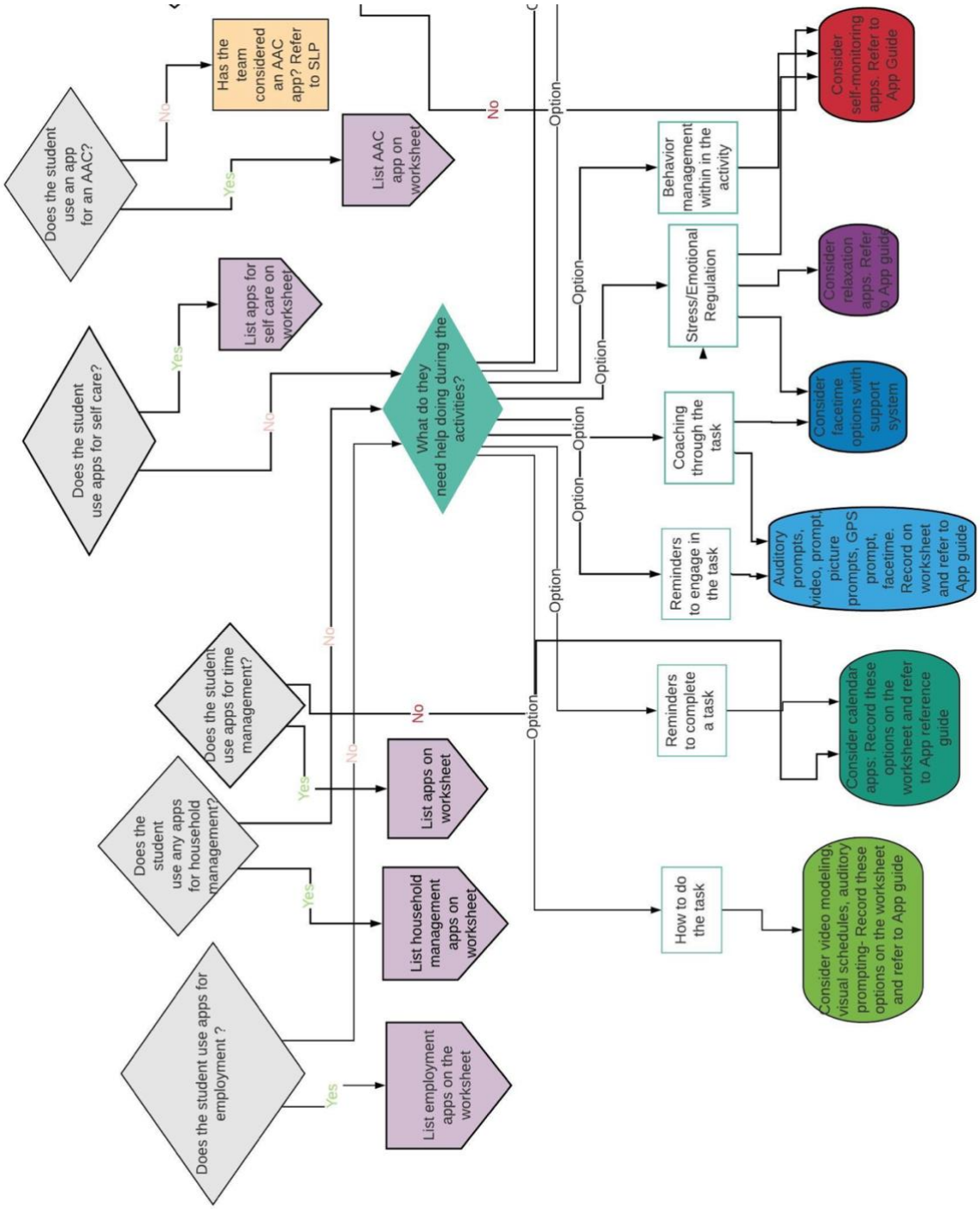
Flow Chart Zoomed Out



Left Section of Flow Chart



Right section of Flow Chart



APPENDIX B: Mobile Device Worksheet

Mobile Device Worksheet

Student Name:
Team Members Involved:

SECTION 1: History

Apps currently used:

App Name:	**Purpose/Transition Need**	**Is this app still appropriate for the student?**	
		Y/N	Date Assessed

SECTION 2: Student Considerations

Fine motor: Can the student on a touch screen?

- Swipe
- Click to access icons
- Pinch to zoom

Can the student perform the following on the home button?

- Click once
- Click three times to activate other menus

Can the student press the volume buttons? Y/N
Can the student press the power switch? Y/N

Has the team considered alternatives to accessing the screen (e.g. eye gaze, stylus, voice access) ? List options:

_____

Vision: Consider the student's hearing performance and needed settings:

Does the student's performance improve with any of these options? Check of all suggestions that help student

- Larger Icons
- Icons placed further apart
- Use of Contrast
- Size of text

Reading: Consider the student's reading ability

Does the student read? _____

At what reading level should text prompts be written?

Hearing: Consider the student's hearing performance and needed settings:
Does the student's performance improve with any of these options? Check off all suggestions that help student

- Text in Apps
- Pictures in Apps
- LED Flash for Alerts
- Captioning on videos when available

Does the student require the iPad/iPhone to be paired to a hearing device? y/n

Preferred prompting: Consider the type of prompting the student requires to complete tasks

- Picture
  - Clipart
  - Pictogram
  - Real Images
- Auditory
- Text
- Video Modeling
  - Video chunking/prompting
  - Whole Video Modeling
  - Point of View
  - 3rd person
  - Self
- Visual Notifications (LED Flash)
- Location/GPS prompt
- Combinations of notifications- List combinations needed below:

Cognition: Consider the student's cognition with regard to switching between apps
Can the student switch attention to multiple apps? Y/N
Can the student determine which app to use for certain functions? Y/N

Section 3: Matching App to Student
***Refer to app characteristics worksheet to fill out chart. If app is missing from chart, trial it to determine the characteristics.**

Transition Need	App considered	App Characteristics	Student Skills	Do they match?
EXAMPLE: Time Management	Calendar (built in to iPad)	-Vibration alert set -Color coding for events -Location services to prompt when to leave based on traffic conditions -Displays text requiring reading	Reads, needs prompting to transition, can hear but does better with tactile prompts	Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No

Section 4: Device Consideration

Does the student have a preference for a device? _____
What devices has the student used before?

Does the student's fine motor and vision skills impact the device needed?

Do the types of transition activities require a certain device?

Have different device sizes been trialed? What were the results?

Device Chosen:

Device Name/model	Why was the device chosen?

Section 5: Additional Hardware

*refer back to this section after completing observation

- ☐ Stand
- ☐ Case
- ☐ Strap
- ☐ External Portable Speaker
- ☐ Battery Charger
- ☐ Headphones
- ☐ Other:

Section 6: Apps to be installed on Device
***Gentry et al. (2015) and Gentry (2015) recommend 4 to 5 apps on a device**

1. _____

2. _____

3. _____

4. _____

5. _____

Section 8: Timeline and Criteria to install apps

*Based on transition need priority and student's cognition

App	Date to be Implemented	Criteria to Install Additional App

Section 9: Operational, Strategic, Social Competence Skills to be addressed in transition plan

*****Section should be completed after performance assessment

Student:

- ☐ Learns to adjust volume
- ☐ Turns on device
- ☐ Manages battery power
- ☐ Navigate to different apps
- ☐ Adjust brightness of screen
- ☐ Maintenance of device

Plan to address competency skills (list if student will be taught or designated person, and needed training):

Competency Skill	Student or Designated Person (List who)	Training Plan

Section 10: Training Needs
***consider both school-based professionals, student, parents, family members and outside agencies**

Who needs to be trained?	Components of training? App specifics, operational competence, device in functional context	Who will train?	Training Dates
			Initial training date: Follow up training date:

Section 11: Post-secondary Action Plan for Funding and Maintenance of the Device

How will the device be funded post-graduation?

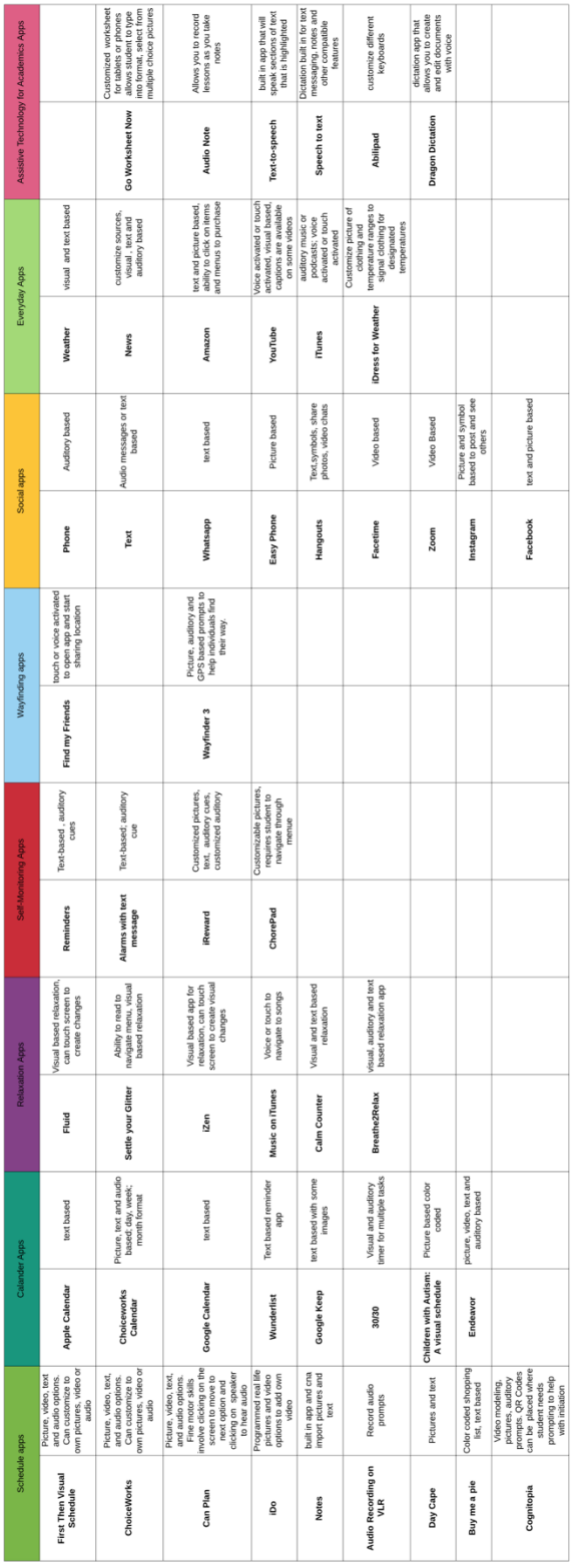
- **Privately**
- **Insurance**
- **Medicaid Waiver**
- **Vocational Rehabilitation Services**

Who will be in charge of the maintenance of the device?

Contact information for device repair:

Name:
Organization/Employer:
Phone Number:
Email Address:
Comments about any available funding for future repairs:

APPENDIX C: App Suggestion Chart



Schedule apps		Calender Apps		Relaxation Apps		Self-Monitoring Apps			Wayfinding apps		Social apps		Everyday Apps		Assistive Technology for Academics Apps		
First Then Visual Schedule	Picture, video, text and audio options. Can customize to own pictures, video or audio	**Apple Calendar**	text based	**Fluid**	Visual based relaxation, can touch screen to create changes	**Reminders**	Text-based , auditory cues		**Find my Friends**	touch or voice activated to open app and start sharing location	**Phone**	Auditory based	**Weather**	visual and text based			
ChoiceWorks	Picture , video, text, and audio options. Can customize to own pictures, video or audio	**Choiceworks Calendar**	Picture, text and audio based, daily, week, month format	**Settle your Glitter**	*Ability to read to navigate menu*, visual based relaxation	**Alarms with text message**	Text-based, auditory cue				**Text**	Audio messages or text based	**News**	customize sources, visual, text and auditory based	**Go Worksheet Now**	Customized worksheet for tablets or phones allows students to type into format, select from multiple choice pictures
Can Plan	Picture, video, text, and audio options. Fine motor skills involve clicking on the screen in order to next option and clicking on speaker to hear audio	**Google Calendar**	text based	**iZen**	Visual based app for relaxation, can touch screen to create visual changes	**iReward**	Customized pictures, text, auditory cues, customized auditory	**Wayfinder 3**	Picture, auditory and GPS based prompts to help individuals find their way		**Whatsapp**	text based	**Amazon**	text and picture based, ability to click on items and menus to purchase	**Audio Note**	Allows you to record lessons as you take notes
iDo	Programmed real life pictures and videos options to add own video	**Wunderlist**	Text based reminder app	**Music on iTunes**	Voice or touch to navigate to songs	**ChorePad**	Customizable pictures, menus, text to navigate through menue				**Easy Phone**	Picture based	**YouTube**	Voice activated or touch, videos and visual based captions are available on some videos	**Text-to-speech**	built in app that will speak sections of text that is highlighted
Notes	built in app and cna import pictures and text	**Google Keep**	text based with some images	**Calm Counter**	Visual and text based relaxation						**Hangouts**	Text,symbols, share photos, video chats	**iTunes**	auditory music or podcasts, voice activated or touch activated	**Speech to text**	Dictation built in for text messaging, notes and other compatible features
Audio Recording on VLR	Record audio prompts	**3020**	Visual and auditory timer for multiple tasks	**Breathe2Relax**	visual, auditory and text based relaxation app						**Facetime**	Video based	**iDress for Weather**	Customize picture of clothing and temperature ranges to signal clothing for different temperatures	**Abilipad**	customize different keyboards
Day Cape	Pictures and text	**Children with Autism: A visual schedule**	Picture based color coded								**Zoom**	Video Based			**Dragon Dictation**	dictation app that allows you to create and edit documents with voice
Buy me a pie	Color coded shopping list, text based	**Endeavor**	picture, video, text and auditory based								**Instagram**	Picture and symbol based to post and see others				
Cognitopia	Video modeling, pictures, auditory prompts, Choices can be placed where student needs prompting to help with initiation										**Facebook**	text and picture based				

APPENDIX D: Sample Task Analyses

Grocery Store Task Analysis

Student Name: **Date:**
Device Used: Mini iPad
Apps Needed: First Then Visual Schedule, TouchChat
Environment/Context: D'Agostinos on Columbus Avenue and 91st street; mid-day, not crowded
Social Context: Cashier, other customers

Steps	Level of Prompting Independent (I) Verbal (V) Gestural (G) Model (M) Physical Assistance (PA)	Comments about step: List environment factors that affect performance?
Taps First Then Visual Schedule to open app	I V G M PA	
Touches first picture (shopping basket) on First Then Visual Schedule to activate auditory cue	I V G M PA	
Gets shopping basket	I V G M PA	
Taps checkbox next to picture of shopping basket on First Then Schedule	I V G M PA	
Taps second picture (banana) First Then Visual Schedule to activate auditory cue	I V G M PA	
Locates banana in produce section	I V G M PA	
Taps checkbox next to picture of banana on First Then Visual Schedule	I V G M PA	
Taps third picture (yogurt) on First Then Visual Schedule to activate auditory cue	I V G M PA	
Locates yogurt in dairy section	I V G M PA	

Taps checkbox next to picture of yogurt on First Then Visual Schedule	I V G M PA	
Taps fourth picture (granola) on First Then Visual Schedule to activate auditory cue	I V G M PA	
Locates granola in cereal section	I V G M PA	
Taps checkbox next to picture of granola on First Then Visual Schedule	I V G M PA	
Taps fifth picture (cashier) on First Then Visual Schedule to activate video modeling cue	I V G M PA	
Watches video of person using a debit card to purchase items	I V G M PA	
Locates cashier	I V G M PA	
Waits in line appropriately	I V G M PA	
Places items on belt	I V G M PA	
Closes First Then Visual Schedule using the home button	I V G M PA	
Taps TouchChat to open app	I V G M PA	
Navigates to greetings folder	I V G M PA	
Taps “hi”	I V G M PA	
Purchases items using debit card	I V G M PA	
Bags items to avoid crushing items	I V G M PA	
Navigates to comments folder on Touch Chat	I V G M PA	
Taps “Thank you”	I V G M PA	
Takes bags	I V G M PA	

Meal Prep at Home

Student Name: **Date:**
Device used: iPad
Apps used: CanPlan, ChoiceWorks Calendar
Environment/Context: Home Kitchen, afternoon 3:30pm
Social Context: 2 younger siblings and dad come in and out of kitchen during task

Steps	Level of Prompting Independent (I) Verbal (V) Gestural (G) Model (M) Physical Assistance (PA)	Comments about step: List environmental factors that affect performance?
Taps Choiceworks Calendar notification upon alarm	I V G M PA	
Taps Day format at top of screen on Choiceworks Calendar	I V G M PA	
Taps picture of prepare breakfast to activate auditory cue	I V G M PA	
Presses home button to close Choiceworks Calendar	I V G M PA	
Navigates to CanPlan app	I V G M PA	
Taps breakfast meal prep visual schedule	I V G M PA	
Taps image to activate video prompt of person gathering bowl, cutting board, knife, fork and spoon	I V G M PA	
Watches video	I V G M PA	
Gathers bowl, cutting board, knife, fork and spoon	I V G M PA	
Swipes to next image	I V G M PA	
Swipes to next image	I V G M PA	
Taps image to activate video prompt of person opening yogurt and spooning into bowl	I V G M PA	
Watches video prompt	I V G M PA	
Opens yogurt	I V G M PA	

Spoons yogurt into bowl	I V G M PA	
Swipes to next image	I V G M PA	
Taps image to activate video prompt of person peeling banana, placing it on cutting board, and slicing it	I V G M PA	
Peels banana	I V G M PA	
Places it on cutting board	I V G M PA	
Pierces banana with fork	I V G M PA	
Slices banana with knife	I V G M PA	
Swipes to next image	I V G M PA	
Taps image to activate video prompt of person opening granola and pouring it into bowl with yogurt and placing banana slices on top	I V G M PA	
Opens granola	I V G M PA	
Pours granola into bowl of yogurt	I V G M PA	
Places banana slices on top	I V G M PA	
Swipes to next image	I V G M PA	
Taps image to activate video prompt of person gathering cutting board, knife, and fork and placing it into sink	I V G M PA	
Gathers cutting board, knife and fork	I V G M PA	
Places it into sink	I V G M PA	
Swipes to next image	I V G M PA	
Taps speaker button to activate auditory cue “Eat breakfast” paired	I V G M PA	

with picture of student eating breakfast		
Sits at table	I V G M PA	
Eats breakfast	I V G M PA	
Taps Choiceworks Calendar notification upon alarm and visual prompt to open choiceworks	I V G M PA	
Swipes image over to crosses off eating breakfast on Choiceworks Calendar	I V G M PA	
Taps next image on calendar to activate auditory cue “get bag”	I V G M PA	

Internship

Student Name: SAMPLE **Date:**
Device Used: iPad
Apps Needed: Notes, Calendar, Notes, Proloquo2Go, Clock
Environment/Context: Street to walk to office, office at local school located 2 blocks away, morning 10am
Social Context Internship supervisor, job coach, school personnel, students at school

Task Steps	Level of Prompting Independent (I) Verbal (V) Gestural (G) Model (M) Physical Assistance (PA)	Comments about step: List environmental factors that affect performance?
Taps notification from calendar for internship event	I V G M PA	
Walks to office with job coach	I V G M PA	
Opens Proloquo2go	I V G M PA	
Opens greeting folder to say "hi" to internship supervisor	I V G M PA	
Opens questions folder to ask supervisor "what do you need today?"	I V G M PA	
Listens to the two tasks (shredding for 15 minutes and copying bin) listed by supervisor	I V G M PA	
Opens Notes app	I V G M PA	
Type in shredding 15 minutes	I V G M PA	
Types in copying bin	I V G M PA	
Gets shredding bin	I V G M PA	
Goes to shredder	I V G M PA	
Opens clock app	I V G M PA	
Taps timer feature	I V G M PA	
Slides to set timer to 15 minutes	I V G M PA	
Shreds till timer goes off	I V G M PA	
Turns off timer	I V G M PA	
Returns shredding bin	I V G M PA	
Opens Notes	I V G M PA	
Checks off shredding task	I V G M PA	
Goes to "To copy" bin	I V G M PA	
Gets first sheet	I V G M PA	
Takes off post-it note of # of copies	I V G M PA	
Makes designated number of copies	I V G M PA	

Repeats until items in bin are finished	I V G M PA	
Puts copies in “Pick-up Copy” bin	I V G M PA	
Puts “To Copy” Bin back	I V G M PA	
Check off Copy task	I V G M PA	
Goes to school office	I V G M PA	
Opens Proloquo2 go	I V G M PA	
Taps comment folder to open	I V G M PA	
Says “I’m finished” to internship supervisor	I V G M PA	
Responds to internship supervisor with appropriate greeting “Bye” or “See you soon”	I V G M PA	
Opens calendar to see next event	I V G M PA	

APPENDIX E: Observation Checklist

Observation Checklist

Directions: Fill out checklist in the same setting where the three task analyses were completed. Record all decisions on mobile device worksheet

Student Name:
Environment:
Time of Day:
People student interacted with:

Operational and Social Competence:

Is the volume appropriate for the setting? Y/N

- Does the student adjust the volume as needed for the setting?

Options:

- portable speaker
- headphones to hear auditory cues on mobile device

Can the student turn on the device? Y/N

Options:

- Implement plan to teach
- Designate person

Is the mobile device sufficiently charged for the activity? Y/N

Options:

- Backup battery charger;
- Teach recognizing low battery and plugging in device
- Designating point person to charge device

Does the student adjust the brightness of the screen when navigating through the environment? Y/N

Options:

- Implement plan to teach this skill
- Turn on Auto-Brightness on accessibility settings

Device considerations:

Can the student hear the notifications? Y/N

What volume level should the device be on so the student will hear notifications?

Options:

- External speaker
- Combine with alternative prompting (auditory, visual and/or tactile)

Can the student see the notifications? Y/N

Options:

- Enlarge font and size on Accessibility Settings
- Combine with alternative prompting (e.g. sound, vibration)

Navigation:

Can the student navigate to the different apps for the task? Y/N
Can they press the home button to close an app? Y/N/NA
Can they open apps by scanning pages and tapping app? Y/N

Options:

- rearrange apps closer together on the home screen to facilitate
- categorize into different folders for different tasks
- Consider reducing number of apps on mobile device
- On-screen home button

Carrying Device:

Student's neck position when using the device

Wrist:
Hand (include if the student uses one or two hands to operate device):
Fingers:
Shoulders:

On average, how long is the student looking at the device to complete the task?

Options:

- Strap
- Case
- Blue light glasses
- Screen protector

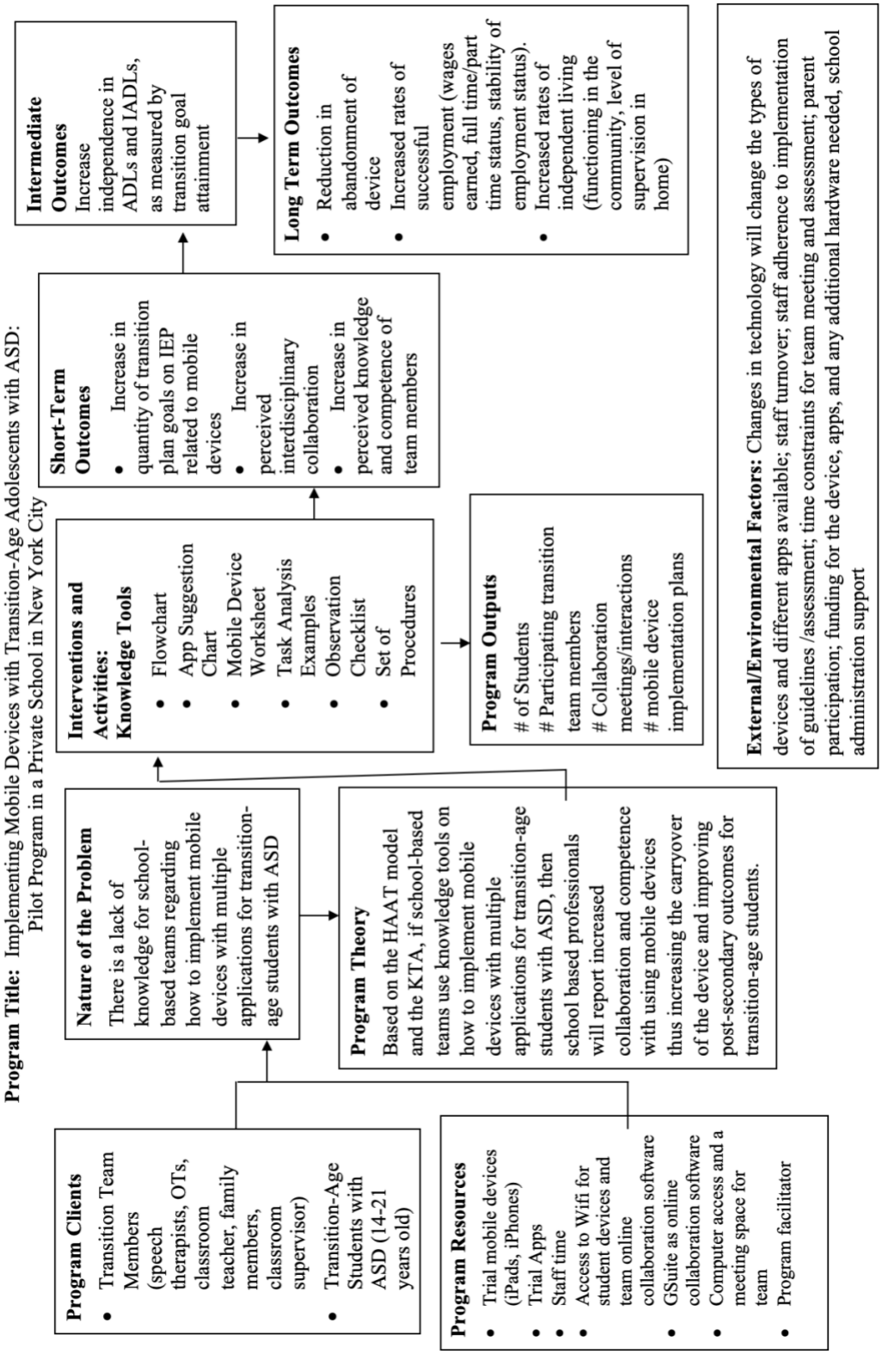
Maintenance:

Does the student know who to go to if something is not working on their mobile device in this setting? Y/N
Does the student have a back-up AT for this setting? Y/N

Options:

- Set up action plan in place for device maintenance: List point person, device manufacturer and back up AT plan.

APPENDIX F: Logic Model



EXECUTIVE SUMMARY

Executive Summary

Introduction

An estimated 50,000 American teenagers with autism spectrum disorder (ASD), a lifelong developmental disability, enter adulthood each year (Roux, Shattuck, Rast, Rava, & Anderson, 2015). These young adults with ASD are less likely to enter post- secondary education, have gainful employment, live independently, and engage in social situations than their peers with other types of disabilities (Roux, et al., 2015; Wei, Wagner, Hudson, Yu & Shattuck, 2015). There is a need for interventions that address some of the factors, such as cognitive and communication deficits, behavioral challenges and difficulties with activities of daily living (ADLs) and instrumental activities of daily living (IADLs) that influence these outcomes for young adults with ASD. It is especially important to implement transition plans and activities that support these young individuals as they age out of the school system, considering their poor outcomes and the lack of therapeutic services and support for adults with ASD (Hendricks & Wehman, 2009; Roux et al., 2015; Shattuck et al., 2012).

Software applications on mobile devices, such as smartphones and tablets, are types of assistive technology (AT) that may help increase the ability of individuals with ASD to function independently and reduce their need for support from teachers, therapists, or job coaches (Gentry, Kriner, Sima, McDonough, & Wehman, 2015; Kim & Kimm, 2017;Odom et al., 2015; Walsh, Holloway, McCoy, & Lydon, 2017). Mobile devices are any computing device that can be held in one hand or worn on the body

(Ayres, Shepley, Douglas, Shepley & Lane, 2016). Applications, commonly referred to as apps, are the software programs either built in or added to a mobile device that help a user perform functions or tasks

Apps have been used to assist individuals with ASD in improving their independence in vocational settings (Gentry et al., 2015); grocery shopping (Douglas, Ayres & Langone, 2015); meal preparation and leisure skills (Bereznak, Ayres, Mechling, & Alexander, 2012; Kagohara, et al., 2011; Kellems & Morningstar, 2012; Smith, Ayres, Alexander, Shepley & Shepley, 2016; Wu, Cannella-Malone, Wheaton, & Tullis, 2016). In addition, apps such as Proloquo2go™, which is an alternative and augmentative communication app can be used as a speech generating device, addressing communication deficits (Achmadi, et al., 2012; Alzrayer, Banda, & Koul, 2017; King et al., 2014). In addition, the customization of mobile devices, specifically the accessibility features, as well as their ubiquitous use make them appealing to young adult users (McMahon & Walker, 2014).

However, without clear guidelines for implementation of such AT or proper training for the student and their team, it can lead to misuse of the device, lack of carryover, or an unawareness by the education team for its potential as a useful tool in the transition process (Bowser & Reed, 2012; Zabala, 2000). School-based professionals often report not having the training to implement technology, specifically mobile devices and apps (Ferdig, Pytash, Kosko, Gandolfi, & Matthews, 2016; Okolo & Diedrich, 2014). To further understand the support needs, a survey with a small population of school-based professionals who work with transition-age students with ASD, was conducted by

this author. The majority of professionals surveyed reported not having guidelines or formal assessment procedures for implementing mobile devices.

There is currently a lack of research on mobile devices with multiple apps as most research examines one app at a time (Gentry, 2015). Additionally, research has not addressed the navigation and usage within a chosen device (Cullen & Alber-Morgan 2015). This is partly due to the fast pace of technology innovation, often leading to a lag in research (More & Travers, 2013; Schmidt, Lin, Paek, MacSuga-Gage & Gage, 2017). However, multiple apps are most likely being used on one device. A marketing agency has found that mobile device users access an average of nine apps per day (App Annie, 2017). There is also potential to use multiple apps together to target different areas of support for young adults with ASD. For example, an AAC app, such as Proloquo2go could help a student to communicate with the cashier, a schedule app, such as First Then Visual Schedule, could be used for a picture-based grocery list, and a relaxation app , such as Breathe2Relax could lead the student through a deep breathing exercise if they are feeling overwhelmed in the grocery store. Therefore, there is a need to assist school-based teams in how to implement this novel technology with transition-age students.

Project Overview

In order to assist school-based teams in implementing mobile devices with multiple apps with transition-age students, a set of guiding documents were developed. The Knowledge to Action (KTA) framework by Graham et al. (2006) suggests the creation of knowledge tools and products, such as guidelines and decision aids to increase access to knowledge for professionals. The goal in creating these knowledge tools is to

make the research available on mobile devices more useful to school-based teams.

In order to design the knowledge products and tools, the Human Activity Assistive Technology (HAAT) model by Cook and Hussey was used (Cook & Polger, 2014). Since, mobile devices are used as assistive technology for the transition-age population, it is important to consider how assistive technology theories, frameworks and models recommend practitioners implement technology. The HAAT model recommends teams use a collaborative process that considers the human (student), the activities (transition goals), the context where they will be performing these activities (post-secondary environments), and the interaction of the assistive technology (applications, mobile device) with each of these factors, in order to avoid misuse or abandonment of the device (Cook & Polger, 2015).

In addition to these frameworks and theories, an extensive literature search was conducted on the use of apps with individuals with ASD, the use of multiple apps on a mobile device for individuals with ASD, and research on assistive technology implementation. Using the literature, clinical observations, and discussions with other professionals, a set of knowledge tools were designed. The knowledge tools consist of a flowchart, worksheet with guiding questions, and a chart of app suggestions. These tools aim to increase professionals' competence and awareness on how to match the device and apps to the transition-age students. School-based teams also need a way to assess how the student navigates and uses the mobile device with multiple apps in their environments and context. Therefore, an observation checklist was developed, and examples of task analyses were created to help a school-based team member assess the student's ability to

operate and navigate the device.

Core Components of Implementing a Mobile Device with Transition-Age Students

Interdisciplinary collaboration. Research on assistive technology and transition planning has found that using a collaborative team approach can improve AT outcomes, as well as transition outcomes for students with disabilities (Anderson, et al., 2018; Copley & Ziviani, 2007; Watson, Ito, Smith, & Andersen, 2010 Lubbers & Mcgorray, 2015; Okolo & Diedrich, 2014; Watson, Ito, Smith, & Andersen, 2010). Due to the apps covering different practice areas, it is important to incorporate the viewpoints of multiple professionals in the customization and implementation process of mobile devices. Therefore, the knowledge tools are designed to be used with online collaboration software in order to increase the accessibility and ability for team members to input data asynchronously. The recommended members of the team include parents, teachers, school administrators, speech language pathologists, occupational therapists, behavioral consultants, representatives from outside vocational agencies, and the student. A facilitator, a member of the team with AT knowledge, is also recommended to follow up with team members, coordinate meetings, and ensure the documentation and assessments have been conducted. The use of a facilitator has been found to improve AT outcomes and goal attainment with children with disabilities (Watson et al., 2010).

Matching device to student and performance assessment. School-based teams need a method for evaluating how transition-age students are using multiple apps on mobile devices, however performance assessments currently do not exist. The proposed knowledge tools consist of documents to systematically match the app and device

characteristics to the student profile. The examples of task analyses and an observation checklist provide team members with assessment strategies to determine if the student navigates between apps, operates the device, and adjusts settings such as the volume appropriately for each app and setting. Research on using mobile devices indicated that there are some musculoskeletal, vision and sleep issues that should be considered when using this technology (Ayaki, Hattori, Maruyama, Negishi, & Negishi, 2017; Kim, et al., 2016; Heo, et al., 2017; Young, Trudeau, Odell, Marinelli, Dennerlein, 2013). School-based teams who use the knowledge tools should be able to make the necessary recommendations for hardware and device modifications to reduce harm to the student when using these devices. The observation checklist helps team member's address and consider these concerns.

Transition plan incorporation. QIAT recommends that transition planning be individualized, and the team address specific equipment, maintenance, and funding issues (Behnke & Bower, 2010). These knowledge tools can help with identifying goals related to operating and navigating the device, establishing plans for support and maintenance of the device, as well as recognize additional areas of training needed for the student, family and staff members. This information should then be incorporated into the transition plan to help ensure carryover of the device to the student's post-secondary environment and increase the independence of the student.

General Conclusions

The cost and time required for implementing this program will be high as a variety of professionals are needed to implement this new procedure. In addition, the

hardware and software needed to create a lending library, salaries for a program facilitator and IT support specialist, as well as the software needed to evaluate the program can make the implementation a costly endeavor. It is estimated to be $31,132.83 in the first two years. However, using a planned team approach when implementing mobile devices with multiple apps, according to assistive technology frameworks is a factor in achieving better outcomes for students. Expected outcomes for implementing the knowledge tools include increased perceived competence by professionals, collaboration with team members, achievement of transition goals for students with ASD, and eventually a measurement of post-secondary outcomes and carry-over of the device post-graduation.

It is important to note that the knowledge tools were created to be piloted in a private school in an urban area with students with ASD and a co-morbidity of intellectual disabilities. These knowledge tools still need to undergo evaluation in order to understand their potential to change school-based practices and outcomes for students with ASD. Following this evaluation, the knowledge tools will be revised and disseminated to other school-based practitioners. Although the project is in the initial stages, the information and findings gained from the research, as well as the gaps in the literature will hopefully ignite a larger discussion about best practices when implementing mobile devices with transition-age students with ASD and a further examination of current school-based practices

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FACT SHEET

BOSTON UNIVERSITY

A Team Approach to Mobile Device Implementation for Transition-age Students with Autism Spectrum Disorder (ASD)

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OTD Candidate

Introduction to the Problem

- Young adults with ASD are less likely to enter post- secondary education, have gainful employment, live independently, and engage in social situations than their peers with other types of disabilities (Roux, et al., 2015).
- Transition plans and activities that support these young individuals as they age out of the school system are important, considering their poor outcomes and lack of therapeutic services and support for adults with ASD (Hendricks & Wehman, 2009; Roux et al., 2015).
- Software applications on mobile devices, such as smartphones and tablets, are types of assistive technology (AT) that may help increase the ability of individuals with ASD to function independently and reduce their need for support from teachers, therapists, or job coaches (Gentry, Kriner, Sima, McDonough, & Wehman, 2015; Kim & Kimm, 2017; Walsh, Holloway, McCoy, & Lydon, 2017).
- School-based professionals often report not having the training to implement technology (Ferdig, Pytash, Kosko, Gandolfi, & Matthews, 2016; Okolo & Diedrich, 2014).
- Due to the rapid change in technology, research often lags behind, and contributes to professionals' difficulties with implementation.
- There is a need for guidelines and procedures that makes implementing mobile devices easier for school-based teams and helps to ensure carryover of the device by the student post-graduation.

Theoretical Basis of Doctoral Project

- The Knowledge to Action (KTA) framework by Graham et al. (2006) suggests the creation of knowledge tools and products, such as guidelines and decision aids to increase access to knowledge for professionals. The goal in creating these knowledge tools is to make the research available on mobile devices more useful to school-based teams.
- In order to design the knowledge products and tools, the Human Activity Assistive Technology (HAAT) model by Cook and Hussey was used (Cook & Polger, 2015).
- The anticipated expenses for implementing and evaluating the program for the first two years are $31,132.83

Components of Doctoral Project

- **Interdisciplinary Collaboration:** Apps cover different practice areas. It is important to incorporate the viewpoints of multiple professionals in the customization and implementation process of mobile devices.
- **Matching device to student:** The proposed knowledge tools consists of online documents to match the app and device characteristics to the student's profile.

Morillo, C. (n.d.)

- **Performance assessment:** Examples of task analyses and an observation checklist provide team members with assessment strategies to determine if the student navigates between apps, operates the device, and adjusts settings, as well as addressing ergonomic issues that might arise from using this type of technology.

- **Transition plan incorporation:** These knowledge tools can help with identifying goals related to operating and navigating the device, establishing plans for support and maintenance of the device, as well as recognize additional areas of training needed for the student, family and staff members.

Expected Outcomes

- Increased perceived competence by school professionals
- Increased collaboration with team members
- Achievement of transition goals for students
- Carry-over of the device post-graduation

https://www.pexels.com/photo/photography-of-people-using-ipad-1430118/

Impact on Future Occupational Therapy Practice

- Occupational therapists have the activity analysis, observation and client matching skills, as well as the educational background and clinical experience to evaluate, provide and recommend assistive technology, such as mobile devices, to improve functional ability.
- School based occupational therapy practitioners are members of the transition team who can use these tools and guidelines to help establish similar practices in their school setting.

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