The Effectiveness of Using Mobile Applications to Improve Phonological Awareness for Students with Disabilities

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Abstract

This study investigated the effectiveness of using educational mobile applications using an iPad to improve phonological awareness for students with disabilities who struggle with reading. Two mobile applications were selected with functions that included login and personalized words, tracking progress, and reward systems. Three elementary students who received special education services in a separate classroom participated in this case study. The Classroom Reading Inventory was used to measure students’ word recognition levels and identify the letter sounds not mastered in order to design individual instruction plans. Students received two weekly sessions of 30-minute remedial instruction in a separate room for five weeks with an iPad using selected applications followed by a short reading from a McGuffey’s Primer. Students also received word cards and a copy of selected readings for practice at home. The results showed that all students made positive progress in mastering letter sounds and reading words. As the typical language arts lessons were in progress, the results may not totally reflect the unique gains solely from using the iPad applications. Further research is recommended in using mobile applications for reading instruction integrated in small groups or classroom settings.
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Appendix A
The use of technology is ubiquitous nowadays. From communication devices such as Android phones, Windows phones, and iPhones to entertainment devices such as eReaders like Nook, Kindle, iPad, or iPod touch, people have a variety of devices to choose from and make learning and communication more convenient. According to CNET news, the iPad has ranked third since 2010 on the wish lists of children and teenagers for Christmas (CNET News, 2012). Additionally, many parents make use of the colorful interface of mobile phones or tablets, installing educational applications claimed to be useful in learning, and let their children play with them during road trips or any spare time to occupy their children (Franklin, 2011, p. 264). In view of these trends, we cannot ignore the fact that the new generation is growing up with technology and using mobile devices.

The New Media Consortium (NMC) Horizon Report: 2013 K-12 edition which examines “emerging technologies for their potential impact on and use in teaching, learning and creative expression within the environment of pre-college education” suggests mobile learning as one of emerging technologies that are likely to enter the mainstream (Johnson, Adams Becker, Cummins, Estrada, Freeman, & Lugate, 2013, p. 3). The report affirms this phenomenon, pointing out that mobile learning is becoming an integral part of K-12 education as it is increasing common for students to own and use portable devices. With easy to use, touchscreen interfaces, even the youngest children can easily pick up a tablet or smartphone and interact with it almost immediately. (Johnson et al., 2013, p. 4)

How can educators take advantage of mobile devices and children’s interest to integrate technology into classroom instruction to enhance students’ learning? The NMC Horizon Report further points out that mobile devices are gateways to endless possibilities for learning, collaboration, and productivity through the internet, (Johnson et al., p. 4) and mobile applications are regarded as one of the fastest growing facets for these devices. In view of the popularity of iPad, this study
explores the effectiveness of two educational applications using the iPad for improving the phonological awareness of students with special needs.

**Review of the Literature**

The standard from the American Association of School Librarians (AASL) for 21st century learners regards reading as a lifelong learning skill and a key indicator for success at school and in life (AASL, 2007, 2009). With the advancement of technology and the widespread use of the Internet, technology skills are also important for learners for future employment (AASL). Meanwhile, the 2008 National Educational Technology Standards (NETS) educator guidelines addressed the importance of technology skills and demanded, “Teachers develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress” (Arnone & Reynolds, 2009, p.6). In view of the importance of reading and technology skills, educators seek ways to integrate technology in reading instruction, especially for struggling readers (Kiger, Herro, & Prunty, 2012, p. 62, 76).

According to the National Reading Panel (NRP) Report (2000) phonemic awareness is one of the five important elements identified as crucial to reading instruction (Gambrell, Morrow, & Pressley, 2007, p. 63). Other elements include phonics, comprehension, vocabulary, and fluency (Gambrell, Morrow, & Pressley). Researchers also pointed out that phonological awareness or phonemic awareness is a good indicator for reading success (Ehri, Nunes, Willows, Schuster, Yaghoub-Zadeh, & Shanahan, 2001; National Reading Panel 2000). However, phonological awareness is only one part of a beginning literacy program. Yopp and Yopp (2000) pointed out that “phonemic awareness supports reading development only if it is part of a broader program that includes – among other things – development of students vocabulary, syntax, comprehension, strategic reading abilities, decoding strategies, and writing across all content areas (p. 142).
Furthermore, the NRP report also suggested that phonemic awareness has to be considered in reading instruction for young children and struggling readers (Rasinski & Padak, 2008, p. 45).

**Learning Disabilities and Reading Disabilities**

Students with reading difficulties often are diagnosed with learning disabilities (Ergul, 2012, p. 2051). Learning disabilities is defined as “a disorder in one or more of the basic psychological processes involved in understanding or using spoken or written language that may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations” (Ergul, 2012, p. 2051). According to Sundheim and Voeller (2004), it is indicated that learning disabilities affect five to ten percent of population. Of those diagnosed, 68-80% diagnosis were boys (Ergul, 2012). It is a lifelong disability that affects the development of all developmental and academic areas of children with learning disabilities (Ergul). However, if it is identified early and treated with effective intervention programs, students with learning disabilities can succeed in life (Ergul).

Students with learning disabilities often have reading difficulties and have been identified with reading disabilities. These disabilities provide a major bottleneck for readers in the areas of word recognition (Torgesen, Alexander, Wagner, Rashotte, Voeller, & Conway, 2001, p.35). Researchers pointed out students with reading disabilities display two types of word-level reading problems: First, students with reading disabilities tend to guess unfamiliar words based on the context of passage that leads to lots of word-level reading errors. The reason is they have severely impaired skills in using phonics to identify words. Second, students with reading disabilities tend to have limited sight words. Because of their limited phonemic decoding skills, they have struggles with word recognition (Torgesen et.al., 2001). Phonemic decoding skills are recognized as a critical component in supporting children in attaining the orthographic reading skills that enable them to read fluently and effortlessly (Torgesen et.al.).
Phonemic Awareness versus Phonological Awareness

Occasionally, the terms phonemic awareness and phonological awareness are used interchangeably (Chapman, 2003; Rasinski & Padak, 2008; Tindall & Nisbet, 2010). However, *Put Reading First* points out they are not interchangeable and there is a slight difference between the terms. Phonological awareness is a broader term and “includes identifying and manipulating larger parts of spoken language, such as words, syllables, and onsets, and rimes – as well as phonemes” (p.2). By contrast, phonological awareness is “an all-encompassing term for hearing sounds in spoken language” (Johnson, 2004; Tindall & Nisbet, 2010, p. 2). It is the ability to recognize a sequence of sounds or phonemes in speech.

Struggling readers often demonstrate processing deficits in phonological and orthographic awareness (Johnson, 2004, p. 78). Orthographic awareness refers to recognition and discrimination of letters and their related sounds (Johnson). Phonemic awareness, on the other hand, is a subgroup of phonological awareness and is narrower in focus. Its focus is on “identifying and manipulating the individual sounds in words” (*Put Reading First*, p.2-10; Ehri et al., 2001, p.253). In conclusion, phonemic awareness is the ability to manipulate phonemes or letter sounds and phonological awareness also includes the awareness of syllables and rhyming words (Ehri et al.).

In view of the slight difference between phonemic awareness and phonological awareness (PA), this study focuses on the manipulation of sounds, involved in blending and segmenting of phonemes.

As PA is important in assisting students in reading (Tindall & Nisbet, 2010), Ehri et al. (2001) indicate that PA instruction can make a big difference for struggling readers and research has shown that it allows students with disabilities to read at the same grade level as their typically developing peers (Ehri et al.). It helps remediate reading and spelling difficulties in students with disabilities. Further, researchers suggested one-on-one tutoring is the most effective form of instruction for these learners because it allows for individual instruction planning tailored to meet students’ needs and
difficulties (Ehri et al., p. 256). Most important, in spite of obstacles, research shows that phonemic or phonological awareness can be taught (Tindall & Nisbet, 2010).

**Instructional Tools for Struggling Readers**

According to the NRP 2000 and research from Ehri et al. (2001), there are components of phonemic awareness instruction that increase the effectiveness of improving reading skills. First, PA instruction should last between five and 18 hours (Ehri et al., 2001). The basic value of PA instruction is to achieve alphabetic insight and prolonged instruction may create confusion.

Second, teaching one or two PA skills with letters are more effective than a multi-skilled approach (Ehri et al., 2001; National Reading Panel, 2000), especially in the areas of segmenting and blending phonemes. Explicit instruction focused on the connection between PA skills and reading can strengthen the effects. Third, with appropriate training, teachers can teach PA effectively (National Reading Panel, 2000). Encouraging children to use invented spellings is one way of teaching PA (National Reading Panel, 2000; Rasinski & Padak, 2004). Fourth, small group instruction appeared to be better than individual and classroom instruction (National Reading Panel, 2000) as small group instruction was associated with larger effect sizes in meta-analysis instructional programs. More research is called for to confirm this finding. The final component deals with the motivational properties of PA training programs and the use of a computer in PA instruction programs (National Reading Panel, 2000). For both, more research is needed to affirm their effectiveness.

In conclusion, the National Reading Panel (2000) affirmed the positive value of PA instruction in promoting students’ reading and spelling skills. The NRP also noted a lack of published research with regard to the use of computer technology and reading instruction and encouraged additional research in these areas (National Reading Panel). In response to a call for the integration of technology used for reading instruction, technology-based reading instruction is examined.
Technology-Based Reading Instruction

Technology-based reading instruction often refers to teachers’ use of technology such as computer software in reading instruction. According to the National Reading Panel’s report (2000), using computerized reading instruction software can support reading instruction and allows readers to interact with text for greater amounts of time. “Digitized and high-quality synthetic speech has been incorporated into programs focusing on phonological awareness and issues related to emergent literacy, letter-name and letter-sound knowledge, phonological decoding, spelling, and support for word decoding and comprehension while reading and writing stories” (Bishop & Santoro, 2006, p. 57). Many critical features such as computerized speech, interesting graphics, animation, and speech recording can entertain and motivate readers of all levels. Not only do these features support general readers, they are also effective for helping at-risk students to gain access to the general education curriculum.

In their study of the triangular relationship between tutor, child, and computer in early acquisition of literacy skills, Schmid, Miodrag, and Di Francesco (2008) confirmed the recommendations of the NRP, indicating that “there is a need for innovative technological assistance in reading instruction and for software integration and for software integration designed explicitly for young children” (p. 65). Their study further pointed out that these types of computer-assisted programs are effective and offer enticing features for young children in view of their visually attractive interfaces and immediate feedback.

Mobile technologies. Franklin (2011) suggested that “educators should be aware of the literacies and future implications of all technologies especially mobile technologies” (p. 266) when talking about 21st century student outcomes and support systems. Currently mobile technologies are popular and many students use their mobile devices in the learning environment. Parents also use these devices as a way to educate and entertain their children. Franklin further suggested that the iPad 2 and other tablets are changing the focus in education due to their mobility and tactile appearance (p.
However, the technology does not change the essential aspects of how people learn, but rather the delivery of learning (p. 264). Next, Franklin outlined the new 3Es’s for education: enabling, engaging, and empowering, explaining that educators should realize that learning must enable learners to reach their potential through increased access to educational resources locally and globally. Learning also should engage students in rich and compelling learning experiences for developing deeper knowledge and skills especially in problem-solving and critical thinking. Finally, learning should empower students to take responsibility for their learning destinies and become life-long learners (p. 264). Though her study is focused on higher education, the overview of 21st century teaching and learning, and integrating mobile technologies into classroom is still applicable to the K-12 classroom.

To examine the efficacy of mobile learning in an elementary school setting, Kiger, Herro, and Prunty (2012) conducted a study of using an iPod (mobile device) for a math intervention with third graders. The authors mentioned that because of the prevalence of mobile devices among students and the availability of digital learning resources through the Internet, schools are motivated to reconsider their instructional and operational practices (p. 62). Many school are incorporating “iTechnology” using Apple’s products, such as the iPod and iPad in learning activities for their “versatility (e.g., e-reading, calculating, mapping, video and audio recording, Internet browsing, gaming), familiarity to students, and affordability” (p. 63). The software applications designed for these devices also have potential educational value, however, evidence of the impact of iTechnology on students’ achievement is still limited.

Gaming. Petkov and Rogers’ study (2011) suggested serious games should be integrated into the existing curriculum instead of added on as a supplementary. “Serious games” refer to games whose main goal is to educate the user instead of entertaining (p. 8). The authors also encouraged educators to take advantage of the appeal video games have for students. This type of gaming can offer the motivational boost students need (p. 10). Finally, the authors indicated games should be
appealing, fun, and engaging with the educational aspect well-integrated with the gameplay.

Consequently, a balanced instructional method will be needed to ensure that educational and motivational purposes are achieved (p. 11).

**Computer-based instruction.** Lovell and Philips (2009) conducted a comprehensive evaluation of 13 commercial software programs used for teaching reading and writing. They recognized the importance of using technology in contemporary education in light of many children’s access to technology outside the classroom. They pointed out that “the multi-media capabilities of modern computers, especially text-to-speech capabilities and graphic representations, support the teaching of phonological awareness” (p. 200). The educational benefits of some reading and writing programs have been reported. The authors mentioned that it is important computer programs have an evaluative component and provide feedback to ensure “the program can be adapted to meet students’ educational needs as well as monitor their progress” (p. 200). Further, they encourage educators to be aware of the research-based computer programs that support effective and efficient instruction. However, their findings revealed the majority of software programs they reviewed in their study were non-instructional and not tools for meaningful integration of technology into instruction.

On the other hand, Bourne and Whiting (2004) found that the simultaneous presentation of auditory and visual information benefits phonological and orthographic learning. Specifically, their study found that “the matching and connecting of phonological and graphological information is critical in learning to read” (p. 53) and demonstrated positive gains in reading and spelling of words in an intervention class (p. 41).

In evaluating reading software, Bishop and Santoro (2006) provided three criteria for selecting software for children with reading difficulties in the early grades: interface design, instructional design, and beginning reading content (phonological and alphabetic understanding) (p. 57). They pointed out that few commercial software programs meet most of the research-based criteria for at-risk readers (p. 65) and called for needed improvements in instructional software for children (p. 68).
Meanwhile, they proposed standards to evaluate reading software are designed to help schools and educators to make informed decisions about what to purchase and how to use the software for instruction. Further, they suggested that along with explicit instruction delivered by educators, software that includes drill-and-practice but lacks high-quality instruction and strong interface design may still benefit student learning (p. 68).

In conclusion, there are different forms of reading instruction integrated with technology, mobile technology, gaming, and computer based instruction. Educators need to make informed choices of the type of reading instruction that is viable for them and useful in teaching their students. For mobile technologies, Franklin (2011) asserts that the essence of learning is to enable, empower, and engage students to become life-long learners when educators consider integrating technology into the classroom. iTechnology appears to be promising in school but needs more data to affirm its educational value. Petkov and Rogers (2011) suggest gaming is promising if the educational games are engaging, fun, appealing and well-integrated in the instruction. As for computer-based instruction, researchers pointed out the text to speech capacities, graphical presentation, and matching phonological and graphical information in computer are beneficial in reading instruction (Lovell and Philips, 2009 & Bourne & Whiting, 2004). Caution is needed when using commercial software in instruction. Bishop and Santoro’s three criteria for evaluating commercial software is useful for educators to evaluate the educational value of commercial instruction software for reading instruction (Bishop & Santoro, 2006).

Based on the above review, it is necessary to assess the effectiveness of educational applications designed for mobile devices. Given the popularity of iTechnology, the present research further explores this new form of technology to determine its effectiveness. Such research is necessary if iTechnology hopes to meet the research-based criteria mentioned above and be integrated into reading instruction for struggling readers. The purpose of this study was to explore the
effectiveness of using educational mobile applications designed for the iPad to improve phonological awareness for students with learning disabilities who struggled with reading.

**Method**

**Context**

This study was conducted in a special education classroom in an elementary school in Central Ohio. The population of students is approximately 95% Caucasian with the remainder composed of other races. Among the student population, about 64% is identified as economically disadvantaged. The school’s poverty status is medium to high, which indicates the majority of students come from low-income families. The school performance as reported on the school card provided by the State is identified as a B grade, based on assessment results and indicators for the 2012-2013 academic year. Students in grades three through grade five scored from 74% to 94% in reading proficiency. As for students with disabilities in this school, they received a grade of B on the 2012-2013 state report card. The performance in the area of literacy is identified as B overall.

**Participants**

Three students diagnosed with learning disabilities in grades 3 to 5 were recommended by their special education teacher and were selected for this study. The students experienced difficulty in reading specifically with pronouncing words phonetically and their reading scores were below grade level. They all qualified for special education and had individualized education plans (IEP) in reading.

**Procedures**

Upon receiving the IRB approval and parental consent and student assent, a pre-test on word recognition was given from part one of the Classroom Reading Inventory on sight words. A pre-test on sight words was given to every participant at the beginning of the study and the reading errors were analyzed and served as a baseline of their reading levels. On each level, students were required to read 20 words without any prompts. Each correct response equaled 5%. When a student missed
five errors, the test would be stopped on that level. The incorrect sounds would be marked during the test on the running record sheet to help identify error patterns. This diagnostic information was used to tailor-make an intervention program using two iPad reading applications to target the word recognition errors or letter sounds students had not mastered. Next, the researcher met with each student twice a week for 30 minutes one-on-one in a separate room providing intervention focused on letter sounds and blending sounds using two mobile applications, *Make a Word* and *Phonics Word Families* on the researcher’s iPad.

After the phonics activities, students read short stories from a McGuffey’s Primer that contained the words or letter sounds introduced in the lessons. Students brought home a copy of the story and sight words they learned for further practice and reinforcement at home and school. At the end of the study, the students were given a post-test on sight words from the Classroom Reading Inventory to determine their progress in mastering letter sounds and blending words.

All participants also participated in a short interview to determine their opinions in regarding using the use of mobile applications for reading instruction. The interview questions include:

1. Have you had any experience in using applications in an iPad to learn before this study?
2. Do you like learning with an iPad? Why?
3. Did you read the stories I gave you at home and at school? How often?
4. Do you think the applications on the iPad helps you learn better in reading words?

Each interview took approximately seven minutes and was conducting after the last one-on-one session with each participant in a separate room.

Participants’ performance on the post-test and data from the informal interview were analyzed to determine the effectiveness of using mobile applications for reading instruction with students with disabilities.

**Instrument**
The Classroom Reading Inventory (CRI) was used to analyze students’ word recognition errors before the instruction and evaluate their progress at the end of the study following individualized one-on-one reading instruction. The advantage of using CRI is it provides an individualized student miscue analysis that is useful for designing individualized instruction targeting at identified skill deficiencies in reading (Johnson, 2004, p. 81) and is suitable for teachers who have less experience with informal reading inventories (Jennings, 1987, p. 284). After the first assessment, teachers can conduct miscue analysis, inferring information about students’ knowledge and strategies based on their reading errors and designing individualized instruction plan (Walpole & McKenna, 2006, p.592).

**Intervention**

Both *Make a Word* and *Phonics Word Families* are the products of Abitalk Education System. Both applications provide an individual account for every student and allow users to check students’ progress. *Make a Word* focuses on short vowels. After logging onto the student’s account, students can pick a vowel they want to focus on. The learning activities are divided into two parts. In the first part, students pick the right letter by moving the letter to the sound box at the bottom of the screen to form a word corresponding to the picture shown. After the letter is moved into the letter into the sound box, the letter sound will be read aloud by the software. If the letter the student picked is wrong, it does not stick and the student has to pick another one. At the end of the activity, the screen will provide reinforcement for responses, such as “awesome” for completing the activity. The second activity requires students to match the words they learn from the first activity with the correlated picture. For each answer the student gets correct, he/she will receive a dinosaur sticker. Students can check their total rewards on a sticker page. As for *Phonics Word Families*, the program contains a variety of diagraphs or sound clusters for learners to choose from. The activities also require students to blend sounds by dragging the letters to form the right word to match the picture shown. Students also receive a sticker for every correct answer.
To sum up, both applications have similar rewards and tracking systems that allow learners to keep track of their progress and increase motivation due to the unique reward systems. Both applications also have attractive graphics and sounds that help students maintain on-task behavior. The automatic “sound aloud system” also helps students to self-correct their letter sounds and blend letter sounds. *Make a Word* focuses on short vowels while *Phonics Word Families* focuses on diagraphs. Based on the results of individualized miscues analysis, an individualized intervention program targeting students’ skills deficiencies related to letter sounds and blending sounds can be developed. Each student had an individual account to track progress in both applications.

**Findings**

**Classroom Reading Inventory Pre- and Post-Test Data**

Using pretest data from the Classroom Reading Inventory, two of the three participants, Student A and C scored at the pre-primer level and Student B scored at the primer. Student C was in third-grade and Student A was in fifth grade. Student B was in grade 3 and in primer level, confirming that all participants were performing below grade level. Tables 1-3 provide a summary of each participant’s pre- and post-test scores for reading sight words.

Table 1  
*Student A Pre and Post-Test Sight Word Reading Scores*

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest – percent of words correct</td>
<td>Pre-Primer - 30%</td>
</tr>
<tr>
<td>Posttest – percent of words correct</td>
<td>Pre-Primer - 45%</td>
</tr>
</tbody>
</table>
Table 2

**Student B Pre and Post-Test Sight Word Reading Scores**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest – percent of words correct</td>
<td>Pre-Primer – 75%</td>
</tr>
<tr>
<td></td>
<td>Primer – 35%</td>
</tr>
<tr>
<td>Posttest – percent of words correct</td>
<td>Pre-Primer – 95%</td>
</tr>
<tr>
<td></td>
<td>Primer – 55%</td>
</tr>
</tbody>
</table>

Table 3

**Student C Pre and Post-Test Sight Word Reading Scores**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest – percent of words correct</td>
<td>Pre-Primer – 5%</td>
</tr>
<tr>
<td>Posttest – percent of words correct</td>
<td>Pre-Primer – 60%</td>
</tr>
</tbody>
</table>

**Figure 1. Participants’ Pre- and Post-test Scores**

Table 4

**Summary of Participants’ Pre- and Post-test Scores**
Assessment | Student A | Student B | Student C
--- | --- | --- | ---
Pretest – % correct | Pre-Primer - 30% | Pre-Primer – 75% | Pre-Primer – 5%
 | Primer – 35% |
Posttest – % correct | Pre-Primer - 45% | Pre-Primer – 95% | Pre-Primer – 60%
 | Primer – 55% |

Of all the participants, Student A and C gained between 15 to 20 percentage points in reading sight words correctly and Student C gained 55 percentage points. All students showed significant improvement in reading sight words.

**Student Interviews**

As for the result of interviews, Student B and C had no experience in using applications on an iPad to learn before this study. All three students expressed enjoying the use of an iPad to learn and they all mentioned it was fun to learn with an iPad. As for reading the assigned short stories and flash cards, Student B and C expressed they read with their mother or an adult at home every day. Student A did not read the stories at home. When asked their opinions of using iPad applications to improve their reading, they all agreed using an iPad helped them to learn better.

**Discussion**

The results of this study are consistent with existing research that indicates technology-based reading instruction is effective in supporting struggling readers in learning to read. In this study, all students with learning disabilities made progress ranging from 15% to 55% in their ability to accurately read words after using a computer-based reading intervention program for five weeks. The intervention utilized in this study was iPad applications focusing on phonological awareness, which according to the National Reading Panel Report, can make positive impact on the word recognition
skills of students with learning disabilities (National Reading Panel Report, 2000). All participants expressed it was fun using an iPad to learn. From observation, the researcher noted that the built-in reward system (i.e., giving sticker for every correct answer) and the tracking system to check individual student progress motivated students to learn. The text-to-speech function, graphic presentation and touch-screen function also engaged students and helped them stay on task. As reported by Lovell and Philips (2009) and Bourne and Whiting (2004), these features support student learning. The findings also resonate with Schmid, Miodrag, and Di Francesco (2008) that computer-based reading instruction is effective and these enticing features support children to learn.

**Limitations**

One limitation in this study is that all participants received reading instruction as a remedial program in addition to their normal language arts lessons. It is not easy to differentiate if their gains in word recognition can solely be attributed to the intervention program. Second, there were only three participants in this study which is a very small sample size. The data is insufficient to conclude with any certainty that the intervention program is effective. A larger sample is needed for further evidence to decide its effectiveness. As for the instrument in this study, Walpole and McKenna warned that the use of an informal reading inventory is insufficient to indicate the underlying issue of word recognition deficiency of students (Walpole & McKenna, 2006, p. 59). They recommended educators use

… a sight-word inventory to see to whether the problem might be inadequate knowledge of high frequency words and a phonics or pseudo-word decoding inventory to see whether the problem might be lack of knowledge of specific grapheme-phoneme correspondences. If neither of those is problematic, we assume that the problem is a lack of reading practice. If both of those are problematic, we recommended moving one step ‘backward’ to also assess phonemic awareness a potential contributor”(Walpole & McKenna, p. 59).
Walpole and McKenna suggested a thorough and systematic procedure be used to determine deficiencies in students’ word recognition skills in order to design instructional programs that respond to the instructional needs of struggle readers (Walpole & McKenna).

**Implications for Practice**

The findings of this study indicated that the use of technology has positive effects in supporting students with learning disabilities in improving their phonological awareness. These findings were based on progress in word recognition over the course of five weeks. It also reflects that children like to experience and learn with technology. Regardless of their exposure to technology in their personal lives, the popularity of computers and mobile devices gives rise to a comfortable level for students to learn with mobile devices like an iPad. Because of this trend in learning, it is strongly recommended that educators should integrate evidence-based technology in their instruction. As for students with learning disabilities, most experience different levels of difficulty in reading, mobile devices or computers can serve as assistive technology to support their learning.

Research has affirmed the positive effect of using technology as a reading intervention (National Reading Panel, 2000). Educators should be knowledgeable about how to choose the right software or program to help their students learn based on individual reading needs. The evaluation criteria and possible indicators for reading software suggested by Bishop and Santoro (2006) is a helpful tool for educators to evaluate the instructional value of software. Meanwhile, students with learning disabilities have varying needs and deficits in reading skills, and educators should find the right tools and use more than one assessments to assess students’ reading skills in order to gain a full picture of the students’ strengths and weakness to design an effective program or software to help students learn.

Though using an iPad seems to be a good tool for motivating students to learn, it is not recommended to give a mobile device to students without guidance. As suggested by Schmid, Miodrag, and Francesco (2008) technology should have a supporting rather than a leading role in
teaching (Schmid, Miodrag, & Francesco, 2008, p. 80). A careful planning for integrating technology is important in a technology-integrated classroom. The scaffolding of instruction is necessary to bridge the knowledge and skill gap (Schmid, Miodrag, & Francesco).

**Recommendations and Conclusions**

This study focused on evaluating the effectiveness of two reading software applications for supporting students with disabilities in reading. As the market of reading software targeting children is expanding rapidly day by day, more research should be done to evaluate the effectiveness of these types of software especially for students with disabilities according to their skill deficits. Balancing the cost and effectiveness of technology, more research should be done to ensure that the software being used in the classroom utilizes evidence-based instructional strategies. Consequently, technology can never lead instruction, but rather be used as a tool by well-trained teachers (Schmid, Miodrag, & Francesco).

As for choosing the right instrument to evaluate students’ deficit skills in reading sight words, numerous comprehensive assessments are available to educators for formative assessments, such as the Woodcock-Johnson Diagnostic Reading Battery or STAR Early Literacy to help design data-based instruction. Educators can also use curriculum-based assessment by using part of the classroom textbook to assess student progress on a regular basis to monitor student progress.

To help educators evaluate the commercial reading software, the checklist from Bishop and Santoro on interface design, direct support, indirect support, and instructional design is recommended for educators before they invest money in purchasing software (Lovell & Phillips, 2009, p. 215-216). Not all educators are experienced with technology or have time to shop around for appropriate educational software. As a result, Bishop and Santoro’s checklist provides a quick review for preliminary assessment. As most software companies provide a trial for their products, educators may take advantage of the trials to determine if the software is suitable for their students. In the end, it is
up to educators if they are willing to incorporate technology in their instruction to help students learn better and efficiently.

Future research should be conducted to determine if different mobile devices result in positive effects for improving students’ ability to read. Research on different assistive devices for students with different disabilities is also needed to determine if the technology or software has different effects for different disabilities. In this way, educators can learn where to look for evidence-based tools specific to the types of disabilities their students may have.

In conclusion, students are living in a technology-filled environment nowadays. As evidenced by research, technology can make a positive impact to help students with disabilities to learn effectively and improve their reading skills, it is up to educators to make choices to integrate technology in their classroom and choose the right tools for their students. This study can serve as a starting point to help educators to find appropriate tools in iTechology to help students with learning disabilities improve their reading.
References


http://www.jstor.org/stable/20204393


renessdevelopmentintheclassroom.pdf
A determination has been made that the following research study is exempt from IRB review because it involves:

**Category 1**  research conducted in established or commonly accepted educational settings, involving normal educational practices

**Project Title:** The Effectiveness of Using Mobile Applications to Improve Phonological Awareness for Students with Disabilities

**Primary Investigator:** Shuk Man Cheung Osborne

**Co-Investigator(s):**

**Advisor:** Dianne M. Gut (if applicable)

**Department:** Teacher Education

Rebecca Cale, AAB, CIP
Office of Research Compliance

10/28/13 Date

The approval remains in effect provided the study is conducted exactly as described in your application for review. Any additions or modifications to the project must be approved (as an amendment) prior to implementation.