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# The Impact of Computer Applications on the Development of Students' Literacy Skills

## Abstract

Technology continues to change and shape literacy instruction. This study asked the question; how do literacy apps increase student engagement and retention of reading comprehension and spelling skills? The study was completed at the campus of Northern Flamingo College (Pseudonym) in Western, NY with two elementary aged participants. Participants completed reading comprehension and spelling activities on paper, also in apps on an iPad. The findings revealed that student engagement and spelling skills did not increase when using an app over paper. Further, the findings showed mixed results in reading scores and engagement. The implications from this study are that further research should be completed and teachers should use multiple instruction techniques on varying mediums to increase student engagement and learning.

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The Impact of Computer Applications on the Development of Students' Literacy Skills

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M.S. Literacy Education

Supervised by

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### **Abstract**

Technology continues to change and shape literacy instruction. This study asked the question; how do literacy apps increase student engagement and retention of reading comprehension and spelling skills? The study was completed at the campus of Northern Flamingo College (Pseudonym) in Western, NY with two elementary aged participants. Participants completed reading comprehension and spelling activities on paper, also in apps on an iPad. The findings revealed that student engagement and spelling skills did not increase when using an app over paper. Further, the findings showed mixed results in reading scores and engagement. The implications from this study are that further research should be completed and teachers should use multiple instruction techniques on varying mediums to increase student engagement and learning.

### **The Impact of Computer Applications on the Development of Students' Literacy Skills**

Today's students are different from all previous generations, because they were born into a digital world and have always been surrounded by digital technology (Prensky, 2001). In this new digital world, students have grown up using and interacting with a wide range of technology from television to computers, smartphones, and other digital mobile devices. Teachers must find ways to adapt the school setting for this new generation of digital technology users. One way to incorporate new technology into school may be by using computer applications to engage students in literacy learning and improve their retention of reading comprehension and spelling skills. A computer application or an "app" is a computer program that is most commonly run on mobile devices, such as smartphones or tablet computers. An app can be designed to serve any purpose that the designer chooses. Literacy applications that have been designed to focus on specific skills of literacy and have become more available with a varying range of content, skills, level, and age range as well as varying costs. The topic of literacy applications is relevant because instruction of reading, writing, and language continue to be at the forefront of American schools' concerns. Students are expected to achieve higher reading, writing, and vocabulary levels as time progresses. American school children have improved literacy skills over the past decade, but need to continue to improve (U.S. Department of Education, 2012). While there is a revolution occurring about the standards students will be held to with respect to literacy, a different revolution in technology is happening inside and outside of classrooms that will impact student learning just as much as a change in standards. Technology is changing, growing, and evolving at an exponential rate. Children are exposed, engulfed, and surrounded by technology in a way that the human race has never seen before. Schools often struggle to keep up with the pace to integrate new technology as it is being created (Henderson, 2011). Many, if not most of

the students in the schools have access or experience with new digital technologies outside of school. Students are so accustomed to using these new technologies and functioning within the literacies that evolve with these technologies that to disengage them from the school day would cause disconnect between students home lives and their school lives (Henderson, 2011; Mctavish, 2009; Moll & Gonzalez, 1994).

Literacy applications are able to integrate the skills of traditional literacy and their instruction into new literacies that utilize text, images, sounds, video and more. While literacy apps are able to incorporate these mediums together, it continues to be a topic of research, if apps are able to relay these skills onto the participant in a way that is engaging and allows the participant to retain the skills and knowledge obtained from the app. As a greater number of children are using literacy apps it is important for educators and parents to know the differences between literacy apps and traditional literacy instruction in certain skills. Educators should know if literacy apps increase students' engagement in learning about literacy skills. Further it is important as technology becomes more integrated into the classroom to determine if literacy apps can help students gain literacy knowledge and skills. More research should be completed on the use of literacy apps to engage students in literacy education and if these apps help students to gain and preserve literacy knowledge and skills. Further research on the topic of literacy apps would be beneficial to educators, parents and to students. Without expanded research, educators and students could be missing out on an opportunity to use technology in an effective manner in literacy education. Additional research on the effectiveness of literacy apps and their impact on student engagement and literacy skills retention will help app designers/writers to develop new, more useful/effective and fun apps. Technology items like interactive white boards have drastically increased in their use in American classrooms over the past decade (SMART

Technologies Inc., 2001). Applications used on smart phones and tablet computers could very well be the next form of technology to take such a hold in American classrooms. There is a continuous supply of new apps to the market, literacy apps vary in what skill is the focus as well as how each skill is imparted on to the participant. As new technology develops and becomes accessible to more people, literacy is changed by these new forms of communication. Not only does literacy change, but new literacies are developed through the different ways of communication and which leads to new ways of text to be created, interacted with and displayed. Children are increasingly exposed to technology, particularly to mobile devices such as smartphones and tablet computers. These devices can be used to further a child's literacy instruction, targeting specific skills through applications. Not only can these applications be used outside of the classroom during free time, these apps can also be used within the classroom. While it is known who and what these literacy apps are designed for, there is a minimal amount of research and information on whether these apps are effective in instructing literacy skills, helping to maintain the literacy skills of children, and keeping children engaged in literacy learning. As new technologies continue to emerge over time, new literacies will also emerge (Baron, 2001). These new literacies have elements of traditional paper based literacy, but also include new aspects from new technology. Lankshear and Knobel (2006) describe the new literacies that emerge from new technologies by saying that literacy is the process of "generating, communicating, and negotiating" in a meaningful way, using encoded text within Discourses (p. 65). While aspects of the definition of literacy have stayed the same, like the idea that literacy is creating, communicating, and negotiating to make meaning in a secondary discourse, there are differences from paper based literacy and new digital based literacies. One way that technology has drastically changed literacy is the use of an encoded text is very different from paper and

pencil (Baron, 2001; Larson & Marsh, 2005). It is important to include new technologies and new literacies during instruction to ensure that students are given all the opportunities to interact with literacy in every way they will encounter literacy inside and outside of school.

The skills of reading, writing, and language should be taught in a manner that explores ways to experience, acquire, and learn these skills, including literacy through the lens of technology. Literacy is ever changing, particularly the way it is encompassed in new technologies. What this means is that literacy is no longer pen and paper or just to be viewed in these “traditional” ways of paper-based texts. Literacy now has taken on “new literacies and technology,” meaning that new literacies operate as traditional literacy has in that it is a way of “generating, communicating and negotiating meaning...” but that new literacies use text, video, image, sound, hyperlinks and other mediums, rather than just text on paper (Lankshear & Knobel, 2006, p. 65). New technologies and literacies are used in classrooms to support students’ needs, differentiate, and engage students in learning.

This study sought to discover if literacy apps could be used to increase student engagement while increasing reading comprehension and spelling skills. The study was completed using two participants in elementary school, who completed reading comprehension and spelling tasks. These reading and spelling tasks were completed using specific apps for reading comprehension and spelling, as well as paper based methods to determine if there was a difference in the participants scores between apps and paper based methods. Students’ engagement levels were monitored between the two methods of iPad and paper instruction. The findings of this study were that literacy apps can be used in the classroom to increase student engagement and reading comprehension but these findings were not true for spelling. In the future, teachers should work to instruct students in reading using a variety of different methods

including reading digital texts on digital technology like apps. By including reading in apps and other digital technologies in reading instruction, teachers can increase student engagement and skills. If teachers work to incorporate a variety of ways for students to read and write, they will prepare literate students for the real world.

### **Theoretical Framework**

Literacy is dynamic, fluid, and always changing. Literacy can be defined in multiple ways depending on what theory the definition is viewed through. Language is at the heart of what literacy is and how this language is communicated through social interaction is the basis of literacy. Literacy encompasses reading, writing, and control over language, but it also includes the ability to use these activities in various social settings in different contexts (Kress, 2003). The effect new technologies have on literacy has led to a greater understanding of literacy to be more than just the use of reading and writing in print text, but to take the meaning of literacy previously and add to it the requirements of being able to control secondary discourse within these new technologies of multimedia text, image, sound, and video. Lankshear and Knobel (2003) give the name of “new literacies” to the way that literacy is impacted by new technologies.

In the current American culture, technology plays a very important role in the way children acquire literacy (Baron, 2001; Boyd & Ikpeze, 2007; Gainer & Lapp, 2010; Jacobs, 2011). Technology in literacy can range from the invention of paper and the pencil, up to current technologies like the internet, e-readers, and interactive white boards (Baron, 2001). Children’s natural acquisition of literacy through both oral and written languages is impacted by their exposure of oral and written language. This exposure to oral and written language that shapes the literacy acquisition of children is often through new technologies and new literacies that exist

due to these inventions. Technology used in literacy has changed greatly overtime, while it continues to develop and change the way literacy is received it also impacts the way that children acquire literacy (Baron, 2001). This impact can be seen in the way that toddlers and preschoolers can use a smart phone or computer tablet to open and use an app, as easily as they can pick up a book and begin looking at it. Technology impacts literacy acquisition in multiple ways, it can be a tool, engaging students to acquire and learn more literacy or as a cognitive tool used to promote students' thinking (Baron, 2001; Boyd & Ikpeze, 2007; Gainer & Lapp, 2010).

The theory that is guiding and shaping this study is the theory of new literacies. Lankshear and Knobel (2006) define new literacies as “new socially recognized ways of generating, communicating and negotiating meaningful content through the medium of encoded texts within contexts of participation in Discourses” (p. 65). New literacies theory is the same as traditional views of literacy in that at the heart of literacy is communication, but where the theory of new literacies differs is how humans now communicate. Through the development and introduction of new digital technologies, humans are communicating in new and different ways from every before. These new ways impact how humans read, write, and carry out these tasks for the purpose of communicating.

Children acquire further knowledge of literacy through print and the written language. Written language increases a child's comprehension skills, critical thinking ability, and expands their vocabulary (Kucer, 2009). New literacies and technology continue to change and grow, particularly technology that is a way of communicating through text, more children are exposed to text in this way at younger ages (Larson & Marsh, 2005). This increase in exposure at earlier ages leads to a greater number of children who acquire traditional literacy skills (reading and writing) in the ways of new literacies (typing, texting, using the internet, e-readers, apps, etc...)

while also becoming literate in the technologies as well. If new literacies are ignored in the classroom there is a dissonance created between children's exposure to literacy and technology at and in school (Lankshear & Knobel, 2003). Gainer & Lapp (2010) discuss the ways that technology and new literacies can be used as cognitive tools, but go further to discuss the ways that traditional literacy practices can be mixed with new literacies and created in the medium of new technology.

Literacy is acquired by children through oral and written language. Goodman (2001) writes about three principles (relational, functional, and linguistic) that shape the development of a child's literacy acquisition and knowledge. All three of these principles have changed in the way children come to acquire literacy; this change in acquisition has occurred even more, because of the use of technology in society. One way the acquisition of literacy is impacted by their exposure to oral and written language, as well as the way that children are exposed to literacy through technology is through the principle of functional literacy. Children see the function of literacy around them not only as being able to write shopping lists and read the mail, but also being able to send text messages, type the correct search words to watch a video, and use literacy within technology (Larson & Marsh, 2005). There are different attitudes in every household towards reading a book as opposed to reading a blog or sending an email. These are all attitudes that children perceive and which impact their functional principle, and the way they acquire and view literacy.

As children understand that literacy in technology is necessary, they will not only have attitudes, perceptions, and understandings about literacy but also about new literacies and new technologies. In the current American culture, technology is very much a part of everyday life, from cell phones, mp3 players, computers, television and more, the use of technology throughout

the day is never ending. It is known that many children spend time outside of school playing video games, computer games, and apps (Larson & Marsh, 2005). Children who have played these electronic games for fun are more likely to have a positive attitude about playing these electronic games in school (Larson & Marsh, 2005).

Children acquire both literacy and language skills through emersion and interaction with both oral and written language. Due to the intertwining of electronics and new technologies in the current society, children are acquiring literacy and language skills from these new technologies that include typing, texting, using the internet, e-readers, apps, etc... and the new literacies that come out of these new ways of operating within language. As children operate these new literacies and new technologies outside of school they should operate them in school as well (Knobel & Lankshear, 2003). Children are surrounded by electronic representations of language and literacy; it should be studied if programs and applications that are designed to explicitly increase literacy and language skills are as effective as non-electronic strategies. Educators should be able to know if these applications are as effective in imparting the strategies and strengthening literacy skills as well as maintaining these skills as non-electronic strategies are or better.

### **Research Question**

Given that new literacies and new technologies continue to grow and gain holding in American culture, this research study asks, how do literacy apps increase student engagement and retention of reading comprehension and spelling skills?

### **Literature Review**

When reviewing literature on the topic of this study, three main themes appeared in the literature. The first theme that was apparent among the different literature is referred to as the

“home-school” divide (Bulfin & Koutsogiannis, 2012; Henderson, 2011; Levy, 2009; Mctavish, 2009; Spink, Danby, Mallan, & Bulter, 2010). The home-school divide is the concept that there is a difference and a deficit between the technologies children have access to at home and the technologies they have access to at school. The home-school divide goes beyond children having greater access to newer and varying technologies out of school but also to using this technology more frequently, with greater freedom, control, and innovation than in school. One subheading in the home-school divide section is the lack of funding and up to date equipment.

The second theme that is apparent in the literature reviewed is the separation or integration of technology to instruct traditional print based and digital literacies. One subheading of this topic is the attitudes of administrators and teachers about literacy skills, digital texts, and multiliteracies that can lead to separate instruction of traditional literacy skills, digital/multiliteracies skills, and technology skills that should be integrated. This theme can be seen in many writings and studies that highlighted how teachers used technology in classrooms. Technology and literacy were not viewed as the same thing or reliant upon each other. In many of the studies, technology was used as a supplemental to the traditional print based methods of literacy instruction instead of teaching literacy through the use of technology alone or the use of print based instruction of literacy in unison with instruction of literacy through technology.

The third theme that emerged from the literature reviewed for this study is the effective use of technology as an instructional tool in the classroom to teach traditional literacy skills and digital literacies. One subheading of this topic is using technology as a tool to engage students in literacy learning. A subheading of this third theme is commercial games/software. A second subheading for this section is struggling readers/English-language learners (ELLs)/and students with special needs. The second subheading will highlight the way in which technology, literacy,

and multiliteracies are integrated effectively so they can benefit struggling readers, ELLs, and students with special needs (Dalton, Proctor, Uccelli, Mo, & Snow, 2011; Larson, 2010; Proctor, Dalton, & Grisham, 2007; Roswell & Burke, 2009; Vasquez, Forbush, Mason, Lockwood, & Gleed, 2011). The first two themes in this literature review highlight the problems that can occur by not integrating literacy into schools and why literacy is often not integrated in schools. The third theme highlights the way that technology can be used in schools to provide instruction that not only addresses traditional literacy skills but also digital literacies through the use of new technologies. Over and over again the literature states that in order to be successful citizens, students need instruction not only in the traditional literacy skills but in the new literacies skills as well (Bittman, Rutherford, Brown, & Unsworth, 2011; Henderson, 2011; Lynch & Redpath, 2012). As there are many new technologies and many ways to integrate traditional literacy with new literacies, these examples will be emphasized and discussed.

### **The Impact of the Home-School Digital Divide on Students' Literacy Learning and Acquisition**

Today's students often have unlimited access to technology in their home lives while having very restricted use of technology in-school; this variance can lead to a divide in students use and experience with the digital world. Literacy at its foundation is based off of social actions. As the world dives into the use of digital technology to communicate and for social purposes, literacy's communicative powers have been put to use through digital technologies. Technology has also been historically used to help create more forms of communication for humans. Karchmer (2001) states "...the nature of literacy has always been tightly entwined with the name of the communication technology used in any historical period." (p. 442). This idea is apparent in today's society with the discussion and occurrence of digital or multimodal literacies.

Technology is ever-changing, new digital technologies continue to grow in popularity and use in the lives of people at work, school, and home in this present day. A list of these new digital technologies is continuously being changed and growing. Many of these digital technologies are used every day by a large majority of people, particularly children and adolescents in developed countries. Some of these digital technologies included television, computers, tablet computers, mp3 players, smart phones, and more. Henderson (2011) describes the use of these technologies by adolescents and children by writing “for many young people...none of these are “new” technologies, but are simply the technologies of everyday life.” explaining that these technologies are so frequently used and commonplace in the lives of young people that they are a natural part of the day (p. 152). The concept of a home-school divide connects to socio-cultural theory. These two concepts are connected because the use of technology is so prevalent, and natural for children and students in their home that when they go to school and the use of technology is hindered, or completely stopped, a large part of a child’s “funds of knowledge” is being ignored. Moll and Gonzalez (1994) define funds of knowledge as “...those historically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning and well-being.” (p. 443). Due to the prevalence of technology and digital texts today, technology and digital texts holds a large part in children’s funds of knowledge. The children and adolescents of today are considered to be “digital natives.” Prensky (2001) defines digital natives as students who “all are ‘native speakers’ of the digital language of computers, video games, and the internet.” (p. 1). Teachers and parents of the current school aged generation are considered to be “digital immigrants” meaning they were born before the digital technology boom, but have since learned how to use these technologies and operate within the new digital world (Prensky).

Digital immigrants are charged with the job to help the digital natives acquire literacy and language while learning through traditional print based texts and digital texts (Bittman et al., 2011). Helping digital natives navigate literacy and language in the new digital world can be difficult for digital immigrants. One reason for this difficulty is because digital natives acquire literacy and language through print based sources as well as digital sources, while digital immigrants originally acquired literacy and language without digital sources. Another one of the reasons that this process is difficult is because it is not always known by teachers, schools, and parents what children know how to do in literacies and technology. Studies show a discrepancy between what children actually know and what they are thought to know (Dodge, Husain, & Duke, 2011). Just as with traditional print based literacy skills, students need to be assessed on what they know and how far their skills have developed in order to ensure proper instruction.

There are many parts to the home-school digital divide. The base of the home-school divide is that student's funds of knowledge are not being accessed in school, pertaining to technology and digital literacies. The home-school divide can be very complex due to its socio-cultural nature. Socio-cultural theory is the idea that every child comes from a unique community and culture that is constantly changing, this culture impacts the way that children learn and gain information (Kucer, 2009). The world continues to change from the continuous new developments in digital technologies as do the ways that children learn and construct information changes. Due to the changes in society and culture from new digital technologies, curriculum and pedagogies need to change to support these socio-cultural changes, particularly in the instruction of literacy and technology (Walsh, 2008). Children carry their knowledge of digital technologies from outside of school with them to school and vice versa. The concept of funds of knowledge connects to socio-cultural theory in that a child comes to school with their

own funds of knowledge from the home and community that they come from (Moll & Gonzalez, 1994). In one classroom, each child comes from a different home with different knowledge from their home. Each child's fund of knowledge is unique and holds not only prior knowledge on many subjects but family attitudes on learning and topics (Moll & Gonzalez, 1994). If a child's funds of knowledge are ignored or marginalized, it can make the schooling process difficult because the child can feel like their identity and own person is being marginalized and undervalued in the school.

At the secondary level, the home-school digital divide can be very apparent. Often teenagers and adolescents often have more access to technology and the internet through their cellphone (that they are often restricted from using) than they do in any room in their school. The access and exposure that teens have to technology and digital literacies outside of school can be overwhelming in comparison to what they have inside of school. Many teenagers, young adolescents, and children are experts on how to use certain forms of technology, digital literacies, social media, gaming websites, etc. ( Bulfin & Koutsogiannis, 2012; Davidson, 2009; Mctavish, 2009; Roswell & Burke, 2009;). These forms of technology that incorporate and function around literacy should not be ignored in school. Students that struggle in reading and writing in school may be capable of being consumers and creators of literacy using technology outside of school (Roswell & Burke, 2009). The home-school digital divide is often shaped by the attitudes and resources of schools and families. Often times, parents see the use of computers and technology as important for their children to be successful in school or in society and provide their children with the opportunity to work with technology out of school if they are able (Bulfin & Koutsogiannis, 2012). While in a better world, all families would be able to expose their children to varying situations and experiences involving technology, this is not always

possible. There is the problem of parents who are not able to purchase computers and other forms of digital technologies for their children to work with and have access to at their home (Bulfin & Koutsogiannis). The knowledge a child gains in their home and how it impacts their learning in school is not exclusive to technology. Just as children enter Kindergarten with vast levels of traditional literacy skills and knowledge, the same is true for students' (of all ages) knowledge and skills of digital literacies and technologies (Bulfin & Koutsogiannis; Dodge et al., 2011). One of the causes for students entering schools with such varying levels of knowledge can be the socioeconomic status of a student's family. Socioeconomic status can play a role in what access students have to technology inside and outside of schools (Bulfin & Koutsogiannis; Dodge et al., 2011; Russell, Bebell, & Higgins, 2004). Financing and socioeconomic status impacts the access to technology through students' families and through the economic status of their communities and schools. The home-school digital divide has many parts, and while it can be seen to block student growth and engagement over literacies, it should be remembered that it can also be used by students as a way to connect and crossover skills and information from school to home and vice versa (Bulfin & Koutsogiannis). Students may not always be consciously aware that they apply their literacy knowledge from in-school to their out of school pursuits, it is clear that literacy skills permeate all aspects of students' lives. The Bulfin and Koutsogiannis study enforces the notion that the home-school digital divide is not cut and dry, rather like literacy itself, it is fluid and unique to each individual.

The home-school divide does not just occur at the secondary level of schooling, but rather at all ages of students. It appears that the younger the children, the easier they come into digital literacies and the stronger their understanding of new technologies, despite their practice with these new technologies (Levy, 2009). This natural ability to use new technologies is most

likely due to children being born into a digital technology world. There are a number of studies that prove there is a home-school divide that highlight the availability of technology to students outside of school (Henderson, 2011; Mctavish, 2009). The availability of technology to students is not the only part of the home-school divide. The study by Dodge et al. (2011) examined the home-school divide in a different manner by looking at what technologies were being used and how the technologies were being used outside of school. Students then used the technologies in school for the purpose to measure if the perceptions of what they could do at home were accurate while they were in school. This study was completed with young children, so parents completed surveys stating what they thought students could do with technologies at home (Dodge et al.). One of the results from this study was that parents on the average overestimated what their sons were capable of and underestimated what their daughters were capable of with technology. The findings of this study about the difference in gender and abilities, as well as parents' beliefs connected to gender and technology were very different from any of the other literature examined for this paper. This study was unique from other studies because it did not focus on what children did in school or what teachers did, rather it focused upon what children did online at home, what their parents believed they could do, and what they actually could do on the internet. The overall findings from the study were "...children in our study were unaware of the potential dangers of the Internet, yet reportedly used the Internet without adult supervision at least some of the time...parents did not have an accurate understanding of their own child's Internet skills." (p. 95). These results show that parents do not have an accurate picture of children's abilities but in order to be effective in the classroom teachers need to have an accurate understanding of children's abilities. In contrast, many of the studies that focus on the home-school divide identify teachers as underestimating their students' ability and knowledge of digital

literacies, rather than the parents (Davidson, 2009; Henderson, 2011; Levy, 2009; Mctavish, 2009). The discrepancy between the different studies demonstrates that within the home-school divide issue, there is a separation between what students are actually able to do with technologies and digital literacies, and what parents and teachers perceive or expect students to be able to do with technologies and digital literacies.

The study by Mctavish (2009) found a very established home-school digital divide that the participant Rajan (pseudonym) faced. Not only was there a divide in what type of technology Rajan was exposed to and interacted with at home and school, there was a language divide within his use of these technologies, and a divide in attitude between his family's and his teacher's attitudes about new digital literacies and traditional literacies (Mctavish). The views of parents can shape the home-school digital divide. The more willing parents are to let their children use, play, and interact with technology, the greater the children's skill set will be in digital literacy and thus will be more likely to lead to a greater divide when they attend school. This example of schools always being behind the use of technology in the home is not always true, as the Russell et al. (2004) study shows. Sometimes schools seek to integrate technology into the school day as much as children have technology integrated into their lives outside the walls of school. The Russell et al. study focuses on fourth and fifth grade classrooms that either have a 1:1 student to personal laptop or classrooms that are able to acquire a laptop cart for use in the classroom. One of the findings of the studies identifies almost an opposite effect of the home-school divide. The study's findings were "Classrooms that were fully equipped with 1:1 laptops showed more technology use across the curriculum, more use of technology at home for academic purposes, less large group instruction, and nearly universal use of technology in writing." (Russell et al. p. 313). In essence, the study is saying that students with greater access

in school continue to forge their way in digital literacies and technologies at home over their peers. So even though students came to school with very similar funds of knowledge on digital literacy and technology, they had different funds of knowledge going home because of their exposure in school. This example is one of a district that was able to work together with parents to finance the integration of technology into schools (Russell et al.). When districts can afford to purchase a laptop or technology for every child or have parents purchase laptops or technology for their children to use in school and at home, this allows for classrooms where students can have an integration of technology and literacy as well as one way to resolve the home-school digital divide (Bulfin & Koutsogiannis, 2012; Russell et al., 2004). However, districts and parents are often not able to finance large purchases of technology to integrate into the school system as they were able to do in the Russell et al. study.

There are a range of reasons why the home-school divide exists, but one of the biggest reasons for this issue is the lack of funds for schools to acquire new technologies. Schools are often facing budget issues especially in the current era, one of the areas that seem to be impacted by this problem is the budget for new or newer technology. In Henderson's (2011) study, one of the reasons that the teachers gave for their lack of digital literacy use and integration was due to the old and out dated computers, and software. Using out of date equipment and software can be challenging and frustrating for students and teachers. Henderson describes a teacher's experiences with this issue by saying "The teacher in school B bemoaned the limited resources within her school and the age of the school's computing equipment." (p. 156). The home-school divide can be seen further between the issue that teachers view computers as necessary to literacy instruction and multimodal literacies, while students list computers as only one source they use outside of school (Henderson). Having out of date equipment in schools not only means

the actual equipment that students will be using but power sources, internet connection, and more. Even districts that try to address the home-school digital divide by purchasing new technologies can have unforeseen problems relating to funding. Henderson discusses the problems of having out of date computers and software, but McKenna (2012) points to problems with fairly new technology (the iPad) in schools. Despite a district's ability to purchase new technologies, it does not ensure that the district will not encounter technology issues. The district that purchased the iPads in McKenna's (2012) study was trying to be on the cutting edge and provide students with technology access they were aware of outside of school. While it was innovative of that district to purchase the iPads, the teachers in the study ran into several problems when using the iPads in their classrooms. The teachers in the study learned that they had to coordinate when one class would be using the internet, because if more than one class used the wireless router for the use of the iPad, the router would be overloaded and stop working (McKenna). Another issue was the ability and process to charge over 20 different iPads at one time on a regular basis. Districts that purchase new technologies but do not have the funding to update their electrical wiring and internet connections can lead to feelings of frustration the same for teachers and students as using outdated technology.

Another problem with lack of funding is the lack of teacher training in the use of technology. The lack of current technology or new technology from schools because of funding problems is as much of a challenge as lack of proper training on how to use new technology. Schools that are able to acquire new technologies but are not able to afford proper training for their teachers and staff, can be as troublesome as not having the technology at all. One of the biggest reasons for the home-school divide can be placed in the lack of training for teachers (Karchmer, 2001). If a teacher does not feel comfortable using a form of technology at home,

they will most likely not feel comfortable instructing on that technology or asking students to use it in school. Teachers not only need training on how to use the actual technology but also how to instruct and incorporate the technology into the curriculum to be successful and benefit students (Karchmer). Professional development and training is vital for successful instruction in the classroom particularly when teachers are incorporating new tools, materials, or content.

McKenna (2012) also states that a lack of professional training is a problem when teachers and districts are trying to incorporate technology into classrooms. Without proper training and equipment, teachers will not be able to bridge the home-school digital divide.

### **Integration or Separation of Traditional Print Based and Technology Based Literacies**

Students in different schools and classrooms face very diverse instruction or lack of instruction in digital literacies, traditional literacy, and the integration of technology. In many schools and classrooms, print based texts and skills receive precedence and privilege over digital texts and skills. Often these items that are now so interconnected and fluid in the outside world are taught in separate manners in school. Schools often lack instruction of multiliteracies, and instead focus on instructing traditional literacy skills in a separate manner from technology skills. This discrepancy can be a disservice to students because it ignores their funds of knowledge which often include multiliteracies of digital texts and literacy skills together (Coiro, 2011; Henderson, 2011; Lynch & Redpath, 2012; Walsh, 2008). By ignoring students' funds of knowledge, teachers separate the literacy skills the students use at home from the literacy skills being taught in school. There is evidence that students who are able to use their funds of knowledge of technology skills and multiliteracies can boost their traditional literacy skills (Coiro, 2011). Students of today will need to be able to read online texts in their future lives, in school, work, and to be prosperous citizens. Yet reading online is not always a skill taught in

school. It is clear that reading online requires a multitude of skills to be successful. These skills needed to read online, come from traditional print based literacy skills as well as technology skills to manipulate the digital parts of the text and skills from multiliteracies to be able to synthesis, analyze and critique the information if necessary (Coiro). In the future, students, as adults will need to be able to read online texts. Despite this certainty, there is a lack of mixed literacies and technology instruction in many schools (Henderson, 2011).

The divide between traditional literacy practices and new literacies through new technologies is accentuated in schools and at home by the differences between digital natives and digital immigrants. Literacy and technology are often separated in school settings. In many schools, and classes literacy and technology are viewed as different items and topics. Traditional formats of literacy; print based texts are often given higher privilege in the school setting over technology, new literacies, and multimodal literacies (Lankshear & Knobel, 2003). When technology and digital literacies are not given the same value as traditional literacy in schools and by administrators, it can lead to varying instruction. Many teachers instruct literacy and technology as separate subjects, only relying on technology as a way to support literacy (Davidson, 2009; Henderson, 2011). Also leaving instruction in new technologies to technology teachers and when necessary to further literacy instruction. This separation of literacy and technology can occur for many reasons. One of the reasons is the attitude of teachers or schools towards new technologies and new literacies. As previously discussed in this paper, teachers and parents are digital immigrants and do not operate naturally in new or digital literacies in the ways that digital natives can and have since they acquired literacy and language. Mctavish (2009) points out one instance among many where the district or teacher's attitudes and views of what literacy is leads to a separation of literacy and technology. It is explained when Mctavish writes

“...out-of-school literacy practices do not align with in-school literacy practices and are therefore not recognized in the school context.” (p.18). This issue of out-of-school literacy practices not being valued in school helps shape inflexible curriculum and instruction which leaves out essential skills for students to become literate individuals. Mctavish further explains about the attitudes of the school and teacher in the study by writing “...out-of-school literacy practices were only briefly acknowledged as these products did not fit with the teacher’s idea of what ‘school’ literacy should be.” (p. 18). With attitudes and practices like this, the home-school digital divide will be impassable. If teacher and school attitudes as a whole reflect the attitudes from the Mctavish study, then traditional literacy skills will hold a higher value over digital and multimodal literacies. Due to the necessity to be able to work and operate digital literacies and technologies for students now and in the future, students may be forced to learn literacy and technology separate, and like the Mctavish study not only as separate skills but separately in-school and out-of-school.

Literacy and technology should not be viewed and taught as separate subjects in school for many reasons. Some of these reasons are because literacy and technology have become so intertwined in the present world that trying to teach only one without the other is a great disservice to students. Another reason why literacy and technology should be taught in unison can be seen in evidence from the youngest students. The study by Spink, Danby, Mallan and Butler (2010) shows that when young children/emergent readers and spellers struggle with the traditional text part of literacy they may rely on their technology skills and funds of knowledge of technology to supplement their lack of traditional skills. Young children, or emergent readers and spellers can be seen relying on their funds of knowledge of technology to supplement and support their lack of traditional literacy knowledge to push them forward in their academic and

other pursuits. Similarly, the findings for the study by Coiro (2011) were "...that higher levels of online reading comprehension skills may help compensate for lower levels of topic-specific prior knowledge when adolescents are asked to locate, critically evaluate, synthesize, and communicate information using the internet" (p. 352). Both of these studies found that students may be lacking knowledge or skills in one area of their school knowledge, but able to compensate by using their knowledge of technology and digital literacy skills. In contrast, these studies had very different participants, one study having kindergartners and the other having seventh graders, but both studies having similar results. A third study that finds similar results is the Roswell and Burke (2009) study. In the study, Roswell and Burke examine two different students with very different in school traditional literacy behaviors and scores as well as different out of school internet uses. The study finds that one student who is struggling with reading and writing tasks in school is a frequent online reader, even of more complex texts and higher level vocabulary. These findings support several other studies findings that online reading requires a different set of skills than traditional text readings (Roswell & Burke, 2009; Coiro, 2011). The conclusion from these studies is that students need different skill sets to reading online, digital texts, and print based texts. While these are different skill sets, they are interrelated and reliant upon one another. Students can use these different literacy skill sets to support each other and succeed in one form of literacy in which they may have previously struggled. In order to help students become successful in all forms of literacy, teachers need to instruct in a way that students have a strong foundation in technology and digital literacies to sustain and promote their whole education.

There are many sources of digital texts that can be used to teach literacy skills and language. One of these types of digital text that can be used in and out of classrooms is the

sector of e-books. E-books are books in the traditional print based sense, but they often include multimodal abilities to highlight text, have text read aloud, include hyperlinks, interactive images, videos, music, and sometimes more. Many of the e-books that are used in school settings are used by preschool and primary grade teachers who are working with emergent or early readers. One of issues that comes up with e-books is the quality and purpose of these books (Korat, Shamir, & Arbiv, 2010; Segal-Drori, Korat, Shamir, & Klein, 2009). Sometimes e-books do not carry a varying level of digital options as listed previously but are just adaptations of print based children's books that can now be read on digital screens. These books that do not offer digital add-ons would not be quality e-books. The opposite is also true of e-books that have a vast amount of digital add-ons, they can also be labeled as not quality e-books due to their ability to over stimulate and distract from the story narrative (Korat et al., 2010; Segal-Drori et al., 2009). The variety of e-books available in the market place today includes e-books with varying purposes and reasons for designs. There are e-books that are designed specifically for emergent readers and to be used inside and outside of the classroom with children in the stage and age groups of emergent readers (Korat et al., 2010; Segal-Drori et al., 2009). It is important for teachers to remember when they are using texts whether print or digital based what the intent of the text is, who the text was created by and for, and what literacy skills and purpose the text can serve.

Teachers of older children do not need to take into account many of the things that the preschool and kindergarten teachers need to consider when finding e-books. Some of these examples look at the ability of older children to use e-readers independently without instruction from the teacher yet lead to growth in the student and the teacher's understanding of the student's reading comprehension. While Segal-Drori et al. (2009) as well as Korat et al. (2010)

discuss the importance for emergent readers to have e-books that are designed to match emergent readers' skills; Larson (2010) does not focus on this topic at all. Instead of the focus being on e-books, the focus is on e-readers and their capabilities. Larson focuses on the abilities of e-readers and what it allows independent readers to do while they are reading. This discrepancy in discussion of e-books shows the vast difference between age groups and reading levels and how they can use technology to gain traditional literacy skills and learn digital literacies. E-readers like e-books are able to integrate traditional print based literacy capabilities (highlighting, note taking, etc...) with multimodal and digital capabilities (hyperlinks to dictionaries, text to speech features, change in font size, etc...).

### **Effective Use of Technology as an Instructional Tool**

As digital technology continues to become a greater part of everyday life, it is more apparent that students should be instructed on and using technology in the classroom, this notion is supported by studies with positive outcomes of using technology as a tool in classrooms (Dalton et al., 2011; Lacasa et al., 2008; Larson, 2010; Lynch & Redpath, 2012; McKenna, 2012; Proctor et al., 2007; Russell et al., 2004; Walsh, 2010). Literacy and technology does not strictly refer to computers and e-readers, nor is it a new development. The use of technology in accordance with literacy is ever changing, this statement is apparent, as the technology of the pencil has given way to the computer, e-reader, and more (Baron, 2001). The effective use of technology has many variants and factors. What type of technology, what age group/development level, professional development and teacher training, and funding are a few of the many parts of effective use of technology in classrooms. These parts need to all work together in a positive manner to have technology integration in the classroom be successful (Lynch & Redpath, 2012; McKenna, 2012).

One of the studies that have positive results of technology integration that is especially pertinent to the research for this paper is the McKenna (2012) study. This study focuses on the use of tablet computers (specifically iPads) in the classroom to raise reading fluency scores. The study lists problems it did run into with internet connectivity, but it has promising results of boosting students' reading scores. Another important part of this study to be noted is the commentary on how easily students used the iPad and the apps on it, often showing the teachers aspects of the apps of which they were not even aware (McKenna). This study is not the only study that discusses the ease of use for students to use tablet computers and apps. Not only did other studies state the ability of students to use the tablet computer and apps easily, and with less frustration than a regular computer, but these studies all held subjects of varying ages and developmental levels (Lynch & Redpath, 2012; McKenna, 2012). These are just examples of children's abilities to adapt and use technology. The teachers in McKenna's (2012) study noted the ease that students operated the iPads with. In fact, the teachers did not seem to take to the iPads with the ease that the students did. McKenna (2012) describes the students adopting the iPads by saying "...it was quickly observed the students needed little or no instruction irrespective of whether they had used an iPad before. Many times, students knew more about the app [program] than either teacher." (p. 140). This example is one of the ease that students have when using new technologies, particularly mobile and touch devices. Similarly, Lynch and Redpath (2012) describe children interacting with iPads and touch iPods in the same manner as the children from the McKenna (2012) study. These two studies show children at different ages and stages in their literacy and language development but both sets of children were capable to operate the tablet computers and apps with ease. Lynch and Redpath (2012) go even further in describing the capabilities of children through effective instruction of literacy and technology to

be more than consumers. They write “When offered tools and encouragement, young children present as competent users and producers of media texts, engaging in literacy practices deserving of recognition and respect...” (Lynch & Redpath, p. 5). This quotation is one description of what students are capable of doing when provided with opportunities and instruction to use literacy and technology in unison.

A student having a strong understanding of how to use technology effectively is important to them becoming successful with multiliteracies and technology in the future. This ability is particularly true with students’ abilities to use the internet and read from the internet. One part of using technology effectively is being able to use it to support students in their understanding of social justice issues, and critical literacy. Critical literacy using multiliteracies is a truly higher level of literacy instruction, because students are being asked to actively use technology, traditional literacy skills, digital literacy skills, all in the research of social justice issues with the goal to bring change and awareness to the world (Silvers, Shorey, & Crafton, 2010). Technology can be used effectively in literacy instruction, but incorporating critical literacy into multiliteracies instruction pushes students further and can make instruction concrete when based on real-life issues. The example of the study in the work by Silvers et al. (2010) shows how to use technology in an effective way to require students to think and act critically using literacy. This study shows that students at any age can be fully engaged into multiliteracies and by using literacy and technology bring about change. The teacher in the Silvers et al. study sought to teach children more than basic literacy and technology skills, but sought to teach them how to think analytically about topics. This example is not the only example of using multiliteracies to help students develop literacy skills a variety of ways. The Lynch and Redpath (2012) study also examined a classroom where multiliteracies were used to

expand students' skills and thinking. That teacher began with using commercial apps on the iPad for students without instruction to using the iPads to have the students create meaningful work. When using commercial apps or software for education, the technology is often a product to be consumed by the student instead of being a learning tool to be used in constructing knowledge and meaning through the learning process (Lynch & Redpath, 2012). These examples of classrooms shows that instruction of technology, traditional literacy and multiliteracies can lead to students developing thinking on a higher and more critical level than if they just stayed within computer applications and programs that were designed for their age group and literacy skills.

Students need to know how to use technology and be literate in print literacy and digital multiliteracies. Wolfe and Flewitt (2010) explain the need for educators to instruct students in all forms of literacy by saying "In order to assist in children's language and literacy development in different domains, educators need to help them make connections and reflect critically on the purposes of literacy." (p. 389). This argument continues to become clearer as new technologies continue to be created while print based texts stay relevant. Schools need to be prepared to teach all aspects of literacy and technology, as well as teaching students when it is best to use each different source of information and when it is best to create certain types of text (Walsh, 2010; Wolfe & Flewitt, 2010). There is support for this idea that students need to be ready for situation and function of literacy. But before schools are able to instruct students on multiliteracies and new technologies in cooperation with traditional literacy, teachers need to be aware of the differences between linear print text and multimodal digital texts (Roswell & Burke, 2009). Teachers need to further understand how to properly instruct students in the different forms of texts. The difference between linear print texts and multimodal digital texts is something that digital natives are much more comfortable with than digital immigrants. Davidson (2009)

studied children using the internet to search for information on a subject of the children's choice. What Davidson discovered was very young children blur the "old" and "new" technologies of literacy, identifying what form of literacy they need to use to get the results they seek. Davidson describes a subject of the study not being able to find the information they are looking for on a webpage (new technology). Without hesitation, the subject moved from the internet (new technology) to look for the information in a book (old technology) on the topic. Since young children already understand that different forms of literacy can provide the same and different information, schools, teachers, and parents should be supporting children in this endeavor. By teaching students how to use different literacies and types of technologies schools will be helping students to learn, navigate, consume, and create.

Technology and digital texts can be used to not only teach traditional print based literacy skills but also to increase a student's multiliteracies skills and as a way to produce proof of these skills that can be communicated to others. Parents and educators can use software, applications, and programs that are designed and created by commercial companies with a certain age group, development level, and targeted skill(s) in mind. These programs and software are usually mass produced and targeted as educational. Many of these literacy digital programs target traditional print based skills. Lynch and Redpath (2012) discuss the difference between using commercial apps and instructing in digital literacies outside of apps in an early childhood classroom setting. The teacher initially used commercial apps, often as stations for students to read/listen to e-books, and use apps that targeted literacy skills, the students viewed these as enjoyable and "games." This example was a station where the teacher did not need to have a constant presence, however, the teacher wished to change how her students were working with technology. Similarly, other studies of classrooms held teachers who took integration of commercial

technology one step further than just having students be merely consumers of the commercial technology literacy. The studies by Segal-Drori et al. (2009) as well as Korat et al. (2010) are examples of these classrooms that sought to see the difference between students as consumers and students as consumers with digital immigrants as educators to help instruct students in these types of media. In the studies, researchers found that students who worked with commercial e-books that were designed to emphasize emergent readers learning skills, scored higher when the e-books were used in union with instruction from a teacher over those that just worked with the e-book without instruction.

While there are many commercial games, apps, and programs designed with educational intents and targeted literacy skills, commercial games that are not marketed as educational can be just that. Children and adolescents all around the world cite that in their free time they most often spend time using technology to play games (Henderson, 2011; Lacasa, Mendez, & Martinez, 2008 Lynch & Redpath, 2012; Roswell & Burke, 2009). These games vary in what type of technology they are played on and the intention of the game from the game creators. There are varying views on whether this time spent on digital games qualifies as learning (Henderson, 2011; Lacasa et al., 2008; Lynch & Redpath, 2012; Roswell & Burke, 2009). Teachers, parents, and children carry these varying views on if they are learning and what they are learning, during their playing of digital games. Lacasa et al. (2008) argue that games do not have to be designed for education and school purposes to be educational. Games that are not designed for education purposes are tools that can be used to teach students multiliteracies (Lacasa et al.). This concept is a very different idea from the previous studies use of commercial programs that were only targeted at specific traditional literacy skills. Rather than focusing on concepts about print, or reading comprehension, Lacasa's et al. study focused on the use of the

game *The Sims* to teach citizenship/social responsibility, examining and practicing story structure and exploring relationships between simulated worlds and reality. Despite the game *The Sims* not being intended to be an educational game, it holds the ability to be used in that manner in educational settings. The study by Lacasa et al. goes beyond teaching technology skills or to instruct on certain literacy skills, it takes a commercial game and uses it to incorporate traditional literacy skills, technology skills, while having the students discuss, critique, analyze, and blog about their experiences. A positive model of incorporating commercial games and multiliteracies the Lacasa et al. study reflects the notion from other studies that focused on the integration of literacy, technology, and multiliteracies (Lynch & Redpath, 2012; Silvers et al., 2010; Walsh, 2008).

Technology can assist all students in their traditional literacy skills growth (Dalton et al., 2011; Larson, 2010; Proctor, et al., 2007; Roswell & Burke, 2009; Vasquez et al., 2011). Struggling readers and English Language Learners (ELLs) have different needs and issues when reading from average readers. The use of specific computer programs and strategies can boost struggling readers and ELLs reading comprehension scores as well as their vocabulary scores (Dalton et al., 2011; ; Larson, 2010; Proctor, et al., 2007; Roswell & Burke, 2009; Vasquez et al., 2011). The idea that technology could be used to build not only students multiliteracies but their traditional literacy skills is promising, particularly for struggling readers. While there is evidence that technology and digital literacies can improve students reading comprehension, there is a lack of schools using technology to instruct in this manner, and as a result limited research on the subject (Dalton et al., 2011).

One computer program that is designed explicitly with the purpose of raising struggling readers' traditional literacy scores and building up those skills is called a Universal Literacy

Environment or ULE (Proctor et al., 2007). The ULE is a way of integrating traditional literacy skills with new digital literacy tools. This program is designed to focus on traditional reading comprehension through reciprocal teaching while providing students with digital features like text to speech, hyperlinks to vocabulary definitions, and more (Proctor et al., 2007). Programs like the ULE bring attention to the way literacy has changed particularly relating to technology and how new literacy skills have come out of the introduction of digital technology and literacy. The ULE from the Proctor et al. (2007) study is like the use of e-books in the Segal-Drori et al. (2009) as well as Korat et al. (2010) studies. These studies similarly focused on the learning of traditional print based skills taught through the medium of digital technology. Dissimilarly, the studies on young children's literacy learning through e-books Segal-Drori et al. (2009) as well as Korat et al. (2010) focused on whether students made growth in their literacy skills while receiving teacher instruction while the Proctor et al. (2007) study did not examine if teacher instruction made a difference in student scores. These differences and similarities among studies are important to note for the purpose of this paper, particularly if teacher instruction is noted and examined or if strictly the interaction with technology is studied. The Proctor et al. (2007) study focused only on student growth through the use of the computer program and not teacher instruction. The study's findings were positive results that support the use of the ULE with struggling readers. In the results of the study, the students that performed with higher scores used the "strategy coach" within the computer program with higher frequency than their peers (Proctor et al.). This finding was not the only information that came out of this study. An interesting note from the study was that students who would most likely be considered struggling readers based upon the initial testing for the study were more likely to use the reading comprehension and vocabulary supports in the program than their counterparts (Proctor et al.).

Some studies showed positive results for students learning literacy skills through technology, other studies showed that students made greater growth in their literacy skills when instruction from teachers was paired with technology. The Bittman et al. (2011) study contrasts the Proctor et al. (2007) study's findings and supports the findings in the Segal-Dori et al. (2009) and Korat et al. (2010) studies, stating that teacher or parent instruction and interaction through technology is one of the most important factors in promising student growth in language and literacy. It should be noted the difference of age and literacy development stage between these varying studies. The children in the Bittman et al. (2011), Segal-Dori et al. (2009) and Korat et al. (2010) studies were all in the emergent reader stage, while children in the Proctor et al. (2007) were fourth graders. This difference in age and development stage could very well show that emergent readers need to rely more on adults to help them interact with technology and digital literacies than older children with greater literacy skills and understandings. The technology in these studies teaches students traditional literacy skills and specific technology skills but not necessarily multiliteracies or digital literacies. These studies have students as consumers of literacy and technology but do not challenge them to integrate these skills and create literacy.

There are ways to have students be more than consumers of literacy and technology. Students who are able to present and teach what they have learned are more likely to have a higher level of comprehension and vocabulary on what they have read than their peers who merely read the same text. In the world outside of school, students are often not only consuming technology and digital literacy, but actively participating in it and creating their own digital or multimodal texts (Bulfin & Koutsogiannis, 2012; Mctavish, 2009). To pull from students' funds of knowledge, they should not only be working with technology and literacy, but using both to create digital and multimodal texts. While some studies just show students working with

technology for the purposes of learning traditional skills, other studies and teachers seek to push their students so that they are able to be literate on another level. The Dalton et al. (2011) study and the Lynch and Redpath (2012) study show students learning traditional literacy skills through commercially produced educational programs, as many of the other studies did. These two studies however, go beyond many of the other studies and have the students produce digital texts of their own to present to their fellow classmates and other individuals. Having students complete an activity that takes what they have read and learned, while using technology to demonstrate this knowledge makes these activities far more tangible, real, and expressive of the students' knowledge.

The Segal-Drori et al. (2009) study as well as the Korat et al. (2010) study both looked at the difference between having students use technology to learn traditional literacy skills while examining if having instruction from a teacher or no instruction made an impact on students' scores. Both studies showed that when a teacher instructed in union with the e-books targeting traditional literacy skills, students scored higher than their counter parts who did not receive instruction and merely worked independently with the e-books. These students received face-to-face instruction from their teacher, one example of students who also received instruction on traditional literacy skills taught via technology but not in the traditional face-to-face manner is the Vasquez et al. (2011) study. Technology has reached a level where teachers and students are no longer bound by geography and classroom walls for instruction. In the study by Vasquez et al. (2011) struggling students were tutored one-on-one over the internet (via video conferencing) by pre-service teachers. Teachers worked with students to support, strengthen, and grow students' traditional literacy skills while working together over the internet. The results were positive, students gained overall in their oral reading fluency (Vasquez et al., 2011). This study

shows that technology and literacy continue to grow together and that they can be taught together, separately or used to support the instruction of one another.

Another major part about using technology effectively as an instructional tool is the use of technology to engage students. There are not a large number of studies that look explicitly at the use of technology to engage students in school. While there are not many studies that examine strictly the use of technology to engage during instruction, many studies do discuss engagement of students through the use of technology during instruction in school and outside (Larson, 2010; McKenna, 2012; Mctavish, 2009). All successful teachers will state the importance of having students fully engaged in a lesson. New technologies and digital texts have the ability to be more engaging for students because of the nature of the newer technologies to be interactive as well as students being naturally interested in the technologies and literacies they have access to outside of school. These are some reasons for why technology used during instruction can lead to higher levels of engagement. Being able to have students engaged in literacy activities and lessons is essential to having students learning. One example of using technology to engage students in their literacy activities is from the study by Larson (2010). In the study, Larson (2010) describes the change one student experienced through the use of chapter books on e-readers instead of print based chapter books “Amy expressed that she did not like to read, especially chapter books. According to her mother, reading on the Kindle made Amy excited about reading and the experience ‘gave her confidence in herself.’” (2010, p. 20). The example of this one student growing excited about reading and finding pleasure in reading rather than dislike and disinterest in reading. The use of the Kindle to read on, along with its abilities to make the text multimodal (highlighting, text-to-speech feature, defining of words through dictionary hyperlinks, etc...) all make the use of e-reader technology more engaging for the

students in the Larson (2010) study than reading traditional print based chapter books. Using an e-reader like the Kindle is not the only way that technology has been shown to increase student engagement. Another example of study results showing increased student engagement in literacy learning through the effective use of technology is from the McKenna (2012) study. The study focused on difference in student learning and engagement when students used iPads during lessons versus lessons they did not use iPads. When discussing the results, McKenna writes “...both teachers noticed through her observation log that students were engaged more often during the use of iPad lessons than when they were not being used.” (p. 139). E-readers are different from tablet computers like the iPad. E-readers can be used strictly to read books and texts, while tablet computers like the iPad can be used for a wide variety of activities and tasks, both e-readers and tablets can be used to effectively teach traditional literacy skills while employing new technology that interest, engage, and make students more comfortable. The McKenna (2012) study also identified ways that new technology could be used to teach traditional literacy skills, it also directly studied the difference in the number of minutes students were engaged and on task during lessons while using the iPad versus lessons without the use of the iPad. The results were positive towards the use of technology in lessons. Results from the study showed that not only in reading but also in math lessons when students were using the iPad they were engaged in the lesson for longer pieces of time (McKenna). The results also showed that when students were using the iPad during reading instruction, those students read (e-books or the Apple brand of iBook) with greater fluency, accuracy, and speed than when they read traditional print based texts (McKenna). These results of studies on the use of technology in literacy and other subjects are encouraging for teachers. When students are engaged, they are able and willing to learn. Both the Larson (2010) and McKenna (2012) studies are very recent

studies that examine the use of e-books and new technologies to support and increase students traditional literacy skills and engagement. Further studies should be conducted studying the use of new technologies integrated into lessons and how this impacts student engagement and learning growth.

The definition of literacy is ever changing. A large part of literacy is the use of it for communication and the way that it is shaped and defined by social practices, culture, and interactions. Over the past 50 years, social practices, culture, and the way that individuals communicate has changed drastically in the world. One of the biggest changes to literacy was the invention of digital technologies, computers, and the way these have changed communication (Lankshear & Knobel, 2006). Text messages, e-mails, mobile devices, and the internet have forever changed the way that people communicate, write, and read. Due to these changes, children of today are now known as digital natives, having never known a world where they could not instantly look something up on the internet or have an instantaneous conversation via text message with someone thousands of miles away (Prensky, 2001). As teachers and digital immigrants who did not grow up in a world like this, educators have been charged with the task to help navigate digital natives through school and literacy instruction using new technologies, digital texts, and traditional print based texts. Research must be completed to study how digital technologies interact and operate with traditional literacy. This research should be used to shape pedagogy and curriculum. There are problems with technology and its use in schools, some of these problems stem from the nature of new technologies to develop and change so quickly. Many students are able to work with technologies at home that they never will know within the walls of a classroom; this disjunction can hinder the growth, understandings, learning, and exploration of students. The home-school digital divide is a very real issue that schools,

teachers, parents, and students need to be aware of and address (Henderson, 2011). A key to resolving the home-school digital divide is the effective use of technology as an instructional tool. Teachers and schools need to find ways to incorporate the technology that students are using outside of school in the classroom and in effective ways that improve students' literacy skills and knowledge. Further, teachers and schools need to understand the importance of teaching not only digital literacies through multimodal texts, but also the importance of teaching traditional literacy skills through the use of traditional print based texts (Bittman et al., 2011). These varying forms of literacy instruction should be taught in a way that does not preference one over the other or in separation from each other, but in unison as students will often encounter in the real world. To determine and understand the best way to instruct students in literacy and with the use of technology, further research needs to be completed and used to shape instructional tools and methods in schools.

## **Methods Section**

### **Context**

This study took place on the campus of Northern Flamingo College in Western, NY. Through the Education Department at Northern Flamingo College's Master's Degree in Literacy Education, a free tutoring program is run. Students from local schools in the Western New York area K-12th grade can attend the literacy tutoring program for free, each student is provided reading, writing and word study instruction from a literacy education graduate student for an hour and forty-five minutes once a week for 10 weeks. The participants for this study were a fourth grade student and a third grade student. They both participated in the literacy tutoring program during the spring semester of 2013.

### **Participants**

The participants in this study were two students that have been paired up together to work by Northern Flamingo College staff to work with the same literacy graduate student. Based upon the Fountas and Pinnell reading assessment, both students met or exceeded expectations for their grade level in reading. During tutoring sessions, both students received instruction on reading, writing, and word study together with the tutor or one-on-one.

Hannah (a pseudonym) is an eight year old, Caucasian female. She is in the third grade and attends school at a suburban elementary school in Western New York where she lives. Hannah is reading instructionally at a level N/O in the Fountas and Pinnell program. This instructional level places Hannah at the “approaches expectations/meets expectations” level (Fountas and Pinnell, 2008, p. 239). On the comprehension portion of the Fountas and Pinnell assessment, for level N Hannah scored 6/10, for level O she scored 8/10 (she noted that she had previously read that text before). Hannah enjoys reading and writing, often doing so on her own free time for entertainment. She is somewhat reserved and shy.

Ariel (a pseudonym) is a 10 year old, Caucasian female. She attends the fourth grade at a suburban elementary school in Western New York. Ariel is reading independently at a level U and frustrational at a level V in the Fountas and Pinnell assessment program. These scores for reading, place Ariel at the “exceeds expectations” level (Fountas and Pinnel, 2008, p. 239). Ariel’s comprehension score for level U was 8/10 and for level V a 7/10. She is an outgoing and very engaged student. Ariel enjoys playing soccer very much. From this point on all names will be pseudonyms.

### **Researcher Stance**

I am presently enrolled as a graduate student at Northern Flamingo College in Western, NY. I am currently working towards a Master’s degree in Literacy Education, Birth-6<sup>th</sup> grade. I

have a Bachelor's degree in History; I am certified in Childhood Education with Special Education and Middle Childhood Education with Special Education in Social Studies. In this study, my role as a researcher was an active participant observer; this role indicates that I was teaching during the study as well as observing and noting the results of the study (Mills, 2011). The activity of teaching while observing the outcomes of my teaching allowed me to actively adapt and adjust my lesson plans and instruction.

### **Method**

In this study, I collected both qualitative and quantitative data to study the effects iPad app usage has on reading comprehension and word study (spelling) scores. I observed the difference between a student's score of using a spelling app versus using a print based spelling strategy. I also examined the use of an app and paper based texts impacts on a student's reading comprehension score. A third aspect I examined and observed is the level of engagement students have while working with the apps versus working with print and paper based items. Each participant was observed three times completing the skill and strategy using print based materials as well as using apps on the iPad. Observations took place during sessions that lasted one hour and 45 minutes each. During the first observation session, the participants completed a student questionnaire providing me information on their experiences with iPads/technology in and out of school, as well as their attitudes towards using technology during literacy activities.

The app, *Vocabulary Spelling City* was used in conjunction with the "look, say, spell, cover, write, check" method using pencil and paper. For this section both participants used the *Vocabulary Spelling City* app to practice and test five words that contain the spelling features of unaccented syllables, harder suffixes and bases/roots. In the app, the participants used the "teach me" section and go through all of the words once, then took the "test" section. In the "teach me"

section, the word was read aloud and highlighted, then spelled aloud (saying one letter at a time, as the letter appears on the screen, until the whole word is spelled), repeated the word aloud, then placed the word in a sentence, then said the word again. The students then took the test in the app, it said the word they must spell, then gave the word in a sentence, said the word again, and the user then would type in the spelling of the word. Both participants also used the “look, say, spell, cover, write, check” method using pencil and paper. They looked at the word, said the word aloud, spelled the word while looking at it, covered the word up and then wrote the word; lastly they checked if they spelled the word correctly. After completing this practice method of five words from the spelling features of unaccented final syllables, harder suffixes, and bases/roots, I then read aloud the word to the participants, provided it in a sentence, and repeated the word, having them write the word on paper. Prior to the first observation session, I have administered the *Words Their Way* spelling assessment to determine what stage of spelling development each participant was in (see appendix A). Based on their scores, both students need further instruction on the spelling features of: unaccented final syllables, harder suffixes, and bases/roots. The *Vocabulary Spelling City* app allowed me to customize word lists so that the participants were working on the words I choose. The participants’ scores from both the app and on paper from the test portion were recorded.

Studying student’s reading comprehension was completed by using the app *Abi Talk 3<sup>rd</sup> – 4<sup>th</sup> Grade Science Reader* along with print based science readings. The app *Abi Talk 3<sup>rd</sup> – 4<sup>th</sup> Grade Science Reader* is designed to provide the user with a non-fiction science text as the 3<sup>rd</sup>-4<sup>th</sup> grade level. After the user read the text, they then completed comprehension questions about what they have read. While reading the text in the app, users were able to press on a word and it would be highlighted and read aloud to the student. The questions were broken down into three

categories (multiple choice questions, true and false, vocabulary matching). The app *Abi Talk 3<sup>rd</sup> – 4<sup>th</sup> Grade Science Reader* allows for the teacher or parent to create their own lesson, entering their own choice of text and creating their own questions. I used the option of “creating my own lessons” for this app, so that both students were reading texts at their appropriate instructional level. Prior to the study, the students were given reading assessments using Fountas and Pinnell to determine their independent, instructional, and frustrational reading levels (see appendix B). The participants completed a cold read of the text and answered four comprehension questions using the app. Next, participants completed the same process using a paper based copy of text. The non-fiction texts were 150-300 word excerpts from *Readinga-z.com* leveled texts. The text on both the app and the print based text were excerpts from the same *Readinga-z.com* leveled texts. Both participants worked independently, alternating who was working with the iPad. The participants’ scores on the comprehension questions were recorded and the two set of scores between the questions on the iPad and the questions on paper were examined closely.

### **Quality and Credibility of Research**

The quality and credibility of a study is one of the most important factors and aspects of a study. Mills (2011) uses the writings of Guba (1981) to identify four features of a qualitative research study to ensure the credibility of a study. These four factors are identified as the following: credibility, transferability, dependability, and confirmability (Guba, 1981; Mills, 2011). Following the research and practices of Mills (2011) and Guba (1981) these four components will be utilized and observed to ensure the reliability of this study.

Credibility is defined by Mills (2011) as “the researcher’s ability to take into account the complexities that present themselves in a study and to deal with patterns that are not easily explained.” (p. 104). To secure this study was credible, I practiced triangulation. Mills defines

triangulation as the practice “to compare a variety of data sources and different methods with one another in order to cross-check data.” (p. 104). I used triangulation in this study by collecting experiential, enquiry and examination data. These types of data were collected by taking and keeping field notes, pre and post assessment scores/data, student work, student questionnaires, and journals/reflections.

Another important part to having a valid and true study is ensuring transferability of research. Mills (2011) states that “transferability refers to qualitative researchers’ beliefs that everything they study is context bound...” and therefore not applicable to larger sets of people (p. 104). To ensure transferability in my study, I collected detailed data which will allow for associations and comparisons of this study to be used in other contexts. By collecting and including detailed and descriptive data, I have provided others the ability to “...make judgments about fittingness with other contexts possible.” (p. 104). Ensuring transferability supports and provides credibility to my research.

A third component that is important to guaranteeing the validity of a study is dependability. Mills (2011) defines dependability of studies as “the stability of the data” (p. 104). One way I sought to confirm the dependability of my study was through collecting multiple forms and types of data through triangulation. I ensured dependability by collecting student assessment data, observing, taking field notes and using questionnaires. Mills states at least two ways of collecting data should be used to allow the strengths of one method to compensate for the weakness of another. Collecting data through experiencing, enquiring, and examining helps to ensure more stable data from the study.

The last component to ensuring a trustworthy study is by assuring confirmability of a study. Confirmability is defined by Mills (2011) as “...the neutrality or objectivity of the data

that has been collected.” (p. 105). Triangulation of the data and research in my study guarantees confirmability of my study. By using different forms of data that can be compared and contrasted, as well as to support one another triangulation is achieved and allows for confirmability (Mills). In addition, I practiced reflexivity through journaling and reflection during data collection. Practicing reflexivity identified and revealed if any assumptions or biases are present on my behalf (Mills). Identifying underlying assumptions and biases is important to ensure that the findings are not depicted in a certain way due to any assumptions or biases on my behalf (Mills). By attending to these four components that make and ensure valid research, I believe that my research and data in my study to be authentic. Furthermore, having valid and authentic data and results from the study allow for the research to be useful to literacy instruction through the use of the iPad and apps in the classroom.

### **Informed Consent and Assent (Protecting the Rights of the Participants)**

Informed consent and assent must be acquired before starting any research or study (Mills, 2011). I asked for permission from the parents of the participants by providing parents with forms that stated the purpose for the study, and asked for their permission through their signature and the date. Also, I needed to ask for informed assent from both of the participants. Since both of the participants were in the third grade or above, they completed forms where they granted their assent to participate in the study. I explained orally to the girls what the purpose of the study was after they read the forms, and then they signed the forms with their signatures and the date. I notified both parents and student participants that their names would be changed to pseudonyms and that any identifying marks on their work and research artifacts would be removed to ensure anonymity in the study.

### **Data Collection**

I collected three types of data to ensure the triangulation of the data. One form of data collection that was used was the collection of field notes. During each session, I took detailed field notes through observation, noting what I saw in the actions of the participants and using a rubric to note their motivation while completing activities, independence of use of both the iPad and paper based activities. My field notes also noted the scores and progress or lack of in spelling and reading comprehension. After each session, I used my field notes to reflect on and keep a journal of my thoughts about each session.

Another form of data I utilized and collected was pre and post assessments of each participant to identify any literacy growth made in the study. Students were individually assessed on their spelling skills (*Words Their Way*) and their reading comprehension, by answering comprehension questions on texts. At the end of the study, I compared the scores between the spelling and reading activities completed on the iPad to the scores of the tests completed on paper. The scores were analyzed and compared to determine what impact if any literacy apps have on student literacy growth.

A third form of data that I collected was questionnaires completed by the students. They completed one initial questionnaire each. The questionnaires sought to identify their experiences with iPads and technology in and outside of school. As well as their attitudes toward technology and traditional print based activities on paper. In addition, students completed a short response after each session (3 times) commenting on their feelings and thoughts about the activities.

### **Data Analysis**

Once I completed collecting all the data from the study, I began to examine and analyze it. I looked for common occurrences and themes throughout the data. I first analyzed the quantitative data I collected on the students reading comprehension scores and spelling scores

using both apps and paper based method of collection. The students' engagement scores using the engagement rubric were also analyzed at this point. The scores were placed into tables and organized by the session they were taken from. I analyzed these scores by comparing each student's own scores in sequential order, looking for growth over time. Next, I analyzed the scores by looking for similarities or differences between each student's scores on the iPad and using paper methods. The last way that I looked at the students' scores was to compare the two students' scores against each other.

I examined my students' questionnaires that I collected from the first initial data collecting session. I analyzed the students' responses by noting positive or negative feelings and experiences with different forms of technology. I completed these examinations of the questionnaires by reading through each student's answers separately and then comparing the two sets of responses against each other. Next, I connected the student's questionnaire responses and connected this to their spelling and reading scores. Finally, I connected the questionnaire responses to the participants' reflections. This information revealed their attitudes and perceptions about technology, as well as their experience with different forms of technology. From this information I looked for themes or commonalities between these types of information. Some of the data collected reflected themes that I found among the literature and studies from the literature review previously in this paper. The data from student questionnaires as well as student and teacher reflections revealed many links to the literature from the literature review of this paper in connection to attitudes, perceptions, and experiences. Student questionnaires revealed some examples of home-school digital divides.

Reflections were read and analyzed looking for similarities and differences that could be directed into themes. The reflections were analyzed by grouping each written statement into

positive or negative feelings. First the reflections were read all together, then they were read with notations of positive or negative feelings. Finally, the reflections were examined for connections to student's assessment and engagement scores. The students both often had either very positive things to say or negative things to say about using the iPad for reading and spelling. Due to this observation, reflections were coded for positive and negative feelings about spelling and reading using an iPad and paper.

Students' reading comprehension and spelling scores were examined and placed into tables to better visualize the differences and similarities. The students' reading and spelling tests results were coded for their scores. Scores were coded to determine if students scored higher using the apps on the iPad or on paper tests. Results of spelling were that scores were lower on the iPad than using the spelling strategy on paper. This data is an example of disconfirming evidence that apps increase spelling scores and retention. Reading comprehension scores were mixed results with one student scoring higher on the iPad and the other students scoring higher on paper.

Engagement is essential to students' successfully learning. Students' engagement scores were recorded and examined. The engagement scores of the students were coded for the difference between iPad and paper methods. The findings demonstrated that reading on the iPad increased student engagement, but did not necessarily increase student reading comprehension scores. Spelling on the iPad did not make a change in student engagement. Some of this data reflected information from previous studies that students were more engaged during lessons that included iPad (Lynch & Redpath, 2012; McKenna, 2012). Using triangulation by collecting the varying types of data such as, engagement and assessment scores along with field notes and reflections lead to conflicting results.

There are three specific themes that emerged from the data collected. The first theme is native digital users' access and attitudes towards technology and literacy. In this theme, the student questionnaires will be examined. The second theme is the positive or negative impact of apps on reading comprehension and spelling scores. This theme examines the scores that were recorded during the study and notes the differences between the app use and the paper strategies use and their impact on the students' scores. Also in this theme, what part of the app or paper based strategies may have impacted the students' scores is examined. The third theme is increased student engagement and behavior when using literacy based apps. This theme focuses on the difference between student engagement scores between iPad use and paper based activities, as well as between the iPad apps. The students' reflections of their use of the apps and paper methods have a connection to their academic and engagement scores, this information will be further examined in this area.

### **Findings and Discussion**

#### **Native Digital Users' Access and Attitudes of Technology and Literacy**

The first data collected in the study was student questionnaires. The students reported on their use with technology in and outside of school, with some specific information on their use with iPads. Overall, the two students reported fairly similar responses to the questions. Both students noted on their survey by choosing "yes" that they had used an iPad before and both stated that they had not used an iPad in school (Student Questionnaire Responses, February 26, 2013). The responses both participants gave of having used iPads previously, but not in-school shows that the participants had not received scholastic instruction using an iPad before this study. Also from the responses, it should be noted that the participants had access to using iPads, a fairly recent technology (available starting 2010) in their out-of-school lives, so their parents

were able to provide these opportunities with technologies for them. This information reflects what many of the articles pointed to in the literature review of this paper, that there is a home-school digital divide that is present in most of America (Bulfin & Koutsogiannis, 2012; Henderson, 2011; Levy, 2009; Mctavish, 2009; Spink, Danby, Mallan, & Bulter, 2010) The home-school digital divide is apparent from the participants of this study reporting that they have access to certain types of technology outside of school but not in-school (iPad). These two students having been born in the mid-2000s are digital natives (Prensky, 2001). While these students are digital natives, they did not always note that they preferred to use digital technologies over paper based activities (Student Questionnaires, February 26, 2013). These responses can be seen in Table 1-3.

Some of the information obtained from the student questionnaires that were completed on February 26, 2013 is represented in Table 1. The table is organized to show three different questions that they students responded to, they could choose the responses “Strongly disagree, Disagree, Neutral, Agree, Strongly Agree” when they answered these three questions. Table 1 shows the responses that each participant chose.

Table 1

Questionnaire Responses

---

I prefer reading on a type of digital technology over reading a paper book

---

Ariel Disagree

Hannah Neutral

---

The responses give a picture of the participants both as individuals that prefer paper based activities over activities using digital technologies. Looking at these responses to the questionnaire and comparing them to the students’ reflection, there are some contrasts. Ariel stated on the questionnaire that she disagreed with the statement “I prefer reading on an iPad, iPod, Kindle, Nook, Cell phone, Computer, E-reader, Tablet over reading a paper book” but in her first reflection she wrote “Fun—reading on the iPad” (Student Reflection, February 26,

2013). In a later reflection, she may have explained this difference in her answers by writing “I like reading articles on the iPad but not books” (Student Reflection, March 12, 2013). One reason that Ariel may have noted that she preferred reading paper books over reading books on a screen and then later stated she like reading articles on the iPad may have been due to the features the app offered. The app that was used in the study provided the students with non-fiction texts/articles to read. In the app, it provided some features that often e-readers or e-books do not, like the text-to-speech feature. When reading the texts in the app, students could touch any word in the text or questions and it would be highlighted and read aloud to the student. Both of the participants in their reflections noted they liked this feature in the app. This feature most likely made them feel confident and independent in their reading, knowing what the word was and not having to ask a teacher how to pronounce the word. The text-to-speech feature and the positive feelings the participants had towards it, may have been why although both participants initially noted they disagreed or felt neutral about liking to read using a type of technology over a paper book, they both later noted they enjoyed reading the articles on the iPad over the paper texts (Student Questionnaires February 26, 2013; Student Reflections February 26, 2013 and March 12, 2013).

Table 2 represents the answers of the participants from another subject they were asked about on the student questionnaires. Students responded to the statement “I prefer doing my homework on an iPad, iPod, Kindle, Nook, Cell Phone, Computer, E-reader, Tablet over a paper notebook or worksheet” by circling the answer that was closest to their own opinion (Student Questionnaires, February 26, 2013).

Table 2

## Questionnaire Responses

---

I prefer doing my homework on a form of digital technology over a paper notebook or worksheet	
Ariel	Neutral

---

Hannah Disagree

Hannah's response to the statement "I prefer doing my homework on an iPad, iPod, Kindle, Nook, Cell phone, Computer, E-reader, Tablet over a paper notebook or worksheet" was that she disagreed. This negative response was supported by her reflection; she wrote "I liked the paper spelling better. I didn't like the iPad spelling" (Student Reflection, March 12, 2013). Not only does, Hannah's reflection support this choice on the questionnaire, but her spelling scores also represent this with her continuously scoring higher on the paper spelling than the iPad spelling (Table 5). One cause for this dislike of doing homework on technology over using paper and pencil, also preferring the paper and pencil spelling method over the app could be that Hannah dislikes typing or that typing is not an asset of Hannah's. A student, who has never received typing instruction or does not type on a keyboard well, would most likely prefer to write over typing. When Hannah typed on the virtual keyboard in the app, she had to search for each letter before touching it to make it appear on the screen, this could have not only impacted her attitude and preference for the paper method, but could have impacted her spelling scores using the app. Not being able to find the letter a student looking for while sounding-out a word to spell it could impact how a word is spelled.

Table 3 demonstrates participants' answers to another subject off of the student questionnaires. The statement that the participants responded to was "I prefer playing board games and card games over playing games on an iPad, iPod, Kindle, Nook, Cell Phone, E-reader, Tablet." (Student Questionnaires, February 26, 2013). The table represents how the participants responded to the statement with the answer that matched their opinion the closest.

Table 3

## Questionnaire Response

---

I prefer playing board games and card games over playing games on a type of technology

---

Ariel     Agree

Hannah     Agree

In Table 3, both of the participants stated that they would rather play paper based games than technology based games. These responses are interesting, because both participants are considered digital natives, and thus are expected to most likely prefer technology based activities over most others (Prensky, 2001). So the fact that both participants noted they would rather play paper based games was interesting. One reason that could be the reason why is that at the age of the two participants (10 and eight years old) they do not have a high level of independence and access to technology based games for entertainment. At the participants' ages, it is possible that they do not have their own pieces of digital technology to play these games on and that parents do not allow game playing or monitor closely the amount and type of games played on technology. Another reason for their responses might be because of the differences in the social interactions and aspects of the types of games. Hannah stated "I like going to Grandma's house to play Monopoly with my cousin and sister" (Field Notes, February 26, 2013). Being able to go to her grandmother's house and play a board game with her grandma and other family members may be more fun for Hannah than playing a game in an app on her own, particularly her age (eight years old). Digital natives may not prefer technology based activities over paper based activities at all points in time, particularly at certain ages. Also, the exposure to paper based activities rather than technology based activities by family members to digital natives may make digital natives prefer paper based activities due to a lack of exposure to technology based ones.

Both of the girls noted that at home and at school the piece of technology they use most frequently is a computer (Student Questionnaire Responses, February 26, 2013). From this information it can be seen that both of the participants have access to technology in and outside of school. While the participants have access to computers, they most likely have had limited access to newer digital technologies (mobile and touch based). Due to their access to computers over other forms of digital technology, they are both most likely more comfortable using computers, particularly in their use in the school setting than other forms of technology, like the iPad. The two participants both live-in and attend school in a fairly affluent suburb. Schools and parents that are in a higher socioeconomic bracket are able to provide students with more access to technology both inside and outside of school (Bulfin & Koutsogiannis, 2012). One student noted that she would like to use a computer more often in school and the other noted she would like to use an iPad more often in school (Student Questionnaire Responses, February 26, 2013). This desire by both students to use technology more in school and for one to use a technology not used previously in school (iPad) shows that even though these two students have access to technology inside and outside of school, there is a home-school digital divide present in these students' lives. Due to both of the students being digital natives and having experience with technology outside of school that is not being accessed in school, certain portions of their funds of knowledge are being overlooked and not being engaged (Moll & Gonzalez, 1994). Both students noted that they had experience with and access to the iPad outside of school, but never in school. This difference between in-school and out-of-school technology access and experiences is just one way that these two participants are being subjected to a home-school digital divide. Without in-school instruction using new technologies, these participants are reliant on their out-of-school practices on learning how to use the technology. Depending on

their family and friends abilities to provide them access and instruction on the use of the technologies, they may be ahead or behind their peers, without an even exposure in a school setting. On the first fill-in-blank the two students had very different responses but both informative. The student Hannah responded to “I want to learn how to \_\_\_\_\_ using technology” by stating “write.” Ariel changed what the question asked to say “I want to learn using technology” (Student Questionnaire Responses, February 26, 2013). Both responses demonstrate their desire to learn using technology but to also create using technology. Ariel’s response supports the foundation of being a digital native in that learning using technology is a natural practice that she wishes to seek out. Based upon Ariel’s reading, spelling, and writing scores she exceeds the expectations of her grade level (*Fountas and Pinnel, Words Their Way, 6+1 Rubric*). Any chance that Ariel gets to complete individualized work where she can set her own pace, or enrich her learning she jumps at the ability. This information can even be seen in her choice to change the questionnaire to suit what she wanted to say instead of merely filling in the blank. It is clear her feelings from her response that she does not want to just learn to type, or write complete sentences, but to learn as much as she can while learning how to use and create using technology. Hannah also responded that she wants to use technology in school during “libery” class (Student Questionnaire Responses, February 26, 2013). Ariel stated that she “would like to use an iPad in school during math class” (Student Questionnaire Responses, February 26, 2013). The questionnaire responses from the participants show that they both have had more experience using a wider range of technology outside of school than in school. The responses also show the participants’ desire to use more technology over a wider range of classes than they do now in school. From the literature previously studied, it is important for teachers to be aware of students’ funds of knowledge including technology so they do not marginalize or

ignore and negatively impact students (Coiro, 2011; Henderson, 2011; Lynch & Redpath, 2012; Walsh, 2008).

### **The Positive and Negative Impact of Apps on Reading Comprehension and Spelling Scores**

The first part of the quantitative data that was collected was students' reading comprehension scores. These scores demonstrate the reading comprehension scores over the three sessions between the iPad and paper. The reading comprehension scores of the two students in the study turned up mixed results as can be seen in Table 4. Participants' scores were based on out of four multiple choice questions, the percentage they answered correctly.

Table 4

#### *Reading Comprehension Scores*

	Ariel		Hannah	
	iPad	Paper	iPad	Paper
Session 1	100%	75%	75%	75%
Session 2	75%*	100%	25%	50%
Session 3	100%	75%	50%	100%

\*See Field Notes, March 12, 2013 (Ariel Reading on the iPad)

Ariel scored 67% of the time higher using the iPad than using paper. Hannah's results were that she scored 67% of the time higher on the paper version, and the same score between the iPad and paper for the first session. This data shows mixed results on reading comprehension scores using an iPad app versus paper copy of reading text and questions. Hannah had low scores in her second and third sessions. One reason possible for this dip in Hannah's scores could be because she was sick during the last two sessions (Field Notes, March, 12, 2013). Another important item to consider when examining the participants scores is that Hannah used the iPad before using the paper method every time, while Ariel used the paper method and then the iPad. Hannah scored higher on the paper method which was the second process she used, Ariel scored higher on the iPad which was the second method she used. The order the

participants completed their reading method could possibly have impacted how they scored on their reading comprehension. Another item to consider is that Ariel may have a higher-level skill set and confidence when it came to using the iPad leading to her higher scores on the iPad (Field Notes, February 26, 2013 and March 12, 2013). Evidence that might point to this higher-level of skills and confidence using the iPad is Ariel's quickness in learning the apps, fully utilizing the features of the apps, asking for continued use of the iPad after data collection ended (Field Notes, February 26, 2013 and March 12, 2013). The literature on previous studies shows that students with higher understanding of technology can rely on this skill set in technology to boost their literacy skills (Coiro 2011; Roswell & Burke, 2009; Spink et al. 2010). While this study of reading comprehension scores on the iPad or paper had mixed results, other studies that focused on iPad use for reading fluency showed only positive results for iPad use (McKenna, 2012). Further research on reading comprehension scores using the iPad needs to be completed to truly understand the positives and negatives when using it in school. While my study focused on reading comprehension of short non-fiction texts, several of the articles in the literature review studied online/internet reading (Coiro, 2011; Roswell & Burke, 2009).

The second form of quantitative data was collected from the students' spelling scores. This data of spelling scores can be seen in Table 5. Students were given five different words to learn and spell for each method (iPad and paper) and session. Table 5 is set up to display how many words each student correctly spelled in each session and using the different methods.

Table 5  
*Spelling Scores*

	Ariel		Hannah	
	iPad	Paper	iPad	Paper
Session 1	80%	100%	80%	80%
Session 2	80%	100%	20%	60%
Session 3	60%	100%	20%	50%

These scores from both students reflect the same outcome. The outcome was that students did not score as high and spell as many words correctly when using the iPad versus the paper method. Both students consistently scored higher on the paper method of spelling instruction and testing than they did on the iPad app method of instruction and testing. This data is disconfirming evidence that literacy apps increase spelling skills and retention. One reason the participants may have scored higher on the paper version could be because of the way the instruction on the spelling was presented. The paper instruction involved auditory, visual, and kinesthetic properties while the app instruction was presented with just auditory and visual properties. The paper method required students to complete the extra activity of physically writing each letter in each word before they were tested on the words. The additional physical activity of writing the word connects to students multiple intelligences, kinesthetically. Writing the word on the paper during the learning portion pushed the students further in their learning. When students learned the word on the app, they did not have to type in the word, they were just consuming what they app gave them. The paper method of instruction pushed students further by requiring them to consume the word that was already on the paper but then to reproduce the word before they were tested. Having the students physically write the word in addition to hearing and seeing the word spelled out may have been what helped the students score higher on the paper method. These findings show that digital technology is not the answer to everything. Students need many different ways to learn and they need instruction that works to access multiple intelligences. Like the Korat et al. (2010) study, I would like to see the difference between iPad use with and without teacher instruction as well as paper based spelling with and without teacher instruction for spelling. As writing using digital technology becomes more

prevalent, it would be worth further researching spelling instruction and scores using technology and apps.

### **Increased Student Engagement and Behavior When Using Literacy Based Apps**

Students' engagement in the activities and their behavior throughout was monitored. Their level of engagement was monitored using a rubric as well as field notes observing their behaviors and actions during the sessions. The participants' engagement levels/scores can be seen in Table 6 to Table 9. An example of the engagement rubric used throughout the study for all methods and participants can be found in this paper under Appendix D. The engagement rubric was broken up into three different categories to determine each participant's level of engagement in the activity they were completing. The three categories were "on task," "time management," and "independence/questions" (Appendix D). Students were rated on a scale of 1, 3, or 5. A 5 was the highest that a student could score in each category, and meant students were performing at the highest level of that category while a 1 meant they were not. In order for a student to obtain a 5 in the "on task" category, they needed to be completely on task and engaged the whole time. Scoring a 3 for "on task" meant that the student was not on task throughout, but they were able to redirect on their own or with one prompt from the teacher. For students to score a 1 in the category of "on task" they would not be on task at all and require multiple prompts from the teacher to attend to the task. For the category of "time management" students scored a 5 if they worked in a timely manner and evenly paced their work on each section of an activity. If students scored a 3 in "time management" it meant that they worked the whole time they were given, but spent too much time on one section or more section of the activity. Scoring a 1 on "time management" meant that students either wasted time by rushing through the work, or dawdled until time ran out. In the category of "independence/questions" students scored a 5 if

they were able to work independently throughout the time, only asking on topic questions. To score a 3 students needed to work independently most of the time, but needed some teacher assistance/intervention and asked mostly on topic questions. Scoring a 1 on “independence/questions” meant students needed continuous supervision or assistance from the teacher and asked off topic questions. These categories and descriptions of scores was the way that students were assessed on their engagement levels during the sessions and activities along with field notes connecting to the behaviors and engagement levels.

In Table 6, Ariel’s reading engagement rubric scores are presented. Participants could earn 1-5 points, on three different sections of the rubric. Appendix D provides the engagement rubric that was used to score students on their engagement levels.

Table 6  
*Ariel’s Reading Engagement Rubric Scores*

	February 26, 2013		March 12, 2013		March 12, 2013	
	iPad	Paper	iPad	Paper	iPad	Paper
On Task	100%	100%	100%	60%	100%	100%
Time Management	100%	100%	100%	100%	100%	100%
Independence/Questions	60%	100%	100%	100%	100%	100%

Ariel’s reading engagement scores were fairly steady in that no matter what method or medium she was using to read she was actively engaged in her work. During the first session, Ariel needed scaffolding and reassurance that she was using the app correctly (Field Notes, February 26, 2013). In the first session, Ariel scored all fives on the engagement rubrics for both the iPad and paper when reading meaning that she was actively engaged throughout the activity, she completed the activities in a timely manner and at an even pace (Appendix, D). Ariel scored a three on the independence/question session of the iPad reading, because although she worked independently most of the time she did need some intervention from the teacher. The reason why Ariel was not able to complete the reading task on the iPad completely independently was because this was her first time using this specific app on the iPad and was not fully confident in

her ability. In the second session, she was distracted easier when reading a paper text than when she was reading the iPad text. Ariel scored a three in the on task section of the engagement rubric for March 12, 2013 session 2, meaning that she was not always on task but that she was able to redirect on her own. During the third session, on March 12, 2013 Ariel was completely engaged throughout both reading activities. From the observation notes, it is clear that Ariel had the same body position, posture, and behavior when reading on the iPad as well as on the paper (Field Notes, February 26, 2013 and March 12, 2013). Ariel would sit with her feet tucked up underneath her, lay the reading material on the desk and place her hands on her face, just in front of her ears. Ariel used the text-to-speech feature multiple times during each reading session on the iPad, both while reading and answering questions. A strategy that Ariel used both on the iPad and on paper was using look backs to the text (Field Notes, February 26, 2013 and March 12, 2013). When discussing how to use the apps for the first time, Ariel understood very quickly what to do in the apps. Ariel asked questions about what to do in the app and its features at a faster rate than I could explain and instruct on them (Field Notes, February 26, 2013). She clearly felt comfortable using the iPad and its touch features, much like many other digital natives (Lynch & Redpath, 2012; McKenna, 2012; Prensky, 2001). Ariel also discovered features of the app I did not teach her or tell her about, like the ability to change your answer once the app identified the answer as incorrect (Field Notes, March 12, 2013). Her confidence and ability to explore the app and its features proves like many of the other study that felt truly at ease using the digital technology. Ariel's high level of comfort and ease using the app may have supported her reading skills and lead to her increase in iPad scores over the paper method and over the other participant (Hannah) who may not have been as comfortable using the iPad as Ariel.

In Table 7, Hannah’s engagement rubric scores are presented from her reading comprehension activity. Table 7 is presented in the same manner as Table 6, with the three categories of the rubric running along the left hand side and the scores separated based upon the session and method.

Table 7  
*Hannah’s Reading Engagement Rubric Scores*

	February 26, 2013		March 12, 2013		March 12, 2013	
	iPad	Paper	iPad	Paper	iPad	Paper
On Task	100%	60%	100%	60%	100%	60%
Time Management	100%	100%	60%	60%	60%	60%
Independence/Questions	100%	100%	100%	100%	100%	100%

Hannah’s reading engagement scores were consistently higher on the iPad than when using the paper. During the first session on February 26, 2013, Hannah was actively engaged during the reading activity on the iPad. When completing the reading activity on paper for the first session, Hannah was somewhat distracted when she began reading on the paper copy; this distraction is why she only scored 60% (a 3) on the engagement rubric. In the second session on March 12, 2013 Hannah scored 60% for both the iPad and paper reading in the “time management” category. The reason for this score was that she worked very slowly on both activities compared to the previous session and the other participant. Hannah also spend and excessive amount of time reading and answering the questions for both the iPad and paper during this second session. Hannah also scored a 60% on the paper reading activity for “on task” behavior, because she had a hard time getting started, and kept looking around the room but eventually she was able to focus on her work. For the third session on March 12, 2013, Hannah again took a very long time to complete the reading activities on both the iPad and paper earning her scores of 3 or 60% in the “time management” category. During the third session reading on the paper Hannah had a difficult time starting her work, she got up to throw a piece of paper away and after returning to her seat took several more minutes of sitting before she began the

activity. Due to these reasons she only earned 60% of the possible 100% in the “on task” category for session 3 of reading on paper. These results from Hannah’s engagement scores were very similar to the results of the McKenna (2012) study which also noted increases in student engagement when using the iPad. While her engagements scores for reading were higher on the iPad, her assessment scores had the opposite result. One possible cause for the difference between engagement and assessment scores could be that Hannah needed to concentrate more while reading on the iPad to answer the questions. Hannah may have needed to concentrate more using the iPad to read because she many not have had a lot of practice reading on a screen instead of paper. It could also be that Hannah simply enjoyed reading on the iPad more than the paper, thus leading to her being more engaged (Student Reflection 3, March 12, 2013). Hannah wrote in her reflection about reading on the iPad saying “I liked the the ipad for articalls but not for books. I didn’t like the paper as much.” (Student Reflection 3, March 12, 2013) Hannah never explains why she prefers to read articles on the iPad and not books, but there may be a few different reasons. One reason may be that Hannah liked the features of the app that she could use to read the article, like text-to-speech and in her previous reading experiences with the iPad did not have access to these features. Another reason for Hannah noting she prefers to read articles over books on the iPad could be because she was interested in the articles that were chosen for this study over chapter books. In the observations notes, it is recorded that Hannah had different body position while reading on the iPad from paper (Field Notes, February 26, 2013 and March 12, 2013). Hannah would lay the iPad flat on the desk and lean forward towards it, while reading on a paper she would lean back away from it in a much more relaxed pose. One reason for this difference in her posture when reading on the two different mediums may be that in order to see the text clearly on the screen of the iPad Hannah needed to lean

forward, while it did not matter what angle she read from when using the paper. The last two sessions, Hannah seemed to have a harder time getting started on the paper copy reading (Filed Notes, March 12, 2013). She looked around the room for some time before starting reading for the second session. During the third session using paper for reading, Hannah got up to throw a piece of paper away and took a while to settle back into her seat and the task. A reason for why Hannah took longer to get started on the paper reading activity for the second and third sessions may be because as she noted in her reflection, she preferred reading the texts on the iPad so she was less excited to begin reading on the paper and thus took longer to become engaged in the activity (Student Reflection, March 12, 2013). Throughout, whether using an iPad or paper for reading she would often look back at the text to answer questions (Field Notes, February 26, 2013 and March 12, 2013). When Hannah used the iPad for reading and answering questions she used a feature of the app called text-to-speech which reads the word selected aloud for the reader (Field Notes, February 26, 2013 and March 12, 2013). She wrote about this feature in her first reflection saying "...I also liked the word check." (Student Reflection 1, February 26, 2013). Hannah is not the first student to find features of like text-to-speech in apps, e-books and e-readers that help increase student engagement. Larson's (2010) study on e-readers determined an increase in student engagement that could be connected to the features like text-to-speech. Since Hannah previously stated that she did not like reading books on the iPad, if more research was conducted it would be worth noting the extent of practice she has had with books on the iPad and using the additional e-reader features like text-to-speech (Student Reflection February 26, 2013 and March 12, 2013). Hannah's increased engagement while reading reflects the findings of a previous study that students are more engaged while reading on an iPad than when reading on paper (McKenna, 2012).

The spelling portion of the session did not register any significant differences in engagement levels between the use of the iPad and the paper method. Both students were quite engaged in the spelling activities whether they were on the iPad or using the paper method. The spelling activities used the same engagement rubric as the reading activities (Appendix D). Students were scored on the rubric based on three categories that made up their engagement rubric scores. This table describes Ariel's spelling engagement rubric scores over the three sessions.

Table 8  
*Ariel's Spelling Engagement Rubric Scores*

	February 26, 2013		March 12, 2013		March 12, 2013	
	iPad	Paper	iPad	Paper	iPad	Paper
On Task	100%	100%	100%	100%	100%	100%
Time Management	100%	100%	100%	100%	100%	100%
Independence/Questions	100%	100%	100%	100%	100%	100%

Ariel was actively engaged in her spelling activities throughout all of the sessions. On all categories for all three sessions Ariel scored full points on the engagement rubrics for spelling. Ariel noted her enjoyment of using the iPad both in her reflections and orally to the researcher. When data collection of the study ended, Ariel asked "Can we still use the iPad for spelling and can we try other parts in the app?" (Field Notes, March 12, 2013). The students only used two of the six available activities in the spelling app, but could see there were other activities in the app they could access. From Ariel's question, it can be seen that she was curious about the other features in the spelling app. It is also likely that Ariel wished to play the games that were included in the spelling app and not just the sections that "taught" and "tested" the app user. Another idea that can be taken from Ariel's question is that she enjoyed the iPad and did not want to go back to completing spelling activities that strictly excluded the iPad. In her reflection, Ariel noted that she liked various features about the spelling app over the paper method saying "I love touching instead of writing" (Student Reflection, February 26, 2013). This comment provides

the reader with the idea that Ariel would rather type on the iPad than write out the words when taking the spelling test. Typing on the touch screen is a different activity from writing on paper or even typing on a physical keyboard. One reason that Ariel may have noted that she liked typing better could be because she is a digital native, and is not only accustomed to typing but prefers it to physically writing. The idea that although she liked typing better than writing she still scored higher when writing over typing spelling words is intriguing and implores for more research to be completed around this concept. Ariel also noted her preference of being read to in the spelling app rather than using the paper where the students had to read the words to, by saying “I liked when they read it to me....” (Student Reflection, March 12, 2013). The text-to-speech feature that was present in both spelling and reading apps was something both participants reflected positively on (Student Reflections, February 26, 2013 and March 12, 2013). The participants most likely enjoyed the text-to-speech feature because it gave them a sense of confidence in knowing how to accurately pronounce a word. Being able to have the word read to them by the iPad increased not only their confidence levels but also their independence levels of not needing to ask a teacher about how a word was pronounced. Both when using the iPad and paper, Ariel scored fairly high on her spelling, it is something that appears to come fairly easy and naturally for her which may be why she had such high engagement scores no matter what method she was using. Ariel is reading above grade level based upon *Fountas and Pinnel* scores, and is overall a very bright and engaged student. It is possible that in both Ariel’s reading and spelling engagement scores she did not have any significant differences due to the fact that both spelling and reading come easily to her. Due to the ease of these literacy areas Ariel is actively engaged and enjoys learning no matter what method or medium is used to teach or assess the subjects of reading comprehension and spelling.

In the next table, the scores of Hannah's spelling engagement rubric are reported. As the previous tables on engagement rubrics have shown, there were three categories the participants were scored on, over the three different sessions. The engagement rubric that was used for this table can be found in the Appendix section (D).

Table 9

*Hannah's Spelling Engagement Rubric Scores*

	February 26, 2013		March 12, 2013		March 12, 2013	
	iPad	Paper	iPad	Paper	iPad	Paper
On Task	100%	100%	60%	60%	100%	100%
Time Management	100%	100%	60%	60%	60%	60%
Independence/Questions	60%	100%	100%	100%	100%	100%

Hannah's engagement scores for both iPad and paper methods were lower during session two and session three, as were her assessment scores. One cause for this change between session one and session two as well as session three is most likely that she was suffering from a cold for the last two sessions. This difference in engagements and assessment scores as well as in observation of her behavior can be seen throughout session two and three. The only time that Hannah had a lower engagement score using the iPad for spelling was during the first session and that was because she needed some reassurance and scaffolding on how to use the app on the iPad. In the students' reflections, Hannah had clear feelings about spelling instruction. Hannah wrote "I liked the paper spelling better. I didn't like the iPad spelling" (Student Reflection 2, March 12, 2013). Hannah does not explain or give a reason for her preference of the spelling activities, but there are several factors that could be the reason. One reason may be that Hannah did not score very high in the spelling activities on both the iPad and paper methods for the second and third sessions. When Hannah was taking the spelling test on the iPad it gave her immediate feedback about how she scored, while using the paper method, I (the researcher) did not inform her on how well she did on the paper spelling test after she completed it. It is possible that receiving the immediate feedback that she did poorly was a factor in her dislike for

the iPad. Another reason for the preference of the paper method over the iPad could be that Hannah disliked the way that the iPad taught the words. As previously discussed in this section, the iPad only taught using visual and auditory methods, while the paper used those two as well as kinesthetic activities. It is possible that Hannah prefers to learn by motion and activity over visual and auditory instruction. If Hannah learns better kinesthetically than her preference for the paper method is easily explained. She had very strong feelings about not liking the spelling app. Hannah did not like the spelling app and scored very low the last two sessions on the spelling app, while Ariel scored much higher and had a more positive attitude in her reflections to the spelling app. There could be many reasons why Hannah scored much lower in the last two sessions on spelling; one reason may have been that she was not feeling well during the last two sessions which could impact her performance. Hannah may have required more instruction on the words and spelling features that were being focused on during the second and third sessions. Students need different levels and amounts of instruction before mastering skills, Hannah may have needed more time to learn the words than was provide so she scored lower. It is possible that just as teachers' attitudes about technology impact their instruction as is seen in Henderson's (2011) study, students' attitudes toward technology impacts their scores. After the second session, Hannah had negative feelings about the spelling app, which may have impacted her third session scores. Hannah may have had negative feelings about the spelling app after the second session but not the paper, because the iPad gave immediate feedback of a low score, while the paper method did not reveal anything about her score. Feelings of negativity and lack of confidence from a previous performance can impact a student's next performance. While observing, I noted that after Hannah finished the last two sessions spelling tests on the iPad she was very disappointed in her scores which the iPad immediately gave, while I did not provide the

participants with their scores on the paper test (Field Notes, March 12, 2013). This emotion of disappointment was noted by Hannah not making eye contact after completing the spelling app tests and slumped shoulders (Field Notes, March 12, 2013). Disappointment and negative feelings can impact student's future learning and assessments. Hannah being upset on how she scored on the test may not only have impacted the third session's scores, but may have also impacted her feelings and attitudes towards the use of the iPad in a learning setting.

### **Implications and Conclusions**

The data from this study leaves multiple ideas and items to be considered for future use in the classroom. Based upon the information from the literature review and student responses during this study it is clear that digital technology is becoming a greater part of human lives and is intersecting with literacy. As literacy is changing and adapting to new technologies, students are reading more of digital texts than ever before. These skills of reading and writing using digital mediums should be taught in school with traditional literacy skills, but what is the best way to teach these skills? Smartphones and tablet computers are increasingly saturating the market as are apps that can be used on these devices. This study sought to answer the question can apps help increase student engagement and their reading and spelling skills? The answer to that question was a mixed result. Student's engagement and reading scores can be increased by using an app on the iPad over reading paper based texts, but this information was not always true for all of the participants. Spelling and engagement scores were found to not increase when using an app on the iPad, rather the opposite was true in this study, where students performed better on paper than they did using the app on the iPad.

Based upon the spelling scores from the app and engagement rubrics, it is clear that student's do not improve their spelling or levels of engagement when using an app on an iPad

but perform better when using paper strategies. Students are often exposed to situations where they must spell using keyboards and touch screens, so they should have experience with this during school. More research should be completed on the methods of instruction students gain the most from for spelling, as digital features like spell-check and auto-correct change the way that humans write and spell. When instructing students, it is important to teach to multiple-intelligences like kinesthetic, visual, and auditory. The spelling app *Vocabulary Spelling City* used accessed only visual and auditory aspect of spelling instruction, while the spelling strategy on paper utilized these intelligences as well as kinesthetic. From this information from my study, my first implication is that teachers need to teach spelling in a way that attends to and accesses as many types of multiple intelligences as possible. Teaching students the same content through varying ways and mediums is a way to ensure that they master the skill and content in the way that they learn best.

Due to the mixed results on the reading comprehension app scores, more research should be completed on this topic. Students should receive instruction on how to read certain types of texts depending on the medium they are presented in (Coiro, 2011; Roswell & Burke, 2009; Spink et al., 2010). The second implication from this study is that students should be reading on a variety of mediums to peak their interest, increase engagement and student skills. If students are able to read any type of text on any medium, they will be successful inside and outside of the classroom. In order for students to be successful in the real-world where they will be expected to read various types of texts on different mediums, teachers should expose students to all types of texts and literature on varying mediums in the classroom. Studies have shown that reading electronically can increase not only student engagement but also student assessment scores (Larson, 2010; McKenna, 2012). Teachers should be instructing reading using multiple forms of

texts in multiple mediums and teaching strategies and features to use when reading in each situation.

The responses from the student questionnaires in this study provided interesting results. The participants did not always have the same responses to the questions on the questionnaires. From the differences of the answers to the questionnaires the final implication for teachers can be determined. The final implication of this study is that teachers need to be aware of the funds of knowledge that students bring with them into the classroom, not only in content and social experiences but also in their abilities and understandings of different types of technologies. Every student enters the classroom with different experiences using technology when students are tasked to use types of technology they may not have experience with they can easily fall behind their peers become frustrated. Educators must remember the different levels and types of knowledge their students enter the classroom with and do their best to help students become well-rounded individuals.

There were limitations to this study. The amount of time was a limitation. Due to the frequent and mismatch of public school and college breaks, there was a very limited amount of time for the research to be conducted. In the future, a larger number of students over a longer period of time would be studied.

The research process of this study left me with further questions. One of the areas that drew focus was the consistent results that students performed better when spelling on paper than on the iPad. Why did these results occur? These results could be due to the way the words were taught in the app versus the way they were taught using paper, but this may not be the only reason. What is the best way to teach spelling to students when they will be spelling both on paper and using digital technology for the rest of their lives?

In conclusion, digital technology is steadily becoming a more integrated part of everyday life for all Americans. This technology change and integration modifies the way that individuals read and write. For students to be successful in their lives, they need literacy instruction that focuses on traditional paper based literacy instruction as well as digital literacy instruction in cooperation with one another. Educators must remember that students all come to schools with different types and levels of knowledge and experience. Teachers need to assess students' prior knowledge and integrate that knowledge with their instruction to help create literate citizens for the future.

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## Appendix A

*Words Their Way* scores

Ariel's pre and post spelling scores

Stage	Pre-Assessment January 2013		Post-Assessment April 2013	
	Feature	Total Points	Feature	Total Points
<b>Emergent</b>	Initial Consonants	7/7	Initial Consonants	7/7
	Final Consonants		Final Consonants	
<b>Letter Name- Alphabetic</b>	Short Vowels	5/5	Short Vowels	5/5
	Digraphs	6/6	Digraphs	6/6
	Blends	7/7	Blends	7/7
<b>Within Word Pattern</b>	Long Vowel Patterns	5/5	Long Vowel Patterns	5/5
	Other Vowels	6/7	Other Vowels	6/7
<b>Syllable and Affixes</b>	Inflected Endings	4/5	Inflected Endings	4/5
	Syllable Junctures	4/5	Syllable Junctures	4/5
	Unaccented Final Syllables	3/5	Unaccented Final Syllables	4/5
<b>Derivational Relations</b>	Harder Suffixes	2/5	Harder Suffixes	4/5
	Bases or Roots	1/5	Bases or Roots	3/5
	<b>Notes/Comments:</b> Ariel spelled 16 out of 25 words correctly. She acquired 50/62 feature points. Ariel is in the late Syllables and Affixes stage/early Derivational Relations spelling stage.		<b>Notes/Comments:</b> Ariel spelled 19 out of 25 words correctly. She acquired 55/62 feature points. Ariel is in the Middle Derivational Relations stage of spelling	

Hannah's Pre and Post spelling scores

Stage	Pre-Assessment January 29 <sup>th</sup> , 2013		Post-Assessment	
	Feature	Total Points	Feature	Total Points
<b>Emergent</b>	Initial Consonants	7/7	Final Consonants	7/7
	Final Consonants			
<b>Letter Name- Alphabetic</b>	Short Vowels	5/5	Short Vowels	5/5
	Digraphs	6/6	Digraphs	6/6
	Blends	7/7	Blends	7/7
<b>Within Word Pattern</b>	Long Vowel Patterns	5/5	Long Vowel Patterns	4/5
	Other Vowels	4/7	Other Vowels	5/7

<b>Syllable and Affixes</b>	Inflected Endings	4/5	Inflected Endings	4/5
	Syllable Junctures	4/5	Syllable Junctures	5/5
	Unaccented Final Syllables	3/5	Unaccented Final Syllables	2/5
<b>Derivational Relations</b>	Harder Suffixes	1/5	Harder Suffixes	2/5
	Bases or Roots	2/5	Bases or Roots	1/5
	<p><b>Notes/Comments:</b> Hannah spelled 14 out of 25 words correctly. She scored 48 out of 62 in feature points. Hannah is in the Late Syllables and Affixes/Early Derivational Relations stage, but due to her score on other vowels, some attention should be paid to this area.</p>		<p><b>Notes/Comments:</b> Hannah spelled 15 out of 25 words correctly. She scored 48 out of 62 feature points. Hannah is in the Late Syllables and Affixes/Early Derivational Relations stage.</p>	

**Appendix B***Fountas and Pinnell Scores*

Ariel

2/5/13	<i>Earthquakes</i>	U	98% Accuracy 2/3 Fluency 8/10 Comprehension	Independent
2/5/13	<i>A Call for Change</i>	V	Below 95% Accuracy 1/3 Fluency 7/10 Comprehension	Frustrational
4/13	<i>Tsunamis: Might Ocean Waves</i>	V	98% Accuracy 3/3 Fluency 8/10 Comprehension	Independent

Hannah

1/29/13	<i>The Big Snow</i>	N	99% Accuracy 2/3 Fluency 6/10 Comprehension	Instructional
1/29/13	<i>The New Girl</i>	O	97% Accuracy 2/3 Fluency 8/10 Comprehension	Instructional
1/29/13	<i>Plenty of Pets</i>	P	95 % Accuracy 1/3 Fluency 8/10 Comprehension	Frustrational
4/13	<i>Exploring Caves</i>	N	98% Accuracy 2/3 Fluency 9/10 Comprehension	Independent

### Appendix C

#### iPad Questionnaire

1. I have used an iPad before

Yes            No

2. I have used an iPad in school

Yes            NO

3. I prefer reading on an iPad, iPod, Kindle, Nook, Cell phone, Computer, E-reader, Tablet over reading a paper book

Strongly disagree    Disagree    Neutral    Agree    Strongly Agree

4. I prefer doing my homework on an iPad, iPod, Kindle, Nook, Cell phone, Computer, E-reader, Tablet over a paper notebook or worksheet

Strongly disagree    Disagree    Neutral    Agree    Strongly Agree

5. I prefer playing board games and card games over playing games on an iPad, iPod, Kindle, Nook, Cell phone, Computer, E-reader, Tablet

Strongly disagree    Disagree    Neutral    Agree    Strongly Agree

6. At school I often use (circle which one) iPad, iPod, Kindle, Nook, Cell phone, Computer, E-reader, Tablet, Smart board

7. At home I often use (any one of these) iPad, iPod, Kindle, Nook, Cell phone, Computer, E-reader, Tablet

8. I would like to use technology more often in school (circle any of these: iPad, iPod, Kindle, Nook, Cell phone, Computer, E-reader, Tablet, Smart board)

9. I want to learn how to \_\_\_\_\_ using technology

10. I would like to use technology (iPad, iPod, Kindle, Nook, Cell phone, Computer, E-reader, Tablet, Smart board) in school during \_\_\_\_\_ class.

**Appendix D**  
Engagement Rubric

	1	3	5
On Task	Student was not on task, required multiple prompts from the teacher to attend to the activity	Student was not always on task, but was able to redirect on their own, or with one prompt from the teacher	Student was on task and actively engaged throughout the entire activity
Time management	Wasted time: either rushed through or dawdled until time ran out	Worked throughout the whole time, spent too much time on certain sections of the activity	Completed activities in a timely manner, thinking and working through each section at a fairly even pace
Independence/Questions	Needed continuous supervision/intervention by teacher. Asked irrelevant and off topic questions	Able to work independently most of the time. Needed some assistance/intervention from the teacher. Asked questions that were mostly on topic	Able to work independently throughout out, asked relevant and on topic questions when needed

## Appendix E

### Field Notes

#### Questionnaire

- Both girls worked quietly and read thoroughly
- A erased and changed an answer, she also altered the wording of one of the fill in the blank questions
- A asked for an explanation of the last question on the questionnaire
- H “I like going to Grandma’s house to play monopoly with my cousin and sister” in response about the paper based games

#### Session 1-H iPad *Bears*

- Used the text to speech feature while reading words “fascinate, consume, quantities”
- Asked how she got to the next question while completing the questions (I demonstrated for her of pressing submit, then sliding the question section)
- She got one question wrong

#### Session 1- H paper *Bears*

- Paced herself through the reading
- Used her pencil to follow along/touch words while she read
- Looked back at the reading to answer questions

#### Session 1-A paper *Adaptive Athletes*

- Read at a steady pace
- Worked through each question and looked back at reading while answering questions

#### Session 1-A iPad *Adaptive Athletes*

- During instruction on how to use the iPad apps, she asked questions ahead of time as I was explaining
- Used text to speech multiple times
- Needed assistance locating information to answer one of the questions (how long athletes train for) I had to point out what paragraph the information was in after prompting her twice
- Like H, A needed some assistance in reminding to slide the questions to get to the next question
- Used the text to speech feature while answering questions

#### Session 1-H iPad spelling

- Follows instructions easily
- Asked questions for conformation of what to do (how to get to the test)
- On test worked through slowly but steadily
- Asked “what do I press next?”

- At one point it got noisy in the classroom, H couldn't hear when the word was spoken aloud while taking the test. She asked for confirmation on what to do because she didn't hear the word

#### Session 1-H paper spelling

- Practicing look, say, spell, cover, write
- Didn't say word or letters very loudly, but very quietly to herself in a whisper
- Scored 80%

#### Session 1- A paper spelling

- Worked through quickly but steadily
- Read words/letters loud enough for others to hear
- Scored an 80%

#### Session 1- A iPad spelling

- Excited it was her turn to use the iPad
- Worked through each word at a steady pace
- Scored 100%

#### Session 2- H iPad reading *National Parks*

- Lays iPad flat on the table, holds a pencil in her hand
- Looked back at the text to answer questions
- Hesitated on answering questions
- Seemed stuck on the last question, taking a longer time on this question
- Used text to speech feature while answering questions

#### Session 2- H paper reading *National Parks*

- Leaned back away from the paper and desk, relaxed body
- Had a hard time getting started, looking around the room
- Worked through reading at a slow but steady pace
- Taped on desk while finishing reading
- Looked back at text for answers

#### Session 2- A paper reading *Genetics*

- Put hands on head, sat on feet, looking down on paper
- Distracted by another tutor talking in the room, turned body around in seat to listen to what the other tutor was saying
- Looked back at the text multiple times to answer the questions

#### Session 2- A iPad reading *Genetics*

- Same position to read on the iPad as with paper.

- Got one of the questions initially wrong and using the feedback from the app, looked back at the text and changed her answer
- Austen was determined on her own that when the app told her the answer was wrong she could change her answer, so as seen above she changed her answer
- Used the text to speech option while answering questions
- Worked at a much faster pace and rate than H during this session

#### Session 2- H iPad spelling

- Sat with iPad flat on the desk, swung feet back and forth
- Distracted 2xs during the test portion, looked around the room
- “hunt and peck,” searched for each letter slowly then typed with one finger
- Scored 20% (spelling the word “president” correctly)

#### Session 2- H paper spelling

- Started out saying the words and letters to herself, loud enough that I could hear them, then she went silent
- Did not write the words down during the practice portion

#### Session 2-A paper spelling

- Points at each letter with a pencil and says them clear and loudly

#### Session 2- A iPad spelling

- Body was in the same position for reading
- Worked through quickly
- Used two fingers to type on the virtual keyboard, moved quickly in typing
- Scored 80%

#### Session 3-H iPad reading *Penguins*

- Lays iPad flat on the desk
- Used text to speech feature 3 different times
- Looked back at text when answering questions

#### Session 3-H paper reading *Penguins*

- Had a hard time getting settled and started with the paper reading
- Got up to throw paper away
- Used her finger to follow along with words while reading
- Looked back on text to answer questions

#### Session 3-A paper reading *Volcanoes*

- Looked back at text to answer questions
- Read very quickly to ask a question about the photo connected to the text
- Commented on how “it wouldn’t be safe to build a city inside a volcano”

- I responded back talking about how the Hawaiian islands were formed from volcanoes

#### Session 3-A iPad reading *Volcanoes*

- Same reading position with the iPad on the desk and hands on head
- Looked back at the text to answer a question

#### Session 3- H iPad spelling

- Actively engaged, focused, and on task
- Scored 20%
- Spelled “civilize” correctly
- Misspelled fortunate for “fortin”
- Seemed very discouraged by this score, did not make eye contact after completing this task

#### Session 3-H paper spelling

- Worked through at a steady pace
- Read words and letters very quietly to self, wrote each one on the practice sheet

#### Session 3-A paper spelling

- Worked through each word and letter
- Touched each letter with her pencil as she said the letter
- When she misread a letter in a word, she did not start the word over but kept going

#### Session 3-A iPad spelling

- Hands on head to work
- Went through each word quickly
- During test erased on word and retyped it
- Missed two words- fortunate and opposition “forinit” and “opptzion”
- Asked “Can we still use the iPad for spelling and can we try other parts in the app?”

## Appendix F

### Teacher Reflections

#### Reflection 1

Both worked at a similar pace. They both needed reassurance at one point on the iPad, but it is the first time out using them. Ariel seemed more confident in her use of the iPad, asking questions on how to use it before I got to that point in the instruction. Hannah seemed more hesitant about using the iPad. This is also a reflection of their usual behavior and personalities.

#### Reflection 2

Hannah has a cold and seems a little sluggish and unfocused. Today Ariel worked a quick pace through all of her work. Hannah worked at a much slower pace. Ariel was less engaged during reading of the paper this session.

#### Reflection 3

Hannah worked in a slow manner, very discouraged by the spelling score on the iPad. Ariel asked if we could continue to read and spell on the iPad or use it for other things. Hannah's cold seems to impact her pace in work and scores (possibly?)