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The use of handheld devices for improved phonemic awareness in a traditional kindergarten classroom

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Abstract

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M.Ed., Regis University, 2004

B.A., Regis University, 2002

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Abstract

Effective teaching strategies that improve the development of phonemic awareness are important to ensure students are fluent readers by third grade. The use of handheld devices to improve phonemic awareness with kindergarten students may be such a strategy, but no research exists that evaluates the use of these devices. This study explored the effectiveness of Bee-Bot handheld devices in kindergarten classrooms to teach phonemic awareness. A 4-month sequential mixed-methods study was conducted in four classrooms: two that used Bee-Bot handheld devices in phonemic awareness lessons and two that never used the devices. The score gain (Fall 2009 to Winter 2010) for initial sound fluency (ISF) on the DIBELS assessment was analyzed for between-group effects using ANCOVA, controlling for Fall 2009 letter naming fluency (LNF) scores. No significant difference was found between ISF scores of students using the Bee-Bots and those not using them. Interviews of the 4 classroom teachers determined their perceptions of the ways handheld devices supported phonemic awareness. Interviews were coded for (a) assessments, (b) engagement, (c) strategies, (d) social growth and (e) technology standards. Teachers reported that students using Bee-Bot handheld devices remained on task longer, increased motivation, developed leadership skills, and students enjoyed learning with the devices. Findings suggest that handheld devices used to enhance phonemic awareness in kindergarten may offer an engaging way to enhance social skills while providing technology integration. This study contributes to social change by improving teacher knowledge of technology-assisted strategies for social and literacy skills among less advantaged populations.

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Dedication

This dissertation is dedicated with gratefulness and love to my family: my parents Rudy and Susan Magagna, who have always supported my education and career goals, my husband Jim W. McBee, who helped with the day to day work of our household so that I could work on this degree, and my sons Michael Avery and Cristopher Jaden, who supported mommy with their love and understanding. The great working relationship with Bill Glass, of the Terrapin Logo Company who markets the Bee-Bot handheld units, for his professional help throughout this process. It's also dedicated to my school district families with respect and admiration: Dr. Ron Kalicki, Tina Searle, Sandy Bowling, Stacey Court, Brian Kaumo, Chase Hafner, Mike Lopiccolo, Paul Grube, Dr. Craig Sorenson, Stephanie Cordova, and all the others who guided my work in the right direction. Finally, I would like to thank my close Walden friend Heidi Connor, for their help with editing and educational expertise. Thank you to all of you because without your support and understanding I would not have made it.

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Chapter 1: Introduction to the Study

Current educational research indicates that experiences during the early childhood years (birth to age 8) contribute to the development of literacy in both formal and informal learning settings (International Reading Association, 2009; National Association for the Education of Young Children, 2009). A greater knowledge of phonemic awareness is the first step in beginning literacy programs (Fien, Baker, Smolkowski, Smith, Kame'enui, & Beck, 2008; Flanigan, 2007; Musti-Rao & Cartledge, 2007; Powers & Price-Johnson, 2006). Research indicated that phonemic awareness requires readers to become aware of the sounds themselves (Giles & Wellhousen, 2005; Wang, Jaruszewicz, Rosen, Berson, Bailey, Hartle, Griebling, Buckleitner, Blagojevic, & Robinson, 2008).

According to Yopp (1992) phonemic awareness is the ability to hear and manipulate the sounds in spoken words and the understanding that spoken words and syllables are made up of sequences of speech sounds (as cited in DIBELS, 2009). Phonemic awareness is essential to learning to read in an alphabetical writing system, because letters represent sounds or phonemes. Phonemic awareness is a strong predictor of children who experience early reading success.

In addition to engaging children in literature-related resources that emphasize the sounds of language and support the development of phonemic awareness, students begin to establish the basis needed to learn to read (Zeece, 2006). Technology-rich resources can be used to encourage sound and word play in the context of typically occurring events in an early childhood setting, such as prerecorded storytelling and theatrics and listening to audios of recorded books and poems. Technology in the classroom has become a more frequent teaching tool because of 21st century learners, who use video games, computers, and other technology tools to learn and gather information (Padak & Rasinski, 2008).

The computer provides the fastest growing resource of material for reading and learning to read and has become part of everyday life (DeWitt, 2006; Looney, 2005; NAEYC, 1996; Padak & Rasinski, 2008). The Internet can offer a wide variety of opportunities for literacy growth, for parents and educators, by giving opportunities for students to read e-Books, play online reading games, and to use interactive learning formats. Although computers connected to the Internet help students focus on the skills needed to become readers, they must be challenged and engaged, or they will lose interest and begin to falter academically (Padak & Rasinski, 2008).

Researchers have examined the use of handheld devices in a variety of K-12 classroom, but little research has examined their use in a Kindergarten classroom to improve reading in general or phonemic awareness specifically (Baumbach, Christopher, Fasimpaur, & Oliver, 2004; Gulchak, 2008; Jonassen, Howland, Moore, & Marra, 2003; Penuel, 2005; Pownell & Bailey, 2003; Roblyer, 2006; Warlick, 2004). Current research indicates that handheld devices can be powerful tools in educational settings and offer school districts a more economical and resource-rich means of providing technology to students (Roblyer, 2006). If used correctly, handheld devices can be powerful tools for motivating students in their literacy instruction, therefore, increasing student achievement (Baumbach, Christopher, Fasimpaur, & Oliver, 2004).

According to Lucas and McKee (2007) classrooms teachers struggle with issues surrounding the preparation of all students in grades PreK-12. They noted that one of the best practices identified to improve PreK-12 student engagement and academic growth was the integration of technology. Teacher perceptions regarding technology and the instructional research behind it have given both practicing teachers and student teachers a new understanding of the importance of teaching to 21st century students.

The development of phonemic awareness has been identified as an important precursor to literacy (Baumbach et al., 2004). Providing phonemic awareness lessons with the assistance of technology can be equally important because of the demands of living in the 21st century and the needs of students to be successful in this technological age (Roblyer, 2006). There has not yet been a study conducted that examines the use of handheld devices in Kindergarten classrooms to improve phonemic awareness. In the literature review of chapter 2 these issues will be discussed in greater depth.

Problem Statement

Early childhood literacy programs include the use of phonemic awareness in emerging reading development and stress the importance of these skills in order for students to become fluent readers by third grade (Chard, Pikulski, & Templeton, 2000; Flanigan, 2007; Morris, Bloodgood, Loma, & Perrey, 2003; O'Connor, 2008; Pinnell & Fountas, 1998; Powers, Price, & Jonson, 2006). According to Yopp (1992) phonemic awareness has been defined as the ability to hear and manipulate the sounds in words spoken or read aloud, understanding that these oral words and their syllables are comprised of a series of sounds (as cited in DIBELS, 2009). Phonemic Awareness is commonly assessed from the beginning of Kindergarten through the end of first grade and a common measure is the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) assessment (DIBELS Data Systems*,* 2009). The Kindergarten DIBELS assessment for both fall and winter includes Letter Naming Fluency (LNF) and Initial Sound Fluency (ISF).

Furthermore, according to the International Reading Association ([IRA], 2002), the Internet, presentation software, e-Books, and e-mail are regularly redefining the nature of literacy in the United States and around the world, beginning in early childhood education. According to Padak and Rasinski (2008) technology is a frequent teaching tool for the 21st century learner, engaging them and allowing for a faster rate of proficiency. No study has been found which explores the use of handheld devices in a Kindergarten classroom to improve phonemic awareness. This mixed-method sequential contributed to the body of knowledge needed to address the use of handheld computers to improve phonemic awareness.

Purpose of the Study

The purpose of this research was to evaluate the impact of handheld devices on phonemic awareness in a Kindergarten classroom. The research addressed teacher perceptions of the use of the handheld devices with Kindergarten students to enhance phonemic awareness.

Research Questions and Hypothesis

This mixed method sequential study was guided and framed by the following research questions:

RQ 1: Are there significant differences between the phonemic awareness DIBELS score (ISF) for Kindergarten students using the handheld devices and Kindergarten students not using the handheld devices?

$H_{0:}$ There are no significant differences between the phonemic awareness DIBELS score (ISF) for Kindergarten students using the handheld devices and Kindergarten students not using the handheld devices.

$H_{a:}$ There is a significant difference between the phonemic awareness DIBELS score (ISF) for Kindergarten students using the handheld devices and Kindergarten students not using the handheld devices.

RQ 2*:* What are the teachers' perceptions of the ways handheld devices support or do not support student development of phonemic awareness?

Nature of the Study

This mixed-methods sequential study included research in four Kindergarten classrooms: two classrooms had used handheld devices throughout the academic curriculum within their phonemic awareness lessons; two had never used the devices. These four classrooms were selected from two different small, rural school districts in the Rocky Mountain region. The classes were preselected based on availability within the two schools, those who already had the handheld devices and their colleagues who did not have handheld devices, but who had previous teaching experience.

DIBELS assessments are given in both schools three times each year (fall, winter, and spring) to measure phonemic awareness, along with other reading literacy skills. Archived data from the Fall 2009 and Winter 2010 DIBELS assessments were analyzed using an ANCOVA. In this mixed-methods sequential study the researcher did analyze archived scores from DIBELS to determine if Kindergarten students using handheld devices improved their phonemic awareness scores over those students not using handheld devices. The dependent variable was the difference (DIF) between the ISF score for Fall 2009 and Winter 2010 phonemic awareness measured by DIBELS. The covariate was Fall 2009 LNF DIBELS scores.

The student population was pooled in both classes when reporting the findings for both the group using the handheld devices and the group not using them. The model used was a general linear model, which described an observed score (difference between DIBELS Fall 2009 and Winter 2010) as the sum of the population mean, the treatment effect for a specific factor (use of handheld devices), and random error. In this design, the subjects were preassigned to the group using the handheld devices for the treatment and others were been pre-assigned to the group not using the handheld devices. This design had no systematic bias arising from how participants collaboratively worked together in the treatment means (using handheld devices). The classes came from similar rural school districts, with similiar demongraphics and school cultures (see Appendices E & F). As well, both schools offered Title 1, Special Education, and ELL services to their students.

This allowed for individual differences to be uncontrolled as the students worked through the lesson using the handheld devices in a constructivist way. There were equally different numbers of good and poor subjects assigned to the treatment group using the handheld devices and to the group not using the handheld devices.

The qualitative measures were the interviews of classroom teachers about how they used the handheld devices to understand further how they affected students' development of phonemic awareness. Interviews of the four classroom teachers were conducted following the analysis of the DIBELS data to determine the way in which phonemic awareness was taught and their perceptions of how the students learned these skills. Teacher perceptions about the findings were probed.

Prior to collecting any data, letters of cooperation, included in Appendices A & B, between the researcher and the school districts, were gathered obtaining permission to conduct the study, to interview teachers, and to review archived data on the participants in the classrooms. The archived data from the DIBELS assessment did explain the progress the Kindergarten students made with both acquisition and increase of their phonemic awareness, with two measures being taken. The fall 2009 mean LNF DIBELS score was the covariate and these scores were analyzed along side the DIF score (the difference between ISF for fall 2009 and winter 2010) to determine if the treatment had an impact or not. The classroom teachers who used handheld devices were interviewed with questions about what they saw when students were using the handheld devices, their thoughts on whether the handheld devices made a difference with phonemic awareness, what impact the use of these devices has on their teaching, and a discussion on the methods used for phonemic awareness, including what works and what does not work. Those teachers not using the handheld devices were asked questions about their methods for teacher phonemic awareness and whether they think the handheld devices would have helped them or hinder the learning. A list of interview questions for both groups has been included in Appendices C & D.

The research was conducted in the Rocky Mountain region in two different school districts and elementary schools (K-4 building) and in four different Kindergarten classrooms. The school districts are both rural districts and these schools are the only ones using handheld devices to teach students in any grade and in any building. In each of the two schools, one classroom makes use of the handheld devices and one does not.

In the four classrooms there is a balance of experience with the teachers and students. In the two classrooms using the handheld devices, one teacher has been teaching for eight years and in a variety of grade levels and the other teacher has taught five years, and one teacher has only taught in Kindergarten. In the two classrooms not using the handheld devices one teacher has had two years of experience, one being in Kindergarten and the other is a new teacher this year to the district, but has had six years of previous experience in another district.

Students in the two classrooms using handheld devices were provided with a classroom set of Terrapin Logo Bee-Bots. These devices were purchased through a grant written by the researcher and provided by the state Department of Education and a local communication company.

Theoretical Base

This study was based on the constructivist theories of two leading pioneers in learning: Dewey (1938) and Montessori (1965). These theories were chosen because of their tenets regarding the creation of knowledge and meaning from experiences. The theory of constructivism can enlighten our understanding of the way students reflect on their own experiences and then construct their own understandings of the world around them. This theory advocates that students learn best when actively engaged in their curricula. Dewey was instrumental in making the qualities of curriculum more meaningful for young children by helping them retain learning through a constructivist approach and a real-world environment in the classrooms. Montessori ensured that the classroom environment was carefully prepared for optimal learning by ensuring that there was guidance given to the natural physiological and physical development of the student. This method was divided into three parts: (a) motor education, (b) sensory education, and (c) language.

Dewey's theory included the idea that the teacher's role was to plan well thought out and content specific curricula that allowed students to begin to learn about their environment and create their own type of learning (Dewey, 1938). He believed students should invent their own ideas and work outside the traditional means of education and the delivery of learning. Dewey believed that the subject matter of education consisted of bodies of information and skills from the past that were designed to guide educational processes; in the present time, the business of education is to ensure students are ready for a world rich in technology and fast paced schedules. Schools have developed standards and rules of conduct, formed habits and actions that guide students to become good citizens and offer guidance to ensure social skills and communication skills are developed.

Montessori's (1965) theory included the idea of a child-centered learning environment that provided real tools for children to use and for them to be responsible for their learning and the tools they select. Montessori also believed that learning is for the whole child and must include social and intellectual components. Both the social and the intellectual components are taught through sensory, motor, and language skills and with the use of child-sized tools for small hands. This will be discussed in depth, in Chapter 2.

Operational Definitions

Bee-Bot*:* A handheld robot designed for use by young children and used for teaching skills like sequencing, problem solving, and teamwork (Terrapin Logo, 2009).

DIBELS: Dynamic Indicators of Basic Early Literacy Skills) is a set of procedures and measures for assessing the acquisition of early literacy skills from Kindergarten through sixth grade. They are designed to be short measures used to monitor regularly the development of early literacy and early reading skills. The DIBELS assessment will provide an overall score for initial sound fluency and letter naming fluency. Both of these sections are listed as phonemic awareness scores for Kindergarten and initial sound fluency is only reported and tested in Kindergarten (*DIBELS*, 2009).

Early Childhood*:* A stage of development ranging from 3 to 8 years old and traditionally in grades PreK-3rd grade, (NAEYC, 2009).

Handheld Device: A pocket-sized computing device, typically having a display screen or some sort of input buttons, allow for convenience for business and education (Integrating Educational Technology into Teaching, Roblyer, 2006, p. G-5).

Phonemic Awareness: The ability to segment and manipulate the sounds of oral language (IRA, 1998; 2009).

Assumptions

This mixed-methods sequential design included several assumptions. First, it was assumed that teachers' responses to the interview questions were open and honest. Second, it was assumed that the archived DIBELS scores were a valid assessment of phonemic awareness and represented all of the students in the four classrooms. Third, it was assumed that the students using the handheld devices understood how to use the devices correctly. Fourth, it was assumed that the DIBELS scores for the ANCOVA were normally distributed in each group (users and nonusers), and that the variance was homogeneous. Fifth, linearity of regression was assumed in terms of the relationship between the DIF scores (the difference between the ISF fall 2009 and winter 2010 DIBELS) and the independent variable (use of Bee-Bots). Sixth, there was homogeneity of regression where each level of the independent variable (each class) is taught using the same standards, curriculum, and assessments, has a similar student composition, and can therefore be expected to perform about the same on the fall LNF 2009 DIBELS (covariate).

Limitations

This mixed-methods sequential study was undertaken in two small, rural school districts, so the results may be different from those found in other locations. Furthermore, the study was only conducted with Kindergarten students in two rural grade schools and this might have provided different results if conducted in another location and with more classrooms and grade levels.

Another limitation might have been the use of only handheld computers to increase phonemic awareness when so many other devices could have been used. However, this is a beginning for research on technology and the improvement of phonemic awareness.

Third, the teachers chosen volunteered and may not be the best representation of the two schools' districts or the use of technology integration in Kindergarten and fir teaching phonemic awareness to students. These two classrooms were the only ones in the county using the handheld devices and this limited the study to only two classrooms using handhelds and two that were not using them.

Because of these limitations, the results of this study are not generalizeable beyond the sample and should be interpreted as promising possible effects of the implementation of Bee-Bots for teaching phonemic awareness in Kindergarten.

Scope

The research population of this study included students in two classrooms in two different school districts within the Rocky Mountain region. This sampling was selected because of the availability of the handheld devices within these two rural school districts. The handheld devices were only found in two schools, one in the first district and one in the second district, and only in Kindergarten classrooms. The population was limited to only two classrooms not using the handheld devices with Kindergarten students and two classrooms using the handheld devices with Kindergarten students. These teachers were in the same schools with those using the handheld devices to ensure consistency with curriculum and student expectations.

The study gathered data from teacher interviews and from archived DIBELS scores for fall 2009 and winter 2010. The study has defined boundaries as it was only conducted with Kindergarten students in two elementary schools. The school districts used in this study were both rural and the populations were considerably small, with limited resources. The handheld devices were only found in these two schools, within the Rocky Mountain region, which further limited the study to defined classrooms and teachers. The study itself was conducted in a short time frame and archived data was used to determine academic growth.

Delimitations

This research was concerned with discovering if handheld devices could increase student achievement in phonemic awareness. The research population of this study was Kindergarten students in four different classrooms in two schools and school districts in the Rocky Mountain region. There was a maximum of 92 students, 23 in each classroom. The two districts and schools were selected because they were the only ones making use of the handheld devices in the Kindergarten classrooms. The researcher received a grant and purchase handheld devices for two of the four classrooms, and this limited who could make use of the devices.

Significance of Study

The research was based on the premise that phonemic awareness is essential to learning to read and that the need to teach students to use technology is equally as important to their success in a communication rich world. The research was based on the understanding that handheld devices are not currently being widely used in Kindergarten classrooms to teach phonemic awareness. Research was warranted in the areas of handheld devices, and phonemic awareness to discover if reading skills were enhanced through the use of handheld devices, thus filling a gap in literature.

The results of this study might change the thinking of other school district school boards and administrators, paving the way for further use of handheld devices in all grades and curriculum areas, and more specifically in Kindergarten classrooms. School administrators and boards of education might consider additional funding for more technology and new policies requiring constructivist thinking and pedagogy that allows for more independent and innovative learning in early childhood classrooms.

Further, the findings of this study make a significant contribution to the existing body of knowledge on the topic of handheld devices in education. Research exists examining how handheld devices are used in classrooms and in a variety of subject areas, but predominantly at the secondary and intermediate levels. Limited research was found to show that handheld devices were being used in Kindergarten classrooms and for phonemic awareness lessons.

This study contributed to positive social change by giving Kindergarten an opportunity to share their best practices related to the use of handheld devices to improve phonemic awareness. The researcher will use this study to further share the methods of using handheld devices, like the Terrapin Logo Bee-Bot, to enhance learning. Kindergarten teachers now have an opportunity to enhance student learning while using this technology tool and given that Kindergarten is the first formal year of education this gave students empowerment over learning and offered another approach to 21st century leaning.

Summary

In Chapter 1, an explanation of key research on both phonemic awareness and handheld devices was provided and that information showed a gap in the literature that needed to be addressed. The present study focused on increasing phonemic awareness in traditional Kindergarten classrooms that used handheld devices. During the 2009-2010 school year, forty-five Kindergarten students participated in two classrooms that used handheld devices to teach phonemic awareness and another forty-five students participated in two classrooms that did not use handheld devices. This study determined that the use of handheld devices in the classroom enhanced the development of phonemic awareness in current literacy program as measured by the DIBELS pre and posttest scores. The forty-five Kindergarten students in the handheld group engaged in the use of handheld devices for phonemic awareness, while another forty-five Kindergarten students in the non-handheld classes did not use handhelds to learn phonemic awareness.

Chapter 2 includes information on current research and literature regarding phonemic awareness, the integration of other forms of technology in classrooms, and the use of a variety of handheld devices for instructional purposes. A discussion of Dewey and Montessori's constructivist learning theories as they relate to early childhood education will be discussed as a framework for this study. Finally, a discussion of the mixed method sequential study (Teddlie & Yu, 2007) is included, demonstrating its strengths and weaknesses and why the mixed-method sequential study was chosen. Other methodologies that were considered are discussed demonstrating why they were rejected for this study.

Chapter 3 provides a detailed overview of the research design and the methodology used to gather, analyze, and transcribe the information. This research used a mixed-method sequential approach to examine the use of handheld devices in the Kindergarten classroom to improve phonemic awareness. The study was conducted in two different small, rural school districts, in two classrooms that did make use of handheld devices and in two classrooms that did not make use of handheld devices in Kindergarten during phonemic awareness lessons. Interviews of and an analysis of archived DIBELS scores have been used to conduct the study.

Chapter 2: Literature Review

This literature review encompasses themes of best practices to increase levels of achievement in phonemic awareness during instruction in early childhood education. Specific technology integration studies for enhancing student achievement in literacy instruction is reviewed. Technology used in classrooms , including computers and software, digital and video cameras, interactive white boards, projectors, document cameras, and basic robotics, is outlined. All of these technology tools were reviewed for their effectiveness with students in improving student achievement. This chapter will culminate with a review of literature on using handheld devices in classrooms and how they can be used to increase student achievement in all academic areas, but in phonemic awareness specifically.

All of these components of learning can help integrate handheld devices in the Kindergarten classroom to assist with phonemic awareness. Although current literature includes studies on phonemic awareness practices and technology used in literature instruction, it does not address handheld computers in classrooms for phonemic awareness instruction. No current research was found to address handheld computers in Kindergarten classrooms as the technology relates to the improvement of phonemic awareness. No study has encompassed handheld computers in early childhood education classrooms or in the specific use of gaining a stronger knowledge of phonemic awareness. As such, this gap serves as the basis of this study.

This literature review includes four topics: phonemic awareness, technology used in literacy instruction, specific technology used in classrooms, and the use of handheld computers in schools. The research gathered was limited in the areas of Kindergarten students using technology tools, like handheld devices. The research was limited to using technology to improve phonemic awareness, which is an essential skill for the development of stronger readers and also offers a well-balanced approach to technology use in early childhood learning environments.

Research Strategy

This chapter includes a review of best practices in phonemic awareness, including those presented in books, dissertations, and peer-reviewed journals. Online databases used for this research included *Questia* and *Sagepub* as tools for locating experts and websites with additional information. Online library research databases used included Walden University and University of Wyoming, more specifically *Academic Search Premier*, *ERIC*, and *EBSCO.* Other resources were collected from the professional development resource libraries within both rural school districts.

Online search parameters included combinations of the following search terms for phonemic awareness: phonemic awareness fluency, phonemic awareness, phonemic awareness skills, phonics, phonemic awareness lessons, phonemic awareness activities, phonemic awareness research, phonemic awareness assessments, early childhood literacy, International Reading Association (IRA), best practices and literacy, Kindergarten literacy, literacy, early childhood literacy, early childhood literature, and National Association for the Education of Young Children (NAEYC). Search terms used for technology integration included technology and Kindergarten, technology and early childhood, technology and elementary schools, technology integration, technology and education, International Society of Technology in Education (ISTE), e-Books, interactive boards, robotics, robots and education, digital cameras, document cameras, video cameras, interactive white boards, Promethean, Promethean boards, and SMART boards. Search terms used to locate information on handheld devices included handhelds, handheld computers, handheld devices, handhelds and education, handhelds and elementary schools, handhelds and K-12, Special Interest Group: handheld computers, handheld computer devices, iPaq computers, palms, palm units, handhelds and Kindergarten mixed-methods, mixed-methods study, and mixed-methods sequential.

Over 250 books, chapters, research articles, dissertations, and articles were reviewed, including some foundational theory texts and many studies published from 2005-2009. Literature was reviewed for information that included best practices in phonemic awareness and technology integration, specifically in Kindergarten and the early childhood years. The articles and other documents chosen included those that related to the dissertation topic, best practices in phonemic awareness and literacy, technologies used in education, how handheld devices have been used in education, and Kindergarten best practices. This focus limited the search to about fifty research articles and literature pieces.

Theoretical Foundation

The theoretical foundation for this study includes the theories of childhood learning developed by Dewey (1938) and Montessori (1965). These theories were chosen to explain solutions for ensuring that a classroom is ready for learning by all students at the early childhood level. They have had an impact on education through their explanation of how young children think and act, how educators can be more effective with these students, and how to interpret and understand the individual needs of students at this level. Environment, heredity, society, and culture all mold children as they develop into adulthood and educators struggle with how to teach all children. In order to explain these theories better, a review of the work is outlined.

John Dewey

Dewey (1938) is best known for his role in the progressive educational movement, which based teaching in real-life experiences and recommended that teachers encourage critical thinking and experimental learning at all levels of instruction. Dewey believed that teachers must trust their knowledge and experiences and, by using both, provide appropriate lessons and activities to nurture children as they learn curriculum and life skills. He trusted that teacher observation was the key to learning how to create a curriculum that best fits students and their learning styles.

Learning in both society and the classroom must be based upon experience; actual life experiences and hands-on application will allow learners to achieve more (Dewey, 1938). Educators today agree that the educational system is sound and strives to look at the needs of the whole student. Dewey (1938) believed that schools and other educational institutions must either move backward and continue to educate students on intellectual and social standards as has always happened, or they must grasp the future and begin to educate students for a scientific world. This scientific world shall encompass a greater utilization of the scientific process and methods, allow for change and growth, and expand the experiences of students at all levels.

Dewey (1938) suggested that the only failures to moving forward in education are not having experienced growth and change, not having taken the chance to learn from new experiences, and having embraced scientific concepts. Dewey suggested that, although change involved dedication, it would reward the risk taker with progressive results. Dewey (1938) did not want leaders of education to view these concepts as the new versus the old or progressive versus traditional, but instead to question what is worthy of education and the future of children. Students will gain new experiences using technology that links to the real world and to scientific concepts by using handheld devices in the Kindergarten classroom to improve phonemic awareness. Hands-on learning could allow students to become proficient with the curriculum and use their constructivist approaches to learning, using higher-level thinking, problem solving, and cooperation.

Maria Montessori

Montessori (1965) used her observation of children to determine their needs and discovered adults' interpretations and applications of developmental education programs were the greatest challenge to education. Montessori sought to understand why adults provided inappropriate approaches and environments for learning and socialization and why these ineffective instructional designs presented to young children. Children had a need for furniture their own size and tools to fit their hands and they needed to work independently while exploring their surroundings in efforts to gain useful knowledge.

Montessori (1965) claimed that language and other life skills were learned from the environment where young children spent time and some skill development depended on influences from adults and classmates with whom they spent their time. Montessori claimed that children learned best from sensory experiences and, as a result of her research, she created opportunities and theories that tasked teachers with the responsibility of developing learning environments with wonderful sights, textures, sounds, and smells within classrooms.

Montessori (1965) developed the premise that all children could learn. If children were not learning, according to Montessori, the adults were not listening carefully or watching closely enough to determine the needs of the child. The way to educate a child, according to Montessori, was to get to know them well through observation and reflection on the actions of children as they learned, in addition to development of ideas, and understanding of the instructional needs of children. Realizing that children could not always understand new material challenged educators; however, observation and reflection gave educators much more information about their students' individual learning needs (as cited in Mooney, 2000). Montessori maintained that reflections about observations made in educators' classrooms added to the opportunity to understand the educational, social, and emotional needs of a child and learning that must happen early in the lives of students of this age.

Montessori (1965) observed young children to determine their needs. She believed that tools needed to fit the child because of their little hands. She also believed that students learned best through their learning environment and senses, through the integration of visual, auditory, and textile learning into lessons and skill development. Together, these components stimulate students' powers of observation, recognition, judgment, and classification. She often made use of self-correcting learning tools, which she called “teaching machines,” to teach early childhood students through basic hands on activities.

Montessori believed that young students needed little tools to help them socially and academically negotiate school successfully. The use of handheld devices, which are the perfect size for small children, are much easier for them to use in their learning environments. She also believed that students learned best through their learning environment and senses, which handheld computers can also allow through the integration of touch, sight, and sound into every lesson and skill development.

The Terrapin Logo Bee-Bot handheld device can allow students to work socially together while learning, to correct themselves when faced with a problem, and offer them a way to learn to use their sensory tools. The handheld device offered sounds to feed their auditory needs. Directions from the teacher and interaction with peers facilitate social proficiency, too. The small handheld “bug” device fits into the hands of most students, allowing them to use something created for their size bodies. This handheld device provides students with a textile and hands-on approach to learning. Finally, the visual nature of the handheld device in action during phonemic awareness lessons may give students a better understanding of the materials learned..

Phonemic Awareness

Musti-Rao and Cartledge (2007) supported the premise that reading is one of the most researched topics in education. Lane, Menzies, Munton, VonDuering, and English (2005) showed that nearly 40% of fourth graders in the United States has a reading level of below basic comprehension leaving educators with the task of preparing for interventions as a preventive approach. Snow, Burns, and Griffin (1998) concluded that students who do not read with moderate success by the end of third grade have a higher risk of dropping out of school and never graduating (as cited in Marston et al., 2007). These studies had similar findings and concluded that early intervention needs to be explicit, intensive, and systematic in nature with the first step of beginning a program being the focus on development of phonemic awareness skills.

Research has shown that one in every five students has a reading difficulty and that fact along with the limited opportunities available for reading interventions has created an educational gap that must be bridged (as cited in Marston et al., 2007). Students who are not on grade level by the end of third grade will struggle throughout their educational careers. To avoid this deficiency in reading skills administrators consulted with teachers, parents, and support staff in a joint effort to adopt educational programs and interventions to assist struggling readers. This cooperative approach to curriculum development strengthens the programs used to teach phonemic awareness and other literacy skills, which also allows students to learn to read at a much faster rate and reach reading milestones on time.

Letter and Sound Correspondence and Phonological Awareness

According to a study by Oudeans (2003), the integration of letter sounds and phonological blending, as well as segmenting, is a critical first component in learning to read. A review of Kindergarten interventions supports the implementation of these two areas, but does not show enough evidence of when and how they are best integrated into the curriculum. In Oudean's study, two paths for integrating and teaching letter-sound correspondence and phonological blending and segmenting were compared to determine which method resulted in the highest student achievement. Fifty-five students were randomly assigned to two instructional conditions: (a) parallel, integrated (PI) or (b) parallel, non-integrated (PN-I) sequence.

Oudeans (2003) explained that the post test results indicated that initial segmentation skills explained only 7% of the variance for the PI group and 36% of the variance for the PN-I group on segmentation fluency measures. Students in the PI group performed reliably higher on word reading generalization at post test and maintenance, and the rate of change in the growth trajectory for letter-sound fluency was greater for the PI group too. Interestingly enough the research found that the PI group seemed to begin to close the gap in phonemic segmentation between students with low-segmentation skills and those with adequate skills by posttest.

Richards, Leafstedt, and Gerber (2006) completed an in-depth micro genetic methodology (change as it is occurring) study of four Kindergarten students. These students were provided with 10 weeks of explicit phonemic awareness activities to work towards increased academic performance in reading. The researchers collected three types of data during their study related to fluency, strategies used to perform phonological awareness tasks, and students' number of responses during reading instruction. The combination of data collected allowed for both qualitative and quantitative examination.

The four students who were included in the study were pre-selected from a class of nineteen students and these same students were ranked the lowest in reading as determined by the Woodcock-Johnson assessment (Richards et al., 2006). The students in this study resided in a semi-rural community with predominately Spanish-speaking families. The school was a Title 1 school that was scored a “1,” which is the lowest performance score awarded to schools in the state. The Kindergarten students were half time, attended 3 ½ days per week and were instructed in English, with some Spanish supplemental assistance by the staff.

The study included a pretest, a midterm test and a post-test to determine the growth of the students during the ten weeks, measuring fluency and reading strategies (Richards et al., 2006). The assessment focused on the phonological awareness, specifically to onset-rime, blending, and segmentation, and the classroom teachers confirmed the scores as accurate. Three of the four students reached the DIBELS benchmark for Kindergarten by mid-year in both nonsense word fluency and segmentation fluency. The scores for the onset-rime indicated that three of the students reached the R2 level, but did not use their strategies consistently and resorted back to level R1 skills. Similar results were found for segmentation, showing that three of the students could reach a higher level, but were not consistent.

In the mixed-model study by Fien, et al. (2008) the researchers indicated that over 90% of the 1,600 school districts and 5,283 schools in the United States that have implemented the program Reading First, which uses oral fluency (ORF) to screen students for reading difficulty and assists with the monitoring of progress over time, providing information for interventions and additional support. The use of ORF has a great impact on the RTI (Right to Intervention) models that many schools are beginning to use to increase student achievement, predominately in literacy. Fien, et al. (2008) indicated that interventions are most effective in the early years to ensure that students are successful and research clearly shows that in both regular education and special education ORF is used to measure and monitor reading levels, but there is limited research to show that this type of measure is used nationwide with one specific program, such as Reading First.

Three objectives guided the study by Fien, et al. (2008) and they included the investigation between ORF and specific high-stakes reading assessments for Reading First; the second objective was to examine whether slope or ORF predicted performance on specific high-stakes reading tests over and above initial level of ORF performance alone; and the final was to test how well various models that included ORF and performance on high-stakes assessments predicted models performance on the reading comprehension portion.

The study included 34 Oregon schools that used Reading First and met the predetermined criteria for student poverty and low-reading scores, located in 16 independent school districts representing most of the state (Fien et al., 2008). The schools were divided with a mix of urban and rural areas. The students in these schools were divided into sub categories showing that 10% were receiving Special Education, 34% were receiving English as a Second Language (ESL) services, and of the ESL students, 68% were Latino, while the others were of the Asian cultures. The data were collected for just over two years, and the results indicated that on the ORF there was an increase in each measurement point and across the entire year (Fien et al., 2008). The results did show that from the end of one grade level to the next (over the summer) that there was a drop in performance, and this was attributed to the span of time without exposure to direct reading instructions and to the increase in difficulty of the reading materials at the new grade level. The results show that with growth over time teachers and students must continue to work on skills in order to ensure growth at the proficiency level or above, technology can help with this process especially over the summer break.

Phonemic awareness interventions. In a quasi-experimental study by Powers and Price-Johnson (2006), 15 schools in Tucson, Arizona district were studied to determine the effectiveness of the Title 1 reading program with Kindergarten students. Title 1 of the No Child Left Behind Act of 2001, formerly known as ECIA, ESEA or Chapter 1, is the largest federally funded educational program (Department of Education, 2009). This program provides supplemental funds to school districts to assist schools with the highest student concentrations of poverty to meet school educational goals in reading, math, and language arts, but the highest concentration of grade level deficits is found in reading. The intervention used with these Kindergarten students was the Waterford Early Reading Program (WERP), a technology-based program for early elementary grades. The measurement tool used was the Dynamic Indicators of Basic Early Literacy Skills (DIBELS), and it reviewed the effectiveness of the reading curriculum, this intervention, and all supplemental materials used to measure phonemic awareness.

This study concluded that the groups using the technology based WERP program significantly out outperformed the other groups in all areas and in each instance of testing (Powers & Price-Johnson, 2006). These WERP students scored higher than the non-WERP students in all sub-categories including gender, economics, ethnicity, and home language. There were 740 students in the WERP group and 1480 in the traditional group. The study ran over a 6 month period of time, and although there was an increase in all groups between the pre and post tests the WERP group showed significantly higher results indicating that the computer based program served as a beneficial tool for teaching phonemic awareness to Kindergarten students.

In a longitudinal study by Nancollis, Lawry, and Dodd (2005) two groups of children in the United Kingdom were studied. One group received an intervention for phonemic awareness and one group did not. The study reviewed the effects of a phonological awareness intervention focused on syllable and rhyme awareness on the acquisition of literacy and the development of phonological awareness skills. The intervention group included 99 children using the program for nine weeks in their summer session of the final year of preschool. Nancollis, et al. concluded that the intervention group did much better on the phonological awareness intervention receiving higher scores on rhyme awareness and non-word spelling. The research did deliver a surprise in the results for non-intervention group that showed higher scores in the area of phoneme segmentation. It was also concluded that the intervention had no lasting results on the later literacy development of these students.

In a mixed study by Marston, et al. (2007), a total of 324 Kindergarten and first-grade students were studied in four elementary schools. The purpose of the study was to examine curriculum-based measures of early literacy and the utility of these measures in a problem-solving model (PSM). Within the response to the intervention model student data were collected often during the implementation of instructional interventions and the intensity of the interventions increased as a function of the students' non-response to previous interventions and classroom instruction.

The study by Marston, et al. (2007), reviewed phonemic awareness, onset phoneme identification and phoneme segmentation, over a four-month period of time. The results showed over the four months that students showed an increase in assessment scores in all areas. The results showed an increase in assessment scores with general-education students, special education students, and English Language Learners (ELL). The special education students showed less growth than the general education and the ELL students. Further the study indicated that most reading difficulties can be prevented, with the right interventions and monitoring; however, in most traditional approaches reading is monitored infrequently, sometimes only once a year. Therefore, early literacy assessment within a problem-solving framework has the best chance of improving overall student achievement and reducing the number of students with significant reading problems, before third grade when it becomes extremely difficult to bring them back to grade level.

The purpose of a study by Flanigan (2007) was to examine a model of early reading acquisition on the concept of word in the text, which is an area that is seldom researched and reviewed by educators. The skill of understanding a word in text is an important early reading acquisition skill that bridges phonemic awareness with a more sophisticated level of phonological awareness. Decades of research have been collected on phonemic awareness and several studies indicate that if reading levels are not strong by third grade, and then the student would struggle with reading and writing throughout their education and their life.

This study included 56 Kindergarten students who were assessed on measures of beginning consonant awareness, concept of the word in text, full phoneme segmentation ability, spelling ability and word recognition ability. The study made use of a balanced literacy approach, instruction that incorporates the teaching of both specific skills such as phonemic awareness and phonics, and the application of these skills in meaningful contexts. Two Kindergarten teachers provided systematic instruction in phonological awareness and letter–sound relations in the whole group, small group, and individual settings. The teachers made use of morning messages, interactive writing, shared reading, read-aloud, along with multiple opportunities to write, draw stories and respond to literature, all traditional parts of a balanced literacy program.

The study concluded that no student had mastered the skill of concept of the word in the text without having first mastered beginning consonant awareness. Most significant to this study was the finding that no student was able to segment a single syllable consonant–vowel–consonant (CVC) word into its three constituent phonemes without having already mastered a concept of word in text. In other words, it appears that a child's concept of word in text is an important bridging skill that allows beginning readers to orchestrate their knowledge of the alphabet, beginning consonants, and letter sounds to gain an initial foothold into contextual reading (Flanigan, 2007).

The purpose of a study by Menzies, Mahdavi, and Lewis (2008) was to examine best practices from research to the integration in the classroom in an effort to improve reading at an early age. According to Menzies, Mahdavi, and Lewis there has been limited success with the actual practice of teaching phonemic awareness and raising student achievement. The researchers indicated to determine a solution that works best for students that this problem could be divided into two sections. The first obstacle described was to ensure that teachers were aware of the use of research-based best practices and the second was to determine a way to sustain the use of the adopted practices and let them run the course to prove the effectiveness of instruction.

The study involved 42 first-grade students in a small elementary school, in an urban area of Southern California, (Menzies, Mahdavi, & Lewis, 2008). Each of the school's first-grade classes, their classroom teacher, four paraprofessionals, a special education teacher, a literacy coach with background in special education, and a primary researcher participated in this study. The school's student population was 78% free or reduced lunch, had English language learners (ELL), and poor parental support at home and there was a high transient population.

The first intervention added more frequent assessments to determine individual needs and to monitor student progress throughout reading lessons (Menzies, Mahdavi, & Lewis, 2008). The second intervention was to ensure students would reach grade-level proficiency by the end of the given school year by making use of small-group instruction with more intensity and structure. Title 1 funding allowing students to meet with educators Monday through Friday, for 45 minutes for as long as needed provided the additional resources and paraprofessional time. During each session students listened to a rhyming story, daily lessons on phonics, and a read along with the teacher. Blending, segmenting, rhyming, comparing, and fluency were key areas for student work.

The researcher concluded that 90% of the students reached grade-level proficiency by the end of the school year. There was also an increase with 8 of the 16 students identified as at-risk where students showed grade-level or advanced status on the final assessments. The students who did not meet grade-level proficiencies were faced with factors far more than the other students, but each one showed growth overall. The challenges the teachers faced related to the fact that the data from the DIBELS assessment were not always conclusive enough to base instruction upon making it difficult for teachers to plan individual learning goals.

In a recent study by Lane, Fletcher, Carter, Dejud and DeLorenzo (2007) a paraprofessional-led intervention program for first-grade students with poor early literacy skills and behavior problems were studied to determine efficacy. The goals of the study were to determine if the brief intervention could improve academic skills, behavior, and social skills of the students.

The study included 24 first-grade students, 18 boys and 6 girls, who were nominated by classroom teachers because of their low academic levels in literacy and who displayed both poor social skills and had behavior problems in school (Lane, et al., 2007). The study was conducted with the help of three fully certified general education teachers and one paraprofessional located in a suburban elementary school, in a southwestern state. The teachers had 2 to 10 years of teaching experience, and the paraprofessional was a high-school graduate who had some college experience and had been with the school for 5 years.

According to Lane, et al. (2007) the teacher's responsibilities for this study included (a) identifying potential student participants using a systematic screening procedure, (b) participating in assessment procedures at three time points, (c) attending a 2-hour training to learn the intervention procedures, (d) allowing students to participate in the intervention during the instructional day, (e) evaluating social validity at the conclusion of the study, and (f) conducting the intervention with the delayed-treatment control group in the spring of the same academic year. The paraprofessionals' responsibilities included (a) learning the intervention and reviewing behavior management strategies, as well as 30-minute trainings on a weekly basis over the course of the study; (b) conducting the intervention with two groups as part of their regular duties; (c) allowing university research students to observe the sessions to collect treatment integrity data; and (d) evaluating social validity at the conclusion of the study.

The study concluded that the treatment group scored significantly higher on the chosen assessment than the control group (Lane et al., 2007). The results of the same assessment with respect to social skills and behavior were insignificant. There was actually a small increase in behavior problems with the group receiving interventions. Overall the researchers concluded that the intervention program was moderately successful and although it helped with academics it did not help with behaviors and, therefore, should not be used for anything other than academics. Further studies need to take place to determine appropriate interventions for behavior problems.

In the experimental and longitudinal study by Otaiba and Fuchs (2006) the researchers set out to identify student characteristics that reliably predict responsiveness and nonresponsiveness of general interventions. The study included 104 children, including 7 with special needs and Individualized Education Programs (IEP's) and who were tested in Kindergarten and first grade. The responsiveness and nonresponsiveness to generally effective early learning interventions was determined after a 2 year study where students participated in best practice instruction in both Kindergarten and first grade, first grade only, Kindergarten only and in neither year. This met three groups, those that were responsive, those that were sometimes responsive and those that were nonresponsive.

This facilitated the study of three groups: Always responsive students that met responsiveness criteria in both years; Sometimes responsive students that met the criteria in only one year; and Nonresponsive students who did not meet the criteria in either year (Otaiba & Fuchs, 2006). Multivariate analysis of variance and discriminate function analysis indicated that the three groups were reliably different from one another on measures of problem behavior, verbal memory, sentence imitation, syntactic awareness, vocabulary, naming speed segmentation.

The research study included a combination of naming speed, vocabulary, sentence imitation, problem behavior, and amount of intervention correctly predicted 82.1% of nonresponsive students, 30.0% of sometimes-responsive students, and 84.1% of always-responsive students (Otaiba & Fuchs, 2006). Approximately fifty students from Kindergarten and first grade were tested again at the end of what should have been their third-grade year and the results showed that all but 1 of the nonresponsive students who received intervention had been identified as requiring special education and had an IEP with reading goals.

In all of these studies the researchers determined that interventions and additional assistance in phonemic awareness are needed in order for students to succeed and become good readers and communicators. Interventions can come in several different types of tools and methods, one being a program using technology. Many educators rely on the computer for interventions with programs like Headsprout (2009), Lexia (2009), and Read Naturally (2009), but other types of technology may be just as effective. Handheld devices may provide mobile learning for young students and provide a familiar setting since they are similar to handheld gaming devices currently used by many students.

Further evidence found in current research indicated that early childhood students acquire the skill of phonological awareness by beginning with initial sounds and rhyming, and continuing with the development of an awareness of alliteration, syllabication, and intonation (Goswami & Bryant, 1990). Students began with word decoding or deciphering and once that skill was mastered they moved toward learning the skills needed to build reading comprehension. As a result, phonological awareness has become a widely used predictor of the speed and efficiency of reading acquisition and research links individual differences in phonological awareness to the acquisition of reading skills (Bus, 1999). Students who gain these skills are able to decode words better and, in turn, read at a higher level with more comprehension, making phonemic awareness a strong indicator for early reading acquisition.

Foorman, York, Santi, and Francis (2008) conducted a study that utilized early reading assessment data from a randomized trial of 210 urban and rural schools across Texas. The study examined contextual effects on risk prediction in first and second grade. The main focus was to examine roles of (a) individual differences, (b) the grade 1 classroom, and (c) the pairing of first and second grade teachers in determining grade 2 outcomes in word reading and fluency. An underpinning to this was to investigate whether the administrative format of the assessment (paper, paper plus desktop, handheld plus desktop) or the level of the teacher support (web mentoring, no mentoring) moderated the prediction.

The study found that there was a correlation between the pretest and the mean for the pretest that was a much better indicator than just the pretest (Otaiba and Fuchs, 2006). The student scores varied by teacher-pair and on average interclass correlations ranged from 6% to 17%. The differences in the infraclass, at the classroom level were much greater than at the school level, and differences in urban schools were twice that or rural schools.

All of the research studies in phonemic awareness reported that early intervention is key to early literacy and that phonemic awareness is a key component to learning to read. Flanigan (2007) was key in reporting that there are decades of research on phonemic awareness and that in all these findings the reports indicated that early reading acquisition is key to comprehension and communication later on in life. Menzies et al.

(2008) showed that best practices and research-based curriculum are key to providing phonemic awareness lessons to Kindergarten students.

All of the research studies were consistent with best practices for phonemic awareness lessons and with interventions and monitoring of students to ensure success, but the Forman at al. (2008) study discussed the review of data from assessments to determine how to pair up students to provide interventions. The grouping of students was the focus, not so much the actual learning and intervention delivery. Educators determine what is best for the students instead of students taking the lead in their own learning.

All of these studies included best practices, but none of them focused on using technology or other tools to provide lessons to students in an effort to raise student achievement. There is a clear gap in research where the best practice of using 21st century learning tools are missing, and research of using handheld devices in Kindergarten classrooms to raise student achievement in phonemic awareness will fill this gap.

Phonemic awareness with technology. In order to prepare students for both formal education and the real-world teachers must recognize the impact technology has on literacy instruction (Morrow, Barnhart, & Rooyakkers, 2002). Research findings suggested that the technology, used as a tool, has been shown to enhance reading, writing and language arts, which are the focus of education and the foundations of reading success. The demands for early literacy must be addressed as early as possible to ensure success of all students (Morrow et al., 2002). They believed that another benefit to education was to use computers to provide individual reinforcement of skills allowing adjustable levels of difficulty and giving students ownership or their own learning and computer skills.

In order to ensure that technology is successful for students and provides quality-learning experiences, educators must participate in professional development. This ensures the effective use and trouble shooting of the software and technology tools (Morrow et al., 2002). Traditional areas used with early childhood students include word processing programs, educational software and websites with specific phonemic awareness and fluency skills, and equipment used for writing such as scanners, printers, and digital cameras. An additional factor for teachers is the frequency of use by students and how the tools are used.

Teaching is becoming harder because of the individual needs of each student and the lack of adequate funding to reduce class size and provide the best materials possible, including technology tools (May, 2003). Reading and technology tend to be priorities in schools as educators integrate the two to meet student needs. Teachers work toward reaching all students, meeting the standards and preparing students for state assessments and making reading enjoyable.

A program like Kidspiration (2009) is an easy to use software program that helps students create story webs and other types of brainstorming activities that will increase writing and reading fluency (May, 2003). Another widely used and researched program is Timeliner (2008), which allows students to create timelines and other kinds of sequencing charts. There are also a variety of researched web sites that offer stories for children to read and then participate in activities or take quizzes to determine their comprehension of the story. Many classrooms use digital cameras and printers to create literacy projects that show their assessment for learning and begin to raise student achievement through the additional motivation to learn and practice.

According to Lacina (2006) children are exposed to technology at a very early age and begin to comprehend how it works, making it an important component of literacy and labeling them telecommunication literate. Telecommunication literate means that the child cannot only operate a computer but they can also locate and analyze multiple forms of information. Educators must now begin to ensure that all students are proficient in advanced technologies, no longer settling for the basics and no longer just teaching them to read paperback books and write essays, instead they must learn to communicate with text messaging and able to navigate through web sites, computer language, and electronic communications.

Children are learning at an earlier age and growing up in the 21st century requires them to know how to communicate with computers, knowing how they work and how to use them for a variety of measures as is suggested in the Lacina (2006) study. In other situations younger students made use of digital cameras and software programs help them with literacy (May 2003). These research studies, although full of technology and young students, do not show a strong connection between technology and higher student achievement scores in phonemic awareness. This study will fill this gap in research.

Technology Used in Schools: Kindergarten Literacy

Giles (2006) reported that educators could no longer ignore the fact that we all live in a digital age and that technology has permeated every aspect of our daily lives.

Students are exposed to cell phones, DVD players, video games, computers, digital cameras, and iPods on a daily basis. In order to make use of this "real-world" knowledge educators can discover ways to use these technology tools, and others like them, in the classroom, to make learning fun and to raise student achievement levels.

Strommen and Lincoln (2009) suggested that in order to develop a view of the revolution that technology is creating in education careful consideration of how technology has revolutionized American culture is necessary. In addition, research into and development of a deeper understanding of how technologic developments have left many teachers with a profound sense of needing to "catch-up" in both their learning and teaching with the ever-advancing technologies available is essential. In less than twenty years technology has formed a path into every area of society including social and cultural lives. Although this is significant, even more meaningful is how technology has brought change to the instructional program designs and teaching and learning that young children experience.

Children have grown up with electronic devices like remote controls; they watch more television and play more video games than they read and play and they see cellular phones as a common practice for communication, not for the talking abilities only, but also for the text messaging (Strommen & Lincoln, 2009). Even the toys today include technology to create sound, lights and movements and computer-based machines have entered almost every aspect of business. Students are now living in a world with instant access to information, and they must be taught not only how to use the ever-changing technology but also how to incorporate it into the learning process. However, even more important than the training in use of technology, a critical understanding that both students and teachers must come to is learning to verify sources of instant information so that credibility and integrity of information is not misinterpreted, or worse, failed to be considered as an integral evaluative point in the process of learning early research skills.

According to the International Reading Association (IRA, 2002), the Internet and other forms of information and communication technology (ICT), such as word processors, Web editors, presentation software, and e-mail are regularly redefining the nature of literacy, in the United States and around the world. To become fully literate in the 21st century students must become proficient in the new forms of literacy presented in ICT and instruction should begin in early childhood education.

Reading instruction settings and interventions are natural places and processes in which provide exposure to the use of a diverse array of technology. Technology is a form of communication and parallels the literacy concepts, when provided appropriately. NAEYC (2009) indicated that educators must take responsibility for influence events that are transforming the daily lives of all children and their families. According to NAEYC this statement addresses several issues related to technology's use with young children: (a) the essential role of the teacher in evaluating appropriate uses of technology; (b) the potential benefits of appropriate use of technology in early childhood programs; (c) the integration of technology into the typical learning environment; (d) equitable access to technology, including children with special needs; (e) stereotyping and violence in software; (f) the role of teachers and parents as advocates; and (g) the implications of technology for professional development.

Technology is another “tool” to use to deliver reading instruction and to provide creativity to students during learning time (Davis, 2008). Technology can never take the place of an educator; educators must understand that human interactivity factor is essential in educating young learners via modeling and educators must plan lessons accordingly.

The NAEYC statement addresses several issues related to technology's use with young children: (a) the essential role of the teacher in evaluating appropriate uses of technology; (b) the potential benefits of appropriate use of technology in early childhood programs; (c) the integration of technology into the typical learning environment; (d) equitable access to technology, including children with special needs; (e) stereotyping and violence in software; (f) the role of teachers and parents as advocates; and (g) the implications of technology for professional development.

To support what NAEYC recommends school districts must ensure that educators are given professional development on using technologies with their curriculum and teaching students’ new skills (IRA, 2002). Pre-service teachers should also be provided with knowledge of new technologies and how to teach children to use them. Some such technologies that are in many classrooms include interactive boards such as those called the SMART boards, Promethean Activboards and STAR boards, document cameras, classrooms computers equipped with educational software and Internet based programs, iPods and digital cameras. These technologies tools can be used to teach children in all curriculum areas, including physical education, music, and art.

Villano (2007) reported that anything that can be played on a handheld computer has instructional potential and over time will raise student achievement. In southwest Delaware, the Seaford School District is supporting the teaching of reading and writing skills to its early-elementary students with "sight word" mini-movies that K12 Handhelds (2009) created for the district. Students in Kindergarten through second grade to practice recognizing and reading words use these videos. A word is shown, read aloud, and used in a sentence with an accompanying picture. The words are then shown with no audio, giving students an opportunity to practice reading independently.

Jim White, Seaford's technology integration specialist, reported to Villano (2007) that the handheld implementation program began in 2002 as a trial in a handful of Kindergarten classes. The results were astounding, and after the teachers had reported high student achievement gains, the school went out and secured a total of more than $150,000 in funding to expand the program to every school in the district. The district felt that this was another tool for the teacher's toolbox and one that motivates the students in a new way. Each school has at least a set of 30 units, while some have two sets and the K-2 teachers share them to ensure the maximum usage by students. Todd Fishburn, an associate principal at one of the elementary schools was quoted by saying, "Our philosophy is that if handhelds changed this much of the educational experience for us, they've got to be able to have a similar impact for other districts, too. The best way to learn about this stuff is from your peers." The Villano (2007) study explained how handheld devices were used to increase student achievement for student, even at the Kindergarten level, to enhance reading through auditory recordings of vocabulary words. This shows that in at least one study handheld devices are being used in Kindergarten classrooms, but it does not who that they are used in phonemic awareness, which is one of the first steps in beginning reading according to the IRA (2002). The research creates a gap in how the devices are used in Kindergarten for the most effective outcome in literacy.

Research on Technology in Kindergarten: Digital Cameras.

In the qualitative study by Ching, Wang, Shih and Kedem (2006) the researchers investigated the use of digital photography journals to support both social and cognitive growth in Kindergarten and first grade students. The students used digital cameras to record their daily schedule and the experiences they had with each lesson and activity. Student created journals, field notes, and video clips were used to determine the outcome of the research study. A total of twenty-five students were the subjects of a university-affiliated research project on technology and early grade instruction at a school in a Midwest town. The students shared a digital camera causing them to take turns and cooperate to complete the project.

The results showed two areas of technology integration: picture taking and journal creation (Ching, et al., 2006). The students' jobs included both their role being photographers and subjects of photos by fellow students, showing clear proficiency with the use of the camera and in helping their peers achieve their goals. Over time the student's focus in their pictures changed from general to more specific as the students realized they could zoom in and out and they began to focus their attention on very specific items and subjects.

The students had appeared to engage each other in what appeared to be a pleasant time creating the photo journals and learning a great deal about using the computer programs and cameras offering them another new skill set for their future with technology and the real world (Ching, et al., 2006). The collections were diverse in the way that students presented their work and used the layout to display it. Notes revealed that the girls centered their work around a few close friends, while the boys centered their work on several objects.

Ching, et al., (2006) research indicated that the digital photo journal project was effective in facilitating the integration of technology into the physical spaces and social fabric of the classroom. The project provided students with an opportunity to reflect on their environment and social networks in conversation with and a teacher or teaching assistant helping reach the proficiencies for communication and social skills too. In this section, we focus on several important issues related to technology integration in early childhood education. The researchers believed that this helped in showing promise that more technology can and should be used in early childhood classrooms as most are using them as a teacher tool and not as a student tool.

In a similar qualitative study by Boardman (2007), 29 Kindergarten teachers in Australia were studied to determine their perception of how well students could use digital cameras and voice recorders to capture essential components of early learning achievement. The study determined several interesting results that potentially could lead to this type of technology being used for assessment and record keeping of student achievement. Students used the recorders to track conversations between peers and between teachers and students.

Boardman (2007) noted that two essential areas were mentioned and focused on by the teachers including student use to show reflective thinking and documentation of student progress for assessment and record-keeping purposes. The students experienced a few minor challenges when taking the photographs, the first being the identification of students when everyone was wearing the same type and color of hats in outside shots and the movement of subjects for those shots. It was also noted that the voice recordings used made note taking much simpler for teachers and researchers because trying to write down everything said by these young children was almost impossible.

Boardman (2007) found that with the use of the audio recorder there were some set backs or negative aspects, and the most mentionable was the sound quality because some children were soft spoken and it was hard to hear them on the playback. In other cases other children present in the area or background noise would have covered the sounds of the child being interviewed or listened to and this also contributed to lack of being able to hear the child being recorded.

In conclusion, it was determined that the use of digital photography and voice recordings were beneficial to the assessment of early age learners and one additional advantage identified, in the use of this technology, was the immediate ability for children to see themselves and receive feedback during their learning process (Boardman, 2007). It was made clear that the immediate feedback was also a motivator for the students. Students can also actively participate in the selection of the photos and audio that should be included in journals or portfolios to show their best work and highlight proficiencies. Parents gave informal feedback, and they showed positive intentions with their pleasure of seeing student work and hearing the progress being made in their child's learning.

Another form of technology used in the teaching of young learners is the use of robotics in the early learning settings. In a qualitative study, Rusk, Resnick, Berg and Pezalla-Granlund (2008) conducted research on the creation of new strategies for use of robotics to improve learning in the classroom. The researchers engaged students in four areas to determine if that robotics could be successfully used to enhance learning opportunities and they included: (a) focusing on themes, not just challenges; (b) combining art and engineering; (c) using story telling; and (d) hosting exhibitions instead of competition.

Research on Technology in Kindergarten: Computers and Programs.

According to the work of Zevenbergen and Logan (2008) the world of most western children has undergone significant changes in the past several decades, significantly due to the invention and varied use of the computer. The use of computers and computer programs has not been significant in the early childhood classrooms and the research shows that most young children have had exposure to computers outside of formal education and need to be given the opportunities in school for the same experiences. Educators must change their thinking and allow these digital natives to use their talents to learn in and out of the classroom to provide them with much needed skills and to ensure a "real-world" experience. Prensky (2001) has written about the digital native and has argued that this generation has begun to think differently from other generations (as cited in Zevenbergen and Logan, 2008). This generation is aware of the instant feedback that technology (TV remotes, microwaves, computers, and cell phones) can provide them, and the fast speed from action (click of mouse/button) to effect (the result of that click) means that young children process information quickly. There is a broad range of resources to assist students with their individual learning and growth both for entertainment and academics and multi-tasking has become second nature to most children and adults.

The actual research by Zevenbergen and Logan (2008) has sought to identify the amount of access and the ways in which young children used computers in the home. The researchers sought to find out how young children (four to five years) used computers, the skills they were developing, and links with home and formal learning environments. They undertook this through a survey in which parents reported their children's use of computers at home.

The parent survey was developed and implemented in a major regional area in Australia and the community has a socially, economically, and demographically diverse population of over 100,000 people (Zevenbergen & Logan, 2008). The survey asked about the amount of computer usage, the types of computer usage, the frequency of which children accessed the computer (where and for what purposes), and their individual skills. The results between girls and boys were compared to determine if there was a difference in use and types of use.

The results of the survey indicated that well over 87% of young children has significant access to computers in the high for a variety of purposes (Zevenbergen and

Logan, 2008). This suggests that most students come into the formal educational setting with schema (previous knowledge) of using computers and programs on them. Educators need to be cognitive of these results and ensure that they not only use computers in the classroom, but also strive to teach young students new skills. This creates a challenge for educators as they begin to determine ways to teach their students new skills.

Scott (2003) reminded educators that Kindergarten is, in most cases, the first formal year in a young child-learning career and caution must be taken to ensure a positive experience. The Kindergarten classrooms setup, procedures, and curriculum provide students with a balance of rigorous academic standards and appropriate developmental experiences, including technology usage. The typical Kindergarten student entering school does not come with reading-readiness skills or independent writing skills.

Research on Technology: Interactive Boards.

In the study by Preston and Mowbray (2008) the findings from classroom-based observations that the use of SMART Boards (and other interactive whiteboards) were beneficial to Kindergarten students in their science class. The SMART boards had been used to teach science for over 8 years and this type of learning has enhanced thinking skills and detailed observations. The SMART boards proved to be successful with enhancing learning, offering multiple opportunities to assess student progress, and offering a variety of ways to reach the digital native students of today.

Preston and Mowbray (2008) indicated that interactive whiteboards allowed students and teachers to perform a range of functions such as: (a) clicking on icons to hear sound files; (b) working with a variety of multi-media files and activities; (c) viewing graphics, taking virtual tours, and watching simulations; (d) annotating with pen and highlighter tools over text and images (web sites, PDF files, word documents, and Power Points); (e) allowing student work to be saved for future viewing and use; and (f) allowing lessons to be engaging reaching all students.

Preston and Mowbray (2008) indicated that with the short attention span of Kindergarten students and the need to be actively involved in everything to ensure their learning the interactive board served as an educational tool that makes learning fun for teachers and students.

Few limitations were discovered during the study apart from the obvious ones such as the expense, and need for teachers to be educated on the use of and become comfortable teaching with them (Preston & Mowbray, 2008). Another problem noted was the fact that only one person at a time can use the interactive board, leaving the rest of the class to watch and that is something many of the Kindergarten students noted as a reason they don't like using the board.

In conclusion, this study found that the interactive whiteboard can enhance learning, but it must be used appropriately by teachers, which means professional development opportunities and practice outside of the teaching environment (Preston & Mowbray, 2008). It is also best to teach using interactive activities that were short, allowing all students to take a quick turn at the board.

In a 2009 quasi-experimental evaluation study Marzano looked at the effects of the Promethean ActivClassroom on student achievement. A pre-test and post-test design was used to evaluate the process. During the 2008-2009 school year, 79 teachers from 50 schools throughout the country participated in the study to determine the effect of the Promethean (interactive whiteboard) on student achievement. The evaluation study involved 1,716 students in the treatment group and 1,622 students in the control group. In the treatment group the teachers used the Promethean boards to enhance their teaching practices and in the control group the teachers used traditional means of teaching and did not make use of the interactive boards.

According to Marzano (2009) the evaluation study attempted to answer the following questions through a meta-analysis of the independent treatment/control studies:

Question 1: What effect does Promethean ActivClassroom have on students' achievement regarding the subject matter content taught by their teachers?

Question 2: Does the effect of Promethean ActivClassroom differ between school levels?

Question 3: Does the effect of Promethean ActivClassroom differ between grade levels?

Question 4: Does the effect of Promethean ActivClassroom differ between academic content areas?

Question 5: Does the effect of Promethean ActivClassroom differ based on length of teaching experience?

Question 6: Does the effect of Promethean ActivClassroom differ based on how long the teacher has used the technology?

Question 7: Does the effect of Promethean ActivClassroom differ based on the percentage of instructional time the technology is used in the classroom?

Question 8: Does the effect of Promethean ActivClassroom differ based on teachers' confidence in their use of the technology? (p. 11)

The results were significant in most areas, but they were depended how the teacher taught, and the teachers experiences and the way things had been presented to students. The results indicated significant gains in student achievement when the following conditions were in place:

- A teacher had 10 or more years of teaching experience
- A teacher had used the technology for two or more years
- A teacher uses the technology between 75 and 80% of the time in his or her classroom
- A teacher has high confidence in his or her ability to use the technology.

Additionally, the findings noted that in the seventh-grade classrooms the achievement was not as high and further studies would need to be conducted to determine the reasons.

Marzano (2009) noted that students could raise their student achievement levels almost 30% if all the factors were in place, using the ActivClassroom setup by Promethean. This is true for all grade levels K-12 and in all subject areas and can include the interactive board, student response systems and create interactive flip charts, which are interactive for student use at the board.

Research on Technology: Gaming.

Tomlinson (2003) reported that educators tend to shy away from gaming because of the perception that it is purely for entertainment or a time-filer when nothing else is planned, but not for academics. Word games on Personal Digital Assistant (PDA) or game systems like PSP (PlayStation Portable) and Nintendo Game Boy allow learning to continue outside of the classroom walls, because students can take their devices with them wherever they go and in many cases these devices are also inexpensive. In addition, word games can create an incentive for learning language skills, especially for students who find it hard to focus over a long period of time.

Some of the areas enhanced through the use of well-developed PDA games, according to Tomlinson's research (2003) included:

1. Concentration and attention span
2. Memory skills
3. Hand-eye coordination
4. Reading skills
5. Writing skills (learning to write in the "Graffiti" style for handhelds requires considerable care for accurate letter recognition)
6. Vocabulary and numeracy
7. Confidence (appropriate feedback in games can be a great confidence boost)

Students varied in their learning styles and educators adjusted their teaching to what works for students and also meets the changing needs of the real world. Teachers are encouraged to have a variety of teaching methods and tools available at all times.

Research on technology: robotics. Beals and Bers (2006) completed a study on robotics in the early childhood classroom, and they mentioned parental support being important with young children. The researchers mentioned that it had been no secret that new technologies have made their way into the classrooms, however, many families have exposed their young children to these tools before they ever entered the traditional school setting. The parents have been the first teachers of technological literacy to their children, as they learn along side their children.

In the Beals and Bers (2006) study 17 parent-child partnerships and 20 individual children were taught to use programmable Lego (2009) bricks to create their own meaningful projects involving both programming and building, during a five weekend long study. In the study, a significant difference was found between building and programming aspects of the projects between the individual projects and the partnership projects. Beals and Bers suggested that Vygotsky's idea of proximal development played an important role in this study, but it was argued that the children in the partnership groups did not learn as much as the children in the individual groups, as the parents were too involved in their own learning and did not tailor their instruction at a level appropriate for the children to understand and retain the information.

Beals and Bers (2006) entitled the study "Project Inter-Actions," and it was developed with three major educational philosophies and concepts in mind: (a) philosophy of constructionism, (b) the concept of the zone of proximal development, and (c) the concept of peer learning environments. Papert (1980) was credited with developing the idea of constructionism, based on Piaget's theory of constructivism (as cited in Beals & Bers, 2006). Following Piaget's ideas on cognitive development, the students who participated in this research were expected to be in the pre-operational stage, which was marked by the development of symbolic symbols, including speech, or the concrete operational stage. The adults were expected to be in the formal operational stage, identified by the development of hypothetical and abstract thought.

Beal and Bers (2006) discussed the concept of the zone of proximal development (ZPD), which has been extremely influential in both child development research and educational research for years. Vygotsky (1978) defined the ZPD as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or with more capable peers" (as cited in Beal & Bers, 2006).

The idea of the ZPD was important for research and Project Inter-Actions, as each participant brought various skills to the workshop, even though the technology itself was new to most participants (Beal & Bers, 2006). The research did not take into consideration the differences in age and skill levels, but looked at the projects themselves and how the children created them (individual or in a partnership with a parent). The students naturally formed a peer-learning environment and this helped with the achievement of the individuals.

According to Beal and Bers (2006) the results indicated that there was a definite collaborative learning environment between the students and parents in partnerships and students, in both groups, learned by playing and not as much by being taught. The partnership groups were observed, and a notable difference had the parents doing most of the work for the students, where in the individual groups the students had to rely on peers to assist them.

Another robotic tool that is used in several early childhood classrooms is the Pro-Bot, which is a programmable floor robot that is simple and student friendly (McBee, 2009). The Pro-Bot has been a good starting point for teaching young students control, directional language and programming, along with curriculum that is being taught along with the use of the bot. This floor robot is a tool that has enhanced the learning of a curriculum content and processes such as literacy (story telling, recount, sequencing), science (experiments, problem solving, review) and mathematics (counting, patterns, direction, estimation).

The research shows a variety of educational technology tools being used to enhance learning in Kindergarten classrooms, but none specifically identify a tool that enhances student achievement in phonemic awareness. Digital cameras, interactive white boards, computer software, robotics, games and educational software all have made their mark on Kindergarten classrooms and have shown motivation to learn and some achievement with academics. The research done with handheld devices in Kindergarten related to phonemic awareness will fill a gap in the literature and determine if handheld devices are beneficial or not.

Handheld Devices in Schools

Bennett and Cunningham (2008) reported on research that supports one-on-one computing, also known as ambiguous computing (Dieterle, 2008), which has been on the increase for the past 15 years. The need for students to function effectively and efficiently in the classroom and to learn lifelong use of technology skills for the real world offers strong support for this type of education. The biggest appeals for this concept are the inexpensive, lightweight, portable, and easy to use features of handheld computers. One feature of one-on-one computing is the idea of using handheld computers in the classroom.

Research has indicated that handheld computers seem to be a growing trend and these mobile units are becoming more powerful and user-friendlier (Bennett & Cunningham, 2008; Young, Mullen & Stuve, 2005). However, these handheld computers are still viewed as harmful to student learning according to many educators, but their features and cost effectiveness of these technologic units makes them almost impossible not to use in classrooms.

No matter which side of the technology fence you sit on, 'technology happens.' Handheld technology is one of those things that just seemed to happen overnight. Sometimes crayons are better. In our excitement over the promise of new technology in the classroom, we might forget that, despite all its amazing capabilities, handheld technology is just a tool, like chalk, but more exciting! (Williams, 2006, p.60)

Williams stated that handheld computers are a tool that educators can embrace, which make their jobs a littler easier and to engage the students of today. The ease of using handheld computers is one of the top factors in using these devices in the classroom.

Handheld computers changed the attitudes of the users in a positive way, opening the door for further progress in other areas such as the impact on student achievement and proficiency, a strong integration between current curriculum and technology use, and increased time on task (Alexiou-Ray, 2008; Gulchak, 2008; Lai, Wu, Kao & Chen, 2008; Van Hover, Berson, Bolick & Swan, 2006; van't Hooft, 2005). These research studies were conducted with adult educators and with older students, mostly in the college and secondary setting.

Positive Aspects of Using Handheld Computers in Schools.

During the 2001-2002 teachers in 7% of United States public schools used school year handheld computers for educational purposes (Wangemann, Lewis, & Squires, 2003). In addition, the researchers reported on the "Palm Education Pioneers Program: Final Evaluation Report" from 2002. This report was a review of a large-scale study of the use of handheld computers in more than 100 U.S. elementary and secondary classrooms. During a survey of the teachers who participated in this study, about 90% reported that handhelds were an effective classroom tool and had the potential for making a positive impact on student learning.

In the pilot study by Wangemann, Lewis, and Squires (2003) a class section of a secondary education course in social studies was selected for the program. The social studies section was chosen because it integrated two additional strands of technology, and creativity into the social studies methodology. This six-week course had 26 participants and of the participants, 42% were juniors and 58% seniors; 89% were of ages 18 to 23, with 11% of the participants 24 years or older. The study included 70% girls and only 30% boys in the course. During the study the students met daily with university professors, on the university campus, and visited a public school weekly where they provided a classroom lesson. Once the handheld computers were distributed, the students were provided with initial training on how to use the devices and limited help with the actual set up.

The study used two primary instruments for gathering data according to Wangemann, Lewis, and Squires (2003); first, students were required to keep a daily log of how they used their handheld computers. This log identified the type of use or function performed by the handheld computer and the amount of time actually spent in use. Second, a pretest and posttest were conducted using attitudinal scales regarding the effectiveness and use of handheld technology in education. The data were collected on students' experiences with technology before taking the social studies course. In addition, weekly debrief sessions were held in which students could share thoughts and feelings about their experiences with the handheld computers.

Wangemann, Lewis, and Squires (2003) discovered that student use of the handheld computers had a positive impact. Of the 26 students participating, using the units for school-based work, 92% used them for email regularly and 88% used word processing software regularly. It was also noted that 83% used the units for fun programs, and 54% used them for homework on a daily basis. Overall, the most frequently used functions of the handheld computers (in terms of minutes spent by each student per week) were for note taking, tasks and games. The logs indicated that every week the students’ use increased as they became more proficient with their use and discovered other ways to enjoy them.

Wangemann, Lewis, and Squires (2003) indicated that at the conclusion of the six-weeks, the students were asked to report on the most positive experiences they had used the handheld computers and the most frequently mentioned functions included the calendar (54%), e-reading (46%), games (38%) and taking notes (38%). The students, as part of their final examinations, were asked to report what activities or programs should be continued during a course that uses handheld computers, what activities or programs should be discontinued, and what new activities or programs could be added to the current offering.

The students felt that the handheld computers should be used more frequently in course assignments and activities, course material could be made available to them through beaming, and more training activities should be required (Wangemann, Lewis, & Squires, 2003). In fact, the largest response to what should be changed was the suggestion to spend more time in training the students on how to use the devices. There was little agreement among all students on what should be eliminated from the current offering.

The study further concluded that handheld computers offer some distinct opportunities in education (Wangemann, Lewis, & Squires, 2003). A few of the advantages include mobility, beaming or the sharing of information and communications, the personalization of student work, and empowerment of each individual having a learning tool under his or her own control.

Tomlinson (2003) reports that handheld computers are becoming more popular in both the real world and in the classroom because they are more affordable compared to desktop PC's, laptop computers, or other electronic devices. The handheld computers have become modern motivational tools can be used for a number of productive applications that fit into the school model and include: word processing, homework planning, timetable reminder, printer utilities, and for fun through a variety of educational games. Use of the educational games help students, especially those who need the motivation, to learn key concepts become better communicators with their reading and writing through the use of technology.

Furthermore, handheld computers have been key in the development of such skills as greater concentration and attention span, memory skills, hand-eye coordination, reading skills, writing skills, math skills, confidence, problem solving, and technology skills (Tomlinson, 2003). With the need to ensure individual learning for each student the handheld computer can allow the differentiated instruction and set the level of learning a the appropriate place.

In the mixed-method study combining qualitative naturalistic investigation and a one-time pretest posttest quantitative design Gado, Ferguson, and van't Hooft (2006) who conducted research with 21 pre-service teachers, including 17 undergraduate and 4 graduate students, determined the implications of integrating handheld computers in science methods courses to create changes in curriculum and attitudes toward technology use with students. Qualitative data were collected in three stages through interviews, student reflection papers, journals, and classroom observations of peer teaching. The study used a rubric to determine the results of five areas: (a) classroom and school environments; (b) teacher's technology background and predisposition; (c) student's prior knowledge and experience; (d) open and engaging curriculum; and (e) access to handheld computers as learning tools in the classroom. These conditions affected the outcome of the study and future uses of the handheld devices. The study concluded that there was increased student involvement with the integration of handheld computer technology into the science curriculum, that there was some evidence of increased student achievement, the handheld computers had a clear connection to the science curriculum, and methods the teachers used to deliver instruction and remained organized.

Lai, Wu, Kao, and Chen (2008) conducted a study using the jigsaw method of cooperative learning over a three-week period on the use of handheld computers in an effort to determine the implications of this type of technology with concept mapping tools. The study set out to answer two questions: what are the effects of using handheld computers in a traditional classroom and what are the issues associated with the use of handheld computers? The study's sample included 50 college students as subjects, in 12 different groups during a psychiatric nursing course, to determine if the handheld devices were viable. Various data were collected to evaluate the effects of using PDA's including student questionnaires, classroom observation journals, audio-recorded group discussions, students' concept maps, and interviews with the instructor. The study concluded that more time was needed to determine if the devices had a direct impact on student achievement; however, it was determined that by using the handheld computers students were more focused and excited about their work. All students used the devices during the entire study and course. The authors concluded that handheld devices had an impact on student achievement in the sense that the curriculum was integrated with technology, as a tool to provide real-life opportunities for 21st century learning.

In another study using a mixed-method approach, 23 fifth graders were studied to determine if handheld computers used in elementary classrooms gave a positive perception to both students and parents (Alexiou-Ray, 2008). Classrooms observations, discussions, interviews, and surveys were used to collect data. The students used the handheld devices for a nine-week period as part of their regular routine and then both students and parents were interviewed to determine if they had a positive or a negative experience and if this experience affected their education.

The study determined that the changes in attitude were mixed because of prior knowledge of the handheld computers, differences in how the handheld computers were used in education, and how often they were used in the study (Alexiou-Ray, 2008). Most students indicated that they preferred using the handheld computers instead of using paper and pencils or other technological devices. There were mixed views on whether or not the handheld computers made a difference for student achievement. The students expressed a positive perception on the use of the handheld computers in the classroom for a variety of purposes, but the parents did not have a positive experience.

Gulchak (2008) conducted a study of an eight-year old male with emotional and behavioral disorders who made use of a handheld device. The teacher used a handheld device to teach the student how to self-monitor his behavior and increase his overall time on task and student performance in school. The observational data collected indicated that the student did become proficient with monitoring his own behavior, by using a special software program on the handheld device. The student also was able to increase his time on task when using the handheld and this began to increase his achievement.

In a pilot study reported by Ramaswami (2008) the North Carolina Department of Public Instruction (NCDPI), led by the state superintendent June St Clair Atkinson, set out to prove how devices like handheld computers, cell phones, and iPods could be educational. In February (2008), the NCDPI, which is responsible for 115 local public school districts and 100 charter schools, launched Project K-Nect, an effort to address the large math and science skills deficiencies in North Carolina schools by using cell phones. In this pilot study, teachers distributed to students math problems that were aligned to their personal lesson plans and correspond to North Carolina state standards. Students had a chance to solve problems through their mobile devices, such as cell phones, or they could choose to check out a handheld computer to do the same task.

The NCDPI and its pilot partners, Digital Millennial Consulting and the wireless provider Qualcomm passed out 100 smart phones to four high schools and three different school districts in the state of North Carolina (Ramaswami, 2008). Smart phones were considered to be in the category of handheld computers that perform a variety of functions combining different technologies. The project ran for four months, and the data collected were reviewed to determine if there was any gain in student achievement in mathematics. The additional research collected indicated that by 2010 nearly 81 percent of Americans, ages 5-24, will own their own cell phone and these smart phones will be capable of much more than they have been. The research also indicated that with the increase in the use of smaller devices, like cell phones and handheld computers, there will be a shift in economics and they will begin to out sell the computer industry. This would largely be due to the cheaper cost of the mobile units.

Handheld Computers for Multimedia.

Villano (2007) reported that in many classrooms teachers use movies as a reward or on a special occasion, but more creative teachers would integrate videos into their regular lessons to supplement the everyday curriculum and make the learning fun and motivational using such services as United Streaming, National Geographic, and Teacher Tube. In the nine school districts served by the Monroe 2-Orleans Board of Cooperative Educational Services (BOCES) in Spencerport, NY, movies have become part of the regular routine, with the help of handheld computers that are bringing students engaging instructional math content. This decision was arrived at in large due to the middle school math scores and the need to make improvements to student achievement.

To make changes to student achievement, within math, BOCES enlisted the help of K12 Handhelds, a technology integrator in Long Beach, CA, that specializes in building multimedia applications specifically for handheld computers (Villano, 2007). The company created BOCES several mini-movies, about 5-minutes in length, that taught math concepts like algebra, the distributive property, exponents to the students, through their handheld computers. These movies gave basic assistance to students by breaking down the math into different levels and they allow teachers to differentiate instruction and teach students at their own pace.

Villano (2007) reported that anything that can be played on a handheld has instructional potential and over time will raise student achievement. In southwest Delaware, Seaford School District is supporting the teaching of phonics and reading and writing skills to its early-elementary students with several series of "sight word" mini-movies that K12 Handhelds created for the district. Students in Kindergarten through second grade practice recognizing and reading words using the videos. A word is shown, read aloud, and used in a sentence with an accompanying picture. The words are then shown with no audio, giving students an opportunity to practice reading independently. The movies are supplemented with e-Books that enable students to further improve their reading skills. Teachers use both technologies to supplement in-class lessons.

In a different study using multimedia tools in education Caudill (2007) used online learning and blended discussion, both utilizing technology to convey educational content, and shifting from a model working only with e-Learning to encompassing mobile learning (m-learning). The mobile learning included portable digital assistants (PDA), short message service (SMS) messaging via mobile phones (texting), and pod casts via MP3 players. The researchers believe that this shift in learning is both because of the access of instant information and the advances and simplicity of the technology itself.

Parsons and Ryu (2006) define m-learning as the delivery of learning content to learners using mobile computing devices (as cited in Caudill, 2007). This brings about learning advantages of being able to access information and perform tasks anytime and anyplace, breaking down the barriers of being corded and at a learning station. It must be noted that using mobile devices in schools can save money and be convenient but finding the right use and programs for the devices can be a bit of a challenge.

Caudill's (2007) research indicated that PDA's are primarily a data storage system with the primary uses being for electronic date books and contact information.

PDA's can be used for research and electronic communication and in some cases electronic learning tools can be downloaded to the devices for reference and interactive learning. The small screen, limited storage and processing, and lack of a keyboard make the PDA a litter harder to use with young students.

Mobile phones allow students to access information, exchange messages and information through their mobile phones (Caudill, 2007). The mobile phone can be used anyplace that a strong enough signal can be maintained and it is a device that most everyone has access to, outside of school, so integration is easier for educators. The research indicated that students find their mobile phones to be easy to access and use, non-threatening, private, and allows for on-demand support. Students know their own devices and can operate them without instruction time, allowing for the immediate use in the classroom.

Pod Casting allows students to create voice and video recordings of content of interest or educational purpose, much liked a recoded lecture (Caudill, 2007). Students can download pod casts from teacher lectures and instructions for missed days or as an intervention to the learning-taking place.   The research indicated that many newer mobile phones and MP3 type devices allow for the same functions as the PDA and provide more features, therefore are the more popular types of mobile learning devices.

Clough, Jones, McAndrew, and Scanlon (2007) conducted a study on the increasing interest of informal learning in the recent years alongside interest in how this learning is supported by new technology tools, such as PDA's and smartphones. There is little known about how adults make use of their own mobile devices to support intentional informal learning.

The Clough, et al. (2007) study used a survey to investigate whether, and to what extent, users of mobile devices used them for informal learning and does it also support collaborative learning with other adults. The participants in this study were recruited from online forums and businesses, and asked whether they used their devices for informal learning or not.

The study found a pattern of learning, some of which deployed the mobile devices capabilities unchanged, others triggered adaptations to typical learning activities to provide a better fit to the individual learner. This information will be shared with software companies to use in the design and upgrades to current mobile software and programs.

Negative Aspects of Using Handheld Computers in Sschools.

Bennett and Cunningham (2008), Dieterle (2008) and van't Hooft (2005) identified discrepant findings in studies that determined that handheld computers were not associated with student achievement. Researchers determined that handheld computers were a novelty item, whose positive effects would diminish, and that the devices themselves create additional burdens for the users. The burdens included the size of screens being too small and hard to read, the length of battery life for continuous usage, the small buttons, which were hard to push, and the lack of mobile programs for use on the devices.

Some researchers concluded that one-on-one computing, which is having a laptop computer for each student, should be used, but indicated that laptop computers and other forms of technology were better for students than handheld computers (Dieterle, 2008; van't Hooft, 2005). Their research indicated that studies have been too small to determine the real impact of student achievement and motivation or time on task.

In the quantitative two-year pilot study by Bennett and Cunningham (2008) elementary grade students utilized handheld devices to determine if formative assessments using these handheld computers in schools would be beneficial. The study used two groups of pre-service teachers in a small private university to determine the effectiveness, as it was predetermined that teachers must know how to use the handheld computers, not just their students. The study determined that the handheld computers were burdensome for data collection and that the teachers preferred the traditional use of a laptop computer instead, supporting the findings of van't Hooft (2005) and Dieterle (2008). The biggest problem found in this research was when the devices' batteries ran out, data were often lost; thus, creating additional work for the teacher. It was also noted that the screens were too small, not colorful enough, and the buttons and functions were too small to be utilized effectively.

A quasi-experimental study of 104 students by van't Hooft (2005) was conducted to determine the effectiveness of handheld computers used in pre-service social studies education courses on creating positive attitudes of future teachers toward technology integration in social studies curriculum. Of the 104 students 94 finished the three required surveys and used the devices as intended. The results concluded that although the devices were successful for use and that most pre-service teachers determined that the use in the classroom would be beneficial, it was also determined that the limited shelf life of the handheld computers would eventually render the research useless because it would not convert well with new models and software.

A two-year qualitative study by Dieterle (2008) researched work being completed with students, faculty, and staff, at Harvard Graduate School in eight classes that used handheld computers. The study sought out to determine the problems and possibilities, as well as the potential and limitations of using handheld computers in education. The study found that although all of the participants used the devices often and enjoyed them, they did tend to use them for gaming, text messaging, and picture taking more than for research, writing, and educational work. This study also made mention of the idea of handhelds being a novelty that would wear off when the next best thing came along.

This research study explored the findings of these studies to determine if Kindergarten students enjoy using handheld computers in the classroom. Students in this study were assessed to determine if phonemic awareness skills increased as a result of their use of handheld computers. Existing research does not offer studies specific to subjects of Kindergarten students' ages and their usage of handheld computers in the classroom, thus providing a gap in the research that this study will fill.

Further this study was designed to determine if the idea that handheld computers in the traditional Kindergarten classroom will raise student achievement in the area of phonemic awareness, which is a strong component of early literacy (Ball & Blachman, 1991; Byrne & Fielding-Barnsley, 1989; Foorman & Moats, 2004). Technology is considered a modern teaching tool that can assist with the learning of literacy skills in schools and when used properly by educators can provide students with a real-world skill (NAEYC, 2008). In addition handheld devices in classrooms have become increasingly popular because of the low cost for districts, easy portability for students, and ease of use (Bennett & Cunningham, 2008; Williams, 2006).

Villano (2007) reported that handheld computers do not serve everyone, at least not yet. The increase in the desire to switch from standard textbooks to e-Books is on the rise and publishing companies have not yet released their audios in handheld format causing a gap in the desire to use handhelds instead of desktop or laptop computers. There is no information to determine how long it will take for the publishing companies to release audio formats, or if they even are considering it.

Briggs (2006) conducted interviews of classroom teachers and found that handheld computers were not always better for curriculum because of the problems they presented when beginning a new program. Educators can agree that handheld computers increase motivation, encourage networking, are portable, and can cost-effectively improve test scores, but implementing a handheld project can be problematic. School districts and teachers must consider staff development for the teachers, finding appropriate software to use with students and providing adequate technical support when needed. On average the researcher found that teachers needed in the upwards of 100 hours of professional development to feel proficient enough to use the handheld computers with students and begin to work towards raising student achievement.

Despite findings in research showing problematic findings in providing handheld devices to older students research is necessary in the elementary school learning setting where students experience their first exposure to formal education and also where they begin to learn lifelong skills, especially in reading. While little is known about using handheld computers in Kindergarten classrooms for literacy, specifically for phonemic awareness, the research on handheld computers effects in classrooms of younger learners is needed. The above review of research supports the need for further study in the areas of best practices in phonemic awareness and the use of handheld computers by early childhood students to gain that knowledge.

There is a need to further explore the use of handheld computers in schools, specifically in Kindergarten, to introduce a 21st century tool to further student achievement. The handheld devices can be used in literacy instruction, specifically phonemic awareness, in an effort to guide students to a more constructivist approach to learning and to increase achievement levels. This study will address a deficiency in the existing literature because no study has been found which specifically explored the use of handhelds in Kindergarten to enhance phonemic awareness.

The above research supports the need for further study in the areas of best practices in phonemic awareness and the use of handheld computers by early childhood students to gain that knowledge. There is a need to further explore the use of handheld devices in schools, specifically in Kindergarten, to introduce a 21st Century tool that is not only economical for school districts, but also portable and easy to use. The handheld computers can be used in literacy instruction, specifically phonemic awareness in an effort to guide students to a more constructivist approach to their learning and to increase achievement levels. This study will address a deficiency in the existing literature, in that no study had been found which specifically explored handheld computers in Kindergarten to enhance phonemic awareness.

Handheld Devices Used for Behavior

Olswang, Svensson, Coggins, Beilinson, and Donaldson (2006) conducted a study for the purpose of exploring the utility of time-interval analysis for documenting the reliability of coding social communication performance of children in classroom settings. Social communication is a core area in child language and in determining any disorders. The researchers had a vested interest in finding a method for determining whether independent observers could reliably judge both occurrence and duration of ongoing behavioral dimensions for describing social communication performance. This method of research is ideally explored using authentic, real-time observation and coding in natural environments, like the classroom. Handheld devices were used to record the data using a coding method.

Four coders participated in this study, and they all observed and then recorded six social communication behavioral dimensions using these devices (Olswang et al., 2006). Verbal and nonverbal dimensions were observed and noted during a specified time frame. Data were recorded for 20 different student segments of children in Kindergarten through third grade. Interobserver and intraobserver methods were followed within a specific time frame, and intervals for size and total observation length were manipulated to determine reliability. Hollenbeck (1978) defined interobserver as an agreement that reflects how different observers code behaviors using audio or video (as cited in Olswang et al., 2006, pg. 1059). Hollenbeck (1978) defined intraobserver agreement addresses the stability of repeated measurements using similar instruments under similar conditions (as cited in Olswang et al., 2006, pg. 1059).

This research team observed students who were diagnosed with articulation and language disorders while they interacted with their teachers (Olswang et al., 2006). They further used social communication parameters, including both verbal behaviors (topic introduction, turn-taking, contingent responding to questions) and nonverbal behaviors (physical proximity, physical contacts, gestures, and eye gaze). Each parameter was judged as either facilitating the interaction (appropriate) or detracting from the communicative exchange (inappropriate). The research agreement ranged between 93% and 100% with a mean of 94.4% for judging appropriate performance and 92.3% for judging inappropriate performance for children with disorders, according to Olswang, et al. (2006).

The Olswang, et al. (2006) study revealed that interval sorting and kappa were suitable methods for examining reliability of occurrence and observation and duration of ongoing social communication behavioral dimensions. Nearly all comparisons yielded medium to large kappa values; interval size and length of observation minimally affected results. The analysis procedure solved a challenge in reliability: comparing coding by independent observers of both occurrence and duration of behavior. The results further showed that the utility of a new coding taxonomy and technology for application in a classroom setting could be meaningful.

Methodology

This study used a mixed-methods sequential study design. This methodology was chosen because it generates data that has addressed the research questions (Teddlie & Yu, 2007). This method is often used in social and behavioral sciences and in education and allows for both quantitative and qualitative data collection. In this study the teacher interviews provided qualitative data and the results of the archived DIBLES test scores provided quantitative data. Below is a discussion of the strengths and limitations of a mixed-methods sequential study. Other methods were also considered and are discussed below.

Mixed-Method Study Definition

Teddlie and Yu (2007) defined a mixed-method study as sampling that involves combining well-established qualitative and quantitative techniques in creative ways to answer research questions posed by mixed-method research designs. Mixed-methods allow for a variety of techniques, which involve the principle of gradual selection. The sequential mixed-methods involve the selection of units of analysis through the sequential use of probability and purposive sampling strategies (quantitative & qualitative) or vice versa (qualitative & quantitative). In a sequential mixed-methods study information from the first sample is often required to draw the second sample, and the second set of data grows from what is learned from the first set of data.

Strengths of Mixed-Method Sequential Study

The mixed-method sequential study allows the sample size to be small or large, allowing for greater flexibility when the study draws on is a small population (Teddlie &

Yu, 2007). This method is also a simple study because one data point must be collected before the other can begin or become validated. The method allows for ease of data collection, allowing for a simple path to collect all the information needed to make a determination and to adequately address the research questions asked. It is a mixed-method sequential study that can be done over a short period of time and with limitations and still be considered meaningful and complete.

Limitations of Mixed Method Sequential Study

A potential flaw of the mixed-methods sequential study is the fact that the quantitative results can alter the qualitative results, causing a different outcome than might have been projected (Teddlie & Yu, 2007). It is also a study that allows for small sample size, and that focus can mean that the results are not valid in many cases because of the size and the availability or resources.

How a mixed method study will answer research questions. A mixed-method sequential study allowed the experiment to take place in classrooms in an effort to determine whether students improved their phonemic awareness through the use of handheld devices. The first data point was an analysis of DIBELS test scores for students in two groups using ANCOVA. This data shows if there are any significant differences between the classrooms using handheld devices during phonemic awareness lessons and those who do not make use of them. Based on this data, the researcher has gain insight into how handheld devices facilitated or did not facilitate the development of phonemic awareness. The next data point was the structured interviews with the classrooms teachers in all four classrooms. Through these interviews of the classroom teacher's, evidence was collected to either support or refute the idea of handheld devices becoming a key component of reading instruction and having an effect on the development of phonemic awareness.

Case study. This case study design was considered as a valid method of study. According to Schramm (1971), case study tries to illuminate a decision or a set of decisions: why they were taken, how they are implemented, and with what results (as cited in Yin, 2009). Using case studies for research purposes is one of the most challenging of the social science endeavors (Yin, 2009). This type of research design is a rigorous methodological path and begins with a thorough literature review and the careful and thoughtful posing of research questions and objectives. In a case study design, it is important to have dedication to formal and explicit procedures when doing research and have procedures central to all types of research methods and having a strong chain of evidence.

A flaw in this study is that no precedent can be set based on a single case study because of the individual nature of each set (Lain, 2007). This type of study allows the research to fill a specific gap in the research, but it is an isolated instance. Case study takes longer to conduct accurately and because of that does not always fit into the window or data collection in a school setting. It is exploratory and, due to its status as a small single case, might not be accurate enough to be taken. This method was rejected because it does not fit with the research questions chosen in this study and cannot show how using handheld devices can improve phonemic awareness scores in a Kindergarten classroom.

Phenomenology. Another type of research method that was considered but rejected was that of phenomenology. Phenomenology is defined as a philosophical trend that takes the intuitive sense of conscious experience and tends to describe its fundamental essence (Halling, 2002). Phenomenology is one of many types of qualitative research that examines the lived experiences of humans and strives to gain and understanding of the essential truths of these life experiences. Phenomenologists believe that knowledge and understanding are embedded in our everyday world. In other words, they do not believe knowledge can be quantified or reduced to numbers or statistics.

Phenomenology tends to ignore any sort of effort that deals with naturalism, which is growing and includes the use of technology (Marcell, 2005). Phenomenologists believe that knowledge and understanding are embedded in our everyday world. In other words, they do not believe knowledge can be quantified or reduced to numbers or statistics. Phenomonologists believe that truth and understanding of life can emerge from people's life experiences. Although phenomenologists share this belief, they have developed more than one approach to gain understanding of human knowledge.

This theory was rejected because of the lack of connection to life experiences that involve technology to enhance learning. In the research with handheld devices in the Kindergarten classroom to enhance phonemic awareness DIBELS data were used. The DIBELS data shows whether there is a connection between handheld devices and phonemic awareness achievement. This type of methodology does not make use of statistics or quantitative data.

Chapter 3: Research Method

The purpose of this mixed-method sequential study was to determine the impact of handheld devices on phonemic awareness in a traditional Kindergarten classroom. Chapter 3 includes a description of the study and the rationale for completing the research in a mixed-methods sequential format. First, the chapter explains how the mixed-method sequential study answers the research question. Second, the chapter describes the methodology. An explanation is included to show how the groups, both those using handheld devices and those not using them, were selected. Third, the chapter contains descriptions of the researcher's role and the data collection process. Evidence of scholarly research is provided, and a defense given for the validity and quality of data collection and for the study as a whole. Finally, a discussion of how the data were collected, both qualitative and quantitative results, and how the data were organized is provided. Chapter 3 concludes by addressing the ethical issues inherent in this study.

Research Design

The study used a mixed-methods design that included both qualitative and quantitative features. The work was scheduled sequentially (Teddlie & Yu, 2007) to inform the study as it progressed. For example, the results from the data analysis were used to develop the questions in the qualitative portion of the research.

Archived data were collected from the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) assessment administered fall 2009 and winter 2010 to determine achievement of phonemic awareness for students in four classes. Two classes of Kindergarten students were taught phonemic awareness using handheld devices and were pooled together as one group This group was compared with two classes of Kindergarten students who were taught phonemic awareness without handheld devices and who were pooled together as one group. The DIBELS data were analyzed using ANCOVA. Based on the analysis of the archived DIBELS data, interviews of classroom teachers were completed to investigate the reasons for the findings of the quantitative data. The interviews explored the findings in more depth to see what the teachers did and the instructional strategies they used.

A mixed-methods approach was selected because it allowed the researcher to find out if there are differences between the development of phonemic awareness in two groups of students, those who learned phonemic awareness using handheld devices and those who did not. The mixed-methods approach allowed the researcher to determine if there were significant differences between Kindergarten students using handheld devices during phonemic awareness lessons and those who do not, as measured by the DIBELS scores from the fall 2009 and winter 2010 DIBELS scores for both schools. Based on the findings, the qualitative approach used structured interviews of the four classrooms to determine if and/or how the handheld devices supported phonemic awareness instruction.

Role of the Researcher

I am a former 3-year substitute teacher and a 7-year classroom teacher who taught five years of full-day Kindergarten. Currently, I serve as an instructional coach in a district-wide position with the responsibility of technology integration. As an instructional coach, I assist teachers with technology integration and other best practices, but am not in a supervisory role. I work in one of the targeted school districts and, during my first four years of teaching, I worked in the other targeted school district used in this study.

The potential for my bias and conflict of interest has been reduced because I am not teaching in a classroom and was not directly involved in the use of the handheld devices with Kindergarten students in any of the four classrooms selected for this research. The teachers in the four classrooms have all worked with me and, therefore, had a comfort level and basic knowledge needed to assist with this research in the best interest of the students.

I had the responsibility of contacting the two district officials to obtain access to the two schools for the research. A Letter of Cooperation was created between school districts and these documents are found in Appendices A and B. Once IRB approval was obtained the researcher contacted the principals of the two schools to obtain access to the Kindergarten teachers. The school district policies and procedures for research were followed, and a mutual understanding agreement was implied. The letters of cooperation completed by both district officials outlined the procedures and gave permission to review DIBELS assessment data and interview classroom teachers. The study followed strict guidelines for the ethical protection of all participants and data. The actual names of the school districts, schools, and participants were not being used in the data analysis or final report, ensuring confidentiality.

Positioning the role of the researcher in a mixed method sequential study (Teddlie & Yu, 2007) such as this one required acceptance between the study participants, school district educators, and the researcher. I conducted interviews with classrooms teachers, both those who have used handheld devices and those who have not, determined what they saw and heard in the classroom and differences in terms of their phonemic awareness pedagogy. The interview questions for the groups using handheld devices are included in Appendix C and the interview questions for the non-user groups can be found in Appendix D.

A structured interview instrument (Appendix C) was used to help determine if the use of handheld devices as a key component of reading instruction had an effect on the development of phonemic awareness, and to help interpret the analysis of the DIBELS scores. These same questions were used to determine what ways the handheld devices supported or didn't support student development of phonemic awareness in Kindergarten. The interview questions were used to explain what was found in the ANCOVA analysis of the fall 2009 and the winter 2010 DIBELS scores. The design of the questions guided the conversation with classroom teachers in both groups and in both schools. An ANCOVA analysis of ISF for the difference between fall 2009 and winter 2010 DIBELS scores for phonemic awareness was conducted, and results presented in graph format in order to show the growth of the students, identified by number. The fall 2009 LNF scores served as a covariate. The graphs show the target that the students should be at based on the time of year.

Research Questions

The research study explored the use of handheld devices in traditional Kindergarten classrooms to improve phonemic awareness. The integration of handheld devices into the reading curriculum does offer teachers an additional tool to help students learn through 21st Century processes that can be carried into real life settings.

Research Question 1: Are there significant differences between the phonemic awareness DIBELS score (ISF) for Kindergarten students using the handheld devices and Kindergarten students not using the handheld devices?

Ho: There are no significant differences between the phonemic awareness DIBELS score (ISF) for Kindergarten students using the handheld devices and Kindergarten students not using the handheld devices.

Alternative H: There is significant difference between the phonemic awareness DIBELS score (ISF) for Kindergarten students using the handheld devices and Kindergarten students not using the handheld devices.

Research Question 2: What is the teacher's perception of the ways handheld devices support or do not support student development of phonemic awareness.

Context

The research purpose was to discover if handheld devices serve as an effective teaching tool to increase student achievement in the area of phonemic awareness. In particular, the study explored whether Kindergarten students that use Terrapin Logo Bee-Bot handheld devices during their regular phonemic awareness lessons in place of traditional teaching tools show a greater academic growth, overall, with their DIBELS assessment scores between the fall pretest and the winter posttest than students who did not use handheld devices in phonemic awareness lessons.

The participating classrooms were selected based on the cooperating schools that work with the Terrapin Logo Bee-Bot handheld devices and that have classroom teachers who were willing to provide information during the interview process. The researcher conducted the interviews of four-classroom teachers, two who used handheld devices in the classroom for phonemic awareness lessons, and two who did not.

Both districts follow the same state standards and expectations for Kindergarten reading, specifically phonemic awareness. They both make use of DIBELS assessment as the universal screener when the students first arrive in school and again in the winter to determine growth. DIBELS is a set of procedures and measures for assessing the acquisition of early literacy skills from Kindergarten through sixth grade (University of Oregon Center on Teaching and Learning, 2009). These assessments are designed to be snapshots of skills used to regularly monitor the development of early literacy and early reading skills. DIBELS were developed to measure recognized and empirically validated skills related to reading outcomes, and each measure has been thoroughly researched and demonstrated to be reliable and valid indicators of early literacy development and predictive of later reading proficiency to aid in the early identification of students who need interventions to be successful.

Instrumentation and Materials

Instruments that were used included DIBELS as a measure of phonemic awareness and a structured set of interview questions for classroom teachers. There was one set of questions for the classroom teachers who used handheld devices and one set for classroom teachers who did not use handheld devices. I designed these interview questions with students, teachers, and curriculum in mind and to ensure that they provided the information needed to answer the research question adequately.

The DIBELS scores were collected for both fall 2009 and winter 2010 by the school systems for all Kindergarten students, and these archived data, that are disaggregated with no student identification, were analyzed to determine what impact, if any, the handheld devices had on phonemic awareness. The reports indicated which classrooms were using the handheld devices and which ones were not to ensure that the identities of the groups were segregated. The DIBELS assessment provided an overall score initial sound fluency (ISF) for each individual so that the fall 2009 and the winter 2010 scores could be analyzed. Initial sound fluency (ISF) is only reported and tested in Kindergarten, first in the fall and then again in the winter.

DIBELS was developed based on procedures for Curriculum-Based Measurement (CBM), which were created at the Institute for Research and Learning Disabilities at the University of Minnesota in the 1980s (DIBELS, 2009). Like CBM, DIBELS was developed to be cost effective and efficient indicators of a student's progress toward achieving a general outcome, like phonemic awareness.

Initial research on DIBELS was conducted at the University of Oregon in the late 1980s (DIBELS, 2009). Since then, an ongoing series of studies on DIBELS has documented the reliability and validity of the measures as well as their sensitivity to student change. The DIBELS authors were motivated then, as now, by the desire to improve educational outcomes for children, especially those from poor and diverse backgrounds. Research continues to be done at several universities across the country.

According to Kaminski and Good (1996), DIBELS is a set of prereading measures that assess skills in phonological awareness and alphabetic understanding, and have been embraced by the school psychology community to (as cited in University of Oregon Center of Teaching and Learning, 2009). The DIBELS are attractive to educators because they are quick and easy to administer, can be used for making educational decisions, and are well suited for use in a formative manner alongside a problem- solving model. According to the authors, DIBELS can be used in schools, especially with Kindergarten and first-grade students, to answer such questions as: (a) which children are at risk for reading difficulty because of inadequate phonological awareness skills? (b) Which children need additional instruction in phonological awareness skills? (c) Is the current instruction effective in increasing phonological awareness skills? and (d) when has a child developed phonological awareness skills to a degree that is no longer indicative of difficulty learning to read? This goes to the validity of the DIBELS test and shows how it makes a great pre and post assessment for determining if handheld devices make a difference with phonemic awareness achievement in Kindergarten.

The DIBELS assessment has two ways of examining reliability corresponding to the use of data (University of Oregon Center on Teaching and Learning, 2009). Many of the assessment are given in a quick 60 second probe, which is an indicator of what the student knows or needs additional help in. However, brief, repeatable measures can be aggregated to increase reliability. When more reliable information is needed, the average of 3 to 5 probes on different days can be used. For each measure, proctors note how many probes would be necessary to reach .90 reliability. This differs conceptually from the

Woodcock-Johnson, for example, which must reach accepted reliability in one assessment because it is not brief and repeatable. Even the least reliable DIBELS measure, Initial Sound Fluency, yields reliability for .90 when administered 4 or 5 times for an approximate total of 5 minutes of assessment. Therefore, the reliability of 5 minutes of ISF would be .90 (University of Oregon Center on Teaching and Learning, 2009).

According to DIBELS (2009), phonemic awareness is the ability to hear and manipulate the sounds in spoken words and the understanding that spoken words and syllables are made up of sequences of speech sounds. Phonemic awareness is essential to learning to read in an alphabetical writing system, because letters represent sounds or phonemes. Phonemic awareness is a strong predictor of children who experience early reading success. The DIBELS assessment was used to measure phonemic awareness for each of the individuals in the study, those using the handhelds and those who are not.

Interview Protocol

The interview protocol consisted of seven open-ended questions that were asked of the classroom teachers using handheld devices and five open-ended questions that were asked of the classroom teachers not using the handheld devices. The questions asked guided the discussion and were aligned with research question 2. Teachers using the handheld devices described what they saw and heard while their students used handheld devices to explain if the handheld devices had an impact on student growth in phonemic awareness, what impact how they taught phonemic awareness had on student growth, and to describe what worked, what didn't work, and their opinion of the impact using handheld devices had on student growth.

The classroom teachers not making use of handheld devices were asked similar questions as to how they teach and what works and doesn't work, but also their opinion on would the handheld devices impact student achievement or hinder it. Their questions began with five scripted and open-ended questions, but then the conversation continued based on the responses.

Data Collection

About forty-six Kindergarten students representing the handheld group participated in the study by using the Terrapin Logo Bee-Bot handheld devices during the phonemic awareness lessons on a daily basis. About 46 Kindergarten students representing the non-handheld group were included in the study to compare the differences between using the handheld devices and not during phonemic awareness lessons.

Letter Naming Fluency (LNF) from the fall 2009 DIBELS assessment were the covariate, the independent variable were the treatment (whether or not the handheld device were used), and the dependent variable DIF (the ISF difference in scores from fall 2009 to winter 2010 on the Dynamic Indicators of Basic Early Literacy Skills [DIBELS]). The DIBELS scores were put into an ANCOVA and analyzed to determine if there were any significant differences between the groups using the handheld devices during phonemic awareness lessons and those not using them. The model used was a general linear model, which describes an observed score as the sum of the population mean, the treatment effect for a specific factor, and random error. Specifically the data were a Univariate where the population in which the sample is taken is normally, is independent, and the variances of the populations are equal. After reviewing the DIBELS results, the researcher set up interviews with each of the four teachers.

The interviews were scripted questions to determine what pedagogy the teachers are using to teach phonemic awareness in their classrooms. Questions were asked to determine what worked and why and what did not work and why. The groups using handheld devices were asked how they used them and how they compared to the DIBELS reports to determine if there were significant results to determine that the handhelds made a difference with scores. The groups without the handheld devices were asked if they think the devices could work for their classrooms. The interviews were recorded and the audio files were transcribed.

Protection of Participants' Rights

There was no risk associated with the participation in this study. Participants did not face psychological stress, negative effects on their health, unwanted solicitation, unwanted intrusion of privacy, or social or economic loss. The identifiers used by the researcher in regard to the four classroom teachers did not include participants' names, school of record, school email address, and school telephone number. The teachers in the handheld group are identified by the pseudonyms Ann and Alex and teachers in the group without handheld devices are identified as Barbara and Betty. No social security numbers, or personal information beyond this information was required. The pseudonym names are associated with the classroom data. The school districts are referred to as school district A and school district B. The students are not identified on the results, but rather identification numbers are used instead. All participant information and assessment records are being kept confidential. Records and assessments collected over the course of the study are being kept private in a locked file at the school site in which the researcher resides. The researcher is the only person to have access to the information collected in its research format.

The school districts provided a signed Cooperation Agreement for the study to allow teachers to participate and for the research to take place in the schools. This agreement has allowed the researcher to access and use archived DIBELS scores for fall and winter of the 2009-2010 school year. These forms are included in Appendices A and B.

The procedures of the Institutional Review Board (IRB) at Walden University protect the participants and the data being collected to ensure ethical measures were being taken in the development of the data collection materials and the actual research and follow-up process. The school districts involved also had the researcher complete the necessary paperwork to conduct research on the selected classrooms and to conduct interviews, and analyze data collected. A letter of permission to conduct the research study is included in the final documentation (Appendices A and B). My approval number from the Walden IRB is 02-17-10-0305234

Chapter 4: Results

The purpose of this sequential, mixed-methods study was to evaluate the impact of handheld devices known as Bee-Bots on phonemic awareness in a traditional Kindergarten classroom. The quantitative portion of the study involved the relationship between the independent variable (whether or not the handheld device was used, coded as a dummy), and the dependent variable DIF (the ISF difference in scores from fall 2009 to winter 2010 on the Dynamic Indicators of Basic Early Literacy Skills [DIBELS]). The covariate was the LNF from fall 2009. The qualitative portion of the research addressed the teachers' perceptions of the ways handheld devices supported or did not support phonemic awareness. The specific objective of this study was to test the impact of handheld devices on the development of phonemic awareness in Kindergarten students, in a traditional classroom.

Chapter 4 provides the results of the data collected in each phase of the research. The first phase of the research was quantitative and addressed the first research question, while the second phase was qualitative and addressed the second research question. After the Walden Institutional Review Board had approved the study, participant consent forms (Appendix G) were delivered to each of the four teachers. The teachers returned the forms with their written consent. I then gained access to archived DIBELS records for the two groups for fall 2009 and winter 2010; these records were examined for phonemic awareness (letter naming fluency [LNF] and initial sound fluency [ISF]). After completing the quantitative data collection, I conducted four teacher interviews to explore in more detail the experiences of the two groups in the study and seek in-depth understanding of their perceptions of using the devices in teaching phonemic awareness. The four teacher participants were given pseudonyms to ensure confidentiality. The teachers using the handheld devices (experimental participants) were given the names Ann and Alex, while the teachers not using handheld devices (control participants) were given the names Barbara and Betty. Ann and Barbara are both from district A and Alex and Betty are from district B, as seen in table 1.

Table 1

Teacher Participants

	District A	District B
Experimental Teachers	Ann	Alex
Control Teachers	Barbara	Betty

Phase 1: Quantitative Results

In the first phase of this mixed-method study, I analyzed the quantitative data. Seventy-six students participated in the study by taking the LNF and ISF sections of the DIBELS assessment. The two groups (treatment and control) were compared using Analysis of Covariance (ANCOVA). I investigated DIF (the ISF difference between fall 2009 and winter 2010 on DIBELS), the covariate (LNF), ability to adjust for previous level of performance, and found that it provided no predictive or discriminatory value relative to LNF growth. That is, the covariate did not achieve significance, which suggested that the two groups were independent and did not initially differ in terms of their baseline scores. Although the study found no significant differences between the group using the handheld devices and the group not using the handheld devices the results indicate that the use of handheld devices did not hinder growth in phonemic awareness. Table 2 illustrates the actual mean scores for fall LNF, fall ISF, winter ISF, and DIF (the difference between fall 2009 and winter 2010 for ISF) to show where the groups were at the beginning of the study and where they were at the end of the study.

Table 2

Actual Mean Scores from Fall to Winter

	N	Fall LNF	Fall ISF	Winter ISF	DIF
Experimental Group	38	11.55	8.71	22.39	13.68
Control Group	38	17.61	9.79	22.55	12.76

Research Question 1

Research Question 1 was, “Are there significant differences between the phonemic awareness DIBELS score (ISF) for Kindergarten students using the handheld devices and Kindergarten students not using the handheld devices?” Each group consisted of two classes with 38 subjects total, one class from each school; these classes were selected because they were the only ones making use of Bee-Bot handheld devices during phonemic awareness lessons and activities. All students in the study took part in daily phonemic awareness lessons for approximately 15 minutes a day as part of the normal literacy block of instruction in Kindergarten.

Hypotheses

H_1: There are no significant differences between the phonemic awareness DIBELS score (ISF) for Kindergarten students using the handheld devices and Kindergarten students not using the handheld devices.

Alternative H_1: There is a significant difference between the phonemic awareness DIBELS score (ISF) for Kindergarten students using the handheld devices and Kindergarten students not using the handheld devices.

Results

According to the ANCOVA results, the null hypothesis was accepted, and there are no significant differences between the phonemic awareness DIBELS scores (ISF) for students using the handheld devices and students not using the handheld devices (see Table 3). The result was not significant, F (1,74) = 1.54, p = .22. Because the differences were not at a significant level (p < .05), the null hypothesis for Research Question 1 was accepted.

Table 3

ANOVA Summary Table

	Sum of squares	*df*	Mean squares	*F*	Sig.
Between groups	232.750	1	232.750	1.539	.219
Within groups	11189.921	74	151.215		
Total	11422.671	75			

p>.05

Table 4 shows the unadjusted mean score (LNF) of the two groups comparing the classes using handheld devices and the classes not using handheld devices. The classes using the handheld devices showed a very small increase over the classes not using the handheld devices.

Table 4

Descriptive Statistics for the DIBELS Differences From Fall 2009 and Winter 2010

	N	*M*	*SD*
Control	38	10.1842	9.49496
Experimental	38	13.6842	14.56969

Phase 2: Qualitative Results

The qualitative phase was the next step in the sequential mixed-methodology plan. The purpose of the qualitative phase was to explore further and provide insight into why the quantitative differences found in Phase 1 existed. Four interviews were conducted to collect data. Two teachers from each of the groups were interviewed using a basic set of questions, which can be found in Appendices C and D. The interviews were recorded and the audio files transcribed.

Research Question 2: "What is the teachers' perception of the ways handheld devices support or do not support student development of phonemic awareness?"

To answer this research question, interviews of four Kindergarten teachers were conducted and of these participants the two experimental teachers used handheld devices and the two control teachers did not use handheld devices during their phonemic awareness lessons. Themes from these interviews were discovered, and the results provide an account of the teachers' perceptions of the use of handheld devices (Bee-Bots) in the Kindergarten classroom. Four pre-determined categories emerged from the review of literature: (a) assessments (b) engagement (c) strategies and (d) reasons to use or not to use Bee-Bots. Additional themes were added as the data were analyzed, and one category was eliminated.

Coding for Themes

According to Trochim (2006), coding is a process of categorizing qualitative data and is utilized for describing the implications and details of the research, while developing initial categories. Prior to conducting the interviews, a spreadsheet was created with likely categories of key words drawn from the literature review, from which would emerge themes and patterns during the analysis of the interview data. After each interview had been conducted and transcribed, the first step was to read and reread data to find key words or phrases that matched the proposed categories, and to see if any new themes or patterns emerged. Research Question 2 was used to guide interview analysis. Once key words or phrases were determined and highlighted, these were added to the spreadsheet under the appropriate category or under a new category that was created as needed. The initial categories included: (a) assessments, (b) engagement, (c) strategies, and (d) reasons to use or not to use Bee-Bots. Two new categories emerged from the analysis of the interviews and they included: (a) social growth and (b) technology standards. It was also determined that one of the original four categories was too broad and was eliminated: category (d) reasons to use or not use Bee-Bots. From those categories, themes could be developed to provide insight into the research question.

Data Analysis

Once the four interviews were color coded, the process of analysis began. First the data were sorted on a spreadsheet within several categories and then the information was compared and sorted into five main categories. The categories included: (a) assessments, (b) engagement, (c) strategies, (d) social growth, and (e) technology integration. The five categories were then summarized showing themes among the interviews. Themes were identified as: (a) leadership, (b) skill development, (c) differentiated instruction, (d) time on task, (e) interactive activities, (f) enjoyment for learning, (g) hands on learning, (h) time management, (i) cooperative learning, (j) praise, (k) team work and collaboration, (l) parent comments, and (m) technology standards. According to Rubin and Rubin (2005) this type of process included categorizing main points made by the participants and then checking for accuracy and modifying as necessary. The four teachers, who were interviewed, were asked to verify the information was accurate and not taken out of context.

Assessments

Examining the question, "What is the teachers' perception of the ways handheld devices support or do not support student development of phonemic awareness?" had different results between the two groups of teachers. The experimental teachers felt handheld devices were easy to use and fun for the Kindergarten students and offered them a great hands-on learning opportunity that motivated them to grow both socially and academically. The control teachers felt like the Bee-Bot had potential, but was not much different than other types of technology and teaching tools and based on the observation that Bee-Bots were more like a toy than an instructional strategy. Several aspects of how teachers used assessments and measured student growth came out of the interviews. The teachers in the two experimental groups supported the use of Bee-Bot handheld devices to improve student achievement with all students, while the teachers in the two control groups supported the idea that a variety of strategies and the newness of school supported the growth of the Kindergarten students.

The experimental teachers thought that the Bee-Bot worked well with any student and would show growth with achievement based on observation and various formal and informal asessments. Alex reported:

> Bee-Bots helped them a great deal. I can tell them a sound and they program the Bee-Bot to find that sound. I've looked at my assessments throughout the year and you know our letter sound identification, non-sense word fluency, everything has gone up so I really think that um the learning is happening because if I look at my test results they're achieving they are all going up, no ones declining everyone is moving in the right direction.

Continuous analysis within the category of assessments found three themes: (a) leadership, (b) skills development, and (c) differentiated instruction.

Leadership. The teachers in group reported students becoming experts at using Bee-Bots and the unintended byproduct of this experience were the development of leadership skills. Alex said it best:

> I really don't have to do anything, sit back and guide it they need anything or get off track or something. They're so excited they're very positive, their interaction with their peers is very positive if someone is struggling and not getting the answer they, you know they, are very great at giving hints or you know if someone's having a hard time they can relate that to some other word or other experience. It's just; it's just great to see them becoming little teachers.

Ann had this to say: "One of the main things is cooperative learning. They all take a role to help each other, and there are team leaders who will help the lower students identify and drive our little robots."

Skill development. Both groups of teachers felt that the Bee-Bot handheld devices could enhance skills development with the Kindergarten students. Barbara was asked if she had been given the opportunity to use the Bee-Bots would she have taken that opportunity and she had this to say:

> I just think it's another tool that can enhance their learning. Um, I still think that there needs to be that oral direct instruction as well, but this is something that you know is a tool to um enhance what they've already learned and to get it concrete in their minds.

When asked about what they see during phonemic awareness lessons Ann had this to say, "I hear the pronunciation better. I hear also the kids saying, " Oh you made a mistake, let's fix that mistake yourself." So the kids are actually helping each other fix errors to learn in a better environment. Betty stated this, "I think is very useful to enrich their understanding of concepts."

Both groups reported that Bee-Bots would have an impact on students who are in Special Education, Title 1, and English Language Learner (ELL) programs. An example of this was when Alex stated,

> One of my ELL students could not recognize any letters or sounds at the beginning of the year and now she is at a 100% letters and over 60% sounds. She is beginning to use her sounds in words and things like that so you know it's helped a great deal. Students have benefited greatly from using these Bee-Bots and it's a different way of approaching learning.

When Barbara was asked if she were to use the Bee-Bots during her lessons would she want to use them with a certain group of students and not another group and she had this to say,

> I think it would be very helpful for, especially my ELL kids that are very low and um there is a language barrier for them to understand that actual letter matched that sound and stuff like that so I think that it's a very helpful tool for those kiddos.

Barbara believed that the interactive nature and the hands-on approach helped her kids learn, especially the sub-populations like the ELL students she mentioned.

Differentiated instruction. All of the teachers believed that grouping kids and then using the groups for interventions and enrichment was good for the students. An experimental teacher, Alex, had this to say when asked about enrichment opportunities with the Bee-Bot, "Um, the Bee-Bot program has a lot of great ideas with the letters and numbers mat but a I would like to use my own created mat you know to help the higher students take off right away instead of just working where they are, being able to use them as an enrichment activity with the higher students." Ann had this to say about her program, "Bee-Bots is a big part of my ELL instruction and my children with learning difficulties that are either Title 1 or IEP identified. A, it gives them a different way of looking at things than the other structures with the core curriculum and phonemic awareness." When asked if she felt that the Bee-Bots would be helpful for specific students in the class and maybe not for others Barbara had this to say, "Um, I think it's very helpful for, especially my ELL kids that are very low and um there is a language barrier for them to understand that actual letter matched that sound and stuff like that so I think that it's a very helpful tool for those kiddos." She also said, "So you can differentiate what groups you set them in for Bee-Bots and have them using different mats depending upon what level they are at."

Engagement

All four classroom teachers agreed that Bee-Bot handheld devices engaged students, which seemed to be a commen trait teachers desired in Kindergarten classrooms. The two control group teachers observed the experimental teachers and from those observations made their determinations that the Bee-Bots engaged studetns. According to these teachers engagement has been key to keeping the Kindergarten student on task and learning. If the students are engaged then they will follow rules, and show good behavior. Alex expressed her thoughts, "It can take a boring lesson and make it very engaging and I think when kids are engaged they're learning." Betty said this when asked about the idea of using the Bee-Bot with specific groups of students, "I think overall it would be helpful to the students that need that extra you know, hands on activity that can make it really fun for them and interesting." Betty also added that what works for her during phonemic awareness is this, "Hands on, providing them with ownership of their concepts and just making sure that its actively engaging them, its interesting to them, and they're able to have fun and learn." From the data analysis of engagement came three new themes: (a) time on task, (b) interactive activities, and (c) enjoyment for learning.

Time on task. The two groups of teachers had different opinions about the students using handheld devices and remaining on task. Alex had this to say when talking about her Bee-Bots, "I look at my students that have a hard time focusing, they're on task and you know students that are natural leaders are helping and I can just see so much learning going on using them. I think they positively impacted student learning in my classroom um tremendously." When Betty was asked about her opinion about the impact the Bee-Bots would have in her classrooms, whether or not they would impact or hinder learning she had an opposing view. Betty had this to say, "I think it would hinder if they're distracted by it, if they don't understand you know what they are suppose to be doing."

Interactive activities. Kindergarten manipulatives included such things as white boards, tiles, and picture and word cards and all the teachers seemed to include these in their normal routines. Betty declared, "They're learning at all times so anything instruction wise is new to them so I think that they're constantly taking things in and making sure that its actively engaging them, its interesting to them, and they're able to have fun and learn, while not knowing that they are learning." Betty gave interactive directions like this to ensure all her students were paying attention, "If you're listening tap your hands if you're listening follow me." Anything creative, hands-on, and interactive will keep the Kindergarten students attention and from there they will grow and student achievement will be higher. Barbara added, " I would like my phonemic awareness to be more interactive, more doing something different then you know just orally."

Enjoyment of learning. The teachers all expressed concerns that the standard phonemic awareness lessons provided by their core reading programs were scripted and included only direct instruction, which often bored the students. Direct oral instruction was an area that the teachers agreed did not work with this age group. Ann expressed it like this, "When we do direct instruction I get "A, A" and when I do the Bee-Bots they're excited, which makes it easier to observe what their learning patterns are." Betty had this to add, "Um, they need you know fun and they wanna be able to be learning, but not knowing at the same time." Alex said it best when she described first having the Bee-Bots, "So you know I, I guess the excitement that they have to use it is exciting or um surprising but they I just knew when I saw them that they would be a great tool to have in my classroom. I really feel validated that the students are so excited. You know they are as excited as I am using them."

Kindergarten is the first formal year of public education for most students and because of the change from the home environment to a school environment work to ensure a "fun" learning environment. Preston and Mowbray (2008) suggested that allowing all students to participate in lessons that are engaging and enjoyable will improve student growth, through the engagement they offer

Strategies

North Central Regional Educational Laboratory (1999) provided information on strategies for early childhood classrooms, specific to literacy instruction and they promote these areas: (a) early childhood environments, (b) daily schedules that are consistent, and (c) a sense of community. The four teachers had several areas where they believed in the same common best practices for Kindergarten. First off all four teachers taught in classrooms that were structured for Kindergarten learning, including the central carpet for gathering. The materials they used were appropriate for this age group and provided hands-on learning. The teachers began phonemic awareness with whole-group instruction on the reading carpet and then broke into smaller table groups to supplement the learning with technology, movement, or manipulatives. As needed the smaller groups were broken into individual activities for interventions and enrichments as well.

All four teachers expressed their concerns with the core reading programs and not having enough information to teach students phonemic awareness, so they had to supplement with other materials and teaching tools. The two teachers from District A made use of Kagan cooperative learning strategies, their Promethean interactive white boards, computer pods with literacy software and Internet based-programs, and provided music and audio recordings through their listening centers. The two teachers in District B made use of movement activities from their district adopted reading program, SMART interactive white boards, oral activities with specific actions, and music. All four teachers used letter experts from the *No More Letter of the Week* program to learn letters and sounds, build responsibility and leadership, and engage students in their own learning process. According to the National Reading Panel (NRP, 2000) teachers may be able to use a particular program in the classroom, but may find that it suits some objectives and students, but not all and this required additional materials and modes of teaching. No one program is a "one size fits all" (NRP, 2000) model that teachers can use with all students. In addition to this information two themes emerged from the analysis and included: (a) hands-on learning and (b) time management.

Hands on learning. Barbara maintained that, " I have used manipulatives to make it more interactive than um just the oral whole group instruction. Hands-on is better to remember their learning and comprehend; everybody seems to be really involved." Betty had this to say when asked about the possibility of using Bee-Bots, "I think that it would definitely impact, positively impact their understanding because they're able to use their hands on process to understand concepts."

Time management. Ann had this to say about the difference between last year without her Bee-Bots and this year with them, "Last year it took an awful lot longer to find the time to work with each individual group to try and get them to the level they are today." Another perspective to time management came from Barbara who was concerned that the actual time to use the Bee-Bot would hinder her students' learning. She had this to say, "You know to make it a little bit more interactive, um for them to all be able to do something instead of waiting for their turn."

Social Growth

Both the teachers in the experimental group and the control group indicated evidence of social skills learned or needing to be worked on through the use of the Bee-Bot handheld device. Social skills are an important part of the Kindergarten year since this is the first year most students spent in formal education. The National Association for the Education of Young Children (NEAYC, 2009) stated that in Kindergarten, teachers expect children to polish their social skills. Taking turns, playing cooperatively with other children, sharing, and listening to an adult other than their parent or caregiver are vital to the student's success in school. Three themes came out of this search and include: (a) cooperative learning, (b) praise, and (c) team work and collaboration.

Cooperative learning. Ann stated this about using Bee-Bots during phonemic awareness instruction,

> One of the main things is cooperative learning. They all take a role to help each other and there are team leaders who will help the lower students identify and drive our little robots. I see more teamwork and more cooperation with all students, independence to practice with the handheld devices.

Alex said it this way,

> I think you know cooperative learning is a great way to learn and um to meet the standards the kids need to meet and um you know I think the different abilities, they all bring different things to the table. I think grouping them that way is also beneficial.

Barbara mentioned cooperative learning in her classroom and this is what she had to say about it, “We use a lot of Kagan like structures; uh we have our knee to knee, eye-to-eye partners or elbow partners.”

Praise. Ann said, “Oh, and I also hear a lot of good praise from the students, “You did that right, you did not get that last time now you got it.” So a lot of individual praise, which helps the learning.” Alex added to this when she said, “They’re so excited they’re very positive, their interaction with their peers is very positive if someone is struggling and not getting the answer they you know they are very great at giving hints or you know if someone’s having a hard time they can relate that to some other word or other experience. It’s just; it’s just great to see them becoming little teachers.”

Teamwork and collaboration. Ann praised the Bee-Bots for teamwork when she said, “I see more teamwork and more cooperation with all students. So the kids are actually helping each other fix errors to learn in a better environment.” Betty had this to add about working together in groups, “I think that any student that’s distracted easily from whole group instruction they would benefit from it.”

Meeting Requirements for Technology Integration

Since the Bee-Bot is a handheld technology tool the device can help teachers meet requirements for technology integration in Kindergarten. Each of the teachers mentioned the need for technology education in the classroom because of the types of students being taught in this digital world. Two themes came up including: (a) parent comments and (b) technology standards.

Parent comments. Ann commented on technology integration when she stated what her parents had been saying at conferences,

> The parents say, they come in for the parent-teacher conferences, and they wanted to know what the kids were talking about. These baby robots that they hear about them at home all the time. So the parents were very interested watching at the parent-teachers how it involved their child's learning and were amazed that the kids could actually do this much technology at the Kindergarten level. And last year when I did not have the Bee-Bot*,* there was nothing that excited them. They did not even know how to tell their parents how they were learning the sounds.

The students take more ownership in their own growth, both socially and academically, when they demonstrate the use of the handheld device and at the same time show their joy for using it. The modeling and use of the handheld devices helped the Kindergarten students gain the essential knowledge needed to master the technology standards provided in the curriculum mapping guidelines.

Alex added this when she mentioned sharing the Bee-Bots with her parents:

> I've actually had several kids want a Bee-Bot for Christmas and their parents are wondering what these Bee-Bots are. I've showed them to my parents at conferences and a couple of parents that have volunteered in the classroom have had the opportunity to work with them and um they are very user friendly and um my parents keep telling me how excited their kids are to be using them. They're so excited that they got to use the Bee-Bot today and they say they got to play with it so they are using it to learn and so they are so excited with playing with

> this technology and this toy that they don't even realize that they are working on you know phonemic awareness or numerals or whatever your working on for that day, so.

Having parent involvement in the classroom during phonemic awareness lesson and being able to view the Bee-Bots in action is another way that parents help students meet the technology standards and work toward the skills needed to advance to first grade and beyond.

Technology standards. The control group teachers thought that Kindergarten students needed a variety of tools and strategies to keep students learning and showing growth with academics. Betty believes that teaching with technology can not be the only thing teachers use and she said it this way, "I just think that you know using technology is a benefit when you use it to enhance it, obviously not using it as the only lesson." Betty also had this to say when asked about using Bee-Bots, "I think I would have utilized the Bee-Bots because students of this generation are very familiar with technology, having something that they can touch, and move I think is very useful to enrich their understanding of concepts." Another point of view can from Alex when she said, "I think the Bee-Bots and the using that type of technology provides opportunity for all the students. You know I think that if you can just put any kind of technological spin on something it turns a boring lesson into something. Like I said before if the kids are engaged then they're gonna retain and I think the Bee-Bots have done that for my classroom."

Integration of Quantitative and Qualitative Data

Statistically there was no significant difference between the two groups during their phonemic awareness lessons, one using the Bee-Bot handheld devices and one not using them. The ANCOVA resulted in the null hypothesis being accepted. In the qualitative portion of the study interviews of the four Kindergarten teachers were conducted and the findings explained how the two groups viewed how the Bee-Bots were an engaging tool for their students and served well for small group work to enhance social growth and impacting learning, but despite these benefits, the device was not an overly effective teaching tool that impacts learning in the area of phonemic awareness. The handheld devices were viewed as a teaching tool that worked with small groups and helped build such skills as cooperative learning, team work, technology and leadership, but was viewed as a hindrance for students and teachers because of the amount of time to set up lessons and student interpretations of the tool itself, sometimes being called a toy.

Evidence of Quality

To ensure the validity and accuracy of the study, accepted research procedures and practices were followed. The researcher obtained permission to hold the study in both school districts through letters of cooperation from district officials (Appendices A and B) and participant forms were signed by all four-Kindergarten teachers (Appendix G). The four teacher interviews were recorded and then transcribed by the researcher. The transcripts were then shared with the teachers to ensure that the contents of the transcripts were accurate. The transcripts can be found in appendices I, J, K and L and the teachers were given pseudonyms to ensure confidentiality.

Discrepant Cases

According to Teddlie & Yu (2007) discrepant cases are situations where the explanation cannot account or fit the norm and the outcome is neither an exception nor contradiction, just simply something different. In the research analysis no such case was discovered. The four interviews provided information that was consistent with what would be expected with traditional Kindergarten teaching and the use of manipulatives. Chapter 5 will address the interpretation of the findings from the study, the implications for social change, recommendations for action, and recommendations for further study.

Chapter 5: Discussion, Conclusions, and Recommendations

Early childhood literacy programs include the use of phonemic awareness in emerging reading development and stress the importance of these skills in order for students to become fluent readers by third grade (Chard, Pikulski, & Templeton, 2000; Flanigan, 2007; Morris, Bloodgood, Loma, & Perrey, 2003; O'Connor, 2008; Pinnell & Fountas, 1998; Powers, Price, & Jonson, 2006). According to Padak and Rasinski (2008) technology is a frequent teaching tool for 21st century learners, engaging them and allowing for a faster rate of proficiency. No study was found which explored the use of Bee-Bot handheld devices in a Kindergarten classroom to improve phonemic awareness.

The purpose of this research was to evaluate the impact of Bee-Bot handheld devices on phonemic awareness in traditional Kindergarten classroom. Two research questions guided the investigation:

1. Are there significant differences between the phonemic awareness DIBELS score (ISF) for Kindergarten students using the handheld devices and Kindergarten students not using the handheld devices?
2. What are teachers' perception of the ways handheld devices support or do not support Kindergarten student development of phonemic awareness?

This mixed-method sequential study focused on the impact of handheld devices on phonemic awareness in a traditional Kindergarten classroom. The research addressed teacher perceptions of the use of the Bee-Bots with Kindergarten students to enhance student achievement in phonemic awareness. DIBELS scores were collected and analyzed from four Kindergarten classrooms, two using Bee-Bots and two not using Bee-

Bots during phonemic awareness lessons. ANCOVA was calcualted using SPSS software to answer the research question. Interviews of all four Kindergarten teachers were conducted as part of the qualitative results using pre-determined questions (see Appendices C & D).

There was not a significant difference between the group using the Bee-Bot handheld devices and the group not using them during phonemic awareness lessons as measured by DIBELS test of phonemic awareness. According to the ANCOVA results, the null hypothesis was accepted. A conclusion was drawn by the researcher from the four teacher interviews in the qualitative portion of the study that both groups felt that the Bee-Bot handheld device was an engaging tool for students and served well for small group interventions and enrichments, but was not a teaching tool that should be used solely for academic achievement. Bee-Bot was viewed as having a positive impact on (a) assessments, (b) engagement, (c) strategies, (d) social growth, and (e) technology integration. The five categories were then summarized showing themes among the interviews. Themes were identified as (a) leadership, (b) skill development, (c) differentiated instruction, (d) time on task, (e) interactive activities, (f) enjoyment for learning, (g) hands on learning, (h) time management, (i) cooperative learning, (j) praise, (k) team work and collaboration, (l) parent comments and (m) technology standards. On the other hand, all four teachers viewed the Bee-Bot as a manipulative that took time to learn for the teacher and students, and it caused problems with some students because of the wait time to take turns. The teachers agreed that no one tool, including technology devices, should replace traditional direct oral instruction for phonemic awareness.

Interpretation of Findings

Research question 1 explored the early reading growth differences between the phonemic awareness DIBELS score (ISF) for students using the handheld devices and students not using the handheld devices. Archived DIBELS scores from fall 2009 and winter 2010 were collected on 76 students for their phonemic awareness measurement. The two treatment groups were compared using Analysis of Covariance (ANCOVA) to adjust for previous levels of performance. According to the ANCOVA, no significant differences were found between the two groups of Kindergarten students, one using the Bee-Bot handheld devices and the other not using the Bee-Bot handheld devices.

While the results of the ANCOVA indicated that there were no significant differences between the two groups of Kindergarten students on their DIBELS phonemic awareness scores, there was equal growth between the two groups. The growth indicated that the use of the Bee-Bot handheld devices was equally effective as other manipulatives and strategies used by the teachers during phonemic awareness lessons. These findings support the research done by Menzies, Mahdavi, and Lewis (2008) who indicated that there has been limited success with the actual practice of teaching phonemic awareness using specialized methods and raising student achievement. Because the Bee-Bot handheld devices were equally valuable to the development of phonemic awareness as the traditional strategies, their inclusion in Kindergarten classrooms may be important, given the other benefits that were discovered in this study.

This study was based, in part, on the constructivist theory of Dewey (1938). This theory purports the idea that learners construct knowledge for themselves and each learner individually (and socially) constructs meaning as he or she learns. Dewey was instrumental in making the qualities of curriculum more meaningful for young children by helping them retain learning through a constructivist approach and a real-world environment in the classrooms. Using handheld devices in Kindergarten classrooms during phonemic awareness helps students learn through a constructivist, hands-on, and 21^{st} century experience that offers real-world applications. Further research needs to be done over a longer period of time to see if there would be a difference in outcomes.

Research question 2 established the teachers' perceptions of the ways handheld devices supported or did not support student development of phonemic awareness. Interviews of all four Kindergarten teachers were conducted to determine their perceptions and also to discover best practices for teaching phonemic awareness. The interviews were analyzed through a color coding process to determine themes for each of the predetermined categories and several emerged. The categories that were derived from the review of literature included (a) assessment, (b) engagement, (c) strategies and (d) reasons to use or not use Bee-Bots. Of these categories only the first three were determined to be useful based on the data analysis, so category (d) was eliminated because this category was integrated into all of the others. Two other categories were found to be necessary: (a) social growth and (b) technology standards.

The themes that were discovered in the category of assessment included leadership, skills development and differentiated instruction. In the category of engagement these themes that emerged were time on task, interactive activities and enjoyment for learning. Strategies included the themes of hands-on and time management. Social growth included cooperative learning, praise, and team work and collaboration for the themes. Finally, in the category of technology integration the themes found included both parent comments and 21st century learning.

This research supports the work of Morrow, Barnhart, and Rooyakkers (2002) who indicated that, in order to prepare students for both formal education and the real-world, professional educators must recognize the impact that technology has on literacy instruction. Their research findings found that technology, when used as a teaching tool, had been shown to enhance reading skills, which included phonemic awareness. Three of the four Kindergarten teachers were surprised that, statistically speaking there, was no difference on the DIBELS scores between the two groups. All four of the teachers believed that the Bee-Bot could engage students and create fun lessons for students, while meeting technology standards. The interviews concluded that the Kindergarten teachers believed that the handheld devices could help students achieve growth both socially and with 21st century skills.

This study supports the work of Montessori (1965) who believed that children had a need for tools that fit their little hands and they had a need to work independently while exploring their surroundings in an effort to gain useful knowledge. The Bee-Bot handheld devices had an impact on students providing them with an engaging experience while learning phonemic awareness and meeting technology requirements.

In the category of assessment, three themes emerged: (a) leadership, (b) skills development, and (c) differentiated instruction. Through formal and informal assessments the teachers discovered that Bee-Bot handheld devices could help build leadership skills, which provided peer-coaching opportunities for the advanced students and additional opportunities for learning for students needing additional practice. By working in groups and using manipulatives, students could build their skills and master phonemic awareness. The groups were structured in a way that provided a strong basis of differentiated instruction that helped all students learn. Bee-Bot activities can provide teachers with a snapshot of what students know or do not know, through observation. Beal and Bers (2006) discussed the concept of the zone of proximal development (ZPD) and observations of students, which have been extremely influential in both child development research and educational research.

Differentiated instruction is an area that links to the theorist Dewey and supports his work. The research indicated that teachers should observe their students and gain knowledge of what they need and then determine what to do next to ensure key learning points happen (Dewey, 1938). Once the needs have been determined and the learning begins, teachers will observe students gaining skills needed to succeed in Kindergarten and beyond.

This research and findings on skill development and leadership support the work of Dieterle (2008) whose research sought to determine the problems and possibilities, as well as the potential and limitations of using handhelds in education. The work with Bee-Bots followed this same research giving both positive aspects to using them with students and also allowing for possibilities of leadership responsibilities and new skills.

Engagement appeared to be an area that impacted all four classrooms in a positive manner, whether through the use of Bee-Bots or through the use of other manipulatives.

In reviewing the category of engagement three themes were found: (a) time on task, (b) interactive activities, and (c) enjoyment of learning. All four teachers believed that engagement was important at this age and would help ensure a greater level of student achievement in phonemic awareness. By using manipulatives and other teaching tools, like the Bee-Bot, teachers found that students remained on task longer. The lessons with the Bee-Bot were found to be interactive and carried an enjoyment of learning for students. With sound, movement, and lights the Bee-Bot is an attractive and motivating tool that can engage students and keep them learning, especially with sub-categories.

The research associated with time on task supports the work of Villano (2007). He stated that anything that can be played on a handheld computer device has instructional potential and over time will raise student achievement. Students learn when they are engaged and the longer the time-on-task the more learning that the student will possess. This finding is not supported by the teacher interviews because the traditional manipulative teaching tools were equally effective to learning and time on task for students as were the Bee-Bot handheld devices.

Preferred practices or strategies was the next category and from this came two themes. The themes were hands-on and time management. All of the teachers believed that Bee-Bot and other manipulatives provided hands-on learning in phonemic awareness and helped students achieve. Teachers were concerned about time management when using the Bee-Bot. Teachers brought up the fact that students had to wait for their individual turn and this could cause problems with behavior. For teachers, preparing lessons and setting up took time at the beginning of the program. With all new programs, there is a learning curve for both teachers and students and often extra time to prepare and evaluate lessons, but once the program is in place and working the time management may become a more positive thing. Because of the learning curve for teachers and students, the benefits of Bee-Bots on the development of phonemic awareness may take longer to measure with an instrument like DIBELS than the four months duration of the study.

The findings from the teacher interviews supported the work of Montessori (1965) who strived to ensure that young students had small devices to use when learning. The Bee-Bot is a handheld tool that was created for early-childhood education and provided for hands-on learning during phonemic awareness lessons. The hands-on learning also allows for them to be more creative and independent with their learning.

Kindergarten is the first formal year in public education for most students and one of the main focuses is social growth. In the category of social growth three themes came about and included cooperative learning, praise, and teamwork and collaboration. All of the classrooms made use of cooperative learning and during those interactions students found positive praise for each other. The teachers using the Bee-Bots also found that teamwork and collaboration was a skill that students gained and appeared to improve students' skills.

These findings supported the research work of Alexiou-Ray (2008) who believed that by using handheld devices with students of all ages they would gain different attitudes about learning and would grow both academically and socially over time. Her literature supported the use of technology, specifically handheld devices, to improve students' growth. When students have good attitudes and begin to socially praise each other as peer coaches then they begin to learn and grow together.

The final category was meeting technology standards and two themes emerged. They were parent comments and 21st century learning. The classrooms using the Bee-Bots for phonemic awareness noted that parents made comments about the positive use of Bee-Bots and technology in the Kindergarten classroom. All of the classrooms made use of a variety of technology tools to meet the requirements for 21st century learning. The classrooms in district A made use of Promethean boards and the classrooms in district B used SMART boards. Teachers noted they also used computers, educational software, and listening centers to teach students.

Having parents involved in student learning and technology supports the work of Beals and Bers (2006). They stated that in the early childhood classroom that parental support is an important key to learning with young children who use technology tools in the classroom. The Bee-Bot is a useful technology tool for phonemic awareness based on interviews. The input from parents also showed that the concept of having the handheld devices in the classroom for phonemic awareness was supported by the research.

Theoretical Implications

No significant differences were found in phonemic awareness scores between the groups using Bee-Bot handheld devices and the groups not using them so the null hypothesis was accepted. The theories of Dewey (1938) and Montessori (1965) both encouraged the use of authentic experimental activities for learners. The Bee-Bots can help teach students technology applications that may benefit them as they move through the educational process and into adulthood and become productive citizens. According to the experimental teachers using the Bee-Bots helped students with leadership and hands-on discovery, which are both areas that Montessori (1965) supported with early childhood students. She believed that learning independently would build skills like these and students would show growth because students learn to work independently while experiencing their surroundings and this builds knowledge and skills needed for the future. Also, by building leadership skills, as early as Kindergarten, students may gain skills they need to continue learning and to become productive adults. This type of leadership grows peer coaching among the students and cooperation and other lifelong skills begin to emerge.

Dewey (1938) reported that progressive learning rather than traditional learning was better for students because lessons and activities fit the student and his or her learning style, which is a key point to student growth and 21st century learning. As students are placed into learning groups peer coaching will take over leaders will emerge, and an enjoyment of learning will take over allowing more time on task and development of the skills needed to succeed in the real world.

Dewey (1938) believed that lessons should fit the student and differentiated learning is one way of allowing this to happen for students. He believed that critical thinking and experiential learning through collaborative efforts would help students grow and the Bee-Bots provided teamwork for these things to happen. All of the teachers used forms of differentiated learning and collaboration to teach students phonemic awareness. It may be that the strategies, rather than the tools used to implement the strategies are more important to the development of phonemic awareness, thus explaining why there was no difference between the two experimental groups in this study.

Bee-Bots meet the criteria for learning established by both theories because the device is made for early childhood students and supports the idea of small tools for small hands (Montessori, 1965). Using technology, like the Bee-Bot, supports the idea of the constructivist learning with real-world application (Dewey, 1938). As students work together in small groups they form leadership and social skills, both of which are real-world skills. Using the handheld devices also allows students to meet the technology standards needed to become successful students and later citizens. These theories support research question 2 demonstrating how the teachers perceived the use of the handheld devices during phonemic awareness and how this supports these theories.

The students using the Bee-Bot handheld devices did not have significant gains in phonemic awareness scores over the group not using them after four months of use. They do show promise for the two school districts, and others like them, with the integration of an engaging tool for Kindergarten learning. They can also be used as an intervention and enrichment tool for small groups, especially with students in ELL, Title 1, and Special Education. The experimental teachers indicated that their students in the sub-categories showed growth in the classroom when they used the Bee-Bot handheld devices. One teacher explained that her two Special Education students were now at the top of the class in phonemic awareness, while the other teacher indicated that her ELL students showed growth with their acquisition of the English language. This sample of students was too small to be measured on their DIBELS scores, but the findings for these few students are worthy of future research.

Implications for Social Change

The study took a look at whether or not handheld devices helped with phonemic awareness growth in Kindergarten. It was concluded that there was not a significant statistical difference between the Kindergarten classes that used handheld devices and the Kindergarten classes that did not use them during their phonemic awareness lessons. The importance of this research is that it provided reliable data on the use of handheld devices in Kindergarten during phonemic awareness lessons and on how teachers perceive the use of handheld devices in the Kindergarten classroom to improve or hinder phonemic awareness lessons. All of the Kindergarten teachers believed that the Bee-Bot handheld devices generated engagement and fun for learning with all students and because of this social growth was improved. Leadership skills, teamwork, and technology integration were also mentioned by the teachers using the Bee-Bots and the teachers not using them agreed that Bee-Bots could add to technology standards as another tool.

My research filled a gap in the literature by providing a study on using handheld devices in the Kindergarten classroom during phonemic awareness. The previously found research provided research on handheld devices and other technologies, but not for instruction in phonemic awareness lessons and not in Kindergarten for phonemic awareness instruction. There were no Bee-Bot studies found and this provides research on their effectiveness in the classroom too.

My findings helped with the professional application of knowledge for teaching phonemic awareness to Kindergarten students. It cannot be said that Bee-Bot handheld devices made a difference with phonemic awareness scores in Kindergarten, but teachers perceived that the devices had an observable and positive impact on student engagement and work well as intervention and enrichment tools, providing hands-on 21st century learning to young students. The classroom teachers using the handheld devices during phonemic awareness lessons both mentioned that the Bee-Bots engaged the students and motivated them to continue learning over their more traditional strategies. They also felt that using the Bee-Bot in small groups allowed for more leadership and social opportunities for the students as well as providing them with more of a specific and intentional activity. The activities were meant to serve as interventions to build skills that are lacking or enrichment activities that were meant to challenge the student who were more advanced.

My study promoted the development of individuals, communities, and organizations through efforts to improve phonemic awareness and technology with Kindergarten students. Literacy skills and technology skills are two areas that are necessary to be successful in school and in the community and without these skills students cannot be as effective as citizens as those that have them. The handheld devices offered another tool for developing these skills, along with more traditional tools.

Recommendations for Action

Based on my findings the first action step is to provide presentations and workshops for early childhood educators on using Bee-Bot handheld devices in their classrooms. Objectives of such a program would be to provide teachers with strategies to use Bee-Bots in their classrooms to promote teamwork and collaboration, leadership and cooperative learning, engagement and enjoyment of learning, and various ways of using the devices to help student groups for interventions and enrichments.

A second action step would be to encourage both school districts, from this study and then others, to invest in the integration of the Bee-Bot devices in their entire Kindergarten classroom for social instruction and as a teaching tool to engage students, meeting both social skill and technology standards. My research can provide them with data that will help them with their decision-making.

The final action step would be to present my research at local, state and national conventions and conferences so that other educators of Kindergarten and early childhood education can learn how Bee-Bot handheld devices can support student engagement and social growth during phonemic awareness lessons and other areas of education. In conjunction with this scholarly writing will evolve and serve as another outlet for sharing the research about Bee-Bot handhelds and their benefits for young students. Conference might include professional development for Kindergarten at the local level, the Wyoming School Improvement Conference for the state level, ISTE, I Teach K and the National School Board Association (NSBA) T & L conference.

Recommendations for Future Research

This study contributes to the availability of research on Bee-Bot handheld devices in Kindergarten to improve phonemic awareness scores. Further research is needed to determine the following:

1. Would Bee-Bot handheld devices have an impact on academic achievement in phonemic awareness if they were used for a longer period of time with a larger sample? This study provided for a 4-month window of time; research over an entire school may confirm or provide different findings. A replication of this study with an additional measure of DIBELS scores in May would provide that insight.
2. Do Bee-Bot handheld devices have a positive impact on student achievement of specific student sub-groups like ELL, Special Education, and Title 1 given their traditionally lower baseline assessment scores? This study focused on the entire class, rather than measuring specific sub group scores.
3. Does the use of Bee-Bot handheld device for interventions and enrichments improve phonemic awareness? This study focused on the whole group instruction for phonemic awareness, not specifically on interventions and enrichment.
4. A study is needed that analyzes Bee-Bot handheld devices on other parts of literacy, including phonics, reading comprehension, and vocabulary.
5. A study is needed for teachers use Bee-Bot handheld devices in their classrooms after receiving coaching through professional development to ensure they have specific skills before working with students on different reading skills. This study did not offer teachers professional development on integrating them into the classroom with students.

6. A study of the time-on task and motivation with students using Bee-Bots versus students using more traditional teaching tools would extend the findings of this study and provide more insight into other possible effects.

Reflections on the Researchers Personal Experiences

The researcher must take time to reflect upon personal experiences during the qualitative data collection and analysis. As I interviewed the four Kindergarten teachers I realized that I was like them in many different ways. A year ago I was a Kindergarten teacher with a diverse group of students in a similar environment. The difference was that I had an all-digital laboratory classroom and made use of a variety of handheld devices and manipulatives, which I used for all curriculum areas, not just phonemic awareness. Initially, I had a personal bias in that I thought that because I used handheld devices and saw academic growth in my classroom and had a passion for Bee-Bots, that the results would show evidence that everyone experienced the same results with the handheld devices. However, the results of this study were very different.

After the completion of the interviews, I now believe that handheld devices are not always as effective as I had thought and although they seem to engage students they did not affect student achievement directly as measured in this study. Another bias was that I thought that the teachers not using handheld devices would desire to have their own set of Bee-Bots after observing and discussing with their colleagues the effectiveness of the integration of this tool in the phonemic awareness curriculum. This too was not supported. The teachers who did not make use of the Bee-Bots expressed an interest in using them, but did not seem to show a strong passion for having them immediately and had a variety of other manipulatives and technologies they could use equally as effectively when teaching phonemic awareness.

Once this study was complete it confirmed for me that the Bee-Bots were not a technology tool for everyone and that other manipulatives and strategies might be as effective or even better for teaching phonemic awareness to an entire Kindergarten class. A variety of resources, teaching tools, and strategies seemed to be a much better mix for the Kindergarten teachers in these four classrooms and although they liked the Bee-Bot it was not the only tool they needed or used for phonemic awareness instruction.

I learned that I must lay aside my bias as a researcher, and after struggling to do so, the story in the data was able to come forth. What I hoped to find in this study wasn't born out by the data. While this was disappointing, I grew as a researcher as a result of this study, and will be better able to conduct research in the future that is unbiased.

Conclusion

According to Lacina (2006) children are exposed to technology at a very early age and begin to comprehend how it works, making it an important component of literacy and labeling them telecommunication literate. Yet, even though technology appears to be an important part of literacy instruction to teach today's students there is not a strong case that supports that the Bee-Bot makes a direct impact on student achievement of phonemic awareness. In less than twenty years technology has formed a path into every area of society including social and cultural lives (Strommen & Lincoln, 2009) but has left many teachers with a profound sense of needing to "catch-up" in both their learning and teaching. This leaves educators with a gap in how they can effectively use technology tools, like Bee-Bots, to enhance student achievement.

Although this research study did not find a significant difference between the two groups it demonstrated that the classrooms using the Bee-Bots did as well as the traditional classrooms on the development of phonemic awareness in Kindergarten children. This provides contributing research to the literature on phonemic awareness and on using Bee-Bot handheld devices in Kindergarten students. It also must be made known that Bee-Bot handheld devices engage students to remain on task longer, help leadership skills develop, and add a true enjoyment to learning for Kindergarten. With these benefits the Bee-Bot handheld devices may begin to have an impact on education in a variety of ways and at the same time provide an easy to use device for technology integration and meeting current technology standards.

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Appendix A: Letter of Cooperation School District A

School District Number One
Sweetwater County • P.O. Box 1089 • Rock Springs, Wyoming 82902-1089 • (307) 352-3400 FAX (307) 352-3456

Mike Lopiccolo, Director
Elementary Secondary Education / Human Resources

February 10, 2010

Cristy Magagna-McBee
PO Box 548
Green River, WY 82935

Dear Cristy:

I did have the opportunity to review your research proposal that is entitled The Use of Handheld Devices for Improved Phonemic Awareness in a Traditional Kindergarten Classroom with Sweetwater County School District Number One. You have requested to be able to access the DIBELS results for the fall of 2009 and winter of 2010 from kindergarten classes at Sage Elementary School. These DIEBELS results will not include student identifiers when given to you. Two kindergarten teachers, one using handheld devices and one not using hand held devices, with their permission may be interviewed for this research project. On behalf of Sweetwater County School District Number One, I authorize the approval of your research proposal.

I understand that the data collected will remain entirely confidential and may not be provided to anyone outside of the research team without permission from Sweetwater County School District Number One.

Sincerely,

Mike Lopiccolo
Director of Human Resources and Elementary/Secondary Education
Sweetwater County School District Number One
Rock Spring, WY

Appendix B: Letter of Cooperation School District B

Sweetwater County School District #2

320 Monroe Avenue Green River, WY 82935
Phone: 307-872-5500 FAX: 307-872-5518
www.sw2.k12.wy.us

Cristy Magagna-McBee
P.O. Box 548
Green River, Wy. 82935
mcbeec@msn.com

February 9, 2009

Dear Cristy Magagna-McBee,

Based on my review of your research proposal, I give permission for you to conduct the study entitled The Use of Handheld Devices for Improved Phonemic Awareness in a Traditional Kindergarten Classroom within Sweetwater County School District #2. As part of this study, I authorize you to access the DIBELS results for the 2009-2010 school year on the kindergarten classes at Jackson Elementary School. The release of the archived DIBELS data for fall 2009 and winter 2010 will not include student identifiers when given to the researcher. I also approve interviewing two kindergarten teachers at Jackson Elementary School (one who uses the handheld devices and one who does not use the devices) in conjunction with the research. Individuals' participation will be voluntary and at their own discretion. We reserve the right to withdraw from the study at any time if our circumstances change.

I confirm that I am authorized to approve research in this setting.

I understand that the data collected will remain entirely confidential and may not be provided to anyone outside of the research team without permission from the Walden University IRB.

Sincerely,

Craig Sorensen
Superintendent
Sweetwater County School District #2
Green River, WY 82935

Appendix C: Interview Questions for Classrooms Teachers With Handheld Devices

Interview Questions for Classroom Teachers: With Handheld Devices

Research Question #2
What is the teachers' perception of the ways handheld devices support or do not support student development of phonemic awareness?

1. Describe the physical environment of your classroom where you teach your literacy program, more specifically your phonemic awareness lessons.
   a. What works or doesn't work with the environment?
   b. As a professional educator why do you believe this to be the case?

2. Describe the demographic makeup of the students in your classroom, including your sub-groups.

3. Do you have any specific expectations for behavior in your classroom during the phonemic awareness lessons? How about for academics?

4. Describe your philosophy of education.
   a. Has is changed over the years?
   b. Is so how?
      If your philosophy has not changed, why do you think it hasn't?

5. What curriculum do you use to teach phonemic awareness?

6. What, if any schedule do you use for phonemic awareness?

7. What supplemental programs/methods do you use to teach phonemic awareness?

8. What professional development have you have been offered concerning teaching phonemic awareness?

9. Describe how your students' react to the lessons and activities you provide during phonemic awareness lessons.
   a. What are you hearing in regards to your students?
   b. What are you seeing in regards to your students?

10. Do you believe how you teach phonemic awareness has an impact on student growth? Why? How do you know (assessments?)?

12. Describe how you teach phonemic awareness:
    a. What works best?
    b. How do you know it works best?
    c. What doesn't work well?
    d. How do you know it does not work well?
    e. Are there things you might do differently? Why/how?

13. Do you use any interventions or enrichments with your students during phonemic awareness lessons? How about any that no one else in your building uses?

14. When I compared the DIBELS scores between two classes using Bee-Bots and two classrooms not using Bee-Bots, there was no difference in the scores, statistically speaking. That means that using the Bee-Bots didn't improve the academic achievement of the phonemic awareness over more traditional teaching strategies. What do you think of those results do they surprise you at all? Why or why not?

15. Given your experience with this age group of students, what are some reasons you might attribute to not finding a difference between the groups?

16. Do you feel like Bee-Bots positively impacted or hindered student learning in your classroom? Please explain your position, possibly using examples.

17. Do you believe the Bee-Bots were helpful for specific students in your class, and not for others? Please explain.

18. What sort of learning curve did you experience with your students to be able to use the Bee-Bots in your classroom? What about for yourself?

19. How are you using the Bee-Bot handheld now with your students? Will you change anything for next year?

20. Have you shared your experiences with the Bee-Bots with your Kindergarten colleagues? Can you explain?

21. Have you shared your experiences with the Bee-Bots with other teachers in your building? Can you explain?

22. Have you had any feedback from parents about your use of the Bee-Bots in the classrooms? Can you explain?

23. Have you heard or seen anything that surprised you about your students' reactions to using the Bee-Bots?

24. What additional information on your perceptions of the Bee-Bots and their use in phonemic awareness can you provide?

25. Do you have any additional information you would like to add about your phonemic awareness lessons or teaching methods?

Appendix D: Interview Questions for Teachers Without Handheld Device

Research Question #2
What is the teachers' perception of the ways handheld devices support or do not support student development of phonemic awareness?

1. Describe the physical environment of your classroom where you teach your literacy program, more specifically your phonemic awareness lessons.
    a. What works or doesn't work with the environment?
    b. As a professional educator why do you believe this to be the case?

2. Describe the learning climate of your classroom in regards to your students (safety and the care of the students).

3. Do you have any specific expectations for behavior in your classroom during the phonemic awareness lessons? How about for academics?

4. Describe the demographic makeup of the students in your classroom, including sub-groups.

5. Describe your philosophy of education.
    a. Has is changed over the years?
    b. Is so how?
    If your philosophy has not changed, why do you think it hasn't?

6. What curriculum do you use to teach phonemic awareness?

7. What, if any schedule do you use for phonemic awareness?

8. What supplemental programs/methods do you use to teach phonemic awareness?

9. What professional development have you have been offered concerning teaching phonemic awareness?

10. Describe any tools or best practices, which you use to teach phonemic awareness.

11. Describe how your students' react to the lessons and activities you provide during phonemic awareness lessons.

12. Do you believe how you teach phonemic awareness has an impact on student growth? Why? How do you know (assessments?)?

13. Describe how you teach phonemic awareness:
    a. What works best?
    b. How do you know it works best?
    c. What doesn't work well?
    d. How do you know it does not work well?
    e. Are there things you might do differently? Why/how?

14. Had you been given the opportunity to use handheld devices (Bee-Bots) in your classroom for phonemic awareness do you think you would have taken it?

15. Do you feel like Bee-Bots would positively impact or hinder student learning? Please explain your position, possibly using examples.

16. Have you observed the Bee-Bots in use or had any opportunities to discuss using them with Mrs. George?
    a. If so, what are your perceptions of Bee-Bots for helping children develop phonemic awareness as a result of these observations or conversations?

17. Has your perception of the use of Bee-Bots for teaching phonemic awareness changed as a result of these observations?

18. If you had Bee-Bots available to you for use in your classrooms in the future, would you want to use them? Why or why not?

19. When I compared the DIBELS scores between two classes using Bee-Bots and two classrooms not using Bee-Bots, there was no difference in the scores, statistically speaking. That means that using the Bee-Bots didn't improve the academic achievement of the phonemic awareness over more traditional teaching strategies? Does that surprise you? Please explain.

20. Given your experience with this age group of students, what are some reasons you might attribute to not finding a difference between the groups?

21 I want to understand your success teaching phonemic awareness. Do you use any interventions or enrichments with your students during phonemic awareness lessons, which no one else in your building uses?

22. What do you believe the key to good teaching re to phonemic awareness is?

23. Do you believe the Bee-Bots would be helpful for specific students in your class, and not for others? Please explain.

24. What additional information on your perceptions of the Bee-Bots and their use in phonemic awareness can you provide?

25. Do you have any additional information you would like to add about your phonemic awareness lessons or teaching methods?

Appendix E: Enrollment Summary for School District A

Enrollment Summary

as of 11/9/09 ()
District Office

Grade Level	TOTAL IN GRADE	Asian	Black	Hispanic	American Indian	White - Not of Hispanic Origin	Unclassified
0	464 239 / 225	6 4 / 2	7 4 / 3	103 54 / 49	1 0 / 1	347 177 / 170	0 0 / 0
1	453 250 / 203	5 3 / 2	8 4 / 4	89 50 / 39	5 2 / 3	346 191 / 155	0 0 / 0
2	450 239 / 211	4 0 / 4	12 10 / 2	96 48 / 48	4 2 / 2	334 179 / 155	0 0 / 0
3	398 208 / 190	9 4 / 5	7 3 / 4	86 48 / 38	0 0 / 0	296 153 / 143	0 0 / 0
4	413 205 / 208	3 2 / 1	7 4 / 3	84 46 / 38	3 0 / 3	316 153 / 163	0 0 / 0
5	427 255 / 172	2 1 / 1	8 5 / 3	85 50 / 35	5 4 / 1	327 195 / 132	0 0 / 0
6	422 215 / 207	2 2 / 0	9 6 / 3	86 41 / 45	8 4 / 4	317 162 / 155	0 0 / 0
7	397 209 / 188	6 3 / 3	11 4 / 7	72 34 / 38	9 8 / 1	299 160 / 139	0 0 / 0
8	342 173 / 169	4 1 / 3	12 4 / 8	69 33 / 36	3 1 / 2	254 134 / 120	0 0 / 0
9	336 153 / 183	2 0 / 2	7 3 / 4	53 23 / 30	7 4 / 3	267 123 / 144	0 0 / 0
10	365 186 / 179	3 0 / 3	3 1 / 2	68 38 / 30	5 2 / 3	286 145 / 141	0 0 / 0
11	282 152 / 130	7 5 / 2	8 7 / 1	37 14 / 23	5 5 / 0	225 121 / 104	0 0 / 0
12	283 149 / 134	2 1 / 1	4 2 / 2	53 28 / 25	5 3 / 2	219 115 / 104	0 0 / 0
TOTAL	5032 2633 / 2399	55 26 / 29	103 57 / 46	981 507 / 474	60 35 / 25	3833 2008 / 1825	0 0 / 0

Appendix F: Enrollment Summary for School District B

Enrollment Summary as of 8/21/09
District Office

Male	1343	51.70%
Female	1256	48.30%
ELL – Service	94	3.60%
ELL – Monitor	20	0.80%
SPED	426	16.40%
Free/Reduced Lunch	454	17.50%
Asian	25	1.00%
Black	17	0.70%
Hispanic	378	14.50%
Indian	26	1.00%
White	2153	82.80%

TOTAL 2599

Appendix G: Participation Consent Form

PARTICIPANT CONSENT FORM

You are invited to participate in a research study entitled: **The Use of Handheld Devices for Improved Phonemic Awareness in a Traditional Kindergarten Classroom.**

You were selected as a possible participant because of your knowledge and/or experience related to the topic. Please read this form and ask any questions you may have before acting on this invitation to be in the study.

Cristy Ann Magagna-McBee, a doctoral candidate at Walden University, is conducting this study.

Background Information:

The purpose of this study is to evaluate the effectiveness of handheld devices (*Bee-Bot)* in a Kindergarten classroom with regard to their use for facilitating the increase of phonemic awareness. The research will specifically address: (a) student use of handheld devices to improve phonemic awareness, and (b) teacher perceptions of the use of the handheld devices with Kindergarten students to enhance phonemic awareness.

Procedures:

If you agree to be in this study, the researcher will interview you. The interviews will be scripted with open-ended questions to determine what pedagogy the teachers are using in their classrooms to teach phonemic awareness. Questions will be asked to determine what works and why and what does not work and why. The group using handheld devices will be asked how they were used and compared to the DIBELS reports to determine if there are significant results to determine that the handhelds made a difference with scores. The groups without the handheld devices will be asked if they think the devices will could work for their classrooms. The interviews will be recorded and the audio files will be transcribed.

Voluntary Nature of the Study:

Your participation in this study is strictly voluntary. Your decision whether or not to participate will not affect your current or future relations with the researcher, the school, or the school district.

Risks and Benefits of Being in the Study:

There are minimal risks involved with participating in any study. In this case, this risk relates only to the confidentiality of the information you provide in your completed interview. To maintain that confidentiality, the researcher will be the only one who will have access to the information provided in the interviews, and I will keep it in a file drawer that will remain locked whenever I am not actively working with the information. The benefits to participation are that the study may help us to understand more clearly how handheld devices can help students increase their achievement in phonemic awareness in Kindergarten. This research may also provide additional opportunities for using handheld devices in other grades and curriculum areas.

Compensation:

No monetary compensation will be provided for participation in this study; however, your involvement in the study is greatly appreciated should you choose to participate. Your participation will be made known to the school and district administration and a proper thank you will be issued upon the completion of the study.

Confidentiality:

The records of this study will be kept private. In any report of this study that might be
published, the researcher will not include any information that will make it possible to identify a participant or the school district in which the research was conducted. Research records will be kept in a locked file; only the researcher will have access to the records.

Contacts and Questions:

The researcher conducting this study is Cristy Ann Magagna-McBee. The researcher's doctoral committee chair is Dr. MaryFriend Shepard. You may ask any questions you have now. If you have questions later, you may contact them at:

Cristy Ann Magagna-McBee
P.O. Box 548
753 Daniel Boone
Green River, WY 82935
307-871-6035
mcbeec@sw1.k12.wy.us

Dr. MaryFriend Shepard
229-227-0240
maryfriend.shepard@waldenu.edu

You may keep a copy of this consent form.

Statement of Consent:
I have read the above information. I have asked questions and received answers as I wished, and I consent to participate in the study.

Printed Name of Participant
Signature
Date

Appendix H: Confidentiality Form

Confidentiality Agreement

Researcher Information: Cristy Magagna-McBee
cristy.magagna-mcbee@waldenu.edu
(307) 871-6035

Dear Mr. Brian Kaumo,

Sweetwater School District #1 has recommended you as the person who can assist me with my mixed-methods research study entitled: *The Use of Handheld Devices for Improved Phonemic Awareness in a Traditional Kindergarten Classroom.* I will need your assistance with the following activities:

- To access the archived DIBELS assessment data for the four kindergarten classrooms in two school districts for the Fall 2009 and Winter 2010 phonemic awareness scores.
- To assist me with any questions I may encounter during the collection and anaylsis of the DIBELS data.

All information gathered from teachers is confidential. Therefore, I am required to obtain a confidentiality agreement from you stating that you agree to keep confidential the data you access for the study. Please sign this confidentiality agreement and return it to me at your convenience. I look forward to working with you and I thank you in advance for your assistance in this study. If you have any questions about your role, please feel free to contact me at the information listed below.

Cristy Magagna-McBee
(307) 871-6035

Curriculum Vitae

CRISTY ANN MAGAGNA-MCBEE

PROFESSIONAL WORK EXPERIENCE

INSTRUCTIONAL COACH — JUNE 2009-CURRENT
Sweetwater School District #1 — *Rock Springs, Wyoming*

CLASSROOM TEACHER - KINDERGARTEN — JUNE 2006-JUNE 2009
Sweetwater School District #1 — *Rock Springs, Wyoming*

CLASSROOM TEACHER – ELEMENTARY (K-8) — AUGUST 2002 – MAY, 2006
Sweetwater School District #2 — *Green River, Wyoming*

SUBSTITUTE TEACHER (PREK-12) — JANUARY 2000 - MAY 2002
Sweetwater School District #1 — *Rock Springs, Wyoming*

AMERICAN RED CROSS - DIRECTOR — DECEMBER 1995 – DECEMBER 1999
Southwest Wyoming Chapter — *Rock Springs, Wyoming*

EDUCATION

PH D. IN EDUCATIONAL TECHNOLOGY — JUNE 2010
Walden University — *Baltimore, MD*
Graduation Honors: Kappa Delta Pi
GPA: 4.000

NATIONAL BOARD CERTIFIED TEACHER (NBPTS) — NOVEMBER 2010
EARLY CHILDHOOD GENERALIST — ARLINGTON, VA.

EDUCATIONAL TECHNOLOGY CERTIFICATE — AUGUST 2005
Regis University — *Denver, CO*
GPA: 4.000

MASTER OF EDUCATION — AUGUST 20, 2004
Regis University — *Denver, CO*
GPA: 3.848

BACHELOR OF ARTS IN LIBERAL ARTS — MAY 3, 2002
Regis University — *Denver, CO*
Graduation Honors: Magna Cum Laude
GPA: 3.700

ASSOCIATE OF ARTS DEGREE — MAY 1, 1991
Western Wyoming Community College — *Rock Springs, WY*
Graduation Honors: Phi Theta Kappa
GPA: 3.220

PROFESSIONAL DEVELOPMENT, AWARDS, & CERTIFICATIONS

- Wyoming Education Endorsement in Elementary Education (K-6)
- Wyoming Education Endorsement in Middle School Education (6-8)
- Wyoming Education Endorsement in Coaching (Swimming)
- Wyoming Education Endorsement in Leadership (Principal Permit) (anticipated completion fall '10)
- Sweetwater School District #2 Board of Education, Vice-Chairman – since 2007
- Sweetwater County Child Development Center Board Member, Vice-Chairman - since 2008
- Sweetwater BOCES Board Member – since 2010
- Published book: *Bee-Bot Curriculum* (Terrapin Logo, 2009)
- Pending article in *Learning & Leading with Technology* (June/July 2010)
- Have published several other professional articles for newsletters, local news, and online resources
- Have presented at several national conventions (NSBA, NECC, I Teach K!, T & L)
- Current Promethean Interactive Board Trainer
- Advantage Math certified
- Have attended several conferences/workshops related to various district initiatives (PLC, Thinking Strategies, Technology Integration, Differentiation, Brain Friendly, Curriculum)
- CERT certified through Sweetwater County Emergency Management
- Certified in CPR and first aid through American Red Cross
- Served on the Assessment Task Force, Math Adoption, Science Adoption, Social Studies Adoption, and Technology Committee for Sweetwater School District #1
- Served as a member of the Distance Education Task Force for the Wyoming Department of Education - 2008
- Have taught several training sessions on various technology topics
- Formed the McKinnon PTSO – 2004
- Former Teacher-Leader for $5^{th}/6^{th}$ Grade Language Arts for Sweetwater School Dist. #2.
- Served on Language Arts, technology, and mission statement committees for Sweetwater School District #2
- Featured Alumni Display "Student Becomes Teacher" at Western Wyoming Community College
- Recipient of two technology grants (WDE and BOCES)
- Rural Teacher of the Year, Sweetwater School District #2, 2003-2004
- Member of the Rock Springs Education Association, the Wyoming Education Association, and the National Education Association
- Current ISTE (International Society for Technology in Education) Association Member
- Current NSBA (National School Board Association) Member
- Current Member Kappa Delta Pi Member and Foundation Representative/Fundraising Chairperson – Walden University
- Current Member of ISTE – Mobile Learning Community, Communication Chair