Literature Review

Utilizing Handheld Devices in the Education of Students with Special Needs

Edward A. Hoisington

Spring 2012

Lynchburg College

According to the American Psychiatric Association (APA), “Autism Spectrum Disorders (ASD) are a range of complex developmental disorders that can cause problems with thinking, feeling, language, and the ability to relate to others” (APA, 2011). Within ASD is a continuum of disorders with varying levels of intelligence and severity of symptoms (Conroy, Stichter, & Gage, 2011). At one end of the continuum are individual diagnosed with labels such as Pervasive Developmental Disorder – Not Otherwise Specified (PDD-NOS), Asperger Syndrome (AS), or High Functioning Autism (Conroy et al., 2011). Individuals at this end of the spectrum tend to have average to above average intelligence and display sophisticated forms and levels of verbal communication. Those at the other end of the spectrum tend to display the overall symptoms of ASD and exhibit below to average intelligence. Individuals at this end of the spectrum tend to also have more limited language and communication skills (Conroy et al., 2011).

Autism has garnered more attention recently then it has in previous decades. Prior to the 1990 reauthorization of the Individuals with Disabilities Education Act (IDEA), children and youth diagnosed with ASD were less common (Conroy et al., 2011). It was in this reauthorization of IDEA that Autism became an educational category and since has rapidly influenced new medical finding and educational strategies. According to the Centers for Disease Control and Prevention (CDC) estimates, 1 in 88 American children have been identified with an ASD. Boys are five time more likely to be diagnosed with an ASD than girls—1 in 5 for boys; 1 in 253 for girls (CDC, 2011). Conroy et al. (2011) found that even though there is not a consensus as to the causes for the increase in ASD diagnosis, several hypotheses have been posited: “changes in diagnostic criteria; increased awareness of ASD among parents, professionals, and the general public; a recognition that ASD can be dual-diagnosed with other

conditions, including cognitive disabilities and other psychiatric disorders; and the development of specialized services with greater access to these services" (p. 278).

Individuals diagnosed with ASD may face many challenges since many of the characteristics of ASD affect social interaction, communication, and behavior, specifically a tendency for repetitive behaviors (Autism Speaks, Inc., 2012). Many with ASD "have difficulty with memory, organization, planning, and goal direction" (Gentry, Wallace, Kvarfordt, & Lynch, 2010, p. 101). Moreover, individuals with ASD tend to be "resistant to environmental change or change in daily routines, and have unusual responses to sensory experiences" (G.P. Barnhill, personal communication, April 16, 2012). These characteristics profoundly affect the education of an individual with ASD. A tremendous amount of research is available with regards to the development gains and effective interventions (Conroy et al., 2011). Interventions, treatments, and methodologies are perhaps the "most challenging and contentious" issues that face the education of a student diagnosed with ASD (Simpson, Mundschenk, & Heflin, 2011, p.10). According to the National Autism Center (2012), interventions and treatments fall into one of the following categories: established, emerging, unestablished and ineffective/harmful. Modeling, scheduling, and self-management are just three interventions that are established and well documented (G.P. Barnhill, personal communication, April 16, 2012).

In recent years, technology has had a greater influence in the treatments and interventions of students with ASD. The purpose of this paper is to examine the literature with regards to the use of a personal digital assistant (PDA) or other handheld devices with student diagnosed with ASD. A PDA is "a handheld computer that mainly serves as a personal information organizer," it allows the user to input data through "an on-screen keyboard or handwriting recognition program using a stylus" (Ferguson, Myles, & Hagiwara, 2005, p. 60). PDAs and other handheld devices

have the capability to display pictures and play both audio and video clips. These features have been used with student with ASD as self-prompting tools especially with regards to video-modeling. Video-modeling is an intervention that "involves a student watching another person engaging in a target behavior or skill on a video and then performing the behavior or skill" (Cihak, Fahrenkrog, Ayres, & Smith, 2010, p. 103). The use of a PDA or other handheld device as a self-prompting tool by a person with ASD increases their independence while decreasing their reliance on prompt delivery by others. (Mechling, Gast, & Seid, 2009). PDAs or other handheld devices have also been used with students with ASD for maintaining schedules and self-management.

Literature Review

Mechling, L., Gast, D., & Seid, N. (2009). Using a personal digital assistant to increase independent task completion by students with Autism Spectrum Disorder. *Journal of Autism & Developmental Disorders, 39*(10), 1420-1434.

Mechling, Gast, and Seid (2009) posed the question as to whether students with Autism Spectrum Disorder (ASD) can independently use a Personal Digital Assistant (PDA) with picture, auditory, and video prompting options to cook a recipe. In their research, which was a replication of their 2008 study, Mechling et al. (2009) explained that students with ASD respond well to picture or video prompting in order to complete a task. This study focused on the use of a variety of prompts that the student can select, all of which are on the PDA. Students could look at just a photograph, look at a photograph and hear an auditory prompt, or watch a video clip with voice over directions on a PDA until they completed a step (Mechling et al., 2009, p. 1421). The student's cooking environment was actually represented in photographs and video clips

(Mechling et al., 2009). The authors addressed the following three questions: “Would a self-prompting PDA system using video, picture, and auditory prompt levels increase the percentage of steps of a multi-step task completed independently by students with ASD? Would students with ASD adjust their use of prompt levels when using the PDA? Which prompt levels would students most frequently chose to use?” (Mechling et al., 2009, p.1422).

The participants in this study were three male high school students ages 16 and 17 with a diagnosis of ASD. According to Mechling et al. (2009), the participants were screened for the following prerequisite skills through observation and interviews with a classroom teacher: “fine motor ability to use a touch screen or use a small 1/8 inch diameter stylus, visual ability to see video and photographs on a small 2 x 3 inch digital display, auditory ability to hear prompts delivered by the PDA using a head set; cognitive ability to recognize photographs and pictures, motor imitation, and ability to attend to video stimuli for approximately 30 seconds” (p. 1422). Moreover, students were screened for or taught the following skills prior to the start of the study: “operation of a digital kitchen timer; operation of electric stove dials, toaster oven, and microwave oven; use of oven mitts; stirring and pouring liquids; opening Ziploc style bags; opening a bread clip; opening and closing lift up and twist lids; cutting with scissors; operating a spray can; opening cheese slices; spreading with a knife; and use of a spatula” (Mechling et al., 2009, p. 1422). A few adaptations were required: “cut open packets with scissors rather than tearing them open, use of bread clip rather than a twist tie, placing some food items into Tupperware bowls, using pizza sauce in a squirt bottle, using oven mitts rather than pot holders, cuing students verbally or through video for the number of times to stir an time (i.e. “stir the mix 8 times—one, two, etc.), and using color coded measuring cups” (Mechling et al., 2009, p. 1422).

The setting for this study was the room in the high school used for cooking and general home living instruction (Mechling et al., 2009). A Cyrano Communicator TM (Hewlett Packard iPAQ Pocket PC with pre-installed software) was the PDA used in this study. The PDA had a digital touch screen that measured 2.25 x 3 inches, the device itself measured 3 x 4.5 inches (Mechling et al., 2009). Adult models unfamiliar to the student participants were used to produce videos. Steps in a recipe were recorded in video segments which were then imported into the PDA after editing (Mechling et al., 2009). Photographs of each step were converted to a file format compatible with the PDA and then imported. The PDA had a pre-installed template that divided the screen into three boxes—this allowed for students choose which of the prompts they wished to use: photograph, photograph with audio, or video clip with voice over.

A multiple probe design was used in this study across three sets of cooking recipes and replicated with three students (Mechling et al., 2009). Recipes were individually completed during one session per day. Baseline data were collected while all three students attempted to complete each of the three recipes without the use of the PDA. Criterion was met by each student when the student completed 100% of the steps correctly for three sessions. The order of the experimental conditions was as follows: “pre-training to learn the use of the PDA, cooking recipe probe without the PDA (three recipes), cooking with PDA prompting (first recipe), cooking probe without the PDA (three recipes), cooking with PDA prompting (second recipe), cooking probe with PDA (mastered recipe-maintenance), cooking probe without the PDA (two recipes) and so forth” (Mechling et al., 2009, p. 1424).

According to Mechling et al. (2009), their study shows “that a PDA with video, pictures, and audio prompts can serve as an effective self-prompting device to assist student with ASD in performing multi-step tasks” (p. 1429). In a review of the data, all three students showed

improvement with all three recipes once the PDA was introduced. Two of the students favored using the video with voice over and pictures with audio prompts for a majority of the study; however, both these students began to fade their use to the picture prompt as the sessions continued. The third student favored using video with voice over and faded to picture with audio prompt as the study progressed (Mechling et al., 2009). The students in this study maintained their skills, demonstrating high level of independent use of the PDA and could complete tasks over time (Mechling et al., 2009).

Mechling et al. (2009) discovered that a PDA could be used as a prompting tool to assist students with ASD to cook a recipe. The students in this study were able to use a PDA with video, pictures, and auditory prompts to perform multi-step tasks. This study demonstrates that persons with ASD could use the assistance of a handheld device as a prompting tool to perform everyday tasks. Even though this study showed students could be successful in using a PDA, the sample size of three male high school students may not translate to other populations.

Cihak, D., Fahrenkrog, C., Ayres, K. M., & Smith, C. (2010). The use of video modeling via a video iPod and a system of least prompts to improve transitional behaviors for students with Autism Spectrum Disorders in the general education classroom. *Journal of Positive Behavior Interventions, 12*(2), 103-115.

Cihak, Fahrenkrog, Ayres, and Smith (2010) explored “the effects of using video-modeling procedures by means of an iPod and the use of the system of least prompts in a general education classroom for students with ASD” (p. 105). Because most children with ASD struggle with change and have difficulty during transition periods, for example, changing classes in school, Cihak et al. (2010) specifically examined increasing independent transitions from place

to place for elementary students with ASD. In their study, Cihak et al. (2010) were successful in teaching students with ASD a new skill.

Four different elementary schools served as the location for this study in which four elementary students diagnosed with ASD were participants. Students were selected for participation based on the following: "an Individualized Education Program objective related to improving adaptive social behavior skills, difficulty with transitions, no hearing or vision impairments that might impede video instruction, agreement to participate in the study, and parental permission" (Cihak et al., 2010, p. 105). Modeling videos were created using a Sony 72X Digital Zoom camera and iMovie software for MacBook. A total of ten videos were created for each student showing a positive independent transitioning from place to place (Cihak et al., 2010). Videos clips were combined in a way that both "self-modeling and personal point-of-view modeling were used to show each student's transitioning" (Cihak et al., 2010, p. 107).

Each student participant exhibited difficulty transitioning independently. The following behaviors were of a concern: student one—physical aggression, defined as pinching and slapping others; student two—physical aggression, defined as pulling others' hair or slapping; student three—elopement, moving away from the group at least 10 feet; and student four—sitting on the floor (Cihak et al., 2010). The researchers of this study defined independent transition as "walking in the hallway with classmates from place to place without engaging in the targeted inappropriate behavior" (p. 107). Transitions were routine, all students in the classroom experienced these same transitions throughout the school day. Each of the four students engaged in 10 transitions on a daily basis.

Cihak et al. (2010) employed an ABAB experimental design to determine the value of video-modeling procedures using an iPod and student independent transitions. This study

consisted of five primary phases with a pretraining period: “baseline, handheld video-modeling procedures, no handheld video-modeling procedures, handheld video-modeling procedures reinstated, and maintenance phase” (p. 108). During the pretraining period, “students participated in activities to ensure they could attend to and perform the directions displayed in a video format” (Cihak et al., 2010, p. 108). The baseline phase consisted of the students transitioning place to place with data being recorded. If a student was unable to transition independently, it was recorded as assisted. It was in the handheld video-modeling procedures that students received an iPod after arriving at school on the school bus. Students were instructed to turn on the handheld and press the button to play the video. After watching the video, students walked to the designated location. Students were required to reach a criterion of 100% independent transitions without assistance for three consecutive sessions. Once students achieved 100% independent transitions for three consecutive sessions, the no handheld video-modeling procedure began resembling the baseline phase. This phase continued until “data were collected for a minimum of three sessions or when the mean of this phase returned to performances similar to the baseline phase” (Cihak et al., 2010, p. 108). Handhelds were reinstated during the handheld video-modeling reinstated phase. This phase resembled that of the previous handheld modeling phase. The maintenance phase occurred 9 weeks after the students met the criterion. Students did not view videos prior to transitioning during this phase (Cihak et al., 2010).

The data indicated that students demonstrated a limited ability to transition independently from place to place during the baseline phase. The mean of independent transitions for this phase was 7% (Cihak et al., 2010). During the handheld video-model phase, ascending trends in the data were observed and the mean percentage of independent transitions increased to 77% (Cihak et al., 2010). When the intervention was withdrawn, a descending trend was noted and the mean

percentage of independent transitions decreased to 36% (Cihak et al., 2010). Ascending trends were observed when handhelds were reinstated and the mean percentage of independent transitions increased to 88% (Cihak et al., 2010). During the maintenance phase, 9 weeks later, students maintained a mean of 98% of independent transitions (Cihak et al., 2010).

Cihak et al. (2009) found that students with ASD could use a PDA to assist with transitions from place to place. This study showed that students could successfully utilize an iPod as a self-prompting device; however, several limitations were noted. There were only four participants, all elementary age and all diagnosed with ASD. With a sample size of four students, it would be difficult to apply these finding to a larger group—further study would be necessary. The age of the participants and the diagnosis of ASD may also limit to whom these findings could be applied. Future research with older students of varying abilities is required.

Gentry, T., Wallace, J., Kvarfordt, C., & Lynch, K. (2010). Personal digital assistants as cognitive aids for high school students with autism: Results of a community-based trial. *Journal of Vocational Rehabilitation, 32*(2), 101-107.

In their community-based trial, Gentry, Wallace, Kvarfordt, and Lynch (2010) took a different approach regarding personal digital assistants and students with ASD. The purpose of the study was to examine the efficacy of PDAs as a task management tool in a sample of transition-age high school students with ASD. Participants in this quasi-experimental study that utilized a pre- and post-assessment designed were recruited through the use of “fliers posted in public high schools across the Commonwealth of Virginia” (Gentry et al., 2010, p. 102).

In order to participate, the volunteers needed to: “have a diagnosis of autism and a current Individualized Education Plan (IEP), be at least 14 years of age, attend a public high school in

the Commonwealth of Virginia, demonstrate sufficient dexterity to manipulate a stylus used to interact with the PDA, have functional vision and hearing, have a family member or caregiver willing to participate in the assessment element of the study, and have a working home personal computer for backup of PDA data" (Gentry et al., 2010, p. 102). This study was comprised of twenty-two participants—eighteen males and four females—ranging in age from fourteen to eighteen (mean age 16.5). As compensation, participants were able to keep the PDA at the conclusion of the study.

This study utilized two measurement tools: (1) the *Canadian Occupational Performance Measure* (COPM) and (2) the *Functional Assessment Tool for Cognitive Assistive Technology* (FATCAT). The COPM is "a semi-structured interview assessment that is used by occupational therapists" (Gentry et al., 2010, p. 102). This client-centered instrument allows participants to express their own area of need. In this study, each participant self-determined five areas of disability in everyday tasks. The FATCAT was designed to follow up with participants post-treatment. It was a questionnaire designed to assess participant satisfaction with the intervention. This tool also served as a checklist assessing how well participants utilized the handheld and how many entries were logged (Gentry et al., 2010).

According to Gentry et al. (2010), the intervention was conducted in the participants' homes which began with a one-on-one training. This study was conducted in a "stepwise fashion which was intended to provide repetition, reinforcement and ongoing facilitation as participants learned to use the PDA to assist in performing everyday life tasks" (p. 103). The intervention included the following: "a 90 minute study enrollment home visit by the study director, a 90 minute assessment visit, a 90 minute initial training visit, and three 60-minute follow-up training visits…all training was conducted over no less than ten days and no more than 14 days" (Gentry

et al., 2010, p. 103). Eight weeks after the conclusion of the study, a 90 minute post-intervention assessment was conducted. Throughout the study, students were encouraged to enter "appointments, medication schedules, homework assignments, chores, and any other items that could be written on a paper-based calendar" (Gentry et al., 2010, p. 103).

At the conclusion of this study, data for all twenty-two participants were entered into Predictive Analytics SoftWare 17 (PASW) and "statistical comparisons were conducted to determine if a significant change to COPM scores occurred" (Gentry et al., 2010, p. 104). A statistically significant improvement was noted in both the categories assessed—student performance and student satisfaction (Gentry et al., 2010). According to Gentry et al. (2010), eight weeks after the conclusion of the study, 18 participants (82%) were independently able to perform data entry tasks using the PDA. Two participants (9%) needed verbal cues, and two others (9%) were unable to perform use the PDA to enter tasks.

The findings of this study support the premise that PDAs can be used as a task management for high school students with ASD (Gentry et al., 2010). However, this study was limited by the selection process of the participants, the narrow representation of individuals with ASD, and the assessment measures. The study sample was not randomized; as noted, "volunteers were recruited with fliers posted in public high schools across the Commonwealth of Virginia" (Gentry et al., 2010, p. 102). This sample of participants did not represent the whole population of the ASD community—only a fragment of highly functioning individuals of high school age was represented. The measures utilized in this study were self-assessments. Participants and their parents rated both the student's performance and satisfaction with regards to the use of the PDA as a task management tool. Results of this study should be cautiously applied to other populations.

Ferguson, H., Myles, B., & Hagiwara, T. (2005). Using a personal digital assistant to enhance the independence of an adolescent with Asperger Syndrome. *Education and Training in Developmental Disabilities, 40*(1), 60-67.

Ferguson, Myles, and Hagiwara (2005) studied whether a "PDA could enhance the independence of an adolescent with Asperger syndrome (AS) at home and school" (p. 61). The main focus of their study was to see if they could shift a student's heavy reliance on prompts from his parents and teachers to complete daily activities to utilizing a PDA for self-prompting (Ferguson et al., 2005). The participant in this study was a 14 year old male completing his last year of public middle school. This student had an AS diagnosis made by a medical professional, and he had an IQ in the above average range; however, his grades in school were only average (Ferguson et al., 2005). The setting for this study was the student's math and social studies classes at his middle school as well as his home (Ferguson et al., 2005). Math for this student was in the resource room in a small group with two other students; social studies was held in a general education classroom with 20 other students (Ferguson et al., 2005). This study was completed over a 20 day period; however, data were only collected for 15 days at school due to the school year ending.

According to Ferguson et al. (2005), the *Behavior Assessment System for Children* (BASC) was administered to the student, his resource teacher, and his mother. The BASC is designed to pinpoint specific emotional and behavioral issues in order to plan effective treatment and intervention (Pearson Education, 2012). The student rated himself "at-risk" in anxiety and atypicality; all other areas fell within the average range. The resource teacher rated the student "at-risk" in attention problems and identified anxiety, atypicality, and withdrawal as "clinically significant." The student's mother classified the student "at-risk" in hyperactivity, anxiety,

school problems, learning problems, withdrawal, adaptive skills, and behavioral symptom index; she rated the student “clinically significant” in atypicality and attention problems (Ferguson et al., 2005). According to Ferguson et al. (2005), inconsistent responses from educators and parents is consistent with other reports with regards to characteristics of a child with AS.

The target behavior for this student was to have him function more independently in completing routine tasks both at school and at home especially since there would be greater demands for independent behavior in high grade levels and as he got older. Therefore the target behavior for this study was to increase the student’s “independence during morning home activities, school tasks, and evening home activities by decreasing the student’s dependence on adults” (Ferguson et al., 2005, p. 61). The PDA utilized for this study was a Hewlett Packard Jornada 560 Personal Digital Assistant (Ferguson et al., 2005). The student, his mother, and the resource teacher all received training in using this PDA. This study utilized a multi-baseline design across the study settings. The student received a list of tasks and associated times for completing these tasks during the baseline phase. During the invention phases an alarm was set on the PDA to alert the student to start each of the assigned tasks (Ferguson et al., 2005).

The student completed 0% of the morning and evening tasks independently during the baseline phase, and 63% of his school related tasks without prompts (Ferguson et al., 2005). While using the PDA, during the intervention phase, the student completed 47% of his morning tasks and 33% of his evening tasks without prompting. He completed 87% of his tasks while at school independently (Ferguson et al., 2005). The results show that the use of a PDA positively increased the student’s independence with regards to completing home and school related tasks; however, these results should be interpreted with caution as the length of the study and the use of a single subject design may not translate to a larger study. It also must be noted that the novelty

of the PDA may have influenced the student's positive transition into the intervention (Ferguson et al., 2005).

Myles, B., Ferguson, H., & Hagiwara, T. (2007). Using a personal digital assistant to improve the recording of homework assignments by an adolescent with Asperger Syndrome. *Focus on Autism and Other Developmental Disabilities, 22*(2), 96-99.

In another study, Myles, Ferguson, and Hagiwara (2007) examined "whether the use of a PDA would facilitate the recording of homework by an adolescent boy with Asperger syndrome (AS)" (p. 96). As with their previous study, this study focused on a single participant—a 17 year old boy in his junior year at a public high school. This student had been diagnosed with AS by a medical professional and had an above average IQ. He participated in general education classes and received support during study hall from a resource teacher. This student's grades were average to below average despite his above average IQ due in part to the lack of his organizational and study skills—he inconsistently recorded assignments and often forgot to record crucial aspects such as page numbers, number of problems, and/or due dates (Myles et al., 2007).

The BASC was administered to the student, his mother, and the resource teacher prior to the study to gain insight of the student's social and emotional behaviors as well as an understanding of his study skills (Myles et al., 2007). The student "rated himself as 'at-risk' for atypicality, locus of control, depression, sense of inadequacy, relationships with parents, and interpersonal relations" (p. 97). The student "also rated himself 'clinically significant' in self-reliance" (p. 97). The student's mother "rated him 'at-risk' in the area of withdrawal and attention problems;" additionally, she rated the student "clinically significant" in atypicality. In

contrast, the resource teacher rated the student average in all areas. The inconsistency in rating between parents and educators has been reported in other studies (Myles et al., 2007).

This study was conducted in the student's high school, specifically in his history, English, and science general education classes (Myles et al., 2007). In each of these classes, a certified general education teacher and a research assistant were present. Prior to this study, the student was required to record his assignments in a daily planner. Participation points were awarded to the student for successful assignment entry. The target behavior for this study was for the student to independently enter "homework assignments in his planner for history, English, and science classes" (Myles et al., 2007, p. 97). Homework was considered entered into the daily planner successfully if it contained the following: "the subject in which the homework was signed, the date the assignment was due, and qualifying details of the assignment such as the number of problems or questions" (Myles et al., 2007, p. 97).

A Hewlett Packard Jornada 560 PDA was utilized in this study, and both the student and the resource teacher received training in its use prior to the start of the study (Myles et al., 2007). The student's training consisted of a 20 minute one-on-one training; the resource teacher received three additional 30 minute trainings. The researchers noted that the student learned the functionality of the PDA within the first training session, while the resource teacher experienced difficulty requiring the additional training (Myles et al., 2007).

This study consisted of four phases: the baseline phase and intervention phases in which the student was required to record assignments for each of the classes in the study—introducing one subject at a time starting with history. The student was prompted to enter the homework assignment at the beginning of his history class on the first day of the study (Myles et al., 2007). "After achieving stability of level and trend, the intervention was introduced in English and then

in science" (Myles et al., 2007, p. 97). As was the procedure in the history class, the student only received prompting the first day the PDA was introduced in English and science.

Because this study was carried out in several settings and phases, "a multiple-baseline design was used to evaluate effectiveness of using a PDA to improve the student's assignment recording" (Myles et al., 2007, p. 97). Event recording was used to document whether the student entered information into his PDA: "one point was awarded if any information was recorded, two points for the subject, 3 points for subject and qualifying details, and 4 points were awarded if the due date, qualifying details and subject were all entered into the PDA" (Myles et al., 2007, p. 97). The total number of points were divided by four to arrive at a percentage of homework entered correctly (Myles et al., 2007).

During the baseline phase, the student independently recorded his "assignments into his planner with a mean accuracy rate of 33% for history, 29% for English, and 34% for science" (Myles et al., 2007, p. 98). While in the intervention phases, the student accuracy was "75% for history, 75% for English, and 33% for science" (Myles et al., 2007, p.98). The student was only using the PDA in science for 5 sessions.

The results of this study show that the use of a PDA positively influenced the recording of homework by student with AS. These results should be cautiously interpreted given that the length of the intervention, the use of a single subject design, and the narrow scope of the participant's disability (Myles et al., 2007). This study was carried out over just 25 sessions, only 5 sessions for the last phase. In order to replicate this study on a larger scale, more time should be dedicated to each phase. Since the single participant was a high school student with AS, these results may not translate to other students of different ages with a variety of disabilities.

Baker, E. A. (2005). Personal digital assistants: Effects on performance and perceptions of students with special needs. M.S. dissertation, Southwest Minnesota State University, United States—Minnesota. Retrieved April 25, 2012, from Dissertations & Theses: Full Text. (Publication No. AAT 1430484).

Baker (2005) investigated "the use of personal digit assistants with students who have special needs," specifically answering the following research questions: "What are the effects of student performance when using personal digital assistants as assistive technology with special education students in the science classroom? What are student perceptions regarding the use of a personal digital assistant as a form of assistive technology in the science classroom" (p. 10).

Seventh grade students with special needs participated in this study during the fall semester of the 2004-2005 school year. Fifteen students were randomly select to participate from a pool of 21 students in mainstream science classrooms. "The sample included seven students with a 'specific learning disability,' four students with an 'emotional behavioral disorder,' three students with 'other health impairments,' and one student with a 'speech/language impairment'" (Baker, 2005, p. 26). In order to participate, students had to have "the ability to be in mainstream science core classes with minimal adaptations and/or paraprofessional support" (Baker, 2005, p. 26). Six students from the sample group were also randomly selected to participate in a focus group (Baker, 2005).

This was a mixed study with both quantitative and qualitative data collected. Scores for "daily work, quizzes, daily organization, and assessments" (Baker, 2005, p. 27) were collected for the quantitative data. A pre-survey, post-survey, and a focus group were also used to collect data. Information collected through open ended questions in the survey and from the focus group were used as the qualitative data. Focus group interviews were scripted as a part of the data

collection process. A two phase process was used in this study for collecting data—a baseline phase and an experimental phase. During the baseline phase, data were collected for three weeks from the teacher grade book. Prior to this phase, a pre-survey was given to the participants. After the three week baseline phase the experimental phase began. It was during the experimental phase that PDAs were given to the participants. Data were collect for nine weeks during this phase. At the conclusion of the experimental phase the post-survey was given and the focus group discussion took place.

The data from the grade book and the student surveys were analyzed by using the Statistical Package for Social Sciences (SPSS) (Baker, 2005). Scores from the teacher grade book from the baseline and experimental phases were "compiled to attain mean composite scores and standard deviations" (Baker, 2005, p. 28). The baseline and experimental phase "scores were paired and two-tailed *t* tests for paired means were computed and inferences were drawn from the results" (Baker, 2005, p. 28). Data for the assessments (baseline $M = 75$; experimental $M = 66$) and quiz (baseline $M = 79$; experimental $M = 71$) scores actually showed a decrease in the mean when comparing the baseline phase to the experimental phase (Baker, 2005). A slight increase in the means was noted for daily work (baseline $M = 82$; experimental $M = 83$) scores and a slight decrease in the means was shown when scores for daily organization (baseline $M = 90$; experimental $M = 89$) were compared. No significant difference was noted when pre- and post- measures were compared using paired *t* tests for daily work and daily organization. When comparing the paired *t* tests for the assessment and quiz scores, a significant difference was noted; however, "the difference actually indicated that there was a slight decrease in performance scores in these areas" (Baker, 2005, p. 34). Survey and focus group data showed that students were generally positive with regards to perceptions on the effects of the PDAs use on classroom

performance (Baker, 2005). With regards to how students felt about the usefulness of PDAs, students responded “slightly higher on the pre-surveys than on the post-surveys” (Baker, 2005, p. 37).

The results of this study may not translate well if replicated due to the limitations. Baker (2005) recognized that the study conducted was “short term in that there was only a nine-week research period” (p. 45). The number and age of the participants was also a limitation. The fifteen students in this study were in the seventh grade. A training period in which the students learned the functionality of the PDA was not noted in this study; therefore, no information was reported as to whether the students had worked with PDAs in the past.

Discussion

There is no question that technology can and has influenced educational practices. Technology tools and software used correctly can be used to assist those with learning needs especially those with Autism Spectrum Disorder. According to Gentry et al. (2010), because students with ASD “often experience difficulty with executive function-related tasks involving prospective memory, organization, planning, and goal-direction” (p. 101), using a technology tool like a PDA could be used to assist students with some of these difficulties. PDAs have been used with students with ASD for self-prompting removing the need for external prompting from another person (Cihak et al., 2009; Mechling et al., 2009). Students with ASD also have utilized PDAs for task management and entering homework (Ferguson et al., 2005; Gentry et al., 2010; Myles et al., 2007).

Cihak et al. (2009) found that students with ASD could use a PDA to assist with transitions from place to place. Through the use of video-modeling, students we able to view a video clip on an iPod of the appropriate behavior for transitioning from place to place in a school

environment. Students in this study were able to maintain “a mean level of 98% independent transitions nine weeks” after the study (p. 111).

Video-modeling utilizing a PDA was also the subject of the study conducted by Mechling et al. (2009) who discovered that a PDA could be used as a prompting tool to assist students with ASD to cook a recipe. The participants in this study were able to use a PDA with video, pictures, and auditory prompts to perform multi-step tasks. Even though both of these studies showed that students could successfully utilize a PDA as a self-prompting device, several limitations were noted. In the Cihak et al. (2009) study, there were only four participants, all elementary age and all diagnosed with ASD. With a sample size of four students, it would be difficult to apply these finding to a larger group—further study would be necessary. The age of the participants and the diagnosis of ASD may also limit to whom these findings could be applied. Future research with old students of varying abilities is required. Sample size was also a limitation in Mechling et al. (2009), only three students participated in this study. It was also noted in both studies that the novelty of the PDA could have been a factor in the positive response (Cihak et al., 2009; Mechling et al., 2009).

In Baker (2005), Ferguson et al. (2005), Gentry et al. (2010), and Myles et al. (2007) PDAs were used as task management tools with students with ASD or special needs. Ferguson et al. (2005) and Myles et al. (2007) used PDAs in single subject studies in which the PDA was utilized by students with Asperger syndrome to record daily tasks and homework. In both studies, positive results were noted as students were able to use the PDA to remind them to perform tasks around their homes or complete homework assignments. Gentry et al. (2010) found that students with ASD could use PDAs independently to prompt them to complete household tasks, remember appointments, and manage medications. In the study conducted by

Baker (2005), no significant results were noted with regards to the use of PDAs with students with special needs. Limitations were noted with regards to these studies. Ferguson et al. (2005) and Myles et al. (2007) conducted single subject studies with limited intervention periods. Results from both these studies should be interpreted with caution. Gentry et al. (2010) noted "that the study sample was neither randomized nor representative of the autism population as a whole" (p. 106). Also, the assessments utilized were "both self-assessment rating scales" (Gentry, p. 106). Baker (2005) recognized that the study conducted was "short term in that there was only a nine-week research period" (p. 45). This study was also limited by the number and age of the participants—fifteen students in seventh grade. Additionally, this study did not have a training period for students to learn the functionality of the PDA, at least none was noted.

Implications for Leadership

Technology is always changing and educational practices are also evolving or being reinvented—the challenge is to pair the appropriate technology with the educational strategy and practice that works best for student learning. Today's educational leader needs to have an understanding of what technology can and cannot do with regards to educating students. It is a balancing act—teachers, principals, and district level personnel need to come together to answer the following questions: What changes in technology work best in an educational setting specifically for students with special needs? What are the changing needs of students in relation to their learning? What funding sources are available? And what training will be needed for teachers?

Many of the handheld devices presented in the review of the literature are obsolete. Technology changes fast and funding will not allow educational practices to keep pace. What is important for educational leaders to understand is that even though the technology may change,

the theory behind the use for education does not. PDAs may not be the “in thing” right now; however, there are devices such as Smartphones, iPads, and iPods that can be used in the same way as described in a few of the studies reviewed. Students can use these same devices to enter homework and keep up with assignments (Baker, 2005; Ferguson et al., 2005; Gentry et al., 2010; Myles et al., 2007). As more and more textbooks go digital or online, the technology available to students needs to expand to accommodate these changes in the delivery of information. Many of the handhelds currently available have the capability to go online or to download material. Educational leaders need to stay informed with regards to the changes in technology and the way in which information is and will be delivered.

Not only does technology change, but educational practices change. Educational leaders must stay current with the changing landscape of education. With new theories and methodologies emerging, educational leaders need to review the literature and research. For those in special education, especially those teachers working with students diagnosed with ASD, developing their professional judgment (one of the four factors of evidence-based practice) is a must (G.P. Barnhill, personal communication, April 16, 2012). According to Barnhill (personal communication, April 16, 2012), “professional judgment involves: (a) integrating information about a student’s unique history, (b) an awareness of research that goes beyond the National Research Project Report, and (c) the need to make data-based decisions” (personal communication, April 16, 2012). Staying current with trends in the educational field is ongoing and challenging.

Funding is another challenge facing educational leaders. There never seems to be enough funds for what needs to be accomplished. Educational leaders must tap into all funding sources available. For students with special needs, there are federal funds that can be used to investigate

technology tools that can be used to assist in their learning process. Grants and local funds are another source that educational leaders need to look into when thinking about meeting the needs of students. Local funds especially may be used since some of the technology tools that can be purchased can assist students with tasks at home and in the community. As seen in Gentry et al. (2010), PDAs were useful in meeting the needs of students both at school and at home. PDAs may not be the technology of choice at present; however, the technology that is available can be utilized by students or adults with special needs. The challenge is to find the funds to support these individuals in becoming more independent.

Training is crucial. Without the proper training, it is almost for certain that the technology utilized with students with special needs with fail. Teachers will need to be trained in the appropriate use of the technology and students will need training so that they are comfortable with these tools. Often teachers require more training with technology tools than students as seen with Myles et al. (2007), the teacher required additional training. Training also needs to be an ongoing process. As the technology changes and the needs of students change, teachers need to be adaptive to those changing needs. Training also cannot be “one size fits all.” Individuals, both teachers and students, will require different training strategies and pacing timelines. An investment into ensuring that the technology is being used properly and appropriately is a necessity.

As the needs of students change and the technology changes, it is important that educational leaders understand these changes and how to best utilize available technology tools. It is vital that educational leaders keep current with changes in technology and relate those changes to educational strategies and practices specifically targeting what works best for what students as it relates to student learning. Educational leaders must evaluate available funding

sources—looking for new ways to fund projects that meet student needs. Finally, educational leaders need to pay attention to teacher training. Leaders need to investigate what trends in training are emerging and available for teachers. It is a balancing act—making sure that all pieces are balanced and remain in harmony is a challenge.

Reference

American Psychiatric Association (2011). *Let's talk facts about Autism Spectrum Disorders*. Retrieved from http://www.psychiatry.org/mental-illness/lets-talk-facts-brochures.

Autism Speaks, Inc. (2012). *What is Autism? Symptoms*. Retrieved from http://www.autismspeaks.org/what-autism/symptoms.

Baker, E. A. (2005). Personal digital assistants: Effects on performance and perceptions of students with special needs. M.S. dissertation, Southwest Minnesota State University, United States—Minnesota. Retrieved April 25, 2012, from Dissertations & Theses: Full Text. (Publication No. AAT 1430484).

Centers for Disease Control and Preventions. (2011). *Autism Spectrum Disorder: What you should know?* Retrieved from http://www.cdc.gov/ncbddd/autism/index.html.

Cihak, D., Fahrenkrog, C., Ayres, K. M., & Smith, C. (2010). The use of video modeling via a video iPod and a system of least prompts to improve transitional behaviors for students with Autism Spectrum Disorders in the general education classroom. *Journal of Positive Behavior Interventions*, *12*(2), 103-115.

Conroy, M., Stichter, J., & Gage, N. (2011). Current issues and trends in the education of children and youth with Autism Spectrum Disorders. In J.M. Kauffman & D.P. Hallahan (Eds.), *Handbook of Special Education* (pp. 277-290). New York, NY: Routledge.

Ferguson, H., Myles, B., & Hagiwara, T. (2005). Using a personal digital assistant to enhance the independence of an adolescent with Asperger Syndrome. *Education and Training in Developmental Disabilities, 40*(1), 60-67.

Gentry, T., Wallace, J., Kvarfordt, C., & Lynch, K. (2010). Personal digital assistants as cognitive aids for high school students with autism: results of a community-based trial. *Journal of Vocational Rehabilitation, 32*(2), 101-107.

Mechling, L., Gast, D., & Seid, N. (2009). Using a personal digital assistant to increase independent task completion by students with Autism Spectrum Disorder. *Journal of Autism & Developmental Disorders, 39*(10), 1420-1434.

Myles, B., Ferguson, H., & Hagiwara, T. (2007). Using a personal digital assistant to improve the recording of homework assignments by an adolescent with Asperger Syndrome. *Focus on Autism and Other Developmental Disabilities, 22*(2), 96-99.

National Autism Center. (2012). *Significant findings/National Standards Project.* Retrieved from http://www.nationalautismcenter.org/nsp/findings.php.

Pearson Education. (2012). *Behavior Assessment System for Children*. Retrieved from http://www.pearsonassessments.com/pai/ca/productlisting.htm?Community=CA_Ed_AI_Behavior.

Simpson, R., Mundschenk, N., & Heflin, L.J. (2011). Issues, policies, and recommendations for improving the education of learners with Autism Spectrum Disorders. *Journal of Disability Policy Studies, 22*(1), 3-17.