A Study of Teachers' Integration of App Affordances and Early Literacy Best Practices

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Dedication

This dissertation is dedicated to Brody and Evie Israelson, with all my love and gratitude.

Abstract

As a variety of learning technologies become increasingly present in early elementary classrooms the question of how to integrate technologies into early literacy teaching and learning is critical. A great deal is known about best practices for early elementary literacy instruction in traditional print-based texts (Pressley, 2006). Additionally, there is much innovative research studying how to effectively integrate learning technologies into secondary and late elementary literacy learning (Beach & O'Brien, 2012; Leu et al., 2007). Given the increasing prevalence of a variety of learning technologies in early elementary classrooms (kindergarten through 3rd grade) there is a pressing need for research to examine and document how teachers approach the integration of new learning technologies, such as handheld devices (e.g., iPod Touch devices, iPads) and apps, with their knowledge of best practices for effective early literacy instruction and the actual affordances of these practices.

In this study I sought to describe how early elementary teachers integrate technologies into the teaching of literacy when presented with new handheld devices from upper administration. I also examined how (and if) teachers integrate their knowledge of best practices for early literacy learning with multimodalities, affordances and value added literacy opportunities when reviewing and selecting handheld device apps for early literacy instruction. My goal was to describe what happens when handheld devices are actually used in early literacy instruction, focusing on app affordances. Undergirded by a theoretical framework that blended constructivism, pragmatism and social cognitive and social constructivist theories of learning, I employed naturalistic inquiry (Lincoln and Guba, 1985) and case study methodologies (Yin, 1994). I collected data in two phases. First, I conducted a survey with a selective sample of 25 K-3rd grade teachers. Then, I purposively sampled two information-rich cases of kindergarten teachers, collecting data through interviews, verbal protocol procedures, classroom observations and photographs.

Findings indicated that teachers used apps most often for students to independently practice phonics skills, and rarely or never for literacy instructional that required students to engage in higher-order thinking or collaborate with peers. The use of handheld devices and apps yielded a variety of negative affordances that inhibited or detracted from learning, several of these unanticipated by teachers. Teachers' selection of apps to use for instruction was influenced by factors including the cost of apps, student-centered approaches to teaching and beliefs about literacy best practices. The presence of the devices in the learning environment impacted and shaped students social interactions and learning experiences in their kindergarten classrooms, both in both positive and negative ways. This study identified concerns and issues that warrant consideration as handheld devices and apps are integrated into early elementary literacy learning, if teachers hope to use these tools in ways that not only support students' traditional print-based literacy development, but also assure students develop digital literacies strategies and critical 21st century skills.

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Chapter 1

Setting the Purpose

"If we teach today as we taught yesterday, we rob our children of tomorrow."
                                                                John Dewey

The prophetic words of educational reformer and philosopher John Dewey (1916) encapsulate a current and urgent issue in early literacy education. As a variety of learning technologies becomes increasingly present in elementary classrooms the question of how to integrate technologies into early literacy teaching and learning is critical. Students will need technology-based skills and literacies that stretch beyond tradition print-based forms of reading and writing. Educators ensure that today's students are prepared to actively participate in the global community by creating learning experiences that allow students to develop new literacies skills and strategies, as well as essential 21st century skills, such as the ability to think critically, solve problems and flexibly adapt. To simply introduce technology tools such as iPads or other handheld devices into a classroom is not enough. First and foremost, learning technologies must be conceptualized as tools to support teaching and learning. If teachers are not prepared to deliberately and strategically use these tools student learning will not be enhanced, or worse, may be inhibited or negatively impacted.

A great deal is known about best practices for early elementary literacy instruction in traditional print-based texts (Morrow, Tracey & Del Nero, 2011; National Early Literacy Panel, 2008; National Institute of Child Health and Human Development, 2000; Neuman, 1998; Pressley, 2006). Additionally, there is much innovative research

studying how to effectively integrate learning technologies into secondary and late elementary literacy learning (Beach & O'Brien, 2008; Beach & O'Brien, 2012; Leu, Zawilinski, Castek, Banerjee, Housand, Liu, & O'Neil, 2007; Snyder & Bulfin, 2008). The position statement of the International Reading Association on new literacies and 21st century technologies argues, "Traditional definitions of best practice instruction—derived from a long tradition of book and other print media—are insufficient in the 21st century" and calls for "a vision that includes the integration of new literacies within the literacy curriculum" (International Reading Association, 2009). Given the increasing prevalence of a variety of learning technologies in early elementary classrooms (kindergarten through 3rd grade) there is a pressing need for research to examine and document how teachers approach the integration of new learning technologies, such as handheld devices and apps, with their knowledge of best practices for effective early literacy instruction and the actual affordances of these practices.

My Journey with Learning Technologies and Literacy

As an educator and a researcher I have found myself continually intrigued with questions of how learning technologies can be used to enhance students' learning. As a preservice teacher in 2005 I completed the requisite "Tech for Teachers" course that taught me to build a class website using "Teacher Web" or some similar application, and how to design a PowerPoint. As I began my teaching career I quickly became skilled at making overheads with the copy machine, writing in neat, "teacher-print" on a white board and communicating with students' families through the telephone or "Room 210 News" letters printed on colored copy paper; I did not use PowerPoint nor the internet in

my teaching those first years. However, during my third year as a teacher the school acquired SMART boards, sending the overhead projectors into the basement closets to collect dust. Eager to fully realize the potential of this tool in my teaching, I joined the school's technology leadership team and completed extensive training. I continued to enjoy the challenge of designing innovative and engaging instruction that fully utilized the technologies available to me to teach students and communicate with their families. I was equally fascinated with my students' and my colleagues' responses and experiences to not only using the SMART board, but accessing to the Internet and seemingly unlimited information for teaching and learning.

As I transitioned from the classroom to my graduate studies I continued to be intrigued with questions about the role of technology in teaching and learning: What new skills and competencies will students require to prepare for their futures? What technologies ought to be used in the classroom and how? How do schools need to change to educate 21st century students to be globally competitive in the age of data, information and technology? My study of digital literacies furthered my interest in this topic. Studying the work of new literacies scholars grounded in the belief that information and communication technologies alter the nature of literacy by expanding literacy demands to include comprehending and representing meaning through a multiplicity of modes, interactivity and hypertextuality (Coiro, Knobel, Lankshear and Leu, 2008; Roswell & Lapp, 2011) raised questions for me about the implications of these alterations for early literacy learning. I found myself wondering what new literacies skills and abilities young students must now acquire in those early years? What will teachers need to teach them in preparation to understand and represent ideas multi-modally? What does "early"

(Kindergarten-3rd grade) 21st century skills (collaboration, critical thinking, communication) instruction look like?

As a graduate student I designed and completed a tutoring project with 1st grade students that led me to my current research. I taught four struggling first grade readers who were selected by their classroom teachers to receive additional literacy instruction from me using an iPad and apps. Although each student was significantly behind grade level peers in literacy learning, each had unique literacy learning needs. Much like the six profiles of struggling readers developed by Valencia & Buly (2005), each student I worked with demonstrated varying developmental strength and weakness in the areas of word identification, meaning (comprehension) and fluency. All four of these students were unique in their literacy development; however, they were all identified by their classroom teachers as struggling readers. The students were two boys and two girls, and all four students were African American and qualified for free or reduced lunch. I tutored each student for 20-30 minutes once a week using a variety of apps to support their literacy learning. As I searched for apps to use with these students I found that the majority of free apps purported to be for "early readers" emphasized phonemic awareness development and phonics skills such as rhyming, segmenting and blending. I also found an abundance of apps featuring sight words practice in game-like activities. The "comprehension" apps available consisting of a short, poorly written paragraph followed by multiple-choice questions. I wondered how a teacher could even begin to sort through hundreds of available apps, weeding out multitudes of poorly designed ones and selecting those that best aligned with their instructional objectives, all the while tailoring their instruction to meet unique developmental and literacy needs of specific students? How

could teachers develop a schema for assessing apps? Given the frequency of new app releases, a list of "Top Apps" would be practically outdated before you could post it on a blog. Selecting apps for early literacy instruction proved to be an overwhelming and daunting task!

I was fascinated as I watched the students manipulate and navigate the iPad and apps. There was no question they were engaged; yet I found myself wondering if that engagement and the novelty of the device would wear off ultimately. Further, I was interested in whether their engagement was leading to authentic and meaningful literacy learning. I questioned whether these devices could be used for students to understand and represent ideas using multi-modal affordances. When my time with these wonderful young students ended I found I had many questions about using handheld devices and apps in early literacy learning.

I began to study the apps that were available for early literacy learning. I devised a process to explore the available iOS apps for iPads, iPhones or iPod Touch. Given the thousands of apps, with more apps released daily, I needed a strategy to gain an understanding of app affordances (positive and negative), value added, and to think about how apps might be used for literacy instruction guided by best practices. Appendix A documents the searches I conducted in the App Store including the terms searched and the parameters used to narrow the search, the title of the apps reviewed and notes describing the experience of using the app. The strategies I employed to search for and review apps were grounded in the literature on early literacy best practices and new technologies research. My searching and reviewing process attempted to create what a kindergarten, 1st, 2nd or 3rd grade teacher might experience as they seek and test apps.

I organized my findings from the testing of available apps into a grid (Appendix B) mapping best practices for early literacy instruction onto affordance of apps and web tools for the purpose of assessing the relative weight of positive and negative affordances. The first column outlines developmentally appropriate literacy behaviors based on research and cross-checked against the Common Core Standards for English Language Arts and Literacy, specifically the standards for kindergarten, 1st, 2nd or 3rd grade. The second column of the grid outlines instructional practices verified by literacy research to have "consistently shown results superior to those achieved with other means" (Morrow & Gambrell, 2011, p. xvii). These two columns provide a framework of instructional objectives grounded in best instructional practices for reviewing popular apps for literacy learning on handheld devices (iPad, iPod Touch and iPhone). The third column lists positive app affordances (something beneficial to the reader, enabling the reader to do something considered to contribute positively to literacy learning) and the fourth column lists negative app affordances (something that may inhibit literacy learning, prevent certain behaviors or lead to unintended negative consequences) based on the apps tested and reviewed. The third and fourth columns are organized by types of apps available for the dimension of literacy learning in question. For example, for instruction designed to develop students' concepts of print a teacher may use a variety of types of apps such as eBooks, audio recording apps or eVersions of traditional teaching tools, such as magnetic letters or white boards. Since each category of apps has different positive and negative affordances the third and fourth columns show affordances organized by category of apps.

This work allowed me to design and construct an evaluation tool to guide early elementary literacy teachers as they select apps for their literacy instruction (Appendix C). The tool consists of a central map connected to several interconnected branching maps, one for each of the dimensions or component of literacy instruction in an early elementary classroom. The central map emphasizes overall guiding factors including individual learners, the instructional objective and the potential value added to instruction by integrating technological tools. The central map poses several questions for teachers to ask as they review and test apps. These questions include:

- Will the multi-modal features of this app be engaging? Motivating? Distracting?

- Am I looking for an app to use with the whole class? A small group? Individual students?

- Lots of apps have a gaming aspect-assess whether the game is engaging or distracting. Is it pertinent to the dimension of literacy you are working on? To other content?

- Am I looking for an app for students to use independently or with adult assistance?

- Does this app offer any value-added to my instruction?

- Can this app be used for multiple instructional goals? For example, many eBooks can be used for instruction in all areas of literacy; some phonics apps can support phonemic awareness instruction, too.

Throughout the evaluation tool I developed there are interconnected maps purple boxes that offer tips for use of apps. My work exploring and evaluating apps, and developing strategies and a tool to guide early elementary teachers' review and selection of apps for

literacy instruction furthered my interest in this topic. My previous inquiry, exploration and study described led me to design and execute the current study of early elementary teachers, handheld devices, apps and early literacy learning.

Purpose Statement

The purpose of this study is three-fold.   The first purpose is to describe how early elementary teachers integrate technologies into the teaching of literacy when presented with new handheld devices from upper administration. After this exploratory phase to the study, the second emphasis of this work will examine how (and if) teachers integrate their knowledge of best practices for early literacy learning with multimodalities, affordances and value added literacy opportunities when reviewing and selecting handheld device apps for early literacy instruction.   This focus will allow me to understand how teachers make sense of planning and teaching with apps, how this influences their instructional behaviors, and the processes that teachers engage in to plan early literacy instruction with apps. The third emphasis of this study is to describe what happens when handheld devices are actually used in early literacy instruction, focusing on app affordances, or "What each app offers or how it presents for the learner opportunities for learning or…to devise activities that enable literacy practices" (Beach & O'Brien, 2012). This emphasis allows me to see what teachers do with students when using new technologies to teach literacy, the students' responses, and how these interactions shape future teacher planning and instruction. The research questions that guide my work and address the purpose of the study are as follows:

Research Questions

1) To what extent and how are Kindergarten-3rd grade elementary teachers using technologies in their classrooms to teach early literacy (reading, writing and word study)?

2) To what extent and how are teachers choosing apps or web tools based on their knowledge of best practices for literacy instruction? (What characteristics of apps or web tools do teachers see as positive affordances, negative affordances and value added, a belief that it does a better job at the literacy practice than any known technology?)

3) When teachers and students use apps during instructional cycles, what does teaching and learning look like? From the perspective of teachers, what are the actual positive or negative affordances of using these apps to foster early literacy instruction in practice, including unanticipated affordances?

4) How are teachers' beliefs, knowledge, planning and instruction impacted by their experiences planning and teaching with apps and web tools, their observations of students' learning with these technologies and their reflections on classroom lessons?

In the remainder of this chapter I will provide an overview of the additional chapters in my dissertation. In Chapter 2 I review the literature on three pertinent areas. First, I consider the existing body of research on "best practices" in early literacy education in traditional print-based texts. I review the literature about dimensions of literacy including concepts of print, phonemic awareness, phonics (letter knowledge, alphabetic principle) word recognition, language development, vocabulary, comprehension and

writing. I also provide a discussion of best practices for working with English language learners (ELLs) in literacy instruction and issues of motivation and engagement in literacy learning. The second area of literature reviewed in Chapter 2 is digital literacies and new literacies, an area of scholarly inquiry defined by the pressing core question, "How do the Internet and other information and communication technologies (ICT) alter the nature of literacy?" (Coiro, Knobel, Lankshear and Leu, 2008, p. 1). This section explores definitions of digital literacies or new literacies, the concept of affordances, and frameworks for understanding teacher's knowledge and practices when integrating technology into instruction. The final body of research I reviewed focuses on technology integration initiatives, exploring research-identified barriers, obstacles and benefits, as well as current understandings of the factors that impact the success of technology integration, the benefits of technology integration and the often-cited criticisms of technology integration.

Chapter 3 provides detailed information about the methodology and design of this study. I adopted the position of researcher as "bricoleur," or one who uses "the aesthetic and material tools of his or her craft, deploying whatever strategies, methods, or empirical materials are at hand….(and) If new tools or techniques have to be invented, or pieced together, then the researcher will do this" (Denzin & Lincoln, 2000, p. 4). First, I document the design of this case study and tools developed for data collection. These tools include a survey, interview guide and verbal protocol procedure. Second, I describe my role as researcher, the participants and site, and strategies implemented for data collection and analysis.

In Chapter 4 I present the findings of this study. Chapter 4 consists of four sections. The first section is a description of findings from a survey of 25 kindergarten-3rd grade teachers in the participating school district. These findings establish a broader understanding of how early elementary teachers across the district use devices and apps in their literacy instruction and how they choose apps for instruction based on their knowledge and understanding of best practices for literacy instruction. Further, the findings from the survey served as foundation upon which I was able to more closely study two individual teachers and their classrooms. Chapter 4 proceeds with findings from the embedded case studies of two kindergarten teachers, Tracey and Marcy. The findings describe how either teacher uses handheld devices for literacy instruction, their processes for selecting apps for literacy learning, the actual affordances in practice in their classrooms and the impact of teaching with these technologies on their knowledge, beliefs and instructional practices. Finally, this chapter concludes with findings from my cross case analysis of Tracey and Marcy, detailing differences and similarities in their approach to early literacy instruction with handheld devices and apps.

In Chapter 5 I present conclusions of this study and implications for early elementary teachers, educational leaders, app designers, teacher educators, professional developers and educational researchers. Chapter 5 also suggests directions for future inquiry, including methodological possibilities for future research on this topic.

Educational Significance

With the increasing prevalence of a variety of learning technologies in early elementary classrooms it is critical that literacy researchers examine how educators select

and implement apps and web tools into early literacy instruction. Clearly, educators must "meaningfully integrate new literacies into their literacy instruction if they wish for reading experiences to be relevant and authentic to contemporary students" (Morrow et al., 2011, p. 79). While there is compelling research exploring handheld devices, apps and other technologies both in home literacy practices during early childhood and teaching with technology in the upper grades, little is known about the use of apps in early literacy teaching. Researchers need to examine how "new technology can be used to motivate and develop children's meaning making in early education" (Merchant, 2011, p. 769). I provide evidence from my research that supports implications useful to teachers, policy makers, school leaders, professional developers and researchers. The conclusions I provide address the relatively new area of research in integration of specific technologies (handheld devices and apps) into early literacy instruction, offer tools for data collection in this area, and provide direction for future research.

Chapter 2

Review of the Literature

The following chapter reviews the existing research literature in three areas: (a) best practices of early literacy instruction, (b) digital literacies and (c) educational technology integration. Research in these three areas informed and guided the current study. Further, the research reviewed here reveals that at present little is know about how early elementary teachers can most effectively use handheld devices and apps in their early literacy instruction.

Best Practices of Early Literacy Instruction

In order to study the integration of various technologies into early literacy instruction it is necessary to first consider the existing body of research on "best practices" in early literacy education in traditional print-based texts.

Defining "Early literacy." While the term "early literacy instruction" may be used to describe teaching of children from birth through third grade, for the purposes of this work it will refer to instruction of students in kindergarten through 3rd grade. Bear, Invernizzi, Templeton and Johnston's (2012) "Synchrony of Literacy Development" describes the progression through developmental stages of students in these grade levels. According to Bear et al., students progress through the emergent stage, the beginning stage and the transitional stage of reading and spelling. Emergent spellers and readers lack an understanding of the alphabetic principle, may "read" a favorite book from memory, "write" with scribbles and recognize selected letters in their own names (Bear et

al., 2012, p. 15-16). Beginning readers and spellers may begin to use knowledge of letter

sounds to identify words, may read predictable or memorable texts, confuse vowels in

their reading and writing, and choppily read word-by-word (Bear et al., 2012, p. 17).

Transitional readers and spellers can generally recognize and read patterns or chunks of

letters in combinations (such as single syllable rimes), may confuse long vowel patterns,

and begin to read more fluently and with expression (Bear et al., 2012, p. 17-18). Bear et

al.'s synchrony offers an insightful and descriptive method of thinking about these

developmental stages, as opposed to merely naming grade levels.

 Defining "Best practices." The phrase "best practices" can have a variety of

meanings or implications, and thus may be contentious and controversial. For the

purposes of this work it is necessary to clearly define what is meant by "best practices."

In their edited volume *Best Practices in Literacy Instruction* (2011) Morrow and

Gambrell offer definitions of "best practices" including "the best, most effective way to

do something" and "methods and techniques that have consistently shown results

superior to those achieved with other means" (Morrow & Gambrell, 2011, p. xvii).

Effective early literacy instruction is a well-researched field, and the extensive body of

scholarly research suggests certain best practices, or effective instructional techniques

that lead to student growth and achievement in literacy. These best practices are

validated by research as effectively leading to student gains in literacy achievement.

Generally, there is consensus among most reading education scholars that certain sets of

practices ought to be employed in early literacy instruction. The IRA's (2002) position

statement *What is Evidence-Based Reading Instruction?* offers the term "evidence-based

reading instruction" to describe practices with a proven record of success as demonstrated

through "reliable, valid and trustworthy evidence." For the purposes of this work, the phrase "best practices" is used to refer to these sets of literacy instructional practices validated by scholarly research.

  Balanced literacy instruction. There is an ample body of research on the topic of early literacy instructional practices in traditional print-based texts. Despite the historical "Reading Wars" between proponents of whole language instruction and proponents of skills-based instruction, many literacy educators and scholars argue for a balanced approach to literacy instruction; that is a blending of systematic, explicit skills instruction and holistic, authentic reading and writing experiences. Reading research offers numerous ways to organize or conceptualize the dimensions or components of literacy. For the purposes of this study the dimensions of literacy instruction will be conceptualized as components of a whole process, interconnected and intertwined. These dimensions include concepts of print, phonemic awareness, phonics (letter knowledge, alphabetic principle) word recognition, language development, vocabulary, comprehension and writing. A discussion of best practices of early literacy instruction must also include practices for working with English language learners (ELLs) in literacy instruction. Additionally, best practices must attend to issues of motivation and engagement in literacy learning. These dimensions of literacy instruction can be organized in a variety of ways. No matter how they are organized in relation to one another, the ultimate objective is meaning making or comprehension. For each of these dimensions of literacy instruction there exists a robust body of scholarly research. Each will be briefly summarized here for the purpose of establishing best practices in literacy instruction in traditional print-based texts.

Concepts of print. Concepts of print include the knowledge and understanding

that there is a difference between print and pictures, that print is read from left to right

and from top to bottom, that books have a title, author and illustrator, and that words are

separated by spaces (Clay, 1967; Morrow et al., 2011; NELP, 2008; Pressley, 2006;

Roberts, 1998). Research-based best practices for concepts of print instruction include

practices such as having students read the same text repeatedly or retell a story from

looking at the pictures, having students point out words they have learned from repeated

readings or letters in their own name (Morrow et al., 2011), as well as exposing young

children to a variety of literacy materials and objects (Pressley, 2006), and creating a

print rich environment with opportunity for literacy-rich play (Neuman, 1998). In digital

texts and apps the have multi-modal possibilities concepts of print are far more complex

and dynamic. However, little is known about effective instructional practices for

teaching "digital concepts of print."

Phonemic awareness. According to Pressley, "Phonemic awareness is the

awareness that words are composed of separable sounds (i.e., phonemes) that are blended

to produce words" (Pressley, 2006, p. 111-112). Early literacy instruction must support

children's development of phonemic awareness: "The theoretical and practical

importance of phonemic awareness for the beginning reader relies not only on logic but

also on the results of several decades of empirical research" (Snow, Burns & Griffin,

1998, p. 54). Best instructional practices for developing phonemic awareness include

chanting or singing rhyming poems or songs, clapping syllables of words, auditory

segmenting, blending and substitution (Adams, 1990; Cunningham, 2011; Morrow et al.,

2011; NICHD, 2000; Pressley, 2006). In "Reading Instruction that Works" Pressley

(2006) asserted that research has shown that phonemic awareness instruction ought to have an element of playfulness, include sound identification tasks, encourage invented spelling and be "metacognitively very rich, providing children with a great deal of information about when, where and why to use the knowledge of phonemes they were acquiring" (p. 117). In the Report of the National Reading Panel NICHD (2000) found that phonemic awareness instruction was most effective when focused on 1-2 phonemic awareness skills at a time, was taught with letters, in small groups for 5-18 hours of total instruction. The development of phonemic awareness is a critical component of children's literacy development and fortunately research has verified several instructional practices shown to develop phonemic awareness in emergent readers. Given the abundance of apps purporting to foster these early literacy abilities, there is a need for research that considers the effectiveness of such apps and how these integrate or complement traditional instruction to develop phonemic awareness in young students.

Phonics. Phonics instruction includes letter knowledge, knowledge of the alphabetic principle and word recognition strategies. Adams (1990) asserted that beginning reading instruction ought to include "activities requiring children to attend to the individual letters of words, their sequencing, and their phonological translations" (p. 237). Pressley's (2006) summary of the body of research on phonics instruction emphasizes the necessity of "explicit efforts to teach the alphabet, letter-sound associations and sounding out of words" (p. 163). There is a consensus among literacy education scholars and experts that no one method or program of phonics instruction is superior to others. In the report of the National Reading Panel NICHD (2000) concludes, "Specific systematic phonics programs are all more effective than non-phonics programs

and they do not appear to differ significantly from each other in their effectiveness" (p. 2-132). Stahl, Duffy-Hester and Stahl (1998) state, "It is the emphasis on early and systematic phonics instruction that makes a program effective and that differences between approaches are relatively small" (p. 344). Cunningham (2011) argues that there is a research base to substantiate the suggestion that "effective phonics instruction might include a variety of approaches" (p. 201). While research demonstrates that effective early literacy instruction ought to include systematic, explicit phonics instruction, it is clear that no one program or method is consistently superior to others. With a wide assortment of phonics apps available there is a clear need for research to support teachers in their assessing the effectiveness of such apps in their instruction of these critical early literacy skills.

Letter Knowledge. Letter knowledge is a component of phonics learning. Certain instructional practices have repeatedly been shown by research to be effective for teaching letter knowledge. Letter knowledge includes knowing the names of each of the 26 letters of the English alphabet, and the associated graphemes (written symbol) and phonemes (sound). Morrow et al. (2011) suggest letter knowledge instruction ought to include teaching children the letters in their own names, and letters such as "S," "T," "B," and "P," frequently occurring letters that have the letter sound in the letter name, teaching more than one letter a week and exposing students to the letters often. Schickedanz (1998) argues that children's exposure to letters and letter knowledge instruction must occur in authentic contexts where the purpose of the letters is obvious, for example, in their own names, classroom signs or titles of storybooks (p. 23). Bear et al. (2012) suggest building words with letter tiles, sharing alphabet books, pointing out letters in

signs around the school building and working with a variety of materials to make letters (markers, chalk, stamps, clay, pipe cleaners) as instructional activities to support students' development of letter knowledge (p. 110). Researchers and educators have indentified numerous creative, engaging and interesting ways to teach letter knowledge in authentic reading and writing contexts. However, letter knowledge instruction cannot be isolated from instruction of the alphabetic principle.

Alphabetic Principle. There are abundant best practice instructional activities to develop students' understanding of the alphabetic principle. Chall (1967) found through her analysis of studies related to letters and letter-sound relationships that instruction that taught the names of letter and the sound values of letters helped children in the beginning stages of learning to read (p. 149-150). Morrow et al. (2011) name several instructional activities based on working with word families (ending rimes, such as –at, -in, -an), including making word family books with words and illustrations, and "matching, classifying, sorts, puzzles, arranging magnetic letters in white boards and making words with oak tag letters in a pocket chart" (p. 75). Bear et al.'s (2012) *Words Their Way* offers numerous approaches to word sorting that are designed to foster and develop students' understanding of the alphabetic principle. Pressley (2006) states that games and activities, as well as picture mnemonics (for example, drawing a pair of wings on a 'W' to integrate the grapheme with a word beginning with the initial sound) are effective for developing students' understanding of the alphabetic principle (p. 152). Pressley also argues that students ought to be afforded lots of practice reading and writing words, both in isolation and in texts. Reading research has agreed on the many types of activities that develop the alphabetic principle in beginning readers. Although one such activity may be

practice using an alphabet app, there is little research that suggests best practices for integrating alphabet learning and practice on apps with traditional print-based approaches. Further, there are few resources for teachers to assess the effectiveness of alphabet apps.

      Word Recognition. Connected to phonetic reading and phonics instruction, word recognition instruction often includes sight word instruction and, less frequently, instruction that supports decoding by analogy.

      Sight Words. Pressley (2006) states, "For good readers, many words are sight words," (p. 51). LaBerge & Samuels' (1974) theory of automaticity states that reading sight words requires little or no effort for a skilled reader. In elementary schools "sight word lists" are often compiled and included in instruction. These lists include high frequency words that often violate the principles of sequential phonetic decoding (Cunningham, 2011, p. 53). Researchers agree that repeated and frequent reading is the most effective means of developing an automatic reading vocabulary (Bear et al., 2012; NICHD, 2000; Pressley, 2006). Many available apps claim to practice sight words, however, little is known about the effectiveness of practicing sight words using apps.

      Decoding by Analogy. Decoding by analogy refers to the practice of drawing on recognizable chunks of words to decode an unknown word. Pressley (2006) argues that beginning reading instruction ought to teach the flexible use of both sounding out or blending individual letters, and decoding by analogy (p. 172). Decoding by analogy is best taught by teaching students key words and letter combinations, and by integrating this instruction with synthetic phonics (Pressley, 2006). Bear et al.'s (2012) pattern sorts (for example, words spelled with –air and words spelled with –are) is an example of an

instructional practice that integrates decoding by analogy (automatic recognition of letter combinations, or "chunks") with synthetic phonics (p. 57).

Language development. Oral language development is an important component of early literacy. Instructional activities known to support oral language development include read aloud practices such as reading with expression to students, asking students open-ended questions while reading and discussing new vocabulary. Additionally, having students repeat key phrases from books, and recite rhymes or poems also supports oral language development (Morrow et al., 2011; NELP, 2008; Roberts, 1998). The multimodal affordances of literacy learning with apps suggest potentially valuable opportunities for language development. However, little is known about effective instruction practices with apps to foster early learners' language development.

Vocabulary. A critical component of reading comprehension, vocabulary instruction includes both word knowledge and use of strategies to understand new words encountered during reading. Research has documented that vocabulary is correlated to academic success and that a child's social class impacts the size of their vocabulary before beginning school (Hart & Risley, 1995). Since vocabulary is linked to academic achievement and is so critical to comprehension, vocabulary instruction is of great importance in early elementary school years. Best instructional practices for vocabulary learning include frequent and repeated read alouds, discussion of new vocabulary prior to readings, building upon students' oral vocabularies, repeated exposure to words in different contexts and teaching both individual words and word learning strategies (Blachowicz & Fisher, 2011; Graves, 2006; Morrow et al., 2011; NICHD, 2000; Pressley, 2006). There is a clear consensus among reading researchers about both the importance

of vocabulary learning and the instructional methods that most effectively accomplish such learning in traditional print. However, certain affordances of apps (just-in-time vocabulary assistance, read-aloud, dictionary) are significant to vocabulary development and instruction. There is a need for a deeper understanding of how positive affordances of apps can be used in instruction to develop early learners' vocabularies.

Comprehension. Pressley (2006) argues, "Good readers are continuously attempting to construct meaning," a practice he and Afflerbach (1995) refer to as "constructively responsive reading." Pressley sees constructively responsive reading as an "appropriate goal" for reading teachers and asserts that this instruction ought to begin in elementary school. The early elementary years should not focus on "learning to read" (phonics and decoding) to the exclusion of comprehension strategies instruction. In fact, research suggests many best practices for early elementary comprehension instruction. For example, early elementary teachers should teach comprehension strategies including making predictions, asking questions, clarifying what is read, making mental images, using prior knowledge, summarizing and interpreting (Morrow et al., 2011; Pressley, 2006). Specific practices such as "picture walks" (prereading familiarization with a text), using graphic organizers to chart story structures, having students close their eyes and visualize certain events, or using Post-It notes to record questions during reading are all examples of early reading instruction that teaches comprehension strategies (Morrow et al., 2011). Research has demonstrated that is it not only possible, but very important that early elementary literacy instruction foster students' development of comprehension strategies. Apps that claim to support comprehension strategy development are generally multiple-choice questions about brief, poorly written paragraphs. There is, perhaps, the

most pressing need for research to identify instructional uses of apps that support practice and development of comprehension skills.

Writing. Writing in the early elementary years is also a critical component of literacy learning. Research has documented that children progress through developmental stages of writing such as scribbles to random letters and invented spelling to conventional spelling. Early writing may also include drawings and literacy instruction ought to include opportunities for students to "write" at their developmental level (Casbergue, 1998; McGee & Richgels, 1990; Morrow et al., 2011). Teachers should develop instruction that connects writing to authentic purposes such as notes, letters, recipes, something that could be shared online or poetry. Students should receive constructive feedback about their writing and have opportunities to share their writing (Morrow et al., 2011). Given the seemingly boundless possibilities of digital composition and multi-modal representation of meaning, there are exciting possibilities for using apps with young writers. Although research has well established effective instructional practices for early writers in traditional print forms there is much to study and learn about using apps with early learners for multi-modal composing.

Cultural and linguistic diversity. Best practices for early literacy instruction when working with students who are ELLs should include the best practices for early literacy instruction previously described. However, since literacy learning in a second language is a complex and challenging process, literacy instruction for ELLs must "go beyond" these practices to address, honor and integrate the linguistic and cultural contexts of ELLs (Helman, 2009, p. 237). The IRA's position statement on second language literacy instruction recognizes the complexity of second language literacy

learning and asserts that the instructional goals of second language literacy instruction should be proficiency in the dominant language, that bilingualism or multilingualism is desirable, and when possible, families ought to be able to select the language in which initial literacy instruction occurs (IRA, 2001). When instructing ELL emergent readers "oral English and the written code become simultaneous goals" (Helman, 2009, p. 117). Therefore instructional activities must afford students opportunities to develop both their use of English oral language and code-based literacies. Emergent literacy instructional activities when working with ELLs might include using picture books and poetry, engaging in concept sorts, practicing reading sight words, hearing sounds in words and learning the alphabet. Academic vocabulary and language structure must be integrated into literacy instruction (Helman, 2009; Helman, 2012). Making connections between what students know in their home language and English literacy learning supports ELLs in their learning (Au, 2009; Helman, 2012). Although the instructional best practices used with native English speakers ought to be utilized when working with ELLs they are not enough. Instruction must be explicit and systematic, and include practices such as modeling, providing visuals and contextualization (such as artifacts), and opportunities for vocabulary and language development (Carlo & Bengochea, 2011; Helman, 2009). Best practices for early literacy instruction for ELLs starts with the same instructional practices used with native speakers and goes beyond those practices to support oral language and vocabulary development and address students' cultural contexts. There is a need for research that documents how affordances of apps for literacy learning shape the learning and experiences of ELLs and how these tools might best be implemented to meet unique needs of ELLs.

Motivation. Consideration of best practices for instruction at any developmental level, in any subject area, must attend to issues of motivation. Students' perceptions of their own ability to successfully complete a learning task and the value they attribute to the task itself shape and inform the student's approach, engagement and success with that specific task. Teachers must account for these factors in their instructional planning. For example, self-efficacy theory suggests students with high self-efficacy (perceived capabilities for learning or performance) work harder, are more persistent and achieve more academically. Teachers can impact students' self-efficacy through decreasing competition among students, avoiding ability groupings, providing feedback that supports students' accurate self-assessment, offering opportunities for self-evaluation and clearly conveying information about students' learning (Bandura, 1986; Schunk & Pajares, 2009). In addition to students' self-efficacy, the value students assign to a task influences their performance of that task. Expectancy-value theory suggests that when students believe they will do well on a learning task (expectancy) and they value the task they are more likely to engage and persist in completing the task. Implications for instruction include focusing on learning rather than performance outcomes, allowing students to have some control and choice over their learning tasks, believing and expecting all students will be able to learn and success, and creating challenging and interesting cognitive content (Wigfield, Tonks & Klauda, 2009). Although developed for adolescent literacy instruction, O'Brien and Dillon's (2014) set of instructional practices to increase motivation may be adapted to early literacy instruction. Teachers can increase students' sense that they can complete a literacy task by offering compelling reasons to read, giving procedural feedback and strategies instruction. They can increase students'

likeliness to want to complete a literacy learning task by providing a range of engaging texts to read, offering students choices of both texts and tasks, and connecting reading tasks to students' personal goals. Teachers can help students feel they have what they need to succeed by providing explicit instruction of strategies, opportunities for feedback, avoiding competition and engaging in reading for a variety of purposes (O'Brien & Dillon, 2014). Research has demonstrated that motivational constructs such as self-efficacy and expectancy-value influence learning outcomes. Therefore any consideration of best instructional practices must attend to these factors. Given the excitement students display at the prospect of using handheld devices and apps in the classroom the impact of these tools for learning on student motivation warrants careful study.

Research in the field of early elementary literacy instruction has yielded ample and rich knowledge of effective instructional practices that lead to successful student literacy learning in traditional print-based texts. A limitation of the existing research is that there is little know about how to effectively integrate handheld devices and apps into early literacy instruction in innovative ways that fully realize the potential of these technologies.

Digital Literacies

Altering the nature of literacy. As technology becomes increasingly pervasive the question of how to effectively integrate technology into literacy teaching and learning is of the utmost importance. Coiro, Knobel, Lankshear and Leu (2008) pose the pressing question at the core of new literacies research: "How do the Internet and other information and communication technologies (ICT) alter the nature of literacy?" (p. 1).

This question includes early literacy, although little research has examined how early literacy instruction is altered by ICTs. In the *Handbook of Research on New Literacies* Coiro et al. (2008) outline four characteristics of a new literacies perspective: that new technologies (a) "require us to bring new potentials to literacy tasks that take place within these technologies," (b) are "central to full civic, economic and personal participation in a world community," (c) are "deictic; they rapidly change as defining technologies change" and (d) are "multiple, multimodal and multifaceted" (p. 14). O'Brien & Scharber (2008) define digital literacies as "socially situated practices supported by skills, strategies and stances that enable the representation and understanding of ideas using a range of modalities enabled by digital tools" (p. 66-67). These perspectives underscore the fact that literacy is a dynamic construct and that the understanding and creating multimodal texts requires new skills, strategies and abilities. Although historically teachers have used technology to support the development of traditional print-based literacy, it is clear today that "as technology has evolved it has created new types of literacy demands" (McKenna, Labbo, Conradi & Baxter, 2011). There is a pressing need for teachers of early elementary grades to consider how their literacy instruction can foster student's development of new literacies skills and strategies. Furthermore, handheld devices, (iPads, iPhones or iPod Touch) and iOS apps designed for these devices are increasingly used in early elementary classrooms, creating the quandary of how these handheld devices and apps ought to be used in early elementary literacy instruction.

  Affordances. Handheld devices and iOS apps offer users multimodalities with which meaning might be made. Therefore the concept of "affordances" is useful in these considerations. With the shift from print to digital media "it becomes easier to use a

multiplicity of modes, such as images and sounds, to signify meaning" (Roswell & Lapp, 2011). Kress (2003) states, "The affordances of different modes have profound effects on that which is to be realized in the mode" (p. 50). This idea underscores the importance of considering what is afforded by the multimodalities of these handheld devices. When assessing iOS apps, affordances include "What each app offers or how it presents for the learner opportunities for learning or…to devise activities that enable literacy practices" (Beach & O'Brien, 2012). Affordances may be defined as: "A characteristic property, something offered or some action enabled-or, more precisely, an action enabled in a certain environment" (O'Brien & Voss, 2011, p. 75). Affordances can be positive, offering something beneficial to the reader and enabling the reader to do something considered valuable, or affordances can be negative, inhibiting certain actions, preventing certain behaviors or leading to unintended negative consequences (O'Brien & Voss, 2011). Furthermore, Wijekumar, Meyer, Wagoner & Ferguson (2006) differentiate between "game affordances" that offer and enable entertainment, and "learning affordances" that offer and enable learning opportunities. Wijekumar et al. (2006) suggest that technologies may be designed to engage students through "game affordances" and gradually move them to "learning affordances." While many literacy and new literacies researchers agree that "carefully naming and studying affordances might provide a better understanding of new digital environments and the design of "value added" literacy opportunities" (O'Brien & Voss, p. 75, 2011), little work of this nature has focused specifically on early literacy instructional opportunities. Therefore, research is only beginning to understand the knowledge and processes teachers draw upon to integrate apps and web tools into their early literacy instruction.

Overall, little is known at present about the knowledge and processes early elementary teachers draw upon to integrate best practices for early literacy instruction with affordances of handheld devices and apps. New literacies as a field of educational research is inherently deictic, dynamic and transformative. Therefore, concepts such as positive and negative affordances and questions such as "How do ICTs alter the nature of literacy?" are useful and important guides to the study, description and analysis of early elementary teachers' instructional app use.

Technology Integration

Research in the area of learning technologies has identified critical factors that impact the implementation of various technologies in K-12 classrooms. Since iPads were first available in 2010 (Murray & Olcese, 2011) at present there is limited research studying factors that impact the relative success of the integration of these specific devices (iPads) in teaching and learning. Therefore, a broader consideration of the research on educational technology integration initiatives (such as one-to-one laptop programs) identifies multiple barriers and obstacles, as well as benefits, to technology integration. This section of the review of research explores findings of the existing body of research in this field and discuss current understandings of the importance of teacher-related factors, professional development strategies and additional technical support, infrastructure and leadership factors that impact the success of technology integration. Research also suggests the benefits of technology integration to students and to teachers as well. Finally, this section concludes with an examination of some of the often-cited

criticisms raised in conjunction with technology integration and current conflicting or inconclusive evidence related to these concerns.

Essential components of effective implementation. A review of the research literature on technology integration in K-12 classrooms suggests that the most frequently validated critical factors impacting the implementation of technology in classrooms are related to teachers, including teachers' knowledge, attitudes, beliefs and readiness. Given the established significance of teacher factors, research has identified certain effective characteristics of professional development. Professional development embedded in a technology integration initiative potentially has a powerful impact on teacher knowledge, beliefs, attitudes and actions, and therefore on student outcomes. Research also suggests specific characteristics of school leadership and infrastructure that facilitate successful technology integration.

Teacher factors. Research in the field of learning technologies has clearly established the influential power of teacher factors on the how technology is used in teaching and learning. Bebell & Kay (2010) contend, "It is impossible to overstate the power of individual teachers in the success or failure of 1:1 computing" (p. 48). Shapley, Sheehan, Maloney & Caranikas-Walker (2010) offer further insight into the impact of teachers stating, "Teacher buy-in for technology immersion is critically important because students' school experiences with technology are largely dictated by their teachers" (p. 24). In a 2012 study Lowther, Inan, Ross & Strahl found evidence that "Teachers who have higher technical skills and hold positive beliefs and readiness are more likely to integrate computers into classroom instruction" (p. 23). Ertmer (1999) identified two types of barriers to technology integration into curricula: external, or first-

order, barriers such as lack of planning time, access and support, and internal, or second-order, barriers as "teachers' beliefs about teaching, beliefs about computers, established classroom practices and unwillingness to change" (p. 48). These internal barriers posed a far more significant obstacle to successful technology integration than external barriers. Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur & Sendurur's (2012) study of the alignment of pedagogical beliefs and classroom technology use of exemplary teachers found that teachers rated internal factors of inner drive and beliefs as having the most influence on their use of technology in their instructional practices. The participant teachers conceptualized their beliefs as facilitating their exemplary use of technology for instruction, while they also identified their less successful colleagues' beliefs as a significant barrier to their use of technology. Ertmer and colleagues describe teachers' internal barriers as the "true gatekeepers" that must be addressed if the learning and teaching potential of technology integration is to be fully realized. Inan & Lowther (2010) also found that teacher readiness (knowledge, skills and confidence to teach with technology) and beliefs (perceived value of technology) strongly predicted the outcomes of one-to-one technology initiatives. Drayton, Falk, Stroud, Hobbs & Hammerman (2010) connected how teachers use technology to their judgment of the benefits afforded to their teaching and to their students' learning and engagement by using the particular technologies. There is ample evidence that teacher factors including knowledge, beliefs, attitudes and readiness have a significant impact on the implementation of technology in classrooms.

     Fostering teachers' powerful ideas. Scholars in the field of learning technologies have identified conceptions or approaches to integrating technology into instruction that

are associated with successful and innovative use of various technologies for learning. Developed by Mishra & Koehler (2006), Technological Pedagogical Content Knowledge (TPCK) is a useful framework for thinking about teachers' knowledge. The TPCK framework conceptualizes three types of teacher knowledge: (a) content knowledge (knowledge of subject matter taught), (b) pedagogical knowledge (knowledge about processes and practices of teaching and learning) and (c) technology knowledge (more fluid and rapidly changing than the other types of knowledge, ways of thinking about and using technology). These three types of knowledge create a Venn diagram with overlaps including pedagogical content knowledge, technological pedagogical knowledge, technological content knowledge, and in the space where all three types of knowledge intersect, the ideal goal of technological pedagogical content knowledge. This framework conceptualizes TPCK as the basis for effective teaching with technology, that to successfully teach with technology educators must be "continually creating, maintaining, re-establishing a dynamic equilibrium between each component" (Mishra & Koehler, 2006, p. 2221). This framework offers a compelling way to think about the requisite knowledge for integration of technology into early literacy teaching and learning, while underscoring the inherently dynamic and transformative nature of technology. Mishra, Koehler & Kereluik (2009) differentiate between basic skilled usage of technology and instructional usage of technology, asserting that teachers must learn both skills. Mishra et al. call for innovations that focus not on specific technologies, but rather allow educators to develop "Flexible and robust knowledge frameworks that are not dependent on the specific affordances of a particular technology, but rather connect to powerful ideas about teaching and learning" (p. 49). In an article advocating for an

integrated approach to the role of media in learning and instructional design, Tennyson

(1994) echoes a similar sentiment: "Computer-based prescriptions (i.e., ranging from

computer-assisted instruction to simulations to mindtools) can improve learning when

they are viewed as an integral component of the entire instructional design" (p. 19).

Lehmann & Livingston (2012) argue that one-to-one technology integration requires a

"Powerful change in pedagogy" (p. 75). Thus successful integration of technology in

classrooms is reliant upon certain skills and dispositions in teachers, including flexible

thinking, creative problem solving, ingenuity and openness (many of the 21st century

skills educators seek to develop in K-12 students through the use of technology). Mishra

and colleagues call for a perspective shift, stating, "If technology is truly to be beneficial

to education, the power and potential of educational technology must be acknowledged to

reside within educators and not within objects" (p. 52). Numerous studies have verified

the significant impact of teacher factors such as knowledge, beliefs, readiness and attitude

on the resulting success, or lack thereof, on technology integration.

Professional Development: Researchers have found that professional

development that fosters certain knowledge and beliefs, skills and dispositions in teachers

yields successful integration of technology into instruction. Therefore, effective

professional development is critical to a successful learning technology initiative.

Teacher knowledge and frameworks for technology use. Researchers have

developed effective theoretical frameworks to categorize and describe potential uses of

technology in learning. These frameworks that aid educators in thinking about and

planning strategic ways to use technology for instruction are often used in professional

development related to technology integration. For example, Hughes, Thomas and

Scharber's (2006) RAT Framework for technology integration differentiates between technology as (a) replacement (e.g., replaces or replicates existing practices with no modification to processes or goals), (b) technology as amplification (amplifies existing practices and allows them to be done more effectively without changing goals) and (c) technology as transformation (transforms, restructures and reorganizes existing practices and goals). Puentedura's (2010) SAMR model categorizes uses of technology in the classroom as either enhancement or transformation. Enhancing uses of technology are broken into two possible categories: (a) substitution in which the technology is a "direct tool substitute with no functional change," or (b) augmentation where the technology used is a "direct tool substitute with functional improvement." Transformative uses of technology are classified as either: (a) modification which is evidenced by the technology allowing for "significant task redesign," or (b) redefinition, indicated by the technology allowing for "creation of new tasks previously inconceivable." Professional development accompanying a technology integration initiative often teaches educators frameworks such as RAT and SAMR, and teachers can use these frameworks to increase their critical decision making as they integrate technology into their instructional practices.

Targeting teacher beliefs. Research suggests that technology integration initiatives must include professional development that focuses on increasing teachers' knowledge and skills about integrating technology into their instruction such that their confidence is increased, their fear is reduced and their beliefs align with those beliefs verified by research to positively support technology integration. Inan & Lowther's (2010) study found that professional development has a strong effect on teacher beliefs and readiness. Sell, Cornelius-White, Chang, McLean & Roworth's (2012) meta-

synthesis of research on one-to-one technology initiatives found that "Professional development will be more successful if it addresses teacher beliefs about instruction and technology, includes relevant hands-on training, involves collaborative or cooperative learning among teachers" (p.28). These findings verify that a major goal of professional development ought to be the targeting of teachers' beliefs through a focus on pedagogical aspects of integration. Drayton et al. assert, "Lack of time for professional development, especially in the form of teacher collaboration to develop best practices within the school, becomes a barrier to effective integration of computer and web resources in the classroom" (p. 41). A summary of research findings on laptop initiatives across six states conducted by Argueta, Huff, Tingen & Corn (2011) also found evidence that professional development must be high quality, well-planned and sensitive to the needs of teachers, particularly the need to collaborate with colleagues. A review of the literature verifies the critical importance of ongoing, systematic professional development designed to foster collaboration among teachers and positively impact teachers' beliefs, readiness and sense of self-efficacy to teach in innovative ways with technology.

Technical support, infrastructure and leadership. Researchers have identified additional factors that must be in place for the implementation of a technology integration initiative. For example, technical support is critical (Lehmann & Livingston, 2012). Although Inan & Lowther (2010) found that professional development had the greatest impact, they found evidence that the availability and quality of technical support also predicted the frequency of teachers' use of technology. Sandholtz & Reilly (2004) claim that quality technical support assures that teachers are able to focus their efforts on integrating technology into their instruction rather than finding themselves "Bogged

down at the initial stage of trying to learn about technology itself" (p. 506). Argueta et al. (2011) found that infrastructure played a critical role in success of an initiative. In their study across six states with laptop initiatives these researchers found that schools with more robust infrastructure found more positive student and teacher outcomes as a result of their technology integration than schools with less developed infrastructure. Administrative support, encouragement and goal setting were also found to impact teachers' use of technology (Inan & Lowther, 2010; Bebell & O'Dwyer, 2010). Argueta et al. (2011) named effective school and district leadership as a critical factor to successful laptop initiatives. Warschauer's (2007) research identified an amplification effect that explains in part why school and district leadership has such critical implications for technology integration. In his study of one-to-one laptops across two states he found that instructional strengths of schools (a factor shaped by leadership) were amplified by the implementation of technology. He states, "Laptops will not make bad schools good, but they will make good schools better" (p. 2537). There is ample evidence from the literature that a robust infrastructure, technical support and strong school and district leadership are essential components of technology integration. While research suggests that the impact of these factors is not as great as that of teacher factors and professional development, technical support, infrastructure and leadership have been verified by research to have an indirect effect on teachers and professional development. Therefore any consideration of technology implementation must take these crucial components into consideration.

Benefits of successful technology integration. A review of current research identifies benefits of well-executed technology integration initiatives for both students

and teachers. Student benefits include increased engagement in learning and acquisition of critical 21st century skills. Teacher benefits include increases in the quality of instruction and adoption of more student-centered pedagogical practices.

Student benefits. Technology integration yields numerous benefits to students. Two of the most significant benefits verified by multiple research studies are increased engagement in learning and the development of 21st century skills such as the ability to work independently, consume information critically, and collaborate with others. For these benefits to be fully realized technology integration must be implemented with student-centered instruction practices and learning environments.

Student engagement is often cited as a significant positive affordance of technology integration. Cavanaugh, Dawson & Ritzhaupt's (2011) study of Florida's "Leveraging Laptops" program found evidence of increased student attention and motivation resulting from the presence of 1:1 laptop computers in classrooms. Increased access to technology is frequently associated with increased student engagement and motivation in instruction (Argueta et al., 2011; Inan & Lowther (2010); Bebell & O'Dwyer (2010). Sell et al. (2012) found through their meta-synthesis of research that 1:1 technology initiatives proved to have a positive impact on students' engagement and motivation, as well as students' attitudes towards technology and various subject matters. Argueta et al. (2011) also found evidence that shifts from teacher-centered to student-centered instructional practices led to "Students becoming more self-directed learners" (p. 15). Research has documented noteworthy impact on student engagement in learning associated with technology integration.

However, the mere act of placing technology in classrooms does not automatically yield increased student engagement. Scholars suggest that student engagement is increased when technology initiatives implement meaningful and innovative shifts to student-centered instruction and learning environments. Sell and colleagues warn, "Student engagement is improved when 1:1 technology is supplemental to systematic improvements in the teaching and learning environment rather than as a stand-alone intervention" (p. 21). Bebell & O'Dwyer (2010) also emphasize the critical nature of instruction and learning environment contexts for engagement affordances of technology to be realized by stating, "The point of any far-reaching technology (pencil, text book, laptop) is not the mastery and success of the said technology, but the improvement of the process and environment in which teaching and learning occur" (p. 12). These scholars suggest that positive affordances of student engagement depend not on the presence of technology tools, but rather on the impact of said tools on the learning activities and environment.

Researchers have identified characteristics of learning environments where technology integration is structured to develop 21st century skills in students. Cavanaugh and colleagues (2011) describe increased student-centered, project-based learning as indicative of a technology integrated learning environment that afford students ample opportunity to develop 21st century skills. Ertmer et al. (2012) discovered that highly successful teachers use technology to create learning environments conducive to self-directed learning, collaboration and problem solving. Sell et al.'s (2012) study found that in technology classrooms with positive student outcomes, included the achievement of goals beyond the scope of "traditional achievement," that students demonstrated 21st

century skills such as the ability to critically evaluate, consume and synthesize information, complete large, complex projects and collaborate not only with peers, but with individuals from greater communities. Argueta et al. (2011) state, "Evaluators also report that laptops have facilitated the development of 21st century skills (e.g., digital literacy, creativity and innovation skills, critical thinking and problem solving skills, communication and collaboration, and self-directed learning) among students" (p. 15). Inan & Lowther's (2010) study comparing the 21st century skills of students in 1:1 laptop classrooms in Michigan with students in a control group (no laptop initiative) found that students in the 1:1 classrooms demonstrated greater 21st century knowledge and skills including critical thinking, communication, collaboration and creativity. Warschauer's (2007) work found that students in laptop classrooms learned to access and manage information and incorporate it into written and multi-media projects, demonstrating skills conducive to success in the 21st century work force. Ertmer et al. (2012) call for sense of urgency to develop students' thinking skills in preparation for the 21st century workforce. They argue that technology should "Be placed in the hands of students, who are encouraged and enabled to utilize it in the same ways, and for the same purposes that professionals do-that is to communicate, collaborate and solve problems" (p. 424). While technology integration has been verified to develop 21st century skills in K-12 students, there is clear evidence that these tools for learning must be implemented in specific and deliberate ways if students are to develop these abilities.

Teacher benefits. If potential student benefits from technology integration are to be an actuality teachers must engage in certain instructional practices and create specific learning environments using technology tools. A review of the research suggests that

benefits of technology integration for teachers include meaningful shifts in instructional practices towards student-centered teaching and learning environments, which in turn functionally improve the quality of instruction while increasing teachers' confidence and self-efficacy to teach with learning technologies.

Many researchers have found evidence that technology integration, implemented with attention to the concerns previously described, yields increases in student-centered teaching practices. By comparing baseline and end-of-the year observation data from "Leveraging Laptop" classrooms Cavanaugh et al. (2011) found a meaningful increase in student-centered, project-based learning through changed teaching practices. Inan & Lowther (2010) consistently found that increased access to technology for instruction expanded teachers' skills both using and teaching with technology (with effective professional development as described previously). Argueta et al. (2011) found evidence that teachers in schools with laptop initiatives demonstrated changes to their pedagogical practices including shifts from teacher-centered to student-centered, and the adoption of the role of facilitator or coach within their classrooms. The shift towards student-centered teaching and learning is a clear benefit to teachers resulting from a well-implemented technology initiative.

Technology integration offers additional potential benefits to teachers. Warschauer (2007) found in his research, "One of the greatest benefits of one-to-one learning, in teachers' eyes, is the wealth of information that can be brought into the classroom at the time that students can best make use of it" (p. 2518). He elaborates on teachers' perceived benefits of technology integration including "just-in-time" learning opportunities, increased autonomous and individualized instruction, greater ease of

conducting research, increased empirical investigation and opportunities for in-depth learning. While technology initiatives hold significant potential benefits to teachers, specifically in the form of improved instructional practices, teachers' knowledge, beliefs, attitudes and readiness as described earlier clearly impact whether these benefits are reaped.

Concerns and unknowns. Research remains inconclusive at present about several frequently cited concerns about technology integration, including the impact on student achievement as measured by standardized tests, the value of technology relative to the cost (or the return on investment (ROI)) and the wide range of instructional uses of technology that vary greatly in effectiveness and potentially further existing inequities in K-12 education. In 2004 Zucker called for research that would allow better understandings of the cost of 1:1 computing and the impacts on student achievement, however, to date research remains contradictory or inconclusive on these important issues.

Cost relative to student achievement. Researchers, school leaders and policy makers often express concerns as they contemplate issues of student achievement and cost vs. benefits of technology integration. Warschauer (2008) names the expense of technology is a major disincentive to implementing 1:1 initiatives. Cost and funding become of particular concern to educators and policy-makers in light of the inconclusive findings regarding the impact of technology integration on student achievement as measured by standardized test scores. Sell et al. (2012) found that writing was the academic area of student achievement that was most significantly positively impacted by 1:1 laptop initiatives, but the impact was inconsistent or minimal on other academic areas

tested. Given this finding, Sell and colleagues acknowledge that at present research does not verify any definitive statements regarding the cost of such initiatives in relation to the benefits. Argueta et al. (2011) found similarly inconclusive evidence that although teachers alleged increases in student achievement resulting from laptop initiative, that only some standardized test scores supported their assertions. Notably, Warschauer (2008) attributes the lack of impact on standardized test scores to the mismatch between what students learn in student-centered, technology integrated classrooms (21st century skills and what is measured and assessed on standardized, high-stakes tests. This fact implies that a consideration of the costs in relation to the benefits ought to include expanded definitions of benefits beyond standardized test scores.

Issues of equity. An additional concern about technology in classrooms that warrants careful consideration is the use of technologies in instruction that is nether transformative, nor engaging, that merely uses these costly tools for "drill and practice." Murray & Olcese's (2011) study of teaching and learning with iPads characterized the classroom use of these technologies they observed as "digital flashcards," stating, "In the context of a K-12 classroom there are few examples of iPad applications that we studied that support truly innovative teaching and learning in the sense that they represent resources that extend what educators and students could otherwise do" (p. 46). When these teacher-centered, ineffective instructional practices intersect with historic and systematic oppression of certain student groups within school systems, technology integration becomes a problematic component of the opportunity gap. A concerning finding from Ross et al.'s (2004) work suggests that "high-risk" schools frequently use computers for non-critical thinking activities such as "drill and practice," direct

instruction and independent seat work, yielding low levels of student learning. This trend indicates that if technology implementation fails to align with the research-validated practices described above, in the case of schools that serve traditionally marginalized populations, the integration of technology may contribute to further deepening these gaps in opportunity among racial, ethnic, linguistic and socio-economic divisions. Warschauer's (2008) work indicated that technology integration did not decrease "achievement gaps" for several reasons, including the schools' lack of preparation to integrate technology and the students' limited literacy skills and lack of prior experience with computers. The potential of technology integration to further deepen gaps in opportunity (or achievement) is real and pressing concern for researchers, policy-makers and school leaders.

In closing, given the rapid pace of technological advancements research ought to focus on "broader, generative frameworks of thought" (Mishra, Koehler & Kereluik, 2009) rather than specific technologies. The existing research on technology initiatives offers critical understandings about research-based practices and strategies for technology integration. This review of the research suggests the importance of studying specific contexts within which learning technologies are implemented to more deeply understand the impact of these tools on teaching and learning. Sell et al. (2012) contend, "The findings from research on 1:1 educational technology initiatives have inherent limitations that reflect a particular time periods, local and cultural context, set of practices, and available technologies" (p. 1). Similarly, Tennyson (1994) asserts, "Media (technology) will always be embedded in a complex association with instructional methods, learner

variables, content, context and risk" (p. 27). Therefore research in this area must be conducted with careful attention to contexts for teaching and learning.

Early literacy learning is arguably one of the most critical elements of a young person's education. Fortunately, there is a well-developed body of research about early literacy instructional practices in traditional print-based forms. In contemporary schools, learning technologies offer boundless educational potential, yet they are only as effective as the teacher who wields them. At present, educational scholars are engaged in innovative research in the fields of digital literacies and learning technologies that explores the potentials and possibilities of new technologies. Further, researchers are also discovering best practices for the integration of learning technologies into classroom environments, including implications for effective professional development. At present, increasing numbers of schools are implementing learning technologies such as handheld devices and apps in early elementary classrooms. Today's educators must meet the pressing need for learning opportunities for that allow students to develop 21st century skills requisite to full participation in the global community.

Currently little is known about how teachers approach the integration of new learning technologies with their knowledge of best practices for effective early literacy instruction. Further, research has not yet documented what literacy teaching and learning look like in early elementary classrooms with handheld devices, nor how teachers' knowledge, beliefs and practices are impacted by their experiences, observations and reflections as they integrate handheld devices and apps into their literacy instruction. These critical questions are best answered with naturalistic inquiry and case study

methodologies. These methodologies allow me to illuminate the perspectives of teachers, describe their instructional cycles and explore the processes in which they engage by investigating these phenomena in "real-life context" (Yin, 1994, p. 13). In Chapter 3 I present my research methodology. I begin by describing the theoretical framework that undergirds this study. I then explain the research methodologies I selected and my rationale for those choices. I also describe my role as researcher and my participants and site. Finally, I conclude Chapter 3 with a description of my data collection tools and analysis and interpretation strategies.

Chapter 3

Research Methodology

Scholarship in both early literacy and new literacies employs a wide range of research methodologies. Diverse methodologies and epistemologies have increasingly been used in the field of literacy research (Duke & Mallette, 2001). New literacies perspectives are grounded in the assumption of multiple realities, and theoretical and methodological stances that "acknowledge the complexity and variation inherent in classrooms and the diverse roles that technology can play in relation to complex sociocultural factors" (Labbo & Reinking, 1999, p. 479). There is not a single, standard methodological approach to studying new literacies, or specifically to studying handheld devices and apps in early literacy instruction. Therefore this study was designed with the research questions positioned as the "heart" of the study, informing, guiding and connecting the other components of the research design (Corbin & Strauss, 2008; Maxwell, 2005). The design of this exploratory study employed carefully selected research methodologies woven together in the spirit of bricolage.

The purpose of this study was threefold: (a) to describe how early elementary teachers integrate technologies into the teaching of literacy when presented with new handheld devices from upper administration, (b) to examine how (and if) teachers integrate their knowledge of best practices for early literacy learning with multimodalities, affordances and value added literacy opportunities when reviewing and selecting handheld device apps for early literacy instruction and (c) to describe what happens when handheld devices are actually used in early literacy instruction, focusing

on app affordances, or "What each app offers or how it presents for the learner opportunities for learning or…to devise activities that enable literacy practices" (Beach & O'Brien, 2012). Research questions posed included:

1) To what extent and how are Kindergarten-3rd grade elementary teachers using technologies in their classrooms to teach early literacy (reading, writing and word study)?

2) To what extent and how are teachers choosing apps or web tools based on their knowledge of best practices for literacy instruction? (What characteristics of apps or web tools do teachers see as positive affordances, negative affordances and value added, a belief that it does a better job at the literacy practice than any known technology?)

3) When teachers and students use apps during instructional cycles, what does teaching and learning look like? From the perspective of teachers, what are the actual positive or negative affordances of using these apps to foster early literacy instruction in practice, including unanticipated affordances?

4) How are teachers' beliefs, knowledge, planning and instruction impacted by their experiences planning and teaching with apps and web tools, their observations of students' learning with these technologies and their reflections on classroom lessons?

As the review of literature in Chapter 2 revealed, there is a currently a gap in the research literature that may be addressed by answering these research questions. Scholars have yet to determine how teachers approach the integration of new learning technologies with their knowledge of best practices for effective early literacy instruction, what literacy

teaching and learning look like in early elementary classrooms with handheld devices, and how teachers' knowledge, beliefs and practices are impacted by these teaching and learning experiences. The purpose and research questions stated previously address this timely and pressing need for knowledge about teachers' beliefs, knowledge and practices as related to the integration of handheld devices into early literacy instruction. Chapter 3 details the research methodology I designed to answer my research questions and accomplish my three-fold purpose.

In the next section of Chapter 3, I describe the theoretical framework used to undergird my inquiry. This theoretical framework blends several scholarly traditions including constructivism, pragmatism and theories of learning, such as social cognitive theory and social constructivist theory. Following my explanation of the theoretical framework I grounded my research in, I discuss the researcher as "bricoleur," naturalistic inquiry, and case study methodologies that I employed in the study I conducted. I then turn to describing my role as researcher and the participants and site. I conclude Chapter 3 with a detailed description of my data collection tools (survey, interviews, verbal protocol, observation and photographs) and strategies I employed for data analysis and interpretation.

Theoretical Framework

A theoretical framework guides research by establishing "a system of concepts, assumptions, expectations, beliefs, and theories that supports and informs" (Maxwell, 2005, p. 33). In this section I will outline the philosophical perspective assumed in this study and describe the influencing theories. I drew from several scholarly traditions

including constructivism, pragmatism and theories of learning such as social cognitive theory and social constructivist theory. The research questions and goals of this study required a theoretical framework that emphasizes concerns of real-world practice, practical knowledge and understanding. I will articulate how these philosophies shaped my design choices including participants and site, sampling procedures, data collection methods, unit of analysis, interpretation and my role as researcher. Throughout this study practical consequences and real effects took precedence over strict, rigid adherence to tenets of constructivism, or any philosophical perspective. The blending of these philosophical perspectives informed my research design that drew from naturalistic inquiry.

Paradigms play a critical role in guiding researchers as they design and execute their inquiries. A paradigm may be defined as a set of beliefs, a worldview that defines "the nature of the "world," the individual's place in it, and the range of possible relationships to that world and its parts" (Lincoln & Guba, 1994, p. 107). Dillon et al. (2000) define paradigm as a "conceptual system…a self-sustaining, internal logic, constituted as a set of epistemological rules directed at solving problems matched to the logic and rules" (p. 13). The current study was influenced by the worldview, conceptual system and beliefs of constructivism, which is explained further below. However, this study was also influenced by pragmatism, a perspective in which the practical usefulness of the inquiry takes precedence over protecting or defending epistemologies (Dillon, O'Brien & Heilman, 2013). Dillon et al. (2000) credit Patton with the suggestion "that researchers work within a paradigm but bring in new frameworks, methods, and tools-whatever is needed-to better address the research questions at hand" (p. 15). Maxwell

(2005) argues that conceptual or theoretical frameworks are constructed or built by the researcher, rather than found; that they do not exist "ready-made" (p. 35). This study was designed and carried out in the spirit of constructing a framework appropriate to the inquiry. First the foundational paradigm of constructivism and the associated ontological and epistemological implications will be explored.

Constructivism

With disciplinary roots in sociology, constructivism is founded on the premise that humans' abilities to interpret and construct reality make the study of the human world inherently different than the study of the natural and physical world (Patton, 2002). Constructivism relies on the overarching belief that reality is socially constructed. Tenets of this paradigm include the existence of multiple realities constructed by humans, the belief that "truth" is consensus among those constructing, that phenomena must be studied in context to be understood, and that social groups construct their own realities (Lincoln & Guba, 1989; Patton, 2002). This study sought to document and understand the multiple realities constructed by teachers and the implications of the teachers' constructions on themselves and their students. According to Crotty (1998) constructivism holds the view that "all knowledge, and therefore all meaningful reality as such, is contingent upon human practices, being constructed in and out of interaction between human beings and their world, and developed and transmitted within an essentially social context" (p. 42). The assumption that all knowledge (all meaningful reality) is generated from interaction between people and their world in social contexts, suggests that to study and understand knowledge, or reality, the researcher must seek

understanding from people and by observing humans interacting with and in their world. To understand teachers' knowledge and their reality of teaching with specific learning technologies, I sought to understand how teachers constructed knowledge. The ontology (nature of reality, what can be known) of constructivism is relativist, composed of "multiple, intangible mental constructions, socially and experientially based, local and specific in nature" (Lincoln & Guba, 1994, p. 110) that are not more or less "true," but more or less informed and sophisticated as the human constructors acquire more information or sophistication. The epistemology (relationship between knower and known) of constructivism is transactional and subjectivist, that is the investigator and what is investigated are "interactively linked so that the "findings" are *literally created* as the investigation proceeds" and "knowledge as created in interaction among investigator and respondents" (Lincoln & Guba, 1994, p. 111). Tenets of the constructivist paradigm are woven with other complementary theories and philosophies used to build the framework for this study.

Pragmatism

Pragmatism also influenced this study in both the assumed relationship between knowledge and experience, and in the concern with solving problems and studying processes (Corbin & Strauss, 2008; Dillon et al., 2013). Early pragmatists such as Mead and Dewey were interested in the relationship between thought and action, knowledge and experience. Pragmatist philosophers viewed knowledge as created through action and experience. A recurring theme in Dewey's work is experience. This study assumes that experience creates meaning and knowledge and is social and communal. Dewey

(1929) states, "The test of ideas, of thinking generally, is found in the consequences of the acts to which the ideas lead, that is in the new arrangement of things which are brought into existence" (p. 136). This quote encapsulates the ongoing problem-solving process by which teachers experientially construct dynamic knowledge of how to use handheld devices and apps in early literacy instruction. According to Dewey (1916/2011) the nature of experience and the value of learning resulting from experience is a transactional process:

> A backward and forward connection between what we do to things and what we enjoy or suffer from things in consequence. Under such conditions, doing becomes a trying; an experiment with the world to find out what it is like; the undergoing becomes instruction-discovery of the connection of things. (p. 78)

Dewey asserts that an experience, while not primarily cognitive in nature, may include cognition in so far as the experience yields meaning. Thinking, understanding meaning and acquiring knowledge occur through experience only when there is a connection between doing (trying) and consequence. Studying instructional planning and reflection that teachers engage in as they integrate learning technologies illuminates how the experiences of planning, teaching and reflecting led to teachers' construction of knowledge and meaning.

Pragmatic explanations of the sensory and physical experience of learning have interesting implications for studying teaching and learning with handheld devices, a multisensory tool for learning that must be physically manipulated by the user. Dewey states, "Senses are avenues of knowledge…because they are used in doing something with a purpose. The qualities of seen and touched things have a bearing on what is

done…they have a meaning" (Dewey, 1916/2011, p. 79). This idea implies that if teachers and students are using handheld devices and apps purposively and perceptively they are constructing knowledge and meaning, thus learning, from that act.

Theories of Learning

Guided by social cognitive and social constructivist theories of learning, this study assumed the existence of an interactive relationship between the individual, the social and cultural environment, with implications for teaching and learning. This assumption suggests that teachers' ideas and experiences working with learning technologies shape their knowledge and the meaning they attribute to teaching with technology. Bandura's (1986) social cognitive theory conceptualizes human functioning as the interplay between personal, behavioral and environmental factors, asserting that the most distinctly human capability is self-reflection. Self-reflection is conceptualized as a process that allows individuals to "make sense of their experiences, explore their cognitions and beliefs, engage in self-evaluation, and alter their thinking and behavior accordingly" (Schunk & Pajares, 2009, p. 36). Studying the self-reflection of teachers as they integrate knowledge of best practices for early literacy instruction and app affordances can offer an understanding of teachers' choices, strategies, processes and thinking.

Social constructivist theories of learning argue that humans generate knowledge and meaning from an interaction between their experiences and their ideas (Vygotsky, 1978). Vygotsky argues, "Learning is a necessary and universal aspect of the process of developing culturally organized, specifically human psychological function"'" (1978, p.

90). According to Vygotsky, learning precedes development, and interaction with others is critical in the development of cognition. These assumptions offer verification of why describing and exploring teachers' processes of generating knowledge and meaning will offer valuable findings with practical implications for educators.

These theories of learning also served as a lens to understand the actual affordances in practice as students engaged in early literacy learning with handheld devices and apps. According to social cognitive theory, teachers can increase students' success in learning through influencing students' habits of thinking, improving their academic skills and altering classroom structures. Social constructivist theory argues that children internalize processes through engagement in problem-solving dialogues with adults. According to Vygotsky (1978), "Learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers" (p. 90). Vygotsky's zone of proximal development suggests the need for teachers to scaffold instruction such that students can perform tasks beyond their level of autonomous functioning. These frameworks are important to understanding how knowledge is constructed, and the thinking processes outlined by Vygotsky for children parallel those for adults as they learn new tasks that are beyond their range of expertise. Both social cognitive theory and social constructivist theory influenced the philosophical perspective and conceptualization of learning assumed in this study.

Researcher as "Bricoleur"

Bricolage positions the researcher as "bricoleur," who uses "the aesthetic and material tools of his or her craft, deploying whatever strategies, methods, or empirical materials are at hand. If new tools or techniques have to be invented, or pieced together, then the researcher will do this" (Denzin & Lincoln, 2000, p. 4). Because this study focused on the intersecting and blending of traditional forms of print-based early literacy instruction with new literacies and learning technologies the research design requires creativity, flexibility and openness of a researcher-as-bricoleur approach. As Patton (2002) states, "Creativity begins with being open to new possibilities, the bricolage of combining old things in new ways…this openness means avoiding forcing new possibilities into old molds" (p. 402). Openness is critical to this study. In my research the unknown, undefined possibilities of new literacies in early literacy planning and teaching were studied with a design shaped by naturalistic inquiry traditions.

Naturalistic Inquiry

Naturalistic inquiry is research done in the style of naturalist paradigm, grounded in specific epistemological and ontological assumptions. Lincoln and Guba (1985) characterize naturalistic inquiry with axioms including: (a) "realities are multiple, constructed, and holistic," (b) "knower and known are inseparable," (c) "only time and context-bound working hypotheses are possible," and (d) "inquiry is value-bound" by the inquirer's choice of problem, paradigm, theoretical framework and context (p. 36-38). Naturalistic inquiry is often contrasted with positivism, a paradigm associated with scientific method, uniformity, singular reality and objectivity. Given that several of my

research questions focus on *how* teachers think about, plan and use handheld devices and apps for instruction, seeking to understand the perspectives of teachers, this study was well suited to naturalistic inquiry. Corbin and Strauss (2008) assert that the most important reason to do qualitative research is "the desire to step beyond the known and enter into the world of participants, to see the world from their perspective and in doing so make discoveries that will contribute to the development of empirical knowledge" (p. 16). By exploring teachers' integration of handheld devices and apps with best literacy practices using qualitative methodologies I was able to describe how teachers constructed knowledge of specific learning technologies and their implementation into literacy instruction. Further, to understand teachers' enactment of literacy instruction with handheld devices and apps I employed methodologies that offered insight and deep understanding of human behavior. Guba and Lincoln (1994) state, "Human behavior, unlike that of physical objects, cannot be understood without reference to the meanings and purposes attached by human actors to their activities. Qualitative data, it is asserted, can provide rich insight into human behavior" (p. 106). In this study, qualitative methodologies allowed me the opportunity to collect data that illuminated the perspectives of teachers, described their instructional practices and explored the reflecting and planning processes in which they engaged.

Case Study

This study drew on the tradition of case study to collect such data. While leading case study researchers differ in what is emphasized in their explanations of case study they agree that boundedness is the critical, defining characteristic of this methodology

(Barone, 2011; Brown, 2008). Boundedness is the explicit defining of what is included and excluded in the study, be it child, teacher, classroom or something else (Merriam, 1988; Stake, 2000; Yin, 1994). For the purposes of this case study the boundaries were one school district with 2 embedded cases of kindergarten teachers. Case study involves "intensive, holistic description and analysis" of the bounded system of focus (Merriam, 1988, p. 16). Yin's (1994) conceptualization of case study as a methodology primarily influenced the design of this study. Yin (1994) emphasizes the investigation of "contemporary phenomenon within its real-life context" (p. 13) and the generation of "theoretical propositions" (p. 10). These qualities of case study make this methodology well suited to the current study. This case study sought to illuminate the perspectives of teachers, describe their instructional cycles and explore the processes in which they engaged.

Researcher's Role

In this study the role I assumed was one of observer-participant. According to Lincoln & Guba (1994) constructions "can be elicited and refined only through interaction *between and among* investigator and respondents" (p. 111). Therefore I sought to actively engage with the participant teachers, approaching these relationships with open-mindedness, flexibility and self-reflexivity. I collaborated with participants in ways that valued and honored their knowledge, experience and expertise. The knowledge and meaning constructed and developed throughout the study was shaped by my personal experiences and social interactions.

Participants and Site

This study took place in a public school district located in a suburb of a large city in the upper Midwest during to 2013-2014 school year. The district implemented a K-12 technology initiative during the 2012-2013 school year. Participants for the survey component of the study were a selective sample of 25 K-3rd grade teachers from Silver Lake Point Schools (pseudonyms used throughout), a public suburban school district in the upper Midwest (see Tables 3.1 and 3.2 below for district demographics). Devices available to in the district teachers varied by grade level. Kindergarten classroom teachers were given iPod Touch devices at a ratio of 1 device per 4 students. 1st grade teachers were given iPad Mini devices at a ratio of 1 device per student. 2nd and 3rd grade teachers were given iPads at a ratio of 1 per student. Thus the devices and amount of devices available varied across the selective sample of survey participants.

Percent of students who receive Free/Reduced lunch	Percent of students who are classified as English language learners	Percent of students who are classified as receiving special education services
40%	12%	13%

Table 3.1: District Characteristics-Silver Lake Point Schools

American Indian	Asian	Latino	African American	White
1%	10%	11%	11%	67%

Table 3. 2: Diversity of student population-Silver Lake Point Schools

The use of selective sampling methods generated data from a specific, defined group (K-3rd grade teachers in one school district). Unlike a random (probability) sample, a selective sample potentially leads to sampling bias and does not allows for generalization

to a broader population. However, in this study selective sampling was the most appropriate method because the results of the survey provided a broad picture of the understandings held by the selected district's K-3rd grade teachers in terms of their knowledge and beliefs about early literacy and learning technologies. Teachers were identified by district administrators and recruited via email. K-3rd grade teachers across the district were invited to participate in the survey, with the exception of teachers working at the Spanish immersion school site. A drawing was held for gift certificate prizes for teachers who completed the survey. Four teachers who completed the entire survey received $25 gift cards to Target.

The two embedded case studies were selected from the overall larger case study (e.g., comprised of the survey participants). Both of these embedded cases focused on a participant kindergarten teacher. Purposive sampling methods were used to select the two teachers who were information-rich cases. The criteria used to purposively select the teachers included a kindergarten[1] teaching assignment, a willingness to be interviewed and observed, and a personal philosophy of a "balanced approach" to literacy instruction according to their survey responses. Although two embedded case studies have the disadvantage of requiring more resources and time than a single case design (Yin, 1994) this decision allowed for the identification and description of both unique characteristics of each case and central themes across cases (Patton, 2002).

Tracey and Marcy were the kindergarten teachers selected as information-rich cases. Tracey teaches at New Park Elementary. She is a white woman in her late twenties in her fifth year as a classroom teacher and her first year with the Silver Lake

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[1] Since both case study participants taught kindergarten the devices they had access to were iPod Touch devices at a ratio of one device for every four students.

Point District when this study was conducted. Marcy is a white woman who teaches at

Pine Towers Elementary. Teaching was a second career to Marcy. In her mid-fifties, she

was in her third year as a classroom teacher at the time of the study. She started her

teaching career with the Silver Lake Point District.

Data Collection and Analysis

The methods of collecting data were teacher survey, teacher interviews and verbal

protocol procedures, observations, class lesson transcripts and photographs. These data

collection methods helped me address the research questions posed at the opening of this

chapter.

Survey. Survey data were collected from a selective sample of 25 K-3rd grade

teachers and helped me address research questions 1 and 2. Surveys are traditionally

used by educational researchers to generate numeric data about the characteristics of a

group that can be explored quantitatively through statistical analysis. Although

considered to be a "blunt instrument" for data collection, structured surveys produce

information that describes characteristics of a group (Baumann & Bason, 2011). Surveys

are an effective method of collecting data to answer research questions about the

"attitudes, knowledge, experiences, and behaviors exhibited by persons" (Baumann &

Bason, 2011, p. 405). The survey created for this study (Appendix D) generated

descriptive data about early elementary classroom teachers' school demographic

information, access to learning technologies, beliefs about early literacy instruction and

approaches, and thoughts and processes engaged in during app selection. The survey was

completed digitally by a selective sample of 25 K-3rd grade teachers. Although a

selective sample potentially leads to sampling bias and does not allows for generalization to a broader population, the results of the survey allowed me to gain an initial understanding of a broad sample of teachers' knowledge and beliefs about early literacy and learning technologies. These findings were triangulated with data collected by other methods to increase the credibility of findings (Maxwell, 2005; Patton, 2002).

Survey Monkey was used to distribute the survey through email and collect responses. Numeric and likert item responses were analyzed using simple descriptive statistics. Open-ended responses were placed in a matrix allowing me to juxtapose each K-3rd grade teacher's responses to the open-ended survey questions in comparison with the other teachers' responses to the same question. Table 3.3 below displays an excerpt from this matrix that illustrates how I analyzed teachers' open-ended survey responses. Frequent patterns of responses (for example, the cost associated with apps highlighted below and mentioned by 14 of 25 participants) were coded and counted across responses. Unique responses (such as struggling to match an app to the purpose of a lesson, which was only mentioned by one participant as a challenge encountered) were also coded. This analysis allowed me to understand the teachers' perceptions of the training they received, their perceived successes and challenges, and their feelings and opinions about using the handheld devices and apps for literacy instruction. By comparing these responses I was able to generate patterns of responses, to count similar responses and create frequencies, and to look for teachers who responded in unique ways.

What challenges have you encountered as you select and use apps for early literacy instruction? Please explain why you note these.	
It is difficult to find quality apps that are free and have a certain purpose when implementing into a lesson.	-$: Money-Quality Hard to match lesson purpose

Table 3.3: Excerpt from data matrix of open-ended survey response analysis

Analysis of the survey data occurred prior to the teacher interviews or observations and findings informed interview questions. For example, there was a clear pattern in survey responses that teachers sought free apps and that cost was a determining factor in their process of selecting apps. Therefore, I sought a deeper understanding of this pattern in the interviews with two kindergarten teachers. Additionally, the survey offered me sensitizing concepts, or guides during the fieldwork stage "with special attention to the words and meaning that are prevalent among the people being studied" (Patton, 2002, p. 278). Through analysis of survey data I developed an initial "start list" of codes for interview and fieldwork data (Miles & Huberman, 1994). For example, survey respondents wrote about "creating apps" in their open-ended responses, a phrase used within the district to refer to apps that facilitated multimodal composition and digital writing. Initial codes generated from analysis of survey data (see Tables 3.4 & 3.5 below), were modified and clarified as data collection and analysis continued. Descriptions of these processes of modification and clarification are forthcoming.

Code	Description
SG: • SGI • SGP • SGTL	SG=student grouping • SGI=student grouping individual • SGP=student grouping pairs • SGTL=student grouping small teacher-led group
LCT: • V • C • WW • Ph	LCT=literacy components taught/practiced with handheld devices • V=vocabulary • C=comprehension • WW=word work • Ph=phonics
Amp	Amplify instruction, increase/enhance ability to meet instructional goals/targets
PAff: • MML • M/E • Coop	PAff=positive affordances • MML=multimodal learning • M/E=motivation and engagement • Coop=cooperative learning, students work together on devices
NAff: • S • DR	NAff=negative affordances • S=size issues, device too big or small or heavy for students • DR=issues with ratio of devices to students

+PD	Want or need more professional development to use devices
CApps	Creating apps-process writing with apps, multimodal composition, literature discussions using apps, etc.

Table 3.4: Survey codes related to RQ1: To what extent and how are early elementary teachers using technologies in their classrooms to teach literacy?

Code	Description
BL	Teacher aligns self with balanced approach to literacy instruction
3-10	Test average of 3 apps, spend 10 minutes
ERec: • ERec-B • ERec-P	Seek recommendations of other educators: • Other educators recommendations from blogs or online • Other educators recommendations in person
-$	Free apps, the importance of low cost or free apps
IV	Instructional value, the app offers authentic reading and writing
SIN	Students' instructional needs considered when picking apps
M/E	Motivation and engagement considered when picking apps
SBP	App supports literacy best practices

QFree:	Quality of free apps:
• I • D	• Instructional quality • Design quality
-CApps	Few creating apps available for composing, writing, higher order thinking
U	Unsure of best apps to use
-T	Not enough time to test apps and apply their knowledge of best practices when testing apps.

Table 3.5: Survey codes related to RQ2: To what extent and how are teachers choosing apps or web tools based on their knowledge of best practices for literacy instruction?

The purpose of using a survey as a method of data collection was not to generalize to a broader population, but to gain a starting point to guide my research and to generate findings to triangulate with data collected by alternative methods. However, the survey was insufficient to answer the research questions. As Yin (1994) asserts, "Surveys can try to deal with phenomenon and context, but their ability to investigate the context is extremely limited" (p. 13). Therefore additional methods of data collection were employed.

Embedded case studies. The case studies I conducted were intense, systematic examinations of 2 different bounded systems including two different teachers and each of their respective classrooms. Purposive sampling methods were used to select information-rich cases. I was able to identify and describe both unique characteristics of each case and central themes across cases (Patton, 2002) and address research questions

1, 2, 3 and 4. Case studies were an appropriate complement to the survey because of the capacity to "explain causal links in real-life interventions that are too complex for the survey or experimental strategies" (Yin, 1994, p. 15). The complexity of early elementary classrooms and teachers' dynamic, shifting knowledge and beliefs necessitated case study methodologies to identify, describe and explain causal links that occurred throughout the planning, instruction and reflection.

  Interviews. Interviews allow a researcher to "elicit information from informants and to explore topics in greater detail" (Purcell-Gates, 2011, p. 146), or "to enter into the other person's perspective…to find out what is in and on someone else's mind" (Patton, 2002, p. 341). The interviewing techniques used in this study were a combination of an interview guide and informal conversational interviews. An interview guide (Appendix E) consisting of an outlined set of issues to be explored was used for the initial interview with each teacher. This allowed me to focus on specific topics, while maintaining the freedom and flexibility to explore and ask questions about anything that emerged from the interview (Patton, 2002). Additional subsequent interviews adopted an informal conversational approach to interviewing, so that I could responsively pursue topics as appropriate based on data (Patton, 2002). Through interview data I documented the teachers' initial knowledge and beliefs, and then described and explored shifts and changes that occurred throughout instructional cycles. Gathering these data allowed me to address research questions 1, 2 and 4. Interviews were recorded using an iPad recording app, transcribed using Mac Speech Scribe and cross-checked for accuracy. I took notes to help myself focus on what the teacher was saying and to track what I wanted to return to later in the interview, or to note additional questions I might pose

(Seidman, 1991). Following each interview I wrote theoretical memos that documented my thoughts and reflections from each session (Miles & Huberman, 1994). These memos were conceptual in intent, tying together concepts, clarifying ideas and linking data. Below is an example of a memo written following my initial interview with Marcy.

> Memo: Marcy, Initial Interview, 10/15/13, teacher self-efficacy, beliefs about technology, technology in early elementary
>
> She herself and her family use a lot of technology and she admires the way it is used in the high school, but clearly doesn't think the way she is using it is that innovative or cool. Marcy seemed concerned about my judging her instruction when I will come to observe. She made comments like, "We are just starting out" or "It's early, my kids can't do much yet." She seemed at various points in the interview to question whether her experience/knowledge/insight was valuable, or "what I was looking for."

Transcriptions and memos from each interview were coded, or dissected meaningfully "while keeping the relations between the parts intact," (Miles & Huberman, 1994, p. 56). Data coding occurred constantly throughout the study. Descriptive codes, interpretative codes and pattern codes were inductively generated from interview data. Some codes were derived from the survey results. Table 3.6 presents an illustrative example of an excerpt from a post-instruction interview with Tracey. The transcript was coded with codes derived from the survey (SGP=student grouping pairs), as well as descriptive (potential uses), interpretive (Peer collaboration-misconceptions) and pattern ("fun") codes from interview data:

Interview Transcription, Tracey, 11/8/2013	Codes
Eventually I think it would be really fun to have them doing like partner work so that they aren't just doing it independently, so that they're able to do it in small groups and apply what they've learned, but also work with someone else because I think one of the best ways to learn is to be teaching so that if I can have some of the ones who are a little bit higher work with some of the ones who are a little bit lower so that they can really understand what they know.	- Fun - SGP=student grouping pairs - Potential use - Peer collaboration-misconceptions

Table 3.6: Excerpt from coding of interview transcript

Coding moved from basic description (teacher identifies ways she would like to use the devices) to conceptual ordering (potential creative uses informed by her understanding of "best ways to learn") to theorizing (teacher misconception about collaborative learning present an obstacle to fully realizing potentials of devices). Data were analyzed using open coding to identify properties and dimensions of concepts and axial coding to relate concepts to each other (Corbin & Strauss, 2008; Patton, 2002; Strauss & Corbin, 1998).

Verbal Protocol. A verbal protocol procedure (Appendix F) was used to more deeply examine the conscious processes that teachers engage in as they review, select and plan literacy instruction with apps. In this study verbal protocol methods were conceptualized as a special application of interviewing because they aimed to elicit inner thoughts and cognitive processes (Patton, 2002, p. 385). A verbal protocol procedure was developed to engage teachers in concurrently "thinking aloud" as they searched for, tested, selected or rejected apps for use in early literacy instruction. This process allowed me to collect data designed to address research questions 1, 2 and 4. Given the limited capacity of short-term memory, the verbal protocol was conducted concurrently with participants' instructional planning because "the recency of verbal reports of cognition and response to their occurrence is critical" (Pressley & Afflerbach, 1995, p. 3). Using

verbal protocol methods allowed me to access deeper understandings of the cooperating teachers' affective and cognitive processes as they selected apps, as compared to conversational interviews alone (Hilden & Pressley, 2011). The verbal protocol was designed to be minimally disruptive and allowed the teacher's review of apps to occur as naturally as possible. Verbal protocol procedures were audio recorded, transcribed using Mac Speech Scribe, and crosschecked for accuracy. Immediately following each verbal protocol procedure I wrote theoretical memos and notes. Teachers were asked to review the data collected from their verbal protocols and to identify problems or inaccuracies, and any disagreements were noted and adjusted (Wyatt, Pressley, El-Dinary, Stein, Evans & Brown, 1993). Three instances occurred where adjustments were requested.

My analysis of data collected by verbal protocol categorized the teacher's verbal reports and characterized his or her process. Below is an excerpt from an initial characterization of Marcy's verbal report:

> Marcy is concerned with cost; "free" is a positive for her. She laughs periodically as she engages in the verbal protocol; it seems she is uncomfortable with it. When the music plays in the background she talks louder. She is focused on if the kids will like it; she repeats that phrase numerous times. She does not talk about best practices, the emphasis is on <u>if the kids will like it</u>.

Further, data collected by this method were coded on an ongoing basis using the same analytic processes used to analyze other interview data. Verbal protocol data were triangulated with survey and interview data to increase credibility of findings.

Observations. Each teacher's literacy lessons using handheld devices and apps were observed for several purposes. Observations allowed me to understand the context

in which the literacy learning with technology was taking place in an "open, discovery-oriented and inductive" (Patton, 2002, p. 262) manner, rather than relying on prior conceptualizations. Observations allowed me to described and understand the instructional enactment of teachers' integration of knowledge of best practices and beliefs about affordances of technology. Understanding these enactments helped me address research questions 3 and 4. Each teacher was observed teaching literacy with handheld devices and apps 3-4 times. Initially I assumed the role of observer, although as the study progressed there were occasionally compelling reasons to blur this positioning and to participate in the learning environment to some degree. For example, in Tracey's classroom when her students were completing a dinosaur "hunt around the room" and scan QR codes activity (fully described in Chapter 4) most of the students struggled to complete the task and asked me for help. I set my notes aside and helped the students. I also took photographs to document what was happening and I wrote field notes immediately following the observation during which I participated in the classroom activity. While I primarily sought to understand the participant teachers' emic perspective, I was not rigid in this stance. My etic perspective standing outside the culture of each classroom offered valuable understanding. I took notes on "what is happening, what is being said and done, and by whom" (Corbin & Strauss, 2008, p. 30). Below is an excerpt of my raw data from notes taken while observing in Tracey's classroom on November 8th, 2013:

> one g gets trade book settles in, 1 girl still by papers on cabinet, fiddles with cord-tangled, plugs in and starts

Follow each observation I wrote descriptive field notes and theoretical memos. The raw data above was processed in the following excerpt from my descriptive field notes:

>One of the girls has picked up a hard cover book, "1000 Things to Spot in the Town." I find out during our interview that she doesn't like earbuds and wants to have full coverage earphones like her peers, but her parents haven't gotten around to getting her a set yet. The other girl is still by the papers, untangling her cord and trying to find the right folder.

An example of a memo from this data is:

>Memo: Tracey, Observation/field notes, 11/8/13, students' choices, digital vs. print-based texts, student engagement
>
>Kids chose to read trade books instead of play phonics games. I didn't see them do this as much during the listening center. What are Tracey's expectations about this: are they allowed to opt for a print-based text instead of devices? I wonder if some students prefer trade books to the devices, and what drives that.

My writing occurred immediately following each observation. I verified my interpretations for accuracy with each teacher I observed. Concepts derived from ongoing analysis of data collected by other methods (survey, interviews) drove and informed the focus of subsequent observations (Corbin & Strauss, 2008). For example, following the sample observation above I sought to determine if students in either case study teacher's classroom repeatedly opted to read a print-based text instead of use the devices, and I included this inquiry in my post-instruction interviews. Following each observation raw data were processed into an intelligible write-up for analysis. I wrote memos and vignettes throughout the study. Data from fieldwork were continuously

analyzed using open coding and axial coding. Below (Table 3.7) is a vignette from Tracey's classroom during the dinosaur "hunt around the room" and scan QR codes activity with examples of how I coded these data using open (Obstacle from QR image) and axial (Anticipate "hiccups"-RQ4: changing planning/practice) coding:

Another girl comes over to me and needs help finding the name 'brontosaurus' on the stamp image. She helps another student spell the word 'brontosaurus.' The girl with the iPad comes to me needing help getting back to the scanner, I show her how to press the done box (x in a square) to return to the scanner. TP is quickly visiting each center to monitor student work. When she is near me I verify with her that she does not mind if I help students and answer their questions. She exclaims, "Of course not!" and states that she expected 'hiccups' with the QR code activity since it the first time they've done it, even though they practiced yesterday.	Obstacle from QR image Obstacle with device navigation Monitor Anticipate "hiccups"-RQ4: changing planning/practice

Table 3.7: Excerpt from coding of field notes

Iterative Analysis and Interpretation

Each data source was analyzed with the specific strategies described above, and data across sources were analyzed in an ongoing manner using constant comparative analysis (Dillon, 2013; Glaser & Strauss, 1967; Corbin & Strauss, 2008). Hammersley and Atkinson (1983) describe this as a process of "systematic sifting and comparison" (p. 180). Constant comparative analysis involves open, substantive coding of data to generate concepts and their associated properties and to continue the "merging, modification and clarification" of codes as more data is collected (Dillon, 2013, p. 3). This ongoing process allowed me to identify core codes by which data may be further analyzed and filtered through theoretical sampling, and ultimately to see "how various

concepts come together into a theory that addresses one's research purpose and questions" (Dillon, 2013, p. 3). For example, open-ended survey data indicated that teachers considered the design and quality of a free app as they reviewed and selected apps for literacy instruction. This generated the code "Quality: Free-Design" or "QFree-D." During my initial interviews and verbal protocol procedures with both Tracey and Marcy, I learned that they both connected the graphic design and visual appeal of an app to whether students would like it or not. This thinking influenced their decisions to use an app for literacy instruction. As the research progressed, I filtered this core code or concept through theoretical sampling. This core code developed into an assertion about how teachers selected apps for literacy instruction. In this study, data analysis was an iterative process across data sources that occurred continuously throughout the study and informed ongoing data collection.

Qualitative analysis is the concurrent flow of "data reduction, data display and conclusion drawing/verification" (Miles & Huberman, 1994). I noted patterns and themes, clustered and grouped pieces of data, and integrated diverse data.   Throughout the study I drew contrasts and comparisons among incidents, concepts and variables for the purpose of understanding properties, dimensions and relationships from data (Corbin & Strauss, 2008; Miles & Huberman, 1994). Writing memos is critical to exploring and connecting new ideas to inductively generate theory from data (Alvermann, O'Brien & Dillon, 1996; Dillon, 2013; Wolcott, 2008). Data displays (matrices or networks) were used throughout the study to transform data, draw conclusions, theorize or make decisions about further data collection and analysis (Miles & Huberman, 1994). As the study proceeded, analysis shifted from the more concrete to the more conceptual, abstract

and explanatory. Assertions were generated across all data sources and findings, and interpretive commentary was constructed to connect the assertions (Erickson, 1986). Evidentiary warrant for assertions was established by reviewing data for "disconfirming and confirming evidence" (Erickson, 1986). Analyses were confirmed and verified by triangulating across data sources, seeking review and feedback from informants during ongoing interviews, considering and analyzing discrepant cases, considering rival explanations and engaging in reflexive self-analysis to detect and reduce biases (Erickson, 1986; Miles & Huberman, 1994). All data collection and data analysis strategies were documented in a researcher's journal.

To summarize my methodology chapter I created Table 3.8 (below). The information in the table aligns my research questions with data sources and analysis strategies. In Chapter 4, I present the findings from my analyses, evidence to support my claims, and interpretation of the ideas presented.

Research Question	Data Sources	Analysis Strategy
1) To what extent and how are early elementary teachers using technologies in their classrooms to teach literacy?	• Survey of 25 K-3 teachers from one suburban district	• Simple descriptive statistical analysis • Open inductive coding (open-ended response items) (Strauss & Corbin, 1990)
	• Interviews with 2 kindergarten classroom teachers	• Transcription of interviews (Patton, 2002) • Development of theoretical memos (Miles & Huberman, 1994) • Inductive and deductive coding (Strauss & Corbin, 1990) • Within- and cross-case matrices development and analysis (Miles & Huberman, 1994)
	• Verbal protocol with 2	• Transcription of interviews (Patton, 2002)

	kindergarten classroom teachers	• Development of theoretical memos (Miles & Huberman, 1994) • Inductive and deductive coding (Strauss & Corbin, 1990) • Within- and cross-case matrices development and analysis (Miles & Huberman, 1994)
2) To what extent and how are teachers choosing apps or web tools based on their knowledge of best practices for literacy instruction?	Survey Interviews Verbal Protocol	• (See above)
3) When teachers and students use apps and web tools during instructional cycles, what does teaching and learning look like? What are the actual positive or negative affordances of using apps and web tools in early literacy instruction in practice, including unanticipated affordances?	Observations Photographs	• Development of theoretical memos (Miles & Huberman, 1994) • Inductive and deductive coding (Strauss & Corbin, 1990) • Within- and cross-case matrices development and analysis (Miles & Huberman, 1994)
4) How are teachers' beliefs, knowledge, planning and instruction impacted by their experiences planning and teaching with apps and web tools, their observations of students' learning with these technologies and their reflections on classroom lessons?	Interviews Verbal Protocol Observations	• (See above)

Table 3.8: Alignment of Data Sources & Analysis Strategies with Research Questions

Chapter Four

Findings

The organization of this chapter commences with a broader, general view of 25 teachers, followed by a deeper examination of two cases, describing each unique, information-rich case before comparing the two cases to identify commonalities and differences. This deliberate funneling down from a broader view to the specific information-rich cases illuminates how teachers in Silver Lake Point District integrated technologies into the teaching of literacy, drew upon their knowledge of best practices for early literacy learning and implemented handheld devices in early literacy instruction.

Findings from the survey revealed an understanding of the broader context of the school district through descriptive characteristics of a group of K-3rd grade teachers' knowledge and beliefs about early literacy and learning technologies. The survey generated descriptive data about early elementary classroom teachers' school demographic information, access to learning technologies, beliefs about early literacy instruction and approaches, and thoughts and processes engaged in during app selection that are presented first in this chapter. The survey section includes findings from numeric and likert item responses and open-ended survey responses. The next two sections of this chapter are case studies, Tracey and Marcy. Both cases open with a description of each teacher's school and surrounding community, their classroom setting, their background and beliefs. Findings from both information-rich cases are then presented, organized by research questions. The final section of this chapter presents findings from cross-case analysis of Tracey and Marcy's information-rich examples. My cross case analysis findings identify and describe both unique characteristics of each case and central themes

across cases (Patton, 2002). The findings presented in this chapter illuminate the perspectives of teachers in the case study district, describe their instructional practices and explore the reflecting and planning processes in which they engaged.

Survey

The first phase of my study sought to establish a broader understanding of how early elementary teachers across the case district were using handheld devices and apps in their literacy instruction and how they were choosing apps for instruction based on their knowledge and understanding of best practices for literacy instruction. The findings of this phase of my research serve as the foundation upon which I was able to more closely study two individual teachers and their classrooms. Participants for the survey component of the study were a selective sample of 25 K-3rd grade teachers from a public suburban school district in the upper Midwest (district demographics available in Chapter 3, Tables 3.1 & 3.2).

The district served 5,500 students from three adjacent residential communities. There were two K-3rd grade schools, a K-4th grade Spanish Immersion school, a 4th-5th grade intermediate school, a 6th-8th grade middle school and a four year high school. Additionally, the district offered the communities they served an alternative area learning center, an online distance learning program, a K-12th grade school of "highly able students" and a variety of community education programs for all ages. The district had a history of placing a high value on integrating learning technologies into classrooms. For example, by the spring of 2011 every elementary classroom across the district had an interactive whiteboard. The district implemented a K-12 technology initiative during the

2012-2013 school year that put handheld devices in every classroom across grade levels district-wide. Handheld devices were initially distributed in January of 2012.

All licensed teachers (about 70 individuals) in both K-3rd grade schools (Pine Towers Elementary and New Park Elementary) were invited to participate in the survey; the teachers in the Spanish immersion program were not included in the sample. 35 teachers completed some or all of the survey. Only the responses of the 25 teachers who completed the entire survey were analyzed. Their collective responses offered a glimpse of how teachers in the district were using the technologies available to them and how they selected apps for instruction.

District demographics: Teachers' views. I will provide a brief description of the 25 teachers who completed the survey, based on their responses. Five respondents (25%) taught kindergarten, two respondents (8%) taught 1st grade, five respondents (25%) taught 2nd grade, two respondents (8%) taught 3rd grade, two respondents (8%) taught a multi-grade classroom (K-3) and nine responded "Other," describing positions such as special education teacher, English Language Learner teacher and "Lead Teacher" (See Figure 4.1).
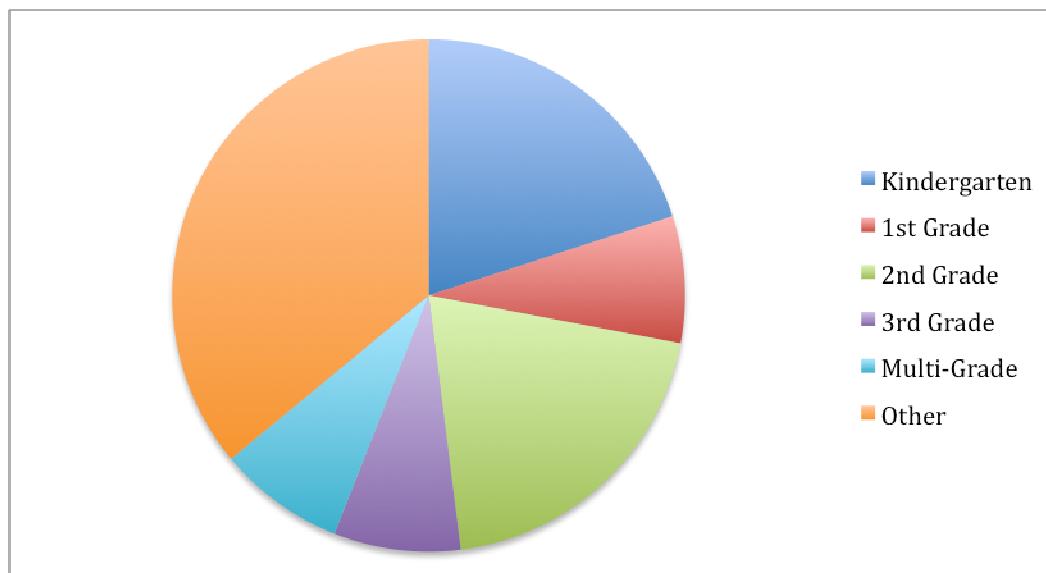
Figure 4.1: Current teaching assignment

Two of the 25 respondents stated that they held technology leadership roles. The respondents reported a wide range of years of teaching experience, from one year to 32 years. One year and three years were the mode and eight years was the median reported years of experience. The average response was eight years (7.92). 24 of the respondents described their district as "Suburban, outside of a major city," with the remaining respondent describing the district as "Urban, in a major city." Most respondents reported having a class of 21-25 students (11 respondents, 44%), with several also reporting a class size greater than 25 students (8 respondents, 32%). Four respondents (16%) reported a class size smaller than 15 students and the remaining two respondents (8%) reported a class size between 16 and 20 students (See Figure 4.2).
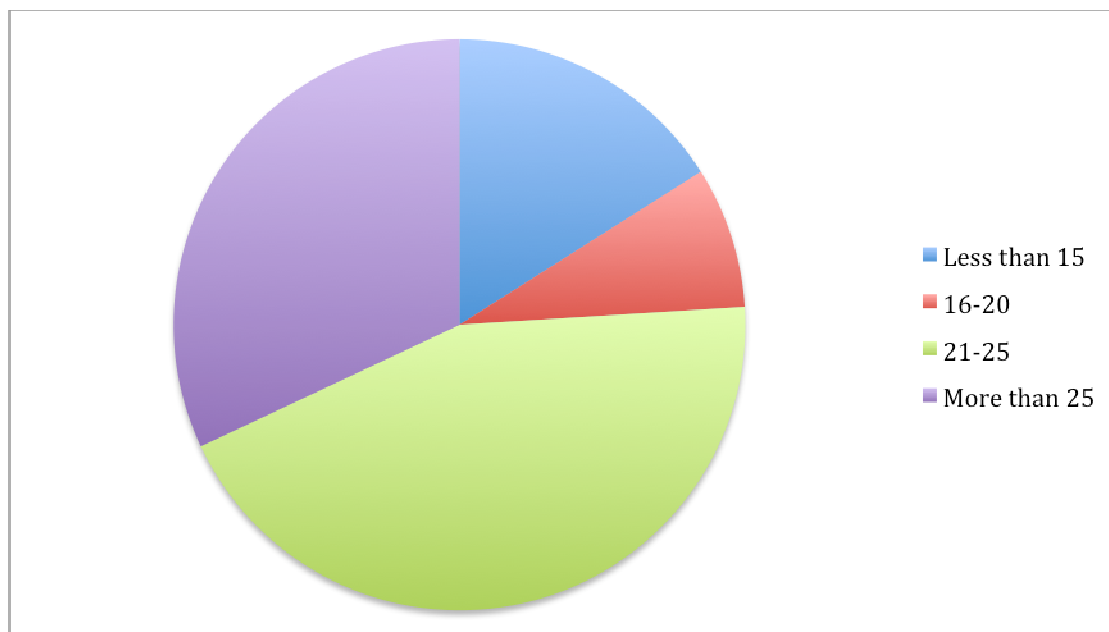
Figure 4.2: Number of students in class

All respondents reported having access to tablets (including iPads, iPadMinis, and iPod Touch devices), SMART Boards and computers for literacy instruction.

Beliefs about literacy instruction. Survey participants were asked to respond to several questions regarding their beliefs about literacy instruction. There were some very clear patterns and trends among the 25 respondents. Respondents were given nine statements representing various perspectives, philosophies and beliefs about literacy teaching and learning and asked to select as many of the nine options that they felt personally applied to them. Two of the options clearly resonated with the largest number of respondents: "I believe in a balanced approach to reading instruction, which combines skills development with literature and language-rich activities" (22 respondents, 88%) and "I believe students need to be immersed in literature and literacy experiences in order to become fluent readers" (19 respondents, 76%). Conversely, none of the respondents aligned themselves with the statement: "I would describe myself as a "traditionalist"

when it comes to reading methods and materials." Few respondents selected the

following statements: "I believe that basal reading materials are useful tools for teaching

students to read, either as the primary instructional material or along with trade books as

a supplement" (3 respondents, 12%) and "I believe that teaching students to decode

words is one of my most important goals for early reading instruction" (4 respondents,

16%) (See Figure 4.3).
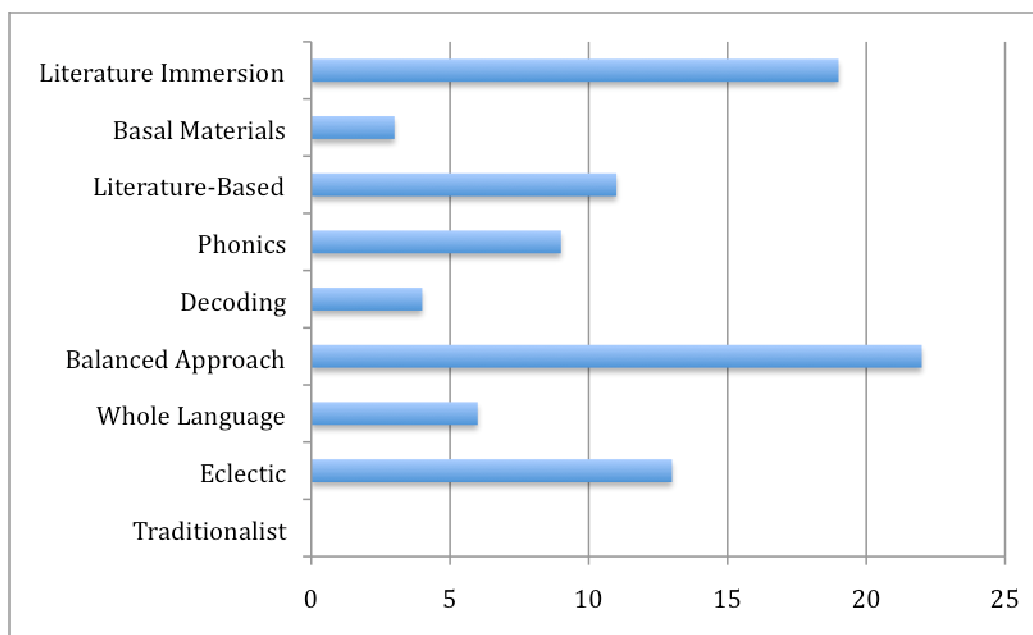
Figure 4.3: Perspectives, philosophies and beliefs about literacy instruction

Overall, teachers align their beliefs about literacy teaching and learning with a balanced

instructional approach and immersion in literacy, while eschewing traditionalism.

Respondents were asked to select from four statements representing goals or

objectives they personally held for their literacy instruction (See Figure 4.4). They had

the option of selecting multiple statements. The statement that the most respondents

selected was "It is my goal to develop readers who are skillful and strategic in word

identification, fluency, and reading comprehension" (24 respondents, 96%). Of the four

goal statements, this option is most closely aligned with a balanced approach to literacy.

Interestingly, more respondents selected this goal statement than the balanced literacy

beliefs option in the previous question. The two of the remaining options for

instructional goal statements were selected with nearly the frequency of the most popular

statement: "It is my goal to develop readers who are independent and motivated to chose,

appreciate, and enjoy literature" (23 respondents, 92%) and "It is my goal to develop

readers who are critical and thoughtful in using reading and writing to learn about people

and ideas, and how they might use literacy to positively affect the world in which they

live" (22 respondents, 88%). The least selected goal statement was "It is my goal to

develop readers who are knowledgeable about literary forms or genres and about

different text types or structures," (17 respondents, 68%). Interestingly, this last

statement is easily connected to digital literacies and the use of multi-modal texts.
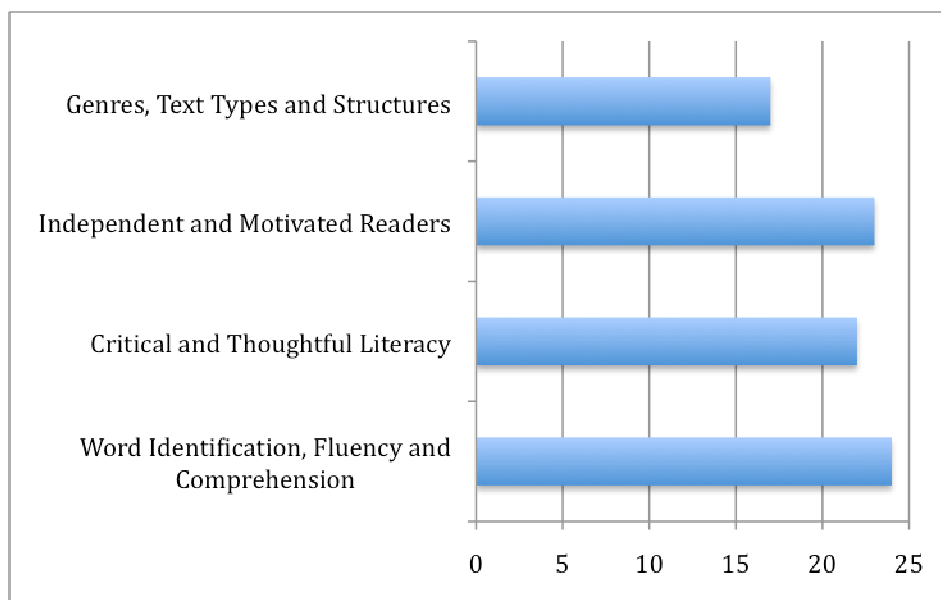
Figure 4.4: Goals and objectives for literacy instruction

Quite possibly the sample of early literacy teachers prioritized skills and strategies of

traditional print-based texts, students' attitude and motivation to read and students'

development of critical thinking in literacy over digital literacies or multi-modal literacies. Another possible explanation for this may be that respondents associate the phrase "literacy forms or genres" with traditional definitions of fiction, non-fiction, poetry, fantasy and so forth, without integrating the concepts of multi-modal texts into their understandings about text structures and text types.

Survey respondents were also asked to share information about the amount of daily instructional time they spent on reading and language arts content. Their responses offered a snapshot of literacy instructional practice trends across the two focal schools of my study. Respondents were asked to write in the number of minutes they devoted daily to reading instruction (average of 71 minutes), applying, practicing and extending reading instruction (average of 38 minutes) and language arts instruction and practice (average of 38 minutes). Respondents also ranked several components of literacy instruction by how much daily instructional time they dedicated to each (See Figure 4.5). They chose among "Considerable Time," "Moderate Time," "Little Time" and "No Time." Specific minute guidelines were not given, rather left to each respondent's interpretation. Seven components (oral language, phonemic awareness, literature circles, writing/composing, handwriting, spelling and reading aloud) were not ranked by one participant, therefore these components totaled 24 responses rather than 25 responses. Several components were identified by respondents as receiving "Considerable Time" or "Moderate Time" including comprehension (considerable: 12 respondents, 48%; moderate: 9 respondents, 36%), vocabulary (considerable: 4 respondents, 16%; moderate: 17 respondents, 68%), word work (considerable: 5 respondents, 20%; moderate: 16 respondents, 64%), oral language (considerable: 4 respondents, 17%; moderate: 16 respondents, 67%) and

reading aloud to students (considerable: 3 respondents, 13%; moderate: 17 respondents, 81%). None of the respondents ranked the previously listed components as receiving "No Time." The components of literacy instruction that most frequently were reported as receiving "Little Time" or "No Time" included spelling (little: 16 respondents, 67%; no: 4 respondents, 17%), handwriting (little: 14 respondents, 58%; no: 3 respondents, 13%), and literature circles (little: 7 respondents, 29%; no: 5 respondents, 21%). Respondents ranking of phonics/decoding (Considerable-7 respondents, 28%, Moderate-8 respondents, 32%, Little-9 respondents, 36%, No-1 respondent, 4%) and phonemic awareness (Considerable-7 respondents, 28%, Moderate-9 respondents, 36%, Little-8 respondents, 32%, No-2 respondent, 8%) yielded varied results. These results were reflective of balanced literacy instruction that includes phonemic awareness and phonics/decoding instruction as developmentally appropriate for students in kindergarten through third grade.
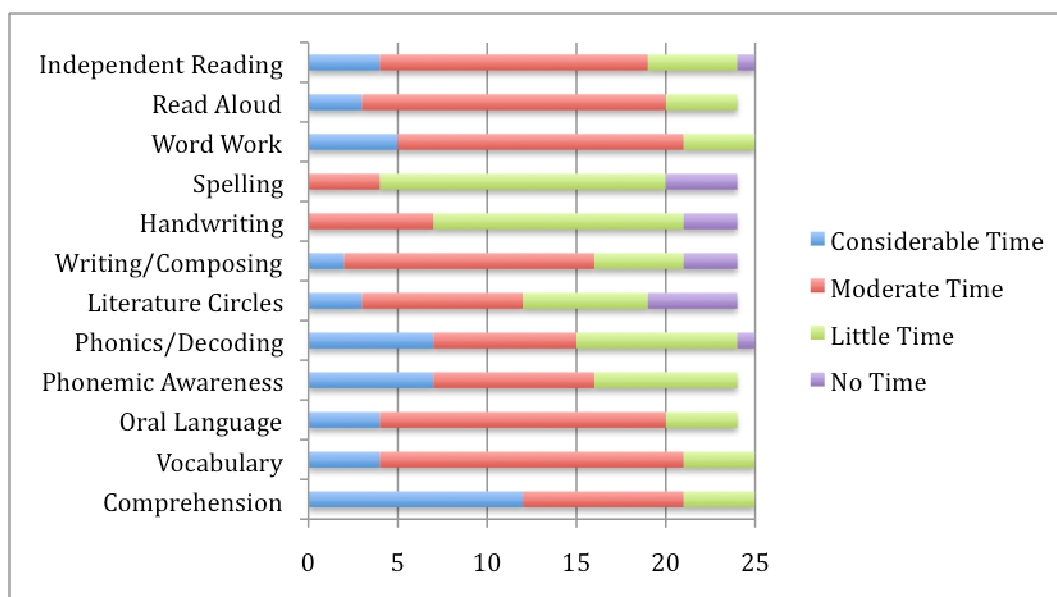
Figure 4.5: Approximate self-reported daily instructional time devoted to components of literacy instruction

Process writing (Considerable-2 respondents, 8%, Moderate-14 respondents, 58%, Little-5 respondents, 21%, No-3 respondent, 13%) and independent reading (Considerable-4 respondents, 16%, Moderate-15 respondents, 60%, Little-5 respondents, 20%, No-1 respondent, 4%) were generally ranked as receiving considerable or moderate time, although some respondents reported dedicating no time to these components of literacy instruction. Overall, the teacher-reported breakdown of instructional time dedicated to various components of reading and language arts reflected a balanced approach to literacy that was developmentally appropriate for students in kindergarten through 3rd grade.

Respondents were asked to share their opinions about teaching kindergarten through 3rd grade students four different word recognition strategies, by rating each as "Essential," "Very Important," "Somewhat Important" or "Not Important" (See Figure 4.6). None of the options were rated as "Not Important" by respondents. Phonics analysis/decoding was most frequently selected as "Essential" (16 respondents, 64%) or "Very Important" (8 respondents, 32%), and only 1 respondent (4%) rated it as "Somewhat Important." Structural/morphemic analysis/parts of words (Essential-10 respondents, 40%; Very Important-13 respondents, 52%; Somewhat Important-2 respondents, 8%) and contextual analysis/context clues (Essential-12 respondents, 48%; Very Important-12 respondents, 48%; Somewhat Important-1 respondents, 4%) were also valued by teachers as word recognitions strategies to teach kindergarten through third grade students. Words by sight/whole words was given the least priority by respondents, with 8 respondents (35%) rating it as "essential," 12 respondents rating it as "Very

Important" and 3 respondents (13%) rating it as "Somewhat Important," and two

respondents not completing this item.
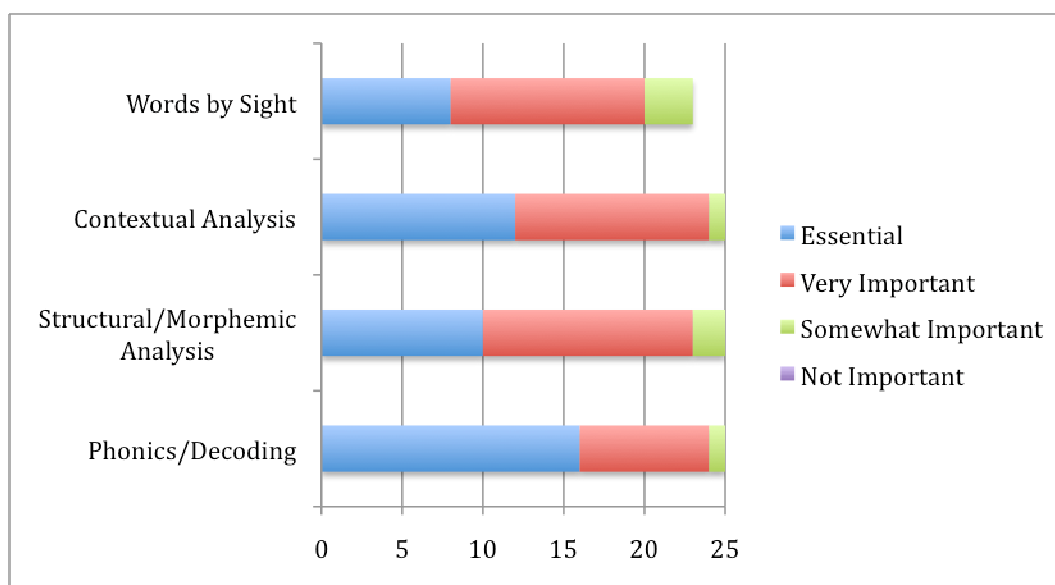
Figure 4.6: Opinions about the importance of teaching various word recognition

strategies to Kindergarten-3rd grade students

Respondents similarly ranked the importance of teaching nine different

comprehension strategies (See Figure 4.7). Respondents did not rank any of the nine

comprehension strategies as "Not Important." The most highly valued comprehension

strategies by respondents were predicting (Essential-13 respondents, 52%; Very

important-12 respondents, 48%), questioning (Essential-15 respondents, 60%; Very

important-10 respondents, 40%) and using prior knowledge (Essential-14 respondents,

56%; Very important-11 respondents, 44%). The comprehension strategies of clarifying

(Essential-12 respondents, 50%; Very important-11 respondents, 46%; Somewhat

important-1 respondent, 4%, not ranked by 1 respondent) and retelling (Essential-16

respondents, 64%; Very important-8 respondents, 32%; Somewhat important-1

respondent, 4%) were almost as highly ranked by respondents. Respondents valued

teaching other comprehension strategies of constructing mental images (Essential-13

respondents, 52%; Very important-10 respondents, 40%; Somewhat important-2

respondents, 8%), summarizing (Essential-15 respondents, 60%; Very important-7

respondents, 28%; Somewhat important-3 respondents, 12%) and inferring (Essential-13

respondents, 52%; Very important-9 respondents, 36%; Somewhat important-3

respondents, 12%). The lowest ranked comprehension strategy was interpreting

(Essential-11 respondents, 44%; Very important-9 respondents, 36%; Somewhat

important-5 respondents, 20%), perhaps attributable to teachers' conceptualization of

interpreting as a higher order thinking skill challenging for early elementary students.

Overall, teacher respondents placed high value on comprehension strategy instruction, as

evidenced in the graph below.
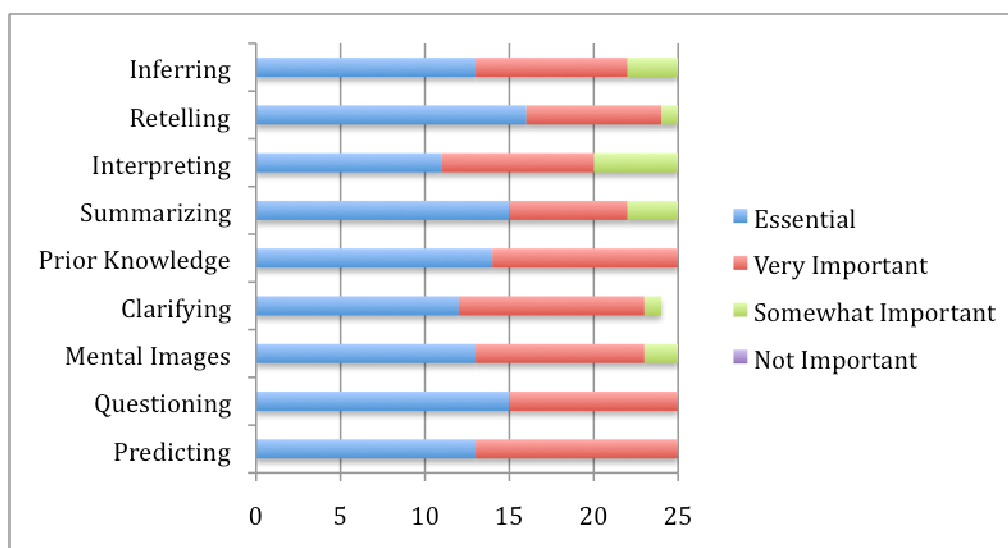
Figure 4.7: Opinions about the importance of teaching various comprehension strategies

to Kindergarten-3rd grade students

Survey results revealed that balanced literacy instruction, immersion in and

exposure to literacy and literature, and strategies instruction in both word recognition and

reading comprehension were generally valued within Silver Lake Point early elementary

classrooms. Establishing teachers' beliefs about literacy instruction and their reported

practices was necessary to understanding to what extent and how they were using

learning technology devices and selecting apps for classroom use in their literacy

teaching.

App selection and use. Survey respondents were asked several questions about

their experience, views and perspectives with the district-wide mobile device integration

initiative. Their responses shed light on the obstacles and opportunities associated with

using hand-held devices in early elementary literacy instruction.

Respondents were asked to rate their personal level of confidence with using apps

for early literacy instruction (See Figure 4.8).
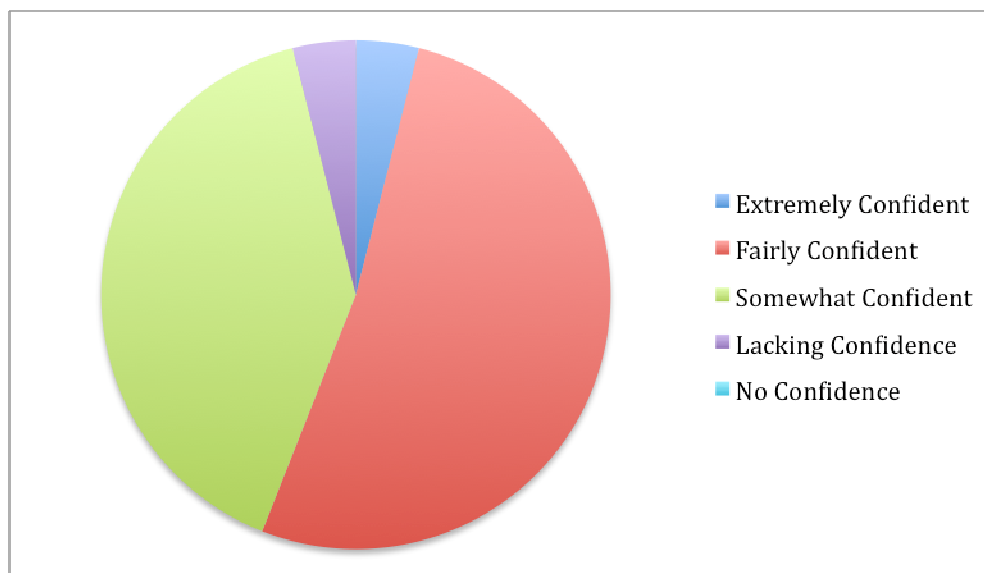
Figure 4.8: Self-reported confidence with using apps for early literacy instruction

The overwhelming majority rated themselves as "Fairly Confident" (13 respondents,

52%) or "Somewhat Confident" (10 respondents, 40%). Of the two remaining

respondents, one (4%) identified themselves as "Extremely Confident" while the other

(4%) self-identified as "Lacking Confidence." Respondents also rated the quality of the

training, professional development and support for integrating apps into instruction (See Figure 4.9). The most frequent ratings were "Very good" (8 respondents, 32%) or "Adequate" (16 respondents, 64%). One respondent (4%) rated the support as "Poor." None of the respondents selected the "Exceptional" nor the "Totally inadequate" rating.
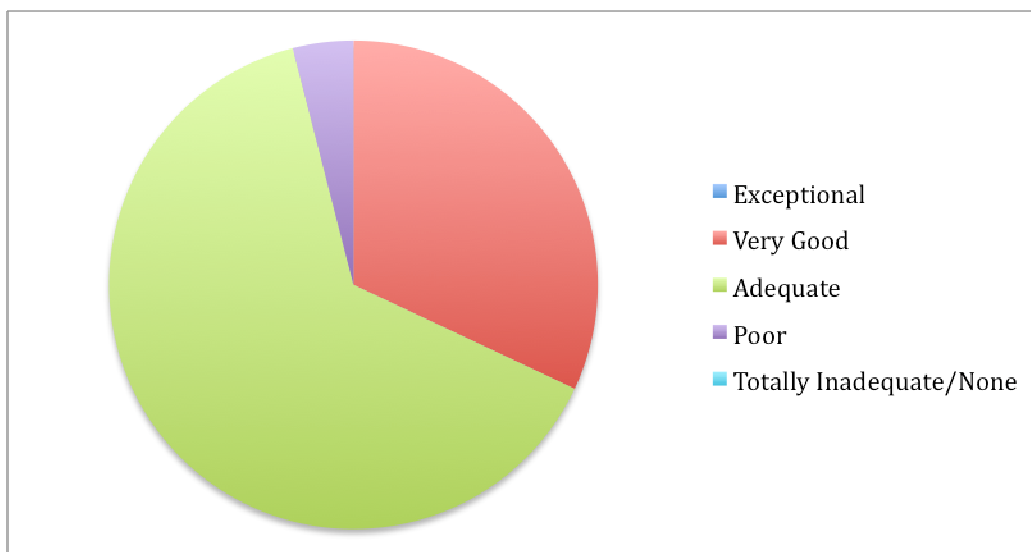
Figure 4.9: Evaluation of the quality of training, support and/or professional development for integrating apps into instruction

Overall, respondents did not give their own confidence or the support and training the highest possible rating, but their ratings were more positive than negative.

Choosing apps for instruction. Respondents were asked to numerically record the average amount of time in minutes that they spent reviewing an app before they decided to use it for literacy instruction. Reponses ranged from zero minutes to 60 minutes. Ten minutes was both the mode (7 respondents) and the median time reported. The average reported time spent reviewing apps was twenty minutes, however, given that two respondents reported spending sixty minutes reviewing an app this figure is somewhat misleading. Data suggested that most teachers spend 5-10 minutes testing an app before deciding to use it for literacy instruction.

Respondents were also asked the average number of apps they reviewed and tested before selecting one to use for early literacy instruction. Two respondents stated they had not reviewed apps, or their average was unknown, thus these two responses were not included in the data analysis. The responses ranged from one app to 10 apps. The response of three apps reviewed was the mode (9 respondents). The average number of apps reviewed was four apps (3.65 apps) and the median response was three apps. Generally, teachers spent about 10 minutes reviewing an app and they tested about three apps before making an instructional decision to use an app in their literacy teaching. This finding posed interesting questions, including is this enough time to adequately review apps and make instructional decisions? Conversely, is this too much time? Should teachers be dedicating that amount of instructional planning to "test-driving apps"?

The survey sought to understand how teachers identified and selected the apps they test and ultimately use in early literacy instruction. While teachers used a variety of sources and criteria to identify apps to test for potential instructional use, the cost associated with apps was reported by survey respondents to be the criteria with the most significant influence. When asked to select all criteria they applied to guide and narrow their search for apps within the App Store, all 25 respondents selected "Free." The category "Education" (17 respondents, 68%) and "Ratings" (14 respondents, 56%) were also used to narrow teachers' searches for apps within the App Store. "Popularity" (7 respondents, 28%), "Paid" (3 respondents, 12%) and "Release Date" (1 respondent, 4%) were far less frequently used to narrow teachers' searches for apps within the App Store (See Figure 4.10).
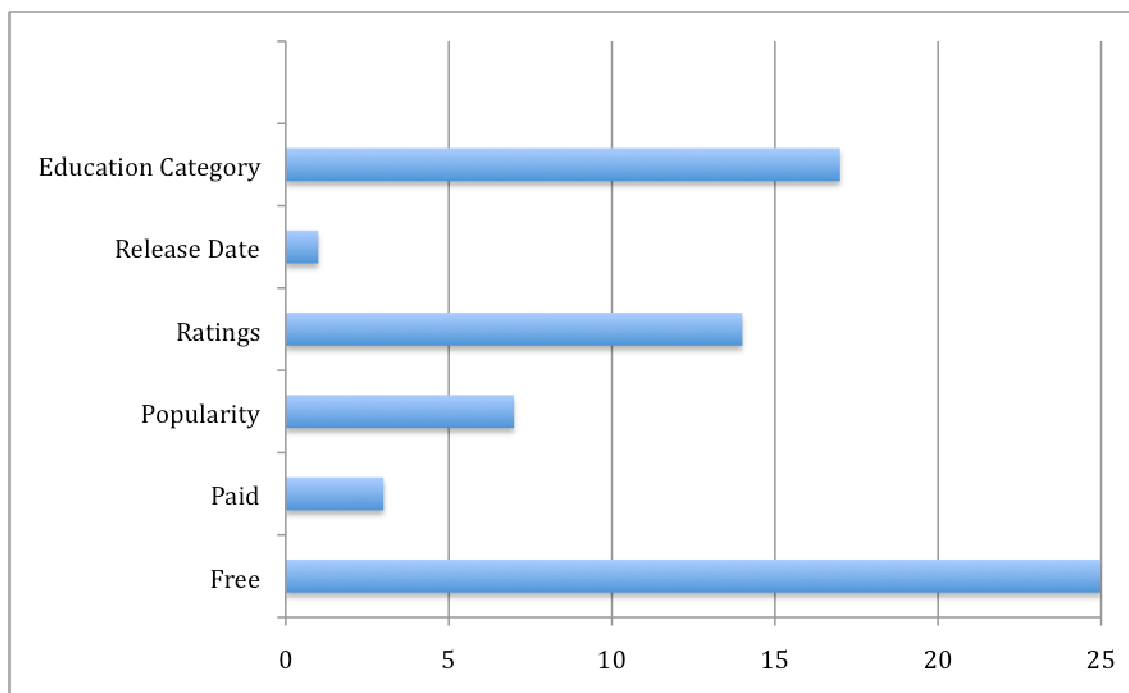
Figure 4.10: Criteria used to narrow search for apps within App Store

Survey respondents were also asked to select from a list of six resources that they might consult to find apps (See Figure 4.11).
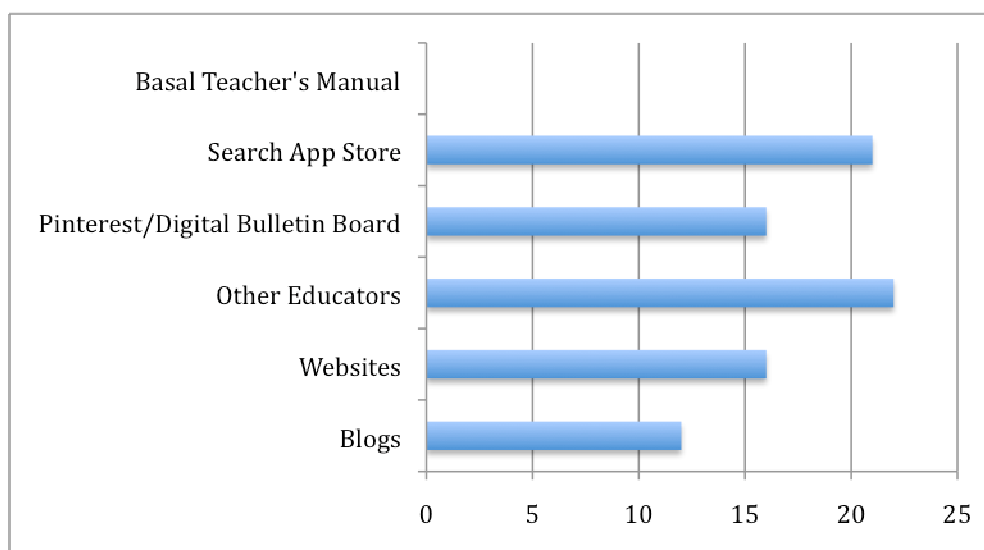
Figure 4.11: Resources consulted to find apps

Respondents selected all that applied. The majority of respondents selected "Other educators" (22 respondents, 88%) and "Search the App Store" (21 respondents, 84%) to

find apps to use in literacy instruction. Respondents also reported consulting Pinterest or digital bulletin boards (16 respondents, 64%), websites (16 respondents, 64%) and blogs (12 respondents, 48%). None of the respondents reported consulting a basal reading program teacher's manual to identify apps for instruction. However, it is worth noting that I learned during interviews with both Tracey and Marcy that the district did not require teachers to use a basal reader for instruction; in fact the basal materials available were dated or incomplete (Interviews, Tracey, 10/8/13; Marcy, 10/15/13). Respondents were given the opportunity to write in the names of blogs and websites they consult to find apps to test and review. Of the 12 respondents who shared examples of blogs and websites they consult seven referred to blogs written by other educators. Specific responses included teacherspayteachers, thinkfinity, Matt Gomez and Mark Coppin. Additional responses include Google (2 respondents), Pinterest (2 respondents), McGraw Hill publishing (1 respondent) and speech-language related websites (1 respondent). These data revealed that whether it be the teacher in the classroom next door, or a teacher across the country or world sharing on their blog, teachers relied first and foremost on the suggestions and reviews of apps by other educators when they sought apps to download and test for possible instructional use.

Respondents were also asked to rate 10 criteria as "Essential," "Very Important," "Somewhat Important" or "Not Important" to them as they selected apps to use in instruction (See Figure 4.12). Consistent with teachers' description of how they narrowed their App Store search, the criteria "Free or Low Cost" proved to be the most important. 18 teachers (72%) rated this as "Essential," while an additional 6 (24%) rated it as "Very Important." The next most highly rated criteria was "Authentic Reading or

Writing Tasks" with 8 teachers (32%) rating this as "Essential" and an additional 15 (60%) rating this as "Very Important." Audio, the capability to read words or texts to the user, was also highly valued by respondents, with 3 respondents (12%) rating this as "Essential," 15 respondents (60%) rating this as "Very important" and the remaining seven respondents (28%) rating audio as "Somewhat important." Three criteria were overall moderately important to survey respondents. These were the theme or characters of an app (Essential-1 respondent, 4%, Very important-3 respondents, 12%; Somewhat important-16 respondents, 64%; Not important-5 respondents, 20%), capacity to support multiple players or users (Essential-1 respondents, 4%, Very important-8 respondents, 32%; Somewhat important-10 respondents, 40%; Not important-6 respondents, 24%) and multimodal affordances such as music, video, animation or audio (Essential-3 respondents, 12%, Very important-11 respondents, 44%; Somewhat important-9 respondents, 36%; Not important-2 respondents, 8%). The capability to share texts produced within the app via email or other means (Essential-0 respondents, 0%, Very important-7 respondents, 28%; Somewhat important-9 respondents, 36%; Not important-9 respondents, 36%), the capability to mark up content, such as highlighting or taking notes (Essential-0 respondents, 0%, Very important-6 respondents, 24%; Somewhat important-12 respondents, 48%; Not important-7 respondents, 28%), gaming elements such as points or stickers or other rewards (Essential-0 respondents, 0%, Very important-6 respondents, 24%; Somewhat important-14 respondents, 56%; Not important-5 respondents, 10%) and the capability for the user to record their own voice (Essential-0 respondents, 0%, Very important-10 respondents, 42%; Somewhat important-12

respondents, 9%; Not important-2 respondents, 8%) were the least important app criteria for survey respondents.
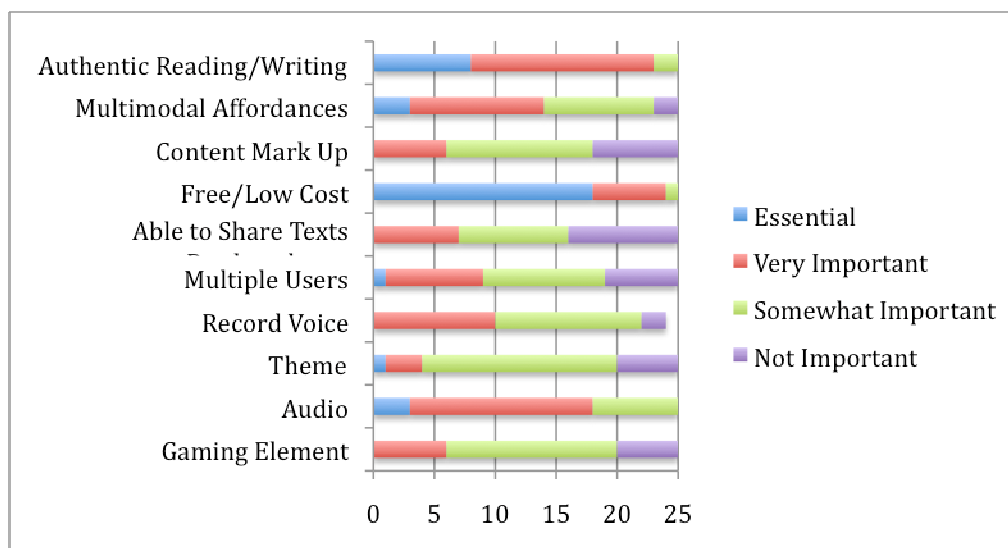
Figure 4.12: The importance of various criteria when selecting apps for literacy instruction

These data demonstrated that the 25 survey respondents were most concerned with identifying free apps, followed by the literacy instructional value of potential of apps. While the survey results indicated that literacy instructional value was clearly a concern of respondents when selecting apps, finding free or low cost apps was even more important. This pattern is concerning and warrants further exploration of the impact of prioritizing cost over authentic reading and writing tasks as criteria for identification of apps.

Survey respondents also ranked the importance of certain instructional and student factors as they test, review and select apps (See Figure 4.13). The most important factors were specific students and their needs, including developmental, language ability and interests (Essential-18 respondents, 72%, Very important-6 respondents, 24%; Somewhat important-1 respondents, 3%; Not important-0 respondents, 0%), motivation

and engagement (Essential-15 respondents, 60%, Very important-9 respondents, 36%;

Somewhat important-1 respondents, 4%; Not important-0 respondents, 0%), learning

objectives (Essential-12 respondents, 48%, Very important-11 respondents, 44%;

Somewhat important-2 respondents, 8%; Not important-0 respondents, 0%), and support

of best practices for early literacy instruction (Essential-14 respondents, 56%, Very

important-9 respondents, 36%; Somewhat important-2 respondents, 8%; Not important-0

respondents, 0%). Value added by using technology (Essential-5 respondents, 20%, Very

important-17 respondents, 68%; Somewhat important-3 respondents, 12%; Not

important-0 respondents, 0%) was a less important factor to survey respondents, while

student grouping (Essential-1 respondent, 4%, Very important-14 respondents, 56%;

Somewhat important-8 respondents, 32%; Not important-2 respondents, 8%) was the

least important factor.
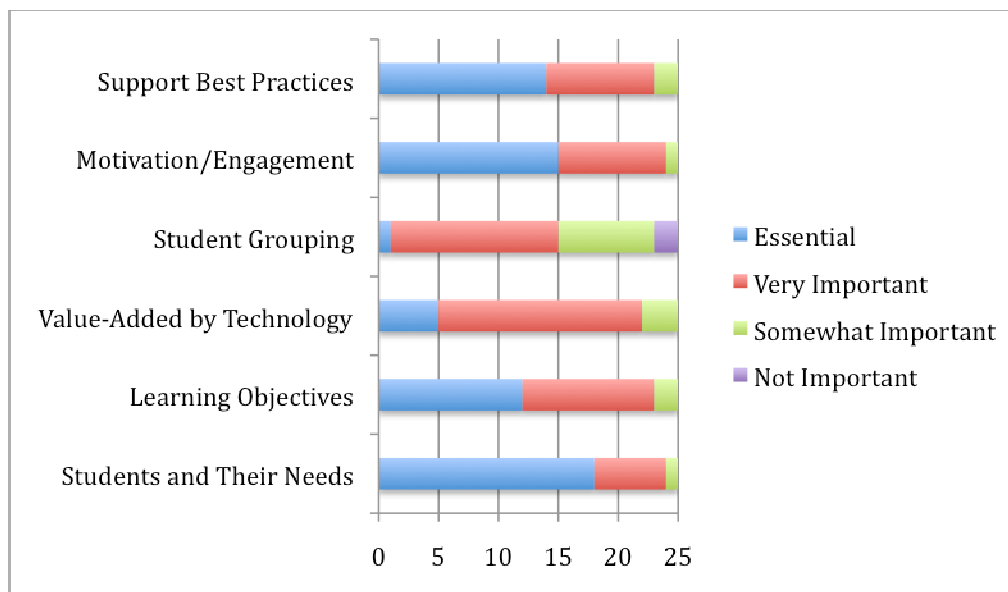
Figure 4.13: The importance of various factors when selecting apps for instruction

        These data suggest that the teachers surveyed prioritized the specific students in

their classrooms and their instructional needs, thus although cost was a significant factor,

teachers maintained a student-centeredness when they selected apps for literacy instructional use.

Using apps. Survey respondents shared how and to what extent they currently used handheld devices and apps in their literacy instructional practices (See Figure 4.14). Respondents were asked to select the frequency with which they used handheld devices and apps for 10 components of literacy instruction, using the markers of "Frequently" (weekly), "Fairly frequently" (monthly), "Rarely" (2-4 times a school year) and "Never." The two components of literacy instruction that all respondents reported using apps to some degree were comprehension strategies (Frequently-7 respondents, 28%; Fairly frequently-12 respondents, 48%; Rarely-6 respondents, 24%; Never-0 respondents, 0%) and vocabulary (Frequently-9 respondents, 36%; Fairly frequently-13 respondents, 52%; Rarely-3 respondents, 12%; Never-0 respondents, 0%). However, the majority of respondents used apps for comprehension strategies or vocabulary instruction monthly or a few times a year, as opposed to weekly. Survey respondents reported the most weekly use of apps for phonemic awareness development (Frequently-11 respondents, 44%; Fairly frequently-10 respondents, 40%; Rarely-2 respondents, 8%; Never-2 respondents, 8%) and phonics/decoding (Frequently-12 respondents, 48%; Fairly frequently-8 respondents, 32%; Rarely-4 respondents, 16%; Never-1 respondent, 4%). Respondents reported varied amounts of use of apps for instruction in oral language (Frequently-5 respondents, 20%; Fairly frequently-15 respondents, 60%; Rarely-4 respondents, 16%; Never-1 respondents, 4%), spelling (Frequently-8 respondents, 32%; Fairly frequently-6 respondents, 12%; Rarely-8 respondents, 32%; Never-3 respondents, 12%) and word work (Frequently-10 respondents, 40%; Fairly frequently-11 respondents, 44%; Rarely-3

respondents, 12%; Never-1 respondent, 4%). Respondents reported the least frequent use

of apps for literature circles and book club (Frequently-2 respondents, 8%; Fairly

frequently-5 respondents, 20%; Rarely-12 respondents, 48%; Never-6 respondents, 24%),

process writing and composing (Frequently-3 respondents, 13%; Fairly frequently-5

respondents, 21%; Rarely-9 respondents, 38%; Never-7 respondents, 29%) and

handwriting (Frequently-2 respondents, 8%; Fairly frequently-7 respondents, 28%;

Rarely-7 respondents, 28%; Never-36 respondents, 9%). These data fell into similar

patterns to the teachers' responses to the earlier question that asked how much time they

spent daily on various components of literacy instruction. Given the sample of teachers

working with students from kindergarten to 3rd grade, these data logically reflected the

variety of literacy developmental stages of students.
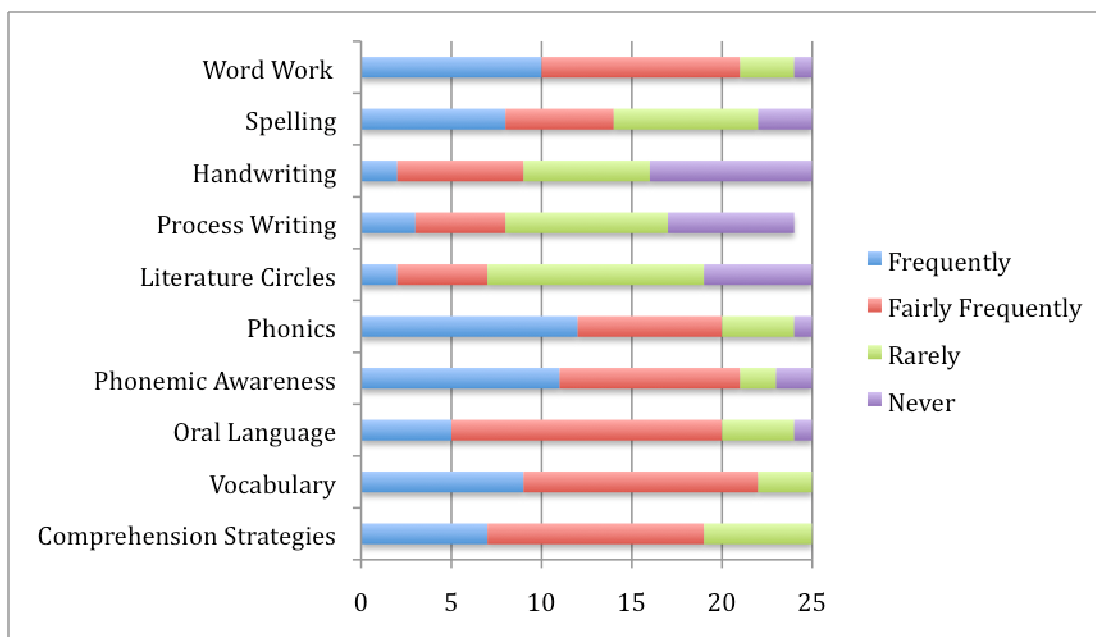
Figure 4.14: Frequency of use of apps/web tools for various components of literacy instruction

Survey participants were asked to identify all the instructional groupings in which they used handheld devices and apps (See Figure 4.15). The most common responses were student pairs (21 respondents, 84%), small, teacher-led groups (20 respondents, 80%) and individual students (19 respondents, 76%). The less common responses were whole class (13 respondents, 52%), small student-led groups (12 respondents, 48%) and teacher one-on-one with an individual student (19 respondents, 76%). These data suggested that survey respondents used apps for a variety of instructional groupings, many of which created opportunity for shared, cooperative or collaborative use of handheld devices and apps.

Individual Student
Teacher and One Student
Student Pairs
Small Groups: Studen-Led
Small Groups: Teacher-Led
Whole Class

0   5   10   15   20   25
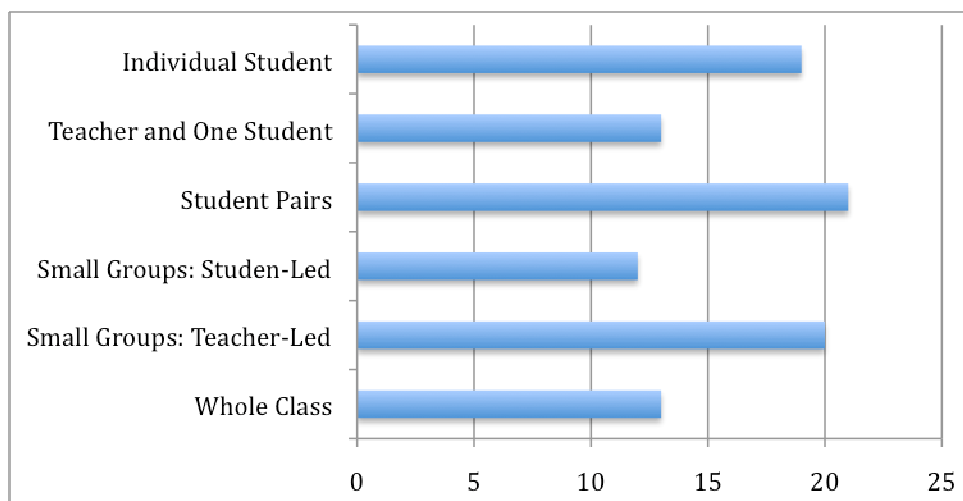
Figure 4.15: Instructional groupings for app use

Respondents were asked to classify their use of apps and web tools in literacy instruction according to the RAT framework (Hughes, Thomas & Scharber, 2006) as replacement, amplification or transformation by agreeing with a statement describing each option (See Figure 4.16). The majority of teacher respondents felt that apps and web tools amplify their literacy instructional practices. 23 survey respondents (92%) selected amplification, in agreement with the statement, "I use technology to amplify my instructional practices. My instruction is more effective through the use of apps and/or web tools. While my instructional goals have not changed, my capability to meet my goals has increased." Two survey respondents (8%) selected replacement, in agreement with the statement, "I use technology as a replacement of traditional learning tools. My instructional practices now use technology tools instead of paper, white board, manipulatives or other traditional materials (for example white board apps, magnetic letters apps, etc.)." None of the teachers surveyed selected the statement, "I use technology to transform my instruction. My instruction has new goals, new roles or new structure than before I began using technology tools."
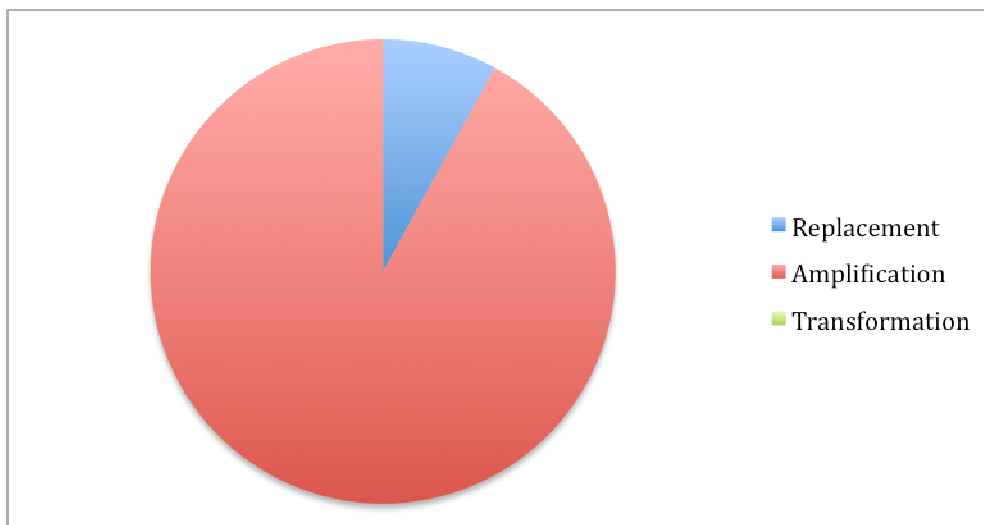
Figure 4.16: RAT Framework classification of technology use

These data reflected teachers' understanding of the technologies available to them as tools to improve their ability to reach instructional goals. Additionally, the teachers surveyed did not, at the time, believe there had been a fundamental shift or restructuring of their teaching practices.

Open-ended responses. Survey respondents completed four open-ended survey items about their experiences and perspectives with the district's technology integration initiative. They were given unlimited characters to type their responses.

Training, support and professional development. Respondents were asked to describe the training, professional development and support they experienced for integrating apps into their early literacy instruction. Nine of the 25 respondents referred to the initial two-day district-wide training held at the district service center that occurred the previous school year at the beginning of the handheld device adoption. Descriptions of the professional development available ranged "extensive" to "minimal," and one respondent wrote "NA" in response to this question. One respondent stated that the there was, "great training in the beginning, but it tapered off after the adoption of 1 to 1

devices." Eight respondents referred to support or collaboration they received from their teacher colleagues, mentioning "time to collaborate," "PLCs" and "study groups" as examples of training, professional development and support they had accessed. Six respondents mentioned the technology leaders (coaches) as a primary source of support for their work integrating apps into early literacy instruction.

A few respondents offered unique perspectives on their experience with professional development, support and training. One respondent (Cecelia) stated, "As a recent grad, I have had several undergrad classes focused on technology," suggesting that her teacher preparation offered training and experiences conducive to using technology in her instruction. Tracey, one of the case study teachers, described her participation in a new staff technology day before the school year began. She shared, "As a new employee, there was a "device training" day where we picked up our iPads and set up accounts, received some training, and had the opportunity to ask questions." New employees to the district had one less day set aside for technology training than the staff did at the beginning of the device adoption. A speech-language pathologist stated that although she received, "Nothing specific through my district for my specific job," she had the opportunity to attend a conference and learn about apps for speech-language pathologists. One respondent (Katherine) offered a more specific description of what the training afforded teachers, "We have received training on a variety of apps (try this one for reading, try this one for math, etc.); we've also been trained in how to evaluate apps (is this a beneficial one for low readers)." While a list of apps to try for different subject areas may feel immediately useful to teachers there are many potential pitfalls to training that amounts to a list of apps to try. This teacher's description stated that she had training

in evaluating apps, an important component of supporting teachers as they integrate apps into early literacy instruction. Given the frequency of new app releases, teachers must have training, support and the opportunity to develop strategies for reviewing the appropriateness and effectiveness of apps for their specific instructional purposes.

    ***Challenges to choosing and using apps*.** The second open-ended question asked survey respondents to describe the challenges they had encountered as they selected and used apps for early literacy instruction. Selecting apps for instruction was identified as a challenging, often problematic endeavor. Respondents named several aspects of selecting apps that they struggled with. The most common responses referred to the cost involved in obtaining apps and concerns with the quality of apps available. 11 respondents mentioned "money" or "cost" in their responses. Six of these 11 respondents described their experience of finding that the free apps were poor quality compared to the apps that cost money. Overall, 10 respondents mentioned challenges they faced selecting apps due to the lack of quality apps available. Specific comments described challenges teachers had encountered including, "Some apps are very limited in their abilities," "Finding an app that is diverse enough for all students to be engaged," and "Not knowing what app to choose to meet the needs of my students." One respondent elaborated on the issue of app quality stating, "The apps are sometimes like an old computer program. Just because they are on a device we use them but if they were on a disc for the desktop we'd say they were not high enough quality" (Survey response, Jessica, 10/7/13). Jessica's comment suggested that convenience may take precedence over quality when apps are used.

Four respondents' comments reflected concern for the needs of their students as a driving factor when they selected apps. They struggled to find apps that would meet the needs of their students. Another commonly experienced challenge was using a free app, only to find that to fully utilize the app, "within app purchases" were required (three respondents). Four respondents suggested time involved in downloading and organizing apps on multiple devices as a challenge they experienced. One respondent (Krista, 3rd) offered interesting comments that suggested she would like to use the device to facilitate engaging students in higher ordering cognitive processes, but the apps available had limitations in this regard:

> I have had a hard problem choosing apps that have students reflect on their comprehension and create/respond based on reading. Even many reading apps have few selections, and the level range is not always given or challenging enough for some students. (Survey response, Krista, 10/2/13)

Krista's comments offered a glimpse of an educator who understands the importance of engaging students in practicing and using comprehension strategies, having students read and write about developmentally appropriate and challenging tasks. Furthermore, her response suggested she understood the potential of creating and responding using multi-modal affordances of the technologies she had available in her classroom. For Krista the challenge arose in finding apps to accomplish her instructional objectives and meet the literacy developmental needs of her students.

One respondent (Katherine) identified affordances she would like to see in apps, but struggled to find them when she searched for apps. These included the capability to save multiple users' work and programming that adjusts in response to students'

performance. She would like to see apps in which the questions or tasks become increasingly difficult or less challenging depending on whether the user was answering items correctly.

Respondents also described challenges they encountered when using the devices in their early literacy instruction. One respondent described challenges experienced due to the size of the devices coupled with the age of the students (first graders using iPad minis), stating that apps were often difficult for students to navigate given their age. One respondent mentioned the management of students while using the devices and another stated that, "Not all the kids understand what to do with." Marcy, a case study teacher, described how having a limited number of devices (one device per four students) limited her use of the devices to small group activities.

Additional comments reflected teachers' uncertainty. One teacher responded she wasn't sure of the best apps to use, while another shared that she felt she hadn't dug "deep enough" to ascertain if the apps were effective. A new (first year) teacher stated that she was "Still trying to figure out the school's system. All of a sudden one day I had 7 new pieces of technology in my classroom and I was expected to use them." Her comment reflected the challenge of transitioning into the position of an inservice teacher with the added task of integrating technology.

Survey responses suggested a range of challenges and obstacles faced by early elementary teachers when both choosing apps and actually using them in their literacy instruction. Pragmatic factors of money and time were clearly the most immediate challenges faced by teachers. However, teachers were struggling to meet goals of using

the devices to meet diverse needs of students and engaging students in higher order thinking.

   Successes experienced. Respondents were also asked to name their successes using apps for early literacy instruction and to describe to what they attributed their successes. Two respondents did not provide an answer for this question, and one stated she had not used the technology at all yet (Kathryn). Nineteen of twenty-five respondents named increased student engagement and/or motivation as a success they experienced using apps for early literacy instruction. This was the most frequently shared response across all four open-ended questions. Two respondents stated that they believed student achievement and success had increased due to the motivational affordances of the devices. One respondent shared that her students were more engaged when using handheld devices than they were when completing a comparable task with paper and pencil. The frequency of comments that referenced motivation and engagement as a success was noteworthy and lead to important questions for further exploration: Do motivational affordances "run their course"? Will students continue to be engaged? Is a student's motivation to use the devices leading to improved learning? Authentic learning?

   Unique responses to this open-ended question described classroom successes afforded by using apps and devices that went beyond "It's a great motivator!" and illuminated ways these tools were being used effectively for instruction. One respondent described the multimodal affordances of the devices as enhancing her students' learning, "They also like learning about things with pictures and videos that they might not have been able to access without the apps" (Katherine). Another respondent described integrating technology and cooperative learning in her classroom, "I have had a lot of

success when I pair students and allow them to explore a game with a partner. I think

students learn best from each other and this definitely held true for the iPods (sic)"

(Kandace). Another respondent coined a phrase "Creation types of apps" to describe

apps that engaged her students in "higher-level thinking learning experiences" (Marissa).

Krista, who described the challenges of finding apps that engage students in

comprehension, creating and responding to texts, stated, "I have had success with

integrating blog apps, and response apps during groups- especially as a way to hold book

discussions. I feel this works well because students can collaborate and share even when

they're not in my group or even the same room." These descriptions of cooperative

learning, higher-order thinking, multi-modal affordances and digital communication

provided a glimpse of lasting and meaningful learning aided by handheld devices and

apps. It is important to note that these teachers taught 2nd and 3rd grade students, the

oldest grades included in this study.

   Feelings and opinions. When asked in the final open-ended item to state their

present feelings and opinions about using apps for early literacy instruction respondents

replied with a wide range of descriptors. Three respondents used the word "love" to

describe how they felt about teaching with apps. Other descriptors varied from, "great"

and "good" to "fine" to "difficult" and "frustrated." Respondent Marissa detailed her

own varied perspective and feelings, explaining how she felt both excited about the

possibilities inherent in the technologies, but simultaneously worried about some of the

more pragmatic and logistical complications of using the devices, especially with

"creating apps." Many themes from respondents' answers to the previous three open-

ended questions were repeated or reinforced in this question. Four respondents restated

concerns about money and the poor quality of free apps in this final question, and four other respondents reiterated their concerns about time limitations negatively impacting their ability to select quality apps aligned with their instructional goals. Case study teacher Tracey described how valuable collaboration with other teacher colleagues was to her as she integrated apps into her early literacy instruction. Five respondents indicated that while generally they felt positive about using apps in their literacy instruction they did want additional training, opportunities to learn or professional development.

Responses to these questions yielded interesting ideas about how teachers conceptualize technology integration and the role technology ought to play in their teaching. Respondents positioned technology as a means to improve their teaching practice and increase their ability to meet their instructional goals, rather than a catalyst to fundamentally evolve or alter their instructional practices. Kandace expressed this idea stating, "I think the apps can definitely work alongside our current practices to enhance student learning and success." Two other respondents clearly addressed the importance of the role of a human teacher in literacy instruction. Cecelia, the first year teacher who had technology training in her teacher preparation, stated, "I don't think apps can replace a teacher, but instead should be used to enhance a teacher's teaching." This sentiment was echoed by Kerry, a 21 year veteran teacher, in her statement, "I feel that apps can greatly improve literacy instruction, but that human interaction is still critical to help students make connections." While generally teachers viewed technology as a welcome addition to their classroom, they felt strongly that technology was a tool to improve their teaching and their students' learning, while the teacher remained the key actor in providing instruction.

Summary and initial codes. Analysis of data from the survey completed by 25 kindergarten through 3rd grade teachers yielded several patterns about the breadth of ideas and experiences early literacy teachers in Silver Lake Point schools had about best practices for literacy instruction, technology integration and using tablets and apps to teach literacy.

Teachers aligned themselves with a balanced approach to literacy instruction, immersion in and exposure to literacy and literature, and strategy instruction in both word recognition and reading comprehension. Generally, teachers spent about 10 minutes reviewing an app and they tested about three apps before making an instructional decision to use an app in their literacy teaching. Other teachers' reviews and recommendations of apps, whether it was a colleague in the same school or a teacher writing a blog, were the most trusted source for identifying apps to use in instruction. The pragmatic concern of money was a dominant and repeated idea throughout the survey, evident in both the constrained response and open-ended survey items. Teachers narrowed their search for apps and generally used free apps, despite their concerns about the quality of free apps. However, data suggested that teachers prioritized the specific students in their classrooms and their instructional needs, thus although cost was a significant factor, teachers maintained a student-centeredness when they selected apps. Handheld devices and apps were generally used for small group activities or independent work. Teachers conceptualized their use of technology as amplifying their instructional practice, helping them more easily meet their instructional objectives, rather than fundamentally transforming their practice. Money and time were the greatest challenges to teachers' use of apps, while motivating and engaging students were viewed as the

greatest successes of their work with apps. Teachers reported varied experiences with support, training and professional development, but the general consensus from survey respondents was that more professional learning would help them use the devices and apps more effectively.

These findings informed subsequent data collection. Interview questions probed the case study teachers' perspectives on these patterns and observations, resulting in both support for and contradicted to the survey teachers' reports of technology use. The survey data were triangulated with all other data collected. Concepts derived from ongoing analysis of data collected via the survey drove and informed the focus of subsequent data collection. Initial codes were generated from this process (see Chapter 3, Tables 3.4 & 3.5), then modified and clarified as data collection and analysis continued.

The findings from the survey describe characteristics of a group (Baumann & Bason, 2011), specifically, K-3rd grade Silver Lake Point teachers. The findings provide an understanding of the teachers' perceptions about the training they received, their notions of successes and challenges with technology, and their feelings and opinions about using the handheld devices and apps for literacy instruction.

I turn now to presenting the findings of the two purposively sampled, information-rich cases of kindergarten teachers to "explain causal links in real-life interventions that are too complex for the survey or experimental strategies" (Yin, 1994, p. 15). Findings from the cases of Tracey and Marcy illuminated the complexity of early elementary classrooms and teachers' dynamic, shifting knowledge and beliefs, and allowed me to identify, describe and explain causal links that occurred throughout these two teachers' planning, instruction and reflection.

Embedded Case: Tracey

New Park Elementary. Tracey taught kindergarten at New Park Elementary

School. New Park Elementary sat on the far north side of Silver Lake Point district. To

reach the school I drove on quiet county roads past large housing development projects

with elegant names: Fountainwood Terrace, Quail Run Glen, River Oaks. There was a

small, primarily commercial airport, a well-maintained golf course and a fancy pet hotel

claiming to offer the state's "Premier Pet Boarding-Nothing but the best for your best

friend!" along the road to New Park Elementary. The drive of several miles from the

interstate was peaceful, very little traffic and no pedestrians. Large signs advertised the

homes for sale in the numerous developments, touting miles of paved recreational trails

and luring potential buyers with a variety of home luxuries. There was the occasional

lonesome small farm home that stood its ground in the midst of the suburban

development, small by comparison and run down, these homes were flagged by rows of

bare trees, yards decorated with rusting pieces of farm equipment.

New Park Elementary had undergone construction to meet the needs of increasing

enrollment. A large, newly constructed building, New Park was geometric: rounded

walls and windows, with layers of tall, staggered rectangles rising up behind the curved

entrance. A dark blue overhang had "New Park Elementary" boldly displayed in large

silver letters. The building was mostly constructed with large, roughly textured bricks of

a lighter orange-brown color than traditional bricks, interspersed with smooth metal

surfaces painted dark blue or left metallic silver. The overall effect was contemporary

and new, the building matched the housing developments that surrounded it. The space

around the school seemed to also be under construction, wooden markers with flags were inserted throughout unplanted plots of dirt. A bright yellow and red playground sat neatly next to the building, a constant flurry of kids in motion and delighted screams of students happy to be outside playing. New Park Elementary was newly built, fresh and attractive, with signs of the last moments of construction still visible, much like the area that surrounded it.

A cheerful young school secretary greeted me, showed me where to sign in and helped me find Tracey's classrooms. The center of the school was a large two-story atrium that served as the school library. This open and sunny space was full of shelves, carts and rows of children's books, as well as small tables and chairs sets for students to read. A bright yellow bulletin board stated, "Students are LOVING the Lovelace Books!" and had construction paper hearts of various colors with students' names and book titles printed on them. There were several display cases full of college pennants that had clearly been created by students. Most of the schools were in the state, or at least the upper Midwest, printed in wobbly children's writing, with mascots and symbols drawn in with crayons or markers. The classrooms were arranged in pods of five to seven rooms that sat off of the library space. The 3rd grade classrooms were on the second floor of the school; most of the other classrooms were on the first floor. All the classrooms led out into the shared common space.

Where the wild things learn!: Tracey and her classroom. Tracey's classroom was very neat and tidy. She did not have a lot much student work displayed, but her décor had a monster theme. Classroom job assignments ("Laboratory Work"), students names taped to the front door and locker tags were all printed on cartoon monsters. Her

door proclaimed, "Where the wild things learn!" above 20 or so monster cut outs, each with a student's name printed on them. The door was in one corner of the classroom; the other three corners held a classroom library space, Tracey's desk and the writing center area respectively. A Pete the Cat poster was taped to the wall right next to the door frame and declared, "Pete Says…"You get what you get and you don't throw a fit." It's All Good!" The SMART Board seemed to be the center of the classroom. Tracey had five short rectangular tables, each with four chairs around them in a neat row across the middle of the room, set far enough back to leave ample space for students to sit in front of the SMART Board. A kidney table sat between her teacher's desk and the SMART Board. The wall directly across from the SMART Board was lined with students' lockers. There was a counter to the immediate right of the door with a sink, drinking fountain, student mailboxes and stacks of math textbooks. The corner between this counter and the SMART Board was the classroom library, sectioned off by a bookshelf with small plastic bins of trade books and a waist-high wooden bookstand. There were eight small black book bins on the shelves of the bookshelf. Each had a printed and laminated label describing its contents: Eric Carle, Animals, Classics, School, Silly, Clifford/Dr Seuss, Leo Lionni/Little Critter and Fall/Autumn. The floor of the library area was scattered with large and inviting comfy pillows in animal prints. There was also a Looney Tunes beanbag chair, a large stuffed tiger and a small kindergarten-sized plush chair with a chipped and worn wooden frame. The bookstand held one lonely "Big Book": *Anno's Counting Book*, the sole oversized read aloud book I saw in the classroom throughout my time with Tracey's class.

Tracey had cartoon-like literacy posters displayed throughout her classroom. Neatly taped to the wall by the writing center were posters like "Super E!" (Super E has the power to change 'tap' into 'tape,' etc.) and "Sneaky Y-the Robber Guy!" (He steals the sound of 'E' or 'I'). Behind her guided reading kidney table were character posters for decoding strategies: "Stretchy Snake," "Chunky Monkey," "Lips the Fish," "Tryin' Lion," "Skippy Frog," "Eagle Eye," "Flippy Dolphin" and "Helpful Kangaroo." There were small stuffed animals stapled to the board, hanging limply next to each corresponding poster. Overall, the classroom was neat, warm and inviting. There was a noticeable lack of trade books and text books in the classroom.

Tracey herself was bouncy, very cheerful and friendly. The first time we met she was fashionable dressed in a neat black pencil skirt, colorful purple blouse and simple black pumps for parent-teacher meetings. However, when her students were there and she was teaching she dressed more casually, but still trendy: long tunics smartly belted at the waist, dark leggings or skinny jeans and tall boots. She wore her brown hair in short, neat bob, slightly longer in the front with side bangs. Tracey was in her mid to late twenties. She was married and did not have children. She thought of herself as one of the younger, newer members of the teaching staff, compared to her colleague, Kathleen, who just turned forty and started teaching "back when there wasn't any technology" (Tracey, Interview, 10/8/13). Tracey stated that she was not *brand new*, like two of her colleagues on the kindergarten team who were both in their first year of teaching.

Information-rich case: Tracey. The characteristic I noticed first about Tracey's approach to education was her enthusiasm and passion for integrating technology into her instruction. Throughout our interviews Tracey consistently expressed her enjoyment of

using technology to teach, as well as her belief that technology enabled her to better meet her instructional goals and afforded her students increased academic success.

Tracey was an information-rich case because her responses to the majority of the survey questions were quite typical of the sample of 25 teachers, including her beliefs and goals for literacy instruction, use of apps for literacy instruction and her processes for identifying apps to use. Tracey's open-ended responses reflected both of the most frequent patterns from survey respondents: the concern with the quality of free apps, "Most of the challenges come with finding quality educational apps for free. Many of the really good apps cost money," and the valuing of the student engagement afforded by technology that was so common among survey respondents, "Students are engaged and responsive when they have the opportunity to use technology to learn" (Tracey, Survey Response, 9/23/13).

Tracey offered a unique perspective given that this was her first year teaching in Silver Lake Point schools, having received her teacher preparation and taught four years prior in a neighboring state. She described her experiences entering the district after the initial handheld technology rollout. Tracey was also an information-rich case in part because of her avidity for using technology in her instruction as much as possible, without loosing sight of maintaining a student-centered approach to teaching. In her open-ended survey responses Tracey shared, "I love integrating technology into learning, so I am all about learning from others in the most effective ways to do so. I love sharing ideas and working together for the benefit of all students" (Tracey, Survey Response, 9/23/13). This excitement for technology integration was evident when I contacted Tracey via email and asked her to participate further in my research. She replied

immediately, her response peppered with emoticons to convey her positivity towards my interest in how she used handheld devices and apps in her classroom.

I observed four different uses of handheld devices for kindergarten literacy instruction in Tracey's room. Following each lesson I conducted an interview with Tracey about the lesson she had just taught, with guiding questions about positive and negative affordances of using the devices, valued added by the use of technology, a verbal protocol of her app selection and her thoughts about planning subsequent instruction with handheld devices. By observing instruction in Tracey's classroom and interviewing her with a focus on instructional reflecting and planning I was able to gain more insight into how Tracey used technologies in her classrooms to teach literacy and how she chose apps or web tools based on her knowledge of best practices for literacy instruction (RQ 1 & 2). Further, I was able to identify patterns of behavior in teaching and learning, and actual positive and negative affordances of using apps and web tools in early literacy instruction in practice (RQ 3). Observing and interviewing Tracey also allowed me to understand how Tracey's beliefs, knowledge, planning and instruction were impacted by her experiences planning and teaching with apps and web tools, her observations of students' learning with these technologies and her reflections on classroom lessons (RQ 4).

Seeking a tech-savvy district: Tracey's background and beliefs. Tracey grew up in a community that was a mix of suburban and rural, fairly close to Silver Lake Point, but she went to college and completed her teacher preparation program in an adjacent state. She also taught for four years in that same state before moving back to her home state. Tracey accepted the kindergarten position at New Park Elementary in part because

of the Silver Lake Point district's investment and commitment to having technology in all classrooms. Because Tracey taught with technology in her previous district she felt that she needed to find a position in a district that also made technology available to teachers:

> Silver Lake Point was so attractive to me because, like I said, I didn't want to take a step backwards, like if they would have said, "Oh you wouldn't get a SMART Board," I would have been like, "What do you mean?""
>
> (Tracey, Interview, 10/8/13).

Tracey described how her last district had a SMART Board in every room and a small number of iPads for teacher use, but no handheld devices for students. At New Park Elementary Tracey had one iPod Touch device for every four students in her class, a SMART Board, an iPad and a MacBook laptop for her use. Tracey described her experience as a teacher new to the district:

> One of the reasons that I accepted the job here was because Silver Lake Point is a very tech savvy district. Right away you were told, you know, we're going to give you a Mac Air Book and we're going to give you an iPad to use yourself and then we're going to give, depending on the grade level you teach, like kindergarten you have iPod Touches for the students and then other grades, older grades, have either iPads or other devices. So depending on the grade, you were given all this technology. Every room has a SMART Board. Stuff like that, which I was just in love with because I love technology and I thought, "Well, yeah, I want to take a step up instead of a step back!" moving here. So that was one of the biggest draw to this district, was that they are very tech-focused. Everything obviously is, we're not just using technology for the sake of using it,

you know? How does it help their education? It's used to enhance their education,

not to, you know, replace it. (Tracey, Interview, 10/8/13)

While she was clearly drawn to the abundance of technology made available to teachers

in Silver Lake Point, Tracey reiterated throughout our interview the importance of using

technology in meaningful ways that enhance or otherwise positively impact student

learning.

RQ#1 Assertion: Case study teacher #1 used handheld devices and apps 10 minutes
daily in her literacy instruction by integrating the learning technologies into
traditional print-based literacy practices such as a listening center, practicing skills
such as rhyming, letter names and sounds, segmenting and blending, and using QR
codes to answer questions or check answers.

"Keeping best practices…and everything is changing." Tracey consistently

strove to implement best practices for literacy instruction in her classroom, balancing this

objective while attempting to design engaging ways to use the devices. While Tracey

dedicated a great deal of time and effort to filling the handheld devices with apps for

students to use, there were essential three types of apps she used in her literacy

instruction: listening apps (digital stories or ebooks), games (practicing literacy skills like

rhyming, letter sounds and names, segmenting and blending) and quick response (QR)

codes. Tracey used the six handheld devices she had access to every day in her literacy

instruction. Because Tracey had a ratio of one device for every four students she always

incorporated the devices into instruction within her rotating small group centers, never

using the devices for whole group instruction. During my observations in Tracey's room

students never used the devices for longer than ten minutes at a time and always as a center. The use of the devices varied between independent tasks, and small, teacher-led guided practice.

RQ#1 Sub-assertion: Case study teacher #1 used handheld devices and apps as a replacement of the traditional practice of an independent listening or reading center during a kindergarten literacy block.

In many ways teaching and learning using listening apps mirrored independent reading in a classroom library. Figure 4.17 below, a photograph of Tracey's students during the listening center, resembles a photograph of students quietly reading print-based texts in a classroom library. The students sat on comfy pillows and beanbags, they may have held a stuffed animal and they were experiencing a book. Each small group I observed demonstrated these behaviors.

Figure 4.17: Kindergarteners at listening center in Tracey's classroom

Tracey reported using the handheld devices most frequently as a listening center. In November she stated that students had "mastered" using devices as a listening center. When students were working with the handheld devices as a listening center they selected

the app/book of their choice from one of several folders Tracey assembled on each

device. All six devices were loaded with identical apps organized into the same folders.

Tracey valued listening to reading as an activity to support students' literacy

development. Additionally, she shared that students' most frequent use of the handheld

devices in her classroom was independently listening to book apps.

In addition to using this activity as a reading center, Tracey often had students use

the devices to listen to book apps upon their arrival at school, before instruction began.

Citing the "Daily Five," (Boushey & Moser, 2006) Tracey described her practice of using

the listening apps in place of "Read to Self" for early arrivers to school.

Sub-assertion #2: Tracey used handheld devices and apps to have students practice

phonics skills independently or with guided practice including letter names and sounds,

rhyming, segmenting and blending.

Tracey used game apps in small group centers often in her instruction, specifically

for students to practice early literacy phonics skills such as letter naming, rhyming and

segmenting and blending. Tracey did on occasion use the devices with students during

their center time with her during which she chose game apps to use for guided practice.

Tracey conceptualized using game apps for early literacy skills as a method of

differentiating for students' developmental instructional needs. She organized games into

folders on the devices by the skill they practice: "Seg & Blend," "Letter ID" or "Letter

Sounds" (See Figures 4.18 & 4.19).

Figure 4.18: Segmenting and blending game app folder

Figure 4.19: Letter sounds game app folder

She printed screen shots of each folder, indicated with a highlighter which apps they

could choose from, and taped a sheet with students' names on it on the cupboard doors by

the library.

RQ #1 Sub-assertion 3: Tracey used QR codes in her literacy instruction as a question and answer activity or as a self-check measure with a traditional print-based literacy worksheet.

Tracey used QR codes in her literacy instruction in two different ways: (a) an activity that involved answering questions based on the image revealed when the code is scanned, and (b) as a means by which students could check the accuracy of their work by scanning a code to reveal the correct answer.

"Hunt around the room." Tracey described one of her uses of QR codes as a "Hunt around the Room." She posted QR Codes with questions on all four walls of the classroom (See Figure 4.20). Students took a device, a slip of paper with numbers down the side (See Figure 4.21) and a pencil (no earphones required for this task) and traveled to each of the six stations, scanning the QR code and writing their response to the question.

Figure 4.20: Dinosaur QR Code Activity
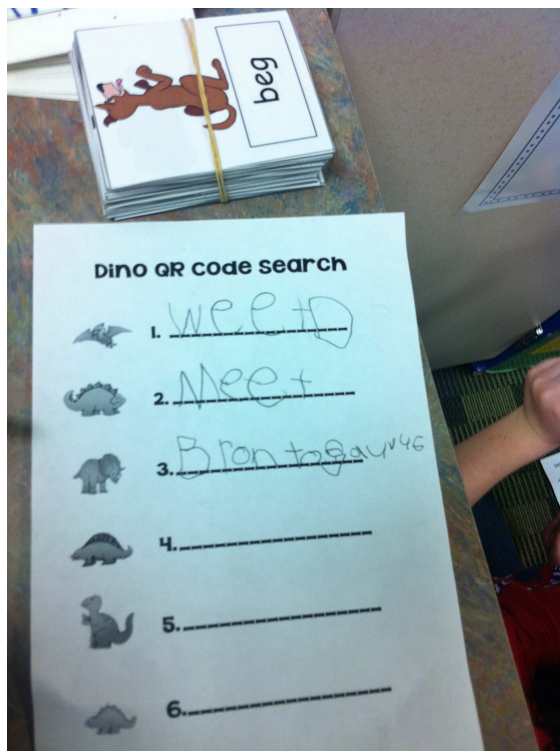
Figure 4.21. Dinosaur QR Code Response Sheet

QR Code Self-Check. Tracey also used QR codes as a means for students to check their work. This activity was a component of her small group instruction. After checking home reading logs and a guided reading of leveled readers Tracey distributed worksheets with QR codes for students to correct their work. There were two variations on these worksheets: one worksheet started with a statement ("The dog has a cold nose") followed by a question ("What is cold?") with a blank for the answer. Students are supposed to write "Nose," then scan the adjacent QR code to verify that they wrote the correct answer. This sheet has five items. Students completed the sheet independently at the kidney table with Tracey monitoring their work and offering support as needed (See Figure 4.22).

Figure 4.22. Student completing QR self-check worksheet during small group with teacher

The other QR code self-check worksheet was simpler: three items only, each was a drawing of a CVC word (dog, pig, sad, etc) with three blank spots for students to write the letters. The QR code revealed the correct spelling. Tracey had several versions of this worksheet, each with a different combination of CVC words, so students had different words than their neighbors. When they completed one sheet they were handed another to complete with three new words until the center time ended (See Figure 4.23).

Figure 4.23. Student completing CVC QR code worksheet in small group with teacher

RQ#2 Assertion: Case study teacher #1 occasionally drew on her knowledge and beliefs about developmentally appropriate best instructional practices for literacy instruction as she reviewed and selected apps for instructional use, although she did not use this knowledge to critique apps and she also considered factors unrelated to best practices for literacy learning such as cost and visual appeal, or she adopted activities from colleagues.

Tracey asserted that the time it took her to download, test and organize apps on her classroom set of devices was "worth it." She described spending entire weekends downloading and testing apps, visiting her favorite blogs for apps suggestions and organizing her folders on devices.

RQ#2 Sub-assertion 1: Case study teacher #1 selected listening apps based on her belief that early in the kindergarten year her students were "not really reading," rather "working on foundational skills," and thus would benefit from listening to fluent reading.

She sought apps that modeled directionality of text, offered "just-in-time" features and modeled fluent reading.

Tracey articulated her thought processes as she chose listening center apps in a verbal protocol procedure that offered a glimpse of how she was choosing this kind of app:

> Story Chimes is one of my favorites because they have a lot of the traditional stories, like, they've got *Goldilocks and the Three Bears*, *the Elves and the Shoemaker, Hansel and Gretel*, things like that which I really like the kids to be exposed to, because a lot of them aren't at home, you know? So they get that traditional literature piece in there…I also love that they have the option of reading to themselves or listening to reading…a lot of the other books (apps) you can tap the words instead and it reads it to you or you can read it completely independently. It's nice because you get kind of the best of both worlds, like they'd be able to read along with it and then when they got stuck on a word they could try the reading strategies if they were comfortable, otherwise they tap it and it would tell it (the word) to them, which was nice (Tracey, Interview/Verbal Protocol, 10/8/13).

As Tracey engaged in a verbal protocol procedure of Storychimes *Snow Queen* app sing-songy, electronic music played in the background, which gave way to an electronic overly cheerful voice reading the story. Although features such as "just-in-time" word assistance and traditional fairytale content attracted Tracey to these apps, a critique she offered was that there was not a comprehension measure or task included in these apps. Tracey also described the value of apps that developed concepts of print in her statement,

"I really like that when it is reading it to them it tracks the words, just to kind of teach that directionality" (Tracey, Interview/Verbal Protocol, 10/8/13). Tracey named her favorite software developers for listening book apps as Story Chimes, ABC Mouse and Magic Town Books (which she refers to as 'tab books' as they are described in the App Store). Story Chimes, as Tracey suggests, were generally digital versions of classic European fairytales: *The Ugly Duckling*, *Hansel and Gretel*, or *the Snow Queen*. The ABC Mouse books, favorites among the students, were rhyming books comprised of sentences like 'The man ran' and 'The fat cat sat'. The Magic Town apps, or tab books, were a mixture of classic fairytales and more recent children's titles animated and digitized. Tracey expressed her beliefs about the importance of listening to fluent reading:

> I try throughout week, they all get a chance to listen to reading because I think its important for them to hear that fluency, you know the intonation of voices, that kind of thing, you know, just to hear the reading, I think that's just an important thing to experience (Tracey, Interview, 10/25/13).

During one of our interview Tracey reiterated numerous times that she felt that listening to stories was developmentally appropriate for her kindergarten students, particularly early in the school year. Although she acknowledged, "They like looking at regular books, too," she asserted that at that moment her students' reading was "still very skill based, they're not really reading, they're working on foundational skills, halfway through the year they may have better skills and they'll be able to read more complicated stories" (Tracey, Interview, 10/25/13). Tracey's comments demonstrated her awareness and understanding of students' literacy development, and her commitment as a teacher to

meet the changing needs of her students. She selected and used listening apps in a manner that is best described as substitution.

RQ#2 Sub-assertion 2: While case study teacher #1 described the instructional potential of "free writing" apps (apps that are not a ebook or game, rather are open-ended for creating multimodal texts), she did not select these apps for instruction; rather, she sought out apps with characteristics such as free of cost, a motivating game element, visual appeal and the possibility students may use the app at home, as opposed to drawing on her knowledge of best practices for literacy instruction.

During our initial interview Tracey described her favorite apps as "Free writing" apps, stating, "The sky is the limit" with these versatile apps (Tracey, Interview, 10/8/13). These are apps designed to afford multimodal meaning making. While Tracey stated, "I like the ones that are just left up to your creativity" for sound practice, letter writing and naming, segmenting and blending and sentence writing I did not observe her using the devices in this way. Nor did she report ever using these apps for her instruction. Tracey was unable to successfully use these apps she was so enthusiastic about at the beginning of the school year. This was due to several factors, including the limited number of devices she had access to, as well as the fact that using free writing apps would have had to be a carefully planned, teacher-led center.

Tracey named several characteristics she sought in game apps she selected for early literacy skill practice as a center during her reading block. Tracey only considered free apps. Apps that practice segmenting and blending in the context of a game were

attractive to Tracey as she described during our interview when she engaged in a verbal

protocol procedure with a Reading Magic App:

> This is one of my favorites because I think segmenting and blending are some of
>
> the skills that are so hard to keep coming up with new ideas for, you know?
>
> Especially blending, to tell parents, how do you play with blending at home with
>
> them? Like, how do you come up with something so that's kind of fun? Just that
>
> this is a way for them to still be manipulating, to still be touching things, but to be
>
> working on the readings. So for this one so they have to listen to the three sounds
>
> (C-A-P) and be able to blend it together before they're able to hit the picture and
>
> see if they were right, and they can kind of see how many sounds there are. I also
>
> appreciate that it'll read the whole thing and has the sounds so that they know
>
> how many (letters) (Tracey, 10/8/13, Interview/Verbal Protocol).

Tracey mentioned during multiple interviews that creating opportunities for students to

use the same apps to practice early literacy skills at school and at home was valuable to

her. She described how students were familiar with some of the game apps she chose

because their parents had them on their phones or devices, or the students went home and

asked their parents to load an app they had used at school on their personal devices at

home. Tracey identified the combination of students seeing, hearing and touching as they

practice skills such as blending and segmenting to have instructional value. The reward

or prize aspect of a game app, a hidden picture revealed or a prize or "sticker" (digital

image saved in a "sticker book" within the app) won was a desirable characteristic she

sought when selecting these apps. Tracey also valued the affordance of a self-check or

student feedback feature, often something that prompted the student to revise an incorrect answer before moving on in the game.

When Tracey described her instructional planning with these game apps to practice early literacy skills she stated she often limited students' choice of app to the apps that did not require teacher modeling, rather the app gave the user directions to play the game. She elaborated on this point, sharing how she practiced gradual release of responsibility when students used certain apps that did not provide the user with clear-cut directions. She often introduced an app and engaged students in guided practice when they were working with her in a small group at the kidney table. She used her full-size iPad and had students take turns completing the task the game involved (segmenting or blending short CVC words, selecting letters that correspond with sounds heard and so forth). Once she introduced a game app to a small group and engaged them in guided practice they were assigned that app as independent center activity on the smaller iPod devices in future instruction.

Another factor in Tracey's app selection process was her consideration of the visual appeal of an app. During a verbal protocol procedure she stated, "As ridiculous as this is, I think the graphic, the picture of it, is more attractive than the other pictures…they weren't as attractive as the cute little caterpillar" (Tracey, Interview/Verbal Protocol, 11/8/13). Tracey viewed an attractive visual quality as a desirable feature of an app. Tracey genuinely enjoyed the trial-and-error puzzle of finding game apps for early literacy skills practice. During an interview she exclaimed, "I've got nothing to do this weekend!" and went on to describe her plans to search for apps that practice "Super E" (CVCe patterns).

While Tracey drew on elements of best literacy practices such as developmentally appropriate differentiation, and implemented gradual release of responsibility when necessary, the factors that guide her selection of game apps for early literacy skills practice were not firmly grounded in a deep understanding of literacy processes and students' development. Although she was very clear about what specific skill she wanted groups of students to practice, she sought characteristics of apps such as free of cost, a motivating game element, visual appeal and the possibility students may use the app at home.

RQ#2 Sub-assertion 3: Case study teacher #1 did not draw upon her knowledge of best practices for literacy instruction to evaluate the QR code activities she used; rather these activities were shared with her by a colleague or reused from an after-school program she had previously taught for older struggling students.

Tracey did not plan or design the dinosaur QR code "Hunt Around the Room." One of her colleagues, another kindergarten classroom teacher, shared the activity with her. During our interviews Tracey was unable to articulate the instructional value, the positive or negative affordances, or any connection between this activity and best practices for literacy instruction.

During a post observation interview Tracey shared that she had taught an extended day program for struggling 1st and 2nd grade readers the past fall semester and used QR code worksheets with them. She asserted that she believed the worksheets were now appropriate for the literacy developmental stages of the kindergarteners she was teaching. Tracey found these worksheets free of charge online from various blogs or the

website Teacherspayteachers. Tracey viewed variety and engagement as the most

valuable affordances of using the devices with QR code worksheets:

> They are so engaged with technology…for them (it's a) different way of getting
>
> the result. It's like "Oh, wow, this answer popped up, it's the same as mine, cool,
>
> move onto the next one!" versus me looking at them or giving them a star, you
>
> know what I mean?   (Tracey, Interview, 1/22/14).

Tracey did not explicitly link this use of technology to literacy learning in her planning;

that is to say this use of the technology did not required reading or composing, or

practicing decoding. Rather, the device served as a unique means for students to self-

check a traditional pencil and paper early literacy practice activity.

RQ#3 Assertion: When case study teacher #1 and her students used handheld

devices and apps in the classroom literacy teaching and learning included minimal

social interaction among kindergarten students, numerous unanticipated obstacles

to literacy learning and varied levels of student engagement.

My observations and photographs of Tracey's students using the devices, as well

as post instruction interviews with Tracey, allowed me to understand what teaching and

learning looked like when devices and apps were used in early literacy instruction, and

the positive, negative and unanticipated affordances of these uses of the technologies.

RQ#3 Sub-assertion 1: When handheld devices and apps were used in literacy teaching

and learning in case study teacher #1's classroom students' interactions with their peers

were rare and usually involved one student asking another for help navigating the handheld device.

Throughout my observations of Tracey's use of handheld devices for a listening center I rarely saw students interact. The interactions between students were brief and often involved one student helping the other locate an app or adjust the device in some way. For example, one pair of girls selected the same Story Chimes app/story to read by holding their devices side by side as they located and opened the app. However once they started the app they did not interact further (Field Notes, 10/25/13). In another incident one girl interrupted another and asked for help finding a book. The other girl shifted her iPod to one hand and looked at the other girl's device. She tapped her friend's screen with her pointer finger, tapping and swiping. After a moment she said, "I can't find it, I don't know where it is." They separated and both went back to holding their iPods with both hands, their eyes trained on their respective devices (Field Notes, 10/25/13). These two interactions were typical of the peer-to-peer interactions I observed during the listening center. Although students often selected the same app to listen to they did not have a shared experience of the story once they put their headphones on and fixed their eyes to the screen. More often, they would ask a peer for help, which would be given somewhat grudgingly. If the problem was not quickly solved the student giving the help gave up, eager to return to his or her own device.

Students interacted with peers more during my observations of game apps as a center compared to listening apps as a center. However, these interactions centered on navigating the devices rather than literacy learning, or were even disruptive to peers' learning. Students would select the same app to use as their peers, often holding their

devices together to assure they selected the same app, or even handing their device to a friend to launch the app. In several of the groups students looked over a peer's shoulder, telling them, "It's –at, AAA TTT," or "It's supposed to be…" as they reached over to touch the other student's device screen. Students also interrupted their peers by shoving their device in front of a friend's face as they achieved a goal within the game, earning a starburst or cheering cartoon character (Field notes, 11/8/13). When using the handheld devices for phonics skill practice game apps students interacted with peers, but more often these interactions centered on navigating the devices, as opposed to literacy learning.

During the dinosaur "Hunt around the room" QR code activity student interactions were notably hostile towards one and other. Students often found themselves clustered around one QR code station. Rather than spreading out or collaborating to read the question and find the answer they pushed and shoved one and other with cries of "Move!" and "She's in my way!" (Field notes, 11/8/13). This activity proved to generate tension among kindergarten peers rather than fostering cooperative learning.

RQ#3 Sub-assertion 2: Case study teacher #1's requirement that her students wear earphones when using the devices yielded unanticipated negative affordances including the isolation of students from their peers, incidents of wasted instructional time and an inequitable learning environment.

Tracey shared that, in addition to crayons, markers and pencils, earphones were an item listed on the kindergarten supply list. In Tracey's classroom earphones were stored in clear gallon plastic bags with each student's name scrawled in colored sharpie

marker across the front. Tracey kept two red milk crates overflowing with earphones stowed in their plastic bags in her lower cupboards for students to find for themselves when they had a turn to use the listening apps. If students did not have personal earphones in the classroom they were not allowed to use the handheld devices during the listening center. When I inquired about equity issues with families without the financial resources to send earphones or headphones to school Tracey responded that the school social worker had some funds to purchase earphones if that happened (at the time it hadn't happened).

The required use of earphones further served to isolate students from peers and reduced peer-to-peer interactions. In a traditional independent reading center students' ears would not be covered, thus they may be more aware of their peers, or even more inclined to share a book with a peer. Additionally, the most frequent disruption I observed during the time the devices were used as a listening center had was related in some manner to earphones. For example, one student did not have his earphones properly plugged and as a result the students at the adjacent center had their work interrupted. These students at the spelling center began to complain loudly, distracting students from other centers as well. Tracey responded, "Tell your friends to check and make sure their headphones are plugged in all the way" (Field notes, 10/25/13). At other times students struggled to locate the plastic bag that held their headphones from the storage bin. There were also multiple incidents when a student had the volume turned up so high on their device that even with earphones the sound distracted other students. One student refused to use the earphones her family had sent (ear buds) and she wanted larger headphones (most girls in Tracey's class had oversized headphones decorated with

rhinestones, animal prints, faux fur and hot pink fabric). Tracey's classroom was unique in that she required students to have earphones to use the devices, which was not the case district-wide.

Similar to the listening center use of the devices, the management of materials with the headphones and distractions of loud volume on the devices were problematic when the devices were used as a literacy center practicing phonics skills with game apps. A critical incident occurred that illustrated how the expectation of earphone use may have created inequitable or unfair situations among peers:

> An African American boy without earphones (I find out during our interview he just switched to all day K and his family hasn't sent earphones yet) starts an app that says, "Aaaaligator, Aaaastronaut." He quickly turns it off. Tracey comes over and helps a girl …The boy without the headphones slides over to where she is helping the girl. She says, "Fred, where are your headphones? You should bring headphones if you're going to use the iPods, tell Mom and Dad you really need headphones." He doesn't say anything. He slides back to corner still holding the iPod, he swipes and touches it but does not pick an app or play game. Tracey goes back to the kidney table. Fred starts playing game without earphones and he looks at me when device makes sounds. He seems embarrassed. He is sitting far away from other kids; his body language suggests he is uncomfortable (Field Notes, 11/8/13).

This incident suggested that Fred was limited in his use of the devices, somewhat alienated from his peers and uncomfortable in the classroom. The other students did not notice his discomfort and Tracey seemed somewhat unconcerned that he was not using

the devices as she planned, nor was he engaged in literacy learning during his time at the center.

Even for students who had their own earphones, the required use of earphones negatively impacted their learning. One girl, upon finding her earphones were not in the storage bin, picked up "1000 Things to Spot in the Town," a library book. After a few minutes she put the book down and snuggled up to the large stuffed tiger in the library, rubbing his paw softly against her check. Tracey came over to monitor students and asked, "What do you do if you don't have headphones? Do you play?" The girl silently shook her head 'No,' Tracey pressed, "Did you look really carefully for your headphones?" The girl nodded 'Yes.' "Okay," Tracey replied as she looked in cabinet. When she found the headphones she said, "You left them out," as she handed them to the girl (Field notes, 11/18/13). Like Fred, this student was not using the devices as assigned. These examples suggest that due to the material management of earphones and the resulting loss of instructional time, requiring the use of earphones was a practice to reconsider.

RQ#3 Sub-assertion 3: When handheld devices and apps were used in literacy learning in case study teacher #1's classroom there were lost instructional opportunities including time lost trying to locate the correct app, students not utilizing certain features with positive affordances such as "just-in-time" assistance or word tracking and students off-task.

There were more incidents of students being off task when students were assigned to use the game apps to practice phonics skills than the listening center. Most students

struggled to locate the correct folder and open an assigned app of their choosing. Every

time a new group of students arrived at the center they clustered around the printed

screen shots with their assigned apps for several minutes, holding their devices parallel to

the paper, struggling to locate their assigned apps (See Figure 4.24), resulting in the loss

of about three-five minutes of center time (Field notes, 11/8/13).

Figure 4.24: Tracey's students viewing their app assignments

During a post-instruction interview, Tracey shared that although they had been

working with assigned game apps to practice specifically assigned skills all week, her

lesson was still "Rough around the edges." She felt students needed more practice using

the devices in this way, especially with finding a specifically assigned folder (Tracey,

Interview, 11/8/13). In addition to time lost due to the challenge of finding the correct

app, I observed lost learning time as one student played a math app during the center and

another sat quietly pressing the home button to light up the screen of his device, but not

swiping to unlock it. Tracey was unaware that these two students were not engaged or

using their assigned apps.

In every group I observed during the phonics skill practice with game apps at least one student decided to not use the devices, but rather after looking at the printed sheets, settled into the comfy pillows and bean-bags with a traditional print book from the classroom library. Occasionally, the student couldn't find their earphones, but more often than not the students who chose to read a trade book did so after playing with a devices for a few minutes and then setting it aside in favor of a book.

As Tracey shared during numerous interviews, using apps allowed students to listen or read to themselves, and many offered "just-in-time" word identification or vocabulary affordances. Tracey sought out apps with these qualities for her listening center. However, during my observations students only used the listening devices in the "Read to me" mode, and some students did not look directly at the screen of their device, rather their eyes gazed off into space, thus negating the concepts of print/directionality affordance of words lighting up as they are read (Field notes, 10/25/13). I did not observe students using the "just-in-time" features, either. Therefore, although these features are designed to offer positive affordances to early literacy learning, if they are not used they do not foster literacy development.

RQ#3 Sub-assertion 4: The literacy tasks involved in the QR code "Hunt around the Room" task were too difficult for students to complete independently, particularly struggling readers, although they were able to successfully use the technology to scan the QR codes and a few students practiced strategies like invented spelling.

During my observation of Tracey's dinosaur-themed QR code "Hunt around the Room" I found myself as a participant observer to a greater degree than I did the other

days I observed in Tracey's room. As one of four dinosaur-themed centers (i.e., the word work activity was reading words printed in the smallest font possible on dinosaur bones with a magnifying glass) this center proved quite difficult for most of the students. Students most frequently needed help with the task of reading the questions. While I began counting how many students needed help reading the questions I was not able to keep track because I began assisting students as they asked for help. Another very common problem was that students were unable to answer the question asked based on the image revealed by scanning the QR code. The following example is illustrative of the problems students encountered during this activity and the help they asked me for:

> A girl comes to me saying she can't read the question. I leave my computer and go over the card she is scanning. I help her decode the question (Is this a plant eater or a meat eater?). She is unsure from the image (a tyrannosaurus rex eating another dinosaur). I ask her if she knows the difference between meat and plants, where each come from. She nods her head "No." I explain that plants grow in the ground and give her examples (lettuce, carrots, etc) and meat comes from animals (hamburgers come from cows, bacon comes from pigs, etc). I ask her if the dinosaur in the picture is eating plants that grow in the ground or animals. She is still unsure, so I point out that he is eating another dinosaur. She hesitantly asks, "Meat?" looking unsure of herself. I let her know she is correct, praise her thinking and indicate that she should record her answer. She tells me, "I don't know how to spell meat." I ask her if she can think of somewhere that word might be written and gesture to the card. She finds the word that starts with 'm' and writes 'meat' on her recording sheet (Field Notes, 11/15/13).

Interestingly, as this example shows, using the technology to scan the QR code was the easiest element of the task. The aspects of the activity that involved decoding, comprehension and spelling proved to be beyond students' zone of proximal development. A few of QR codes revealed images that were exceedingly challenging to use to answer the question. For example, one item asked, "What dinosaur had a hard shell?" The image revealed had the dinosaur's name only in the JPEG file name. When students asked me for help with this I had to look carefully to find the answer (ankylosaurus). A different item only revealed a postage stamp of the dinosaur, with its name printed in elegant cursive script, illegible to kindergarten students.

While most students wrote at least some of the answers using logical invented spellings, I observed that three of the struggling readers in Tracey's class scanned each item, looked at the picture the QR code revealed and then wrote the number of the question on the corresponding line (i.e., they scanned QR code for Question 1 and then wrote "1" on the line next to 1 on their paper). One of these students, a girl, quickly scanned all six QR codes, wrote the numbers 1-6 on her worksheet and then hid in the classroom library behind the bookstand. She peeked out occasionally to see if Tracey noticed she wasn't scanning QR codes (Tracey was unaware). The girl picked up a traditional print book and flipped absent-mindedly through the pages. When she noticed the rest of her group members (all boys) were scanning a QR code next to the library she picked her device back up and scooted over on her knees without her paper and she began scanning again. This student went back and forth between the library and the nearest QR code station three times before the timer chimed telling students it was time to rotate (Field Notes, 11/15/12). My observations of this student's experience of the QR code

Hunt around the Room suggested that this activity did not afford her opportunities to practice any of the essential early literacy skills she struggled with. Furthermore, in the hustle and bustle of kids moving all over the room, she was able to hide, withdrawing from peers and her teacher. This is particularly concerning, given the fact that she was a struggling reader.

With effective scaffolding this activity could have been a rich literacy experience. Ironically, scanning the QR codes, the task Tracey anticipated they would struggle with given the size of the devices and the shakiness of their hands, was in reality the element of the task students were most successful completing. Tracey anticipated "hiccups" with this activity. The images revealed by the QR codes did not making answering the questions easy, a pitfall that should have been easily avoided. This activity was rich with potentially meaningful literacy experiences. However, additional scaffolding of students, clearer questions and answers, and expectations for completing the activity would improve teaching and learning for this activity.

RQ#3 Sub-assertion 5: When case study teacher #1's students engaged in literacy learning with handheld devices and apps they appeared engaged, but at times were not in fact truly engaged in literacy learning.

Tracey's use of handheld devices for a listening center yielded student engagement, the value or positive affordance of using handheld devices that teachers identified most frequently in the survey. Although students took a minute or two to get settled and begin listening, throughout my observations of the listening center in Tracey's room the students were rarely off task. They seemed to enjoy using the devices and often

one or two students would linger in the library with their device after the timer chimed, hoping to finish one more line or "page" of the story. Tracey would kindly but firmly instruct these stragglers to clean up and rotate to the next center. A counter of example of this pattern was a boy who found a game he wanted to play instead of listening to a story. When Tracey did a quick sweep of the room to monitor students' center work she did not notice this because the boy was sitting quietly in the library, wearing his earphones, eyes fixed on the screen. Tracey could not see the screen from where she stood, so she assumed he was listening to a book app and she praised the whole group, "Awesome, awesome!" with a thumbs up and a smile on her face. This counter example illustrated that behavior that appeared at first glance to be engaged learning with technology was in fact off-task. One of the challenges of teaching with handheld devices was discerning methods for monitoring student learning and behavior.

Similar engagement was evident during the dinosaur QR code Hunt around the Room activity. Students, especially three or four of the boys, were quite enthusiastic about the dinosaurs. They were able to identify some of the dinosaurs without having to read the name as written on the QR code image. Tyrannosaurus rex and triceratops were particularly well-known reptiles in Tracey's room. However, as noted earlier, one of the struggling readers "hide out" in the library, avoiding the assigned task for most of the center time, unnoticed by Tracey.

Tracey argued that using the devices for literacy learning increased her kindergarten students' engagement in learning (Tracey, Interviews, 10/15/13; 10/25/13; 11/8/13; 1/22/14). For example, Tracey believed that the enjoyment of scanning a QR code motivated students to continue their practice and move through the worksheet.

During my observation of this practice students did appear excited and enthused to be using the devices, exclaiming, "I knew we got to use the iPods today!" and "Me too, I saw you guys had the iPods out in the last group!" or "It's like when we did dinosaurs!" (Field Notes, 1/22/14). However, this motivational affordance must be weighed against the time spent scanning code and exiting back out of the revealed answer, time that might otherwise be spent in active literacy learning.

RQ#4 Assertion: Case study teacher #1's knowledge, beliefs and planning were impacted by her experiences, observations and reflections in that her lesson planning changed to include new components and objectives, and her beliefs about the social impact of technology and enthusiasm for finding technology resources were more deeply experienced.

Although Tracey's knowledge, beliefs and planning will continue to evolve across the course of her career in education, interviews and my observations of her instruction across four months of the school year suggested that the her experiences planning and teaching with handheld devices and apps impacted her professionally in noteworthy ways.

RQ#4 Sub-assertion 1: Based on her experiences teaching with handheld devices and apps and the multitude of "glitches" she's experienced, case study teacher #1's instructional planning changed to include a "back up" alternative plan in the case that the technology did not work as expected.

During our final interview Tracey appeared more tired and less energetic than she was in our previous interviews. While she maintained her assertion that she loved technology and loved looking for new things to try, she spoke with mild frustration about the multiple "glitches" she and her colleagues were struggling with in their use of technology for instruction, and the impact of these obstacles on her knowledge, beliefs and planning. Tracey described incidents of faulty home buttons and frustrated students, browsers quitting unexpectedly amidst guided practice and wifi disruptions in the building. She stated that she now has to have a back-up plan when she designs her instruction in case she is unable to use the technology, that this practice has become a part of her routine when planning lessons (Tracey, Interview, 1/22/14).

RQ#4 Sub-Assertion 2: Case study teacher #1's planning of instruction with handheld devices and apps sought to balance predictability with novelty. Based on her reflections she structured students' use of handheld devices and apps as a rotation through the uses previously described (listening center, phonics games, QR codes).

After her first half a school year in Silver Lake Point school district, after taking on the challenge of planning and using handheld devices in daily instruction, Tracey summed up her approach to using the devices in literacy learning as "predictable, but not repetitive" (Tracey, Interview, 1/22/14). She planned and taught lessons that involved using the device in some way, shape or form every day. She felt that it was important that she not use the devices in identical ways every day. Generally, each week she had at least one day with listening apps, another with game apps to practice phonics skills, a day

with QR code hunts or worksheets as well. Her use did not vary beyond the methods previously described.

RQ#4 Sub-assertion 3: Although case study teacher #1 questioned the impact of technology on human interactions and relationships in the classroom during the course of my research, her experiences, observations and reflections led her to conclude that the devices did not have a significant impact either positive or negative on the quality of human interactions.

Based on her experiences teaching with handheld devices and apps Tracey believed that the presence of technology in the classroom did not hinder or harm her interaction or relationships with students, or with students and their peers. A couple of months into the school year she wondered about the potential impact on students' relationships with her and with each other:

> I don't really know…in one sense they really like that I let them use it…but on the other hand you're also taking away from, like I used to have them read to some one or read to   self all the time, that's the fear of technology in general, are you taking away those social skills? (Tracey, Interview, 11/8/13).

Two and a half months later Tracey expressed an evolving belief about the impact of using devices on human relationships in the classroom. She stated,

> I would say it doesn't make a difference because a lot of times I'm working with them with the devices so you're still…able to interact and teach through the technology, especially stuff like this where…I'm showing you and I'm helping you, watching and observing as well, so it's kind of beneficial for both of us. It's

a little more independent but I can also just do the informal observation of how

they're doing with segmenting and blending or thinking about those questions

(Tracey, Interview 1/22/14).

Tracey's experience providing students with guided practice and scaffolded instruction

while using the devices, and her experience observing students using devices and

gathering formative data about their literacy development impacted her belief that

technology has a neutral impact on her relationships and interactions with students. In

addition, during our final interview Tracey shared her observation that students help each

other when they encounter "glitches" while using the devices, asking a peer for help with

a malfunctioning home button instead of a teacher. Tracey expressed her curiosity about

whether or not her students would demonstrate less developed social skills at the end of

the year than other kindergarten classes in schools without handheld devices (11/8/13).

While Tracey clearly spent time considering the impact of the devices on human

relationships in her classroom, and her beliefs were evolving, she did not view the

devices as impacting those relationships either positively or negatively.

RQ#4 Sub-assertion 4: Case study teacher #1 maintained her enthusiasm for searching

and locating apps and other resources to integrate into instruction; her experiences,

observations and reflections on instruction inspired her to continue to seek digital

resources for instruction and to share these with her grade-level colleagues.

Throughout our interviews Tracey referred many times to her enjoyment and

enthusiasm for finding resources, apps, ebooks, YouTube videos, blogs and more to use

with students. Tracey positioned herself as the team member who emailed her colleagues

stating, "Look at what I found…this is a great app…this is how I'm using things!" (Tracey, Interview, 1/22/14). During all of our interviews she described her personal passion and commitment to exploring and testing digital learning tools. The following statement exemplified Tracey's relationship with her teaching colleagues within the context of the technology integration:

> I love integrating it...which is funny because I was like one of the first ones who was like "Here is how I'm going to put it into guided reading," you know? Versus the teachers who have been here like two or three years on my team were like, "Oh, you're doing listening to reading?" I was like, "Yeah, I am!" That was like kind of funny that I was like the one who was like, "I'm taking these home and tackling them, getting them all loaded and put into files"...you know? Just kind of passionate enough to make it worthwhile…(Tracey, Interview, 11/8/13).

Following the regrouping of students Tracey found herself in the position of not "needing" new apps. She reported continuing to look for resources and to send them along to her colleagues who worked with kindergarteners who were farther along in their literacy development. Tracey held an unofficial role as the key resource for technology integration in the kindergarten team. She alluded to roles held by other team members: the teacher with the great folder games, the youngest team members who were the most capable of fixing "computer problems," the most experienced members who doled out classroom management advice. Despite Tracey's sense that the apps she loaded her devices with in September were still developmentally appropriate for students, Tracey still felt driven to seek out as many digital resources for the team as she could find. The district expectation that teachers use the devices daily, coupled with Tracey's personal

passion and interest in finding new and unique ways to use the devices, led to the role she assumed in relation to her grade-level colleagues.

Tracey's enthusiasm and confidence with technology and her status as an experienced teacher who was new to the district made her an information-rich case. Through observations, interviews and photographs several clear patterns emerged. Tracey's use of apps for literacy instruction was easily classified as small groups, either independent or with teacher observation and support, using listening apps, game apps or QR code activities. While Tracey considered best practices for literacy instruction when selecting and planning instruction with apps, other factors were considered as well, including whether the app was cost-free, whether an app was visually appealing or otherwise attractive and capable of grabbing students' attention, and whether the app could be used in students' homes on their parents' devices. In practice, teaching and learning in Tracey's classroom with apps included negative affordances of challenges managing materials, distraction of students from other tasks and students using devices in ways other than the assigned task. Positive affordances included students' demonstrated enthusiasm and engagement in most of the tasks and students helping one and other with using the devices. Tracey's knowledge, beliefs and instructional planning had been influenced by her experiences thus far, in her new practice of developing a back-up plan, her assertion that devices did not impact human relationships, her instructional objective of "predictable, but not repetitive" use of devices and her understanding of her role among her teammates and resulting actions of continued searching for digital resources.

Embedded Case: Marcy

Pine Towers Elementary. Pine Towers Elementary sat on the southern side of

the school district in demographically different community than New Park Elementary.

Pine Towers Elementary school was tucked into a quiet bedroom community sandwiched

between two busy thoroughfares that led into a major Midwest city. These two roads had

frequent stoplights, excessive traffic and an assortment of fast food options, gas stations

and big box stores. There were several large apartment complexes sitting just off the

frontage roads: Spring River Homes, Park Brooke Apartments, Johnstown Complex. The

neighborhood itself was a peaceful, working class neighborhood: split level and single

story family homes, parks with brightly colored playgrounds, mid-sized yards contained

with chain-link fences and basketball hoops in the driveways. Residents decorated their

yards for the holidays, displaying inflatable ghosts for Halloween and large pink wooden

bunnies for Easter, and of course, elaborate displays of lights during the Christmas

season.

The Pine Towers Elementary building sat on half a city block tucked in this

residential community. The building was a single story, dark brick structure. There were

many windows that were frosted so one can see out, but not in. The doors and windows

were framed by black metal. The front entrance had fresh, attractive landscaping:

evergreen bushes of varying sizes planted neatly into rust-colored beds of fragrant cedar

chips. As an International Peace Site, Pine Towers Elementary proudly displayed a

"Peace Pole," a permanent wooden monument with the phrase "May Peace Prevail on

Earth" in multiple languages to remind visitors about the universality of peace.   From the

exterior the building looked simple, neat and sturdy. Prior to the start of the 2013-2014

school year Pine Towers facility underwent significant construction to add additional classrooms and expand the cafeteria. In fact the first day of school was delayed one day to accommodate the construction. The interior of the building felt new and fresh. A neutral beige and green patterned carpet covered the floor and all the walls had clean, new coats of white and beige paint.

The front office had a broad, high desk with a sign in book and visitors' stickers. The middle-aged receptionist ensured that all visitors signed in and paged the person they were there to see. The library sat at the center of the building with glass windowpanes at an adult level; the adults could see into the library when they pass by, but the kindergarteners, 1st, 2nd and 3rd grade students could not. The kindergarten pod was past the art room and music room. The carpet and metal frames turned a dark shade of red upon entering the kindergarten pod. The classrooms branched off from a large open shared space that was divided into smaller workspaces by several three-walled structures, each with kidney table for small group instruction by special education or English Language Learner teachers. Each room had the teacher's name and grade level displayed on a small plastic square sign to the right of the door. Most classrooms had student work displayed on the walls and windows directly outside of the room.

The 2013-2014 school year was a unique year for Pine Towers. Silver Lake Point district was undergoing significant restructuring to accommodate a growing population. In 2013 two elementary schools, West Creek Elementary and Pine Towers Elementary merged into one K-3rd grade building, leaving the West Creek Elementary building to the K-4th grade Spanish Immersion program. Thus, half of the staff and students were at West Creek Elementary the previous year and the other half were from Pine Towers.

Additionally, Pine Towers Elementary went from serving approximately 400 students to 800 students. Not only did the student population increase in size, the free and reduced lunch count changed dramatically. West Creek Elementary had about 68% free and reduced lunch recipients, while Pine Towers had significantly less. The merger left Pine Towers with a free and reduced lunch count of 40% of students served. For several of the Pine Tower teachers this posed an instructional challenge (Marcy, Interview, 10/15/13). Staff meetings found teachers who had taught at the 400 student Pine Towers with low free/reduced lunch count in tears of frustration lamenting the increase in disruptive behaviors and other challenges they perceived to be encountering as they attempted to teach students living in poverty. Conversely, the teachers from West Creek had participated in multiple professional development sessions about working with students living in poverty. Therefore there was a division among the staff in their sense of self-efficacy to teach students living in poverty.

The merger created a problematic situation with curriculum as well. Kindergarten teachers from the former Pine Towers Elementary had taught the alphabet using the "Alpha Friends" materials from the Houghton Mifflin basal series that introduced one letter a week. Kindergarten teachers from West Creek Elementary had taught with "Zoo Phonics," a systematic and explicit phonics program, claiming to use a "multi-modal" and "kinesthetic" approach to teach students the letters of the alphabet in two weeks. When the two schools merger, combining the materials and experiences of the teachers, school leadership directed teachers to use "whatever they were most comfortable with." Marcy used Zoo Phonics, asserting she could not take 26 weeks to teach the letters of the alphabet, while her colleague in the classroom next door decided to use the Houghton

Mifflin Alpha Friends in her instruction. The variation of materials and assessments used within the school was further complicated by the technology initiative and the expectation that the handheld devices be used daily in each classroom. For the new Pine Towers staff, the 2013-2014 school year required flexibility, adaptability and constant adjustments.

Information-rich case: Marcy. Marcy had ambivalent and conflicted feelings and experiences teaching with technology. Throughout our interviews Marcy highlighted positive affordances and advantages she identified to using handheld devices in her literacy instruction. However, she also frequently voiced her own frustrations, doubts and concerns with the technology integration initiative. To Marcy technology integration was a complex and complicated endeavor, with many shades of gray and unclear answers.

Marcy was an information-rich case because her responses to the majority of the survey questions were quite typical of the sample of 25 teachers, including her beliefs and goals for literacy instruction, use of apps for literacy instruction and her processes for identifying apps to use. When completing the survey Marcy described her feelings and opinions about using apps in her literacy instruction as, "I think if they add something new or supplement what I'm doing they are great" (Marcy, Survey, 9/23/13). This sentiment was a middle response to this survey item; survey respondents expressed a wide range of feelings and opinions about using apps in their literacy instruction. Additionally, Marcy was teaching kindergarten in Silver Lake Point the past school year at the commencement of the handheld device roll out. As an information-rich case, Marcy offered a unique perspective by contemplating and considering the subtleties and

complexities of using the handheld devices in literacy instruction, rather than positioning herself on either extreme of unquestioning "loving" technology or only expressing "frustration" and "difficulty."

Several other defining characteristics made Marcy an information-rich case. Marcy was earning a Master's degree and reading specialist licensure through a small, private college during the time of the study. Thus, Marcy spent three hours once a week studying reading research with a cohort of educators pursing the same degree. This developing knowledge and learning experience grounded in traditional print-based literacies impacted her approach to integrating apps into her literacy instruction and will be further described. Additionally, Marcy's professional background was in early childhood education. After teaching preschool for five years Marcy transitioned to kindergarten and taught for two year at West Creek before the merger with Pine Towers. Marcy was older than the typical third year teacher, having entered the teaching profession later in her life. Marcy had five children of her own, ranging from 32 years old to 17 year olds (a senior at Silver Lake Point High School), and two preschool-aged grandchildren. Her own children and grandchildren were a frame of reference for Marcy when she discussed the positive and negative affordances of using technology in learning. These personal characteristics were critical to understanding Marcy's selection and use of apps for literacy instruction, as well as the resulting teaching and learning and shifts in her beliefs, knowledge and practices.

I observed consistently structured uses of handheld devices for kindergarten literacy instruction in Marcy's room. Following each lesson I conducted an interview with Marcy about the lesson she had just taught, with guiding questions about positive

and negative affordances of using the devices, valued added by the use of technology, a verbal protocol of her app selection and her thoughts about planning subsequent instruction with handheld devices. By observing instruction in Marcy's classroom and interviewing her with a focus on instructional reflecting and planning I was able to gain insight into how Marcy used technologies in her classrooms to teach literacy and how she chose apps or web tools based on her knowledge of best practices for literacy instruction (RQ 1 & 2). Further, I was able to identify patterns of behavior in teaching and learning, and actual positive and negative affordances of using apps and web tools in early literacy instruction in practice (RQ 3). Observing and interviewing Marcy also allowed me to understand how Marcy's beliefs, knowledge, planning and instruction were impacted by her experiences planning and teaching with apps and web tools, her observations of students' learning with these technologies and her reflections on classroom lessons (RQ 4).

Marcy and her classroom. Marcy's classroom was decorated with a jungle theme. Bold animal print letters spelled out "WELCOME" over her classroom door, small cut out monkeys swung from vines on a nearby wall, each holding a banana with student's name neatly printed. In Marcy's classroom cabinets and counters lined the wall in either direction. The classroom was shaped like a large upper case "L." To the left there was an alcove with open cubbies for students to hang their jackets and backpacks and leave snow-covered boots to melt. There was a bathroom in the classroom with a low mounted sink just outside the door. Marcy had arranged dramatic play centers (a play sink, refrigerator and cash register), a handsome unpainted wooden dollhouse and small tables in the open space immediately through the classroom door. Further in on the

right hand wall the SMART board was mounted and flanked by white boards.   A cane rocking chair with a faded floral cushion sat directly in front of the SMART board. The carpet in front of the SMART board was a large circle with the letters of the alphabet to guide students where to sit for circle activities. In the corner by the SMART board there was a classroom library delineated by open shelves with neat boxes of books and stacked colorful book bags, one with each student's name printed on it. There were abundant nooks and crannies for storage and four rectangular tables with six chairs each. Marcy's desk sat in the space in the short part of the L, stacked with neat piles of papers and books.   Marcy's desk was always adorned with a large vase of fresh cut flowers perched cheerfully on the corner. Adjacent to Marcy's desk there was a kidney table where Marcy delivered small group instruction.

Students' work was displayed on every wall, from clotheslines strung across the ceiling and spilling out into the hallway directly outside the classroom. Students' "Hopes and Dreams for Kindergarten" were written on white fluffy clouds and stapled to a pale blue bulletin board with brightly colored hot-air balloons. Purple and green construction paper lanterns hung from the clothesline, swaying gentle above the classroom. Outside the classroom were students' "Me Poems," with complementary self-portraits in crayon. Student-made faces of paper plates with accordion-pleated rainbow construction paper hang on the walls. The overall effect celebrated students' work, learning and accomplishments; it was inviting and warm.

Marcy herself always looked very coordinated and colorful. She had multi-toned red hair with lots of texture, short and clean in the back and occasionally spiky on top. Her clothes, shoes and jewelry were always color-coordinated: a black a-line midi-skirt

with small white polka dots, a bright magenta scarf knotted around her neck, with tall suede black boots with silver hardware and one chunky magenta bracelet; a black and cream large houndstooth print wrap dress, a rich cranberry colored scarf intricately woven around her neck; a long sleeved white tee shirt under a gray and yellow Pine Towers school shirt, a bright yellow scarf smartly knotted in the front and yellow ankle socks over gray skirt and white leggings with silver sequined converse sneakers. Marcy always wore the same rhinestone-trimmed, tortoise shell framed cat eyeglasses and vivid shades of red or magenta lipstick. Often the tips of her long nails were painted to match the dominant color in her ensemble.

Marcy was warm and energetic, she often called her students "sweetie," and even addressed me this way once. The first time I met Marcy was a parent-teacher conference day. When I arrived and found Marcy's room where she was waiting with an Oromo interpreter for a parent to arrive for a conference. The parent had not shown at the scheduled time, so the interpreter called the parent who was now on her way. Full of energy, Marcy offered Keurig coffee pods to the interpreter and to me, bustling to the staff lounge with both of us in tow. She popped pods into the machine one at a time and brewed three individual cups of coffee, smiling as she handed out steaming ceramic mugs with chalkboards and apples painted on the side. We returned to Marcy's classroom and began our interview, taking a brief pause when the parent arrived for her conference. Throughout our interviews Marcy questioned whether her experience, knowledge and insight were valuable, or "what I was looking for."

"Trying to drink from a fire hose." Marcy equated her experience at the beginning of the handheld device integration to "trying to drink from a fire hose" (Marcy,

Interview, 10/15/13). Marcy recounted her experience attending the initial technology

training at the district service center, being shown "cool apps" and "great stuff," only to

be sent back to her classroom unsure of where to begin and overwhelmed by the sheer

volume of information she received. Throughout our interviews Marcy vacillated from

describing her concerns, frustrations and obstacles to technology integration, to

highlighting unique uses and potential uses she hoped to implement and emphasizing the

affordance of student engagement.

RQ#1 Assertion: To case study teacher #2, the technology was a piece of her

literacy block; she assimilated the devices into her current practices that were very

much grounded in traditional print literacy.

Teaching and learning with handheld devices and apps in Marcy's room

demonstrated consistent patterns of use that varied little during the course of my study.

12 minutes a day. Marcy used the handheld devices as a center during her

literacy block every day. There was little variation in the structure, content or task of the

literacy lessons with the handheld devices. Marcy's literacy block was rotating 12-

minute centers with five groups of students with similar literacy development. Students

were assigned an app to use independently and often give a paper and pencil task to

complete simultaneously, "for accountability for their time" using the devices (Marcy,

Interview, 10/15/13). During the course of my observations there was little variation in

the apps used. Specifically I observed students using: (a) a scan app to scan QR codes,

(b) "Little Writer," a letter tracing app, (c) "Spelling Magic," an app where the user drags

letters into blank spots to spell a word indicated by an image and (d) "Word Wizard," an

app that speaks a word for the user to spell. Marcy's use of the devices in literacy

teaching and learning was almost entirely letter naming, sounds, segmenting and

blending.

Marcy reported that she occasionally used the devices as a listening center;

although she did this so infrequently that I was not able to observe either of days she used

the device in this way. Marcy had a daily listening center during her literacy block,

generally using an old CD player. She had a collection of books with accompanying

CDs. However, there were a few books in her collection that came with cassette tapes

that she no longer had the technology to play. Thus, she and her kindergarten team

solved this problem by using the video app on their teacher-issued iPad. They filmed the

pictures in the book while they read each page. A QR code brought students to a website

with these videos of the teachers reading. On the days Marcy used the iPod Touch

devices at the listening center she planned a traditional print based activity for students to

do at the center that was usually the iPod center.

Marcy set up an "iPod Table," (one of the rectangular tables that sat 6 kids) by

laying out laminated copies of "iPod Expectations" (See Figure 4.25 and Appendix G) as

place mats. These placemats were quickly pushed to the side and rarely even glanced at

by students. On the wall closest to the iPod Table Marcy taped an "App of the Day" (See

Figure 4.26) to show students what the assign app icon looked like, or if groups were

assigned different apps these color coded images indicated which app each group was to

use (See Figure 4.27).
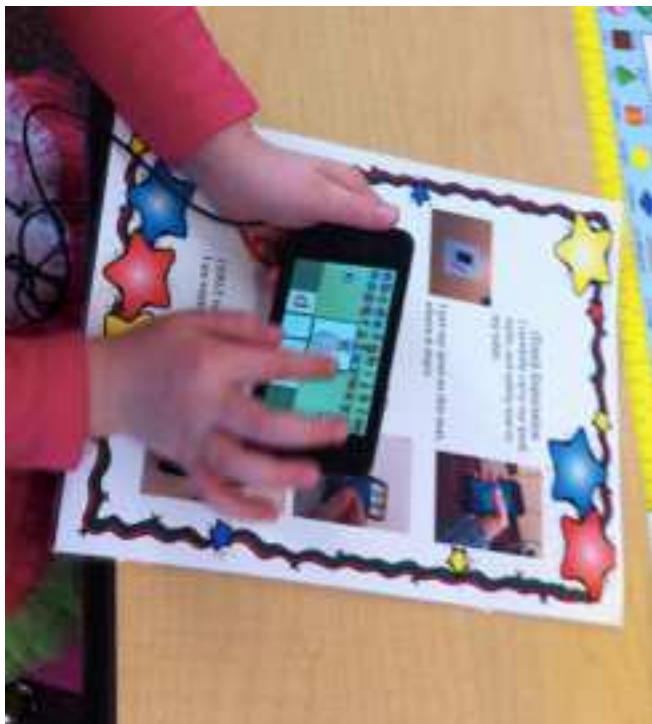
Figure 4.25: Student using device with iPod Expectation place mat

Figure 4.26: App of the Day Poster

Figure 4.27: Differentiated color-coded App of the Day posters

Marcy never used the handheld devices and apps for direct instruction or guided practice.

She felt bound by the district's decision to provide one device for every four

kindergarteners, stating, "We were given five or six iPod for our class of 24 kids so it's

like, well okay, clearly I'm going to have to use it as a small station. I can't like…they're

not all going to be able to share them" (Marcy, Interview, 10/15/13). In two of the four

interviews I conducted with Marcy she asserted that she felt she could use the devices in

more innovative, engaging and meaningful ways if she had one device for each student.

RQ#2 Assertion 1: Case study teacher #2's selection of apps for literacy instruction

was fraught with unexpected obstacles she encountered. However, she integrated

her knowledge of students' developmental needs and her beliefs in the positive

affordances the handheld devices offered of student engagement into her selection

process.

Sub-assertion 1: Case study teacher #2 encountered numerous difficulties selecting apps
for literacy instruction many related to the investment of her time downloading and
reviewing apps.

"**I'm going to give it to you straight, I'm not going to sugarcoat it.**" Marcy

performed a verbal protocol procedure with the "Rocket Speller" app; an app

recommended by a kindergarten colleague that she had been planning to review for

potential use in instruction. Marcy began the verbal protocol procedure with searching

for the app in the App Store. Marcy expressed her approval of the cost of the app (free)

and described her frustration with attempting to remember the password to download the

app on to the device. She deviated from the verbal protocol procedure at this point to

describe her frustration with the fact that her classroom set of devices this school year

were in three different classroom the previous year, therefore she had three different

passwords and three different sets of apps installed. Although the technology support

staff ultimately reset her devices to one shared password, Marcy lamented the amount of

time she spent wrestling with different password for each device, before she could even

begin reviewing apps for potential instructional use (Marcy, Interview, 10/15/13). The

potential cost of Marcy's time invested in reviewing apps was a significant factor in her

process that may explain why Marcy reviewed and used a relatively small number of

apps for literacy instruction. Marcy shared that her personal frustration occasionally

reached a tipping point where she would abandon her efforts to integrate technology into

her lessons, opting instead for more traditional pencil and paper activities, "Sometimes it

is so frustrating it's like, "Oh forget it, I'll do something else there because this is not working for me"" (Marcy, Interview, 10/15/13).

Sub-assertion 2: When selecting apps case study teacher #2 integrated her knowledge of her specific students' literacy development with the elements she perceived to be interesting, visually appealing or otherwise engaging to students.

Once Marcy had successfully downloaded the app she proceeded to describe her thoughts as she reviewed the "Rocket Speller" app, emphasizing how she anticipated her students would respond to the visual and graphic elements of the app and how she could potentially differentiate for varied literacy development among her students. As she tapped the icon to open the app Marcy commented, "I think they are probably going to like it because it has a little spaceship and it's colorful," with a laugh. She went on to describe the graphics as "cute," asserting, "It does, it has to be visually appealing to the kids or they probably aren't going to be really interested in it to begin with" (Marcy, Interview, 10/15/13). As she began to manipulate the app and play the game she mused that the app would be good for her struggling readers because it named the letter as they moved a it into place in the word. She questioned if the task would be too easy for most of her students and wondered if she could change the difficulty of the words given. She explored the setting options, noting that five or six letter words would be a good challenge for her more advanced students. While she expressed an appreciation of the potential of the app to meet varied developmental needs of students, she felt she could only use it during centers with one group, noting that she could not change the settings on six devices in the 30 seconds between centers.

Sub-assertion 3: Case study teacher #2 often drew upon the suggestions of her colleagues or the site technology coordinator to identify apps and methods of app use in early literacy instruction.

As this study progressed, Marcy was not actively reviewing new apps for literacy instruction. When I asked her in each interview following a classroom observation to further describe her process for selecting apps she would mention lessons borrowed from colleagues or recommendations from the site technology coordinator. For example, she borrowed a QR code scanning activity from a colleague that was designed to give students practice scanning QR codes in preparation for using devices in place of the listening center as previously described. This activity consisted of a series of cards with QR codes that when scanned displayed one letter of the alphabet that students were to record on a worksheet. Marcy critiqued this activity stating, "It was not the greatest in terms of content. I want them to know how to scan stuff and it brings you someplace and how to get back out of that. I was trying to teach them that so I achieved my objective" (Marcy, Interview, 11/1/13). Marcy even explained this to her students following her lesson:

> We're going to do more apps that use the scan, that's why I want you to get use to using the scan. Sometimes it brings you to a website or to a book you want to read. Today it just brought you to a letter, but sometimes it brings you to other places (Field Notes, 11/1/13).

Marcy did not select or plan this activity based on her knowledge of best practices for literacy instruction. Rather, it was readily available and designed to be practice for future

use of the devices. Marcy also mentioned emails sent by the building technology support staff person highlighting educational "Apps Gone Free." Apps Gone Free compiles a daily report of apps that are free of cost for a limited time. The building technology support teacher followed this list and notified teaching staff when educational apps of interest are available free of charge. Marcy was consistently concerned with the cost of apps, limiting her consideration of apps for potential use to those free of charge. However, Marcy continued to use the same few apps during the daily 12 minutes student spent practicing literacy skills on the devices. Therefore Marcy did not regularly review and select apps for literacy instruction drawing on her increasing knowledge of literacy best practices.

RQ#2 Assertion 2: Case study teacher #2 drew on her knowledge of best practices for early literacy instruction, grounded in traditional print-based texts, to critique, select or plan instruction with apps. Her approach to using apps was firmly grounded in traditional print-based literacy instruction and the devices were assimilated into those frameworks.

Marcy credited her developing knowledge of best practices for literacy instruction she acquired from pursing her literacy specialist license as shaping her approach to technology integration, "The way I feel about best practices has changed how I approach technology…if it's not helpful, if it's not engaging, if it's not really relevant, if it's not what is best for kids, I won't do it" (Marcy, Interview, 10/15/13). Based on interviews with Marcy, several factors shaped her selection of apps for instructional use, however her conceptions of best practices for literacy instruction, her instructional goals and

students' developmental needs were dominating factors in her process. During an

interview Marcy offered insight into her process for selecting apps:

> I guess the main thing when I'm choosing apps I think in my head what is the
>
> thing I want them to work on? What am I trying to get them to do? Where am I
>
> trying to get them? How am I trying to get them there? And so like I said I feel
>
> like the lower kids, they need to hear the sounds, they need to see the letter and
>
> hear the sound with it, and then the higher kids need to put them together into a
>
> word, to think in their head, "How do I break that word apart into different
>
> sounds?" (Marcy, Interview, 11/22/13).

In this statement Marcy described balancing instructional goals and students' varied

literacy development as she chose apps for her instruction. This reveals that Marcy

approached selecting apps for instruction through a lens of her instructional goals or

objectives, and the current developmental needs of various students in her class.

Counter example: An app case study teacher #2 consistently named as an example of a

high quality app for kindergarten literacy instruction demonstrated several negative

affordances for early literacy learning that did not dissuade case study teacher #2 from

praising the app.

Marcy was extremely enthusiastic about "Endless ABCs," a well-designed,

visually attractive and very popular app. Although she only used this app once or twice a

school year, she repeatedly named the app as an example of a quality app for literacy

learning. Endless ABCs allowed the user to select one of 20 or so unique vocabulary

words (i.e., courage, odor, bellow, gargantuan) and then move the letters into proper

order to spell the word. Upon successful spelling of the word the user was treated to a brief animated video that supposedly explained the meaning of the word (for odor there is an animated cartoon of a monster smelling flowers happily until another larger monster surrounded by a brown cloud comes along causing the flowers to wilt). Endless ABCs had loud music, "cute" monsters and animation designed to hold children's attention.

Conversely, the word selection was limited, some of the videos did not clearly demonstrate the meaning of the word, and most concerning, when the user moved the letters across the screen some letters named the letter (r), while others produced the corresponding phoneme (dddd), potentially a very confusing experience for emergent readers. Marcy touted this app as a favorite because of the "really cool vocabulary words" and the affordance of the user choosing which word to spell. She elaborated on her approval of this app, appreciating the affordance of the animated explanation of the word's meaning. Marcy stated that she appreciated that the app "Made the sound of the letters," seemingly unaware that this was not always the case. Despite Marcy's ongoing study of best practices for literacy instruction she did not critique the Endless ABC apps phonemic shortcomings, rather she highlighted the visually appealing and engaging images and animation design, and the uniqueness of the vocabulary words, as characteristics that made Endless ABCs a favorite app. Further, the limited number of words included in the app caused her to only be able to assign the app once or twice a school year. However, Marcy's only complaint about Endless ABCs was that while it was originally a free app it had become a paid app, so she only had it on five of the six devices in her classroom. Thus she was not able to use it for small groups with six students unless students were to share one device.

RQ#3 Assertion: In case study teacher #2's classroom teaching and learning with handheld devices followed specific patterns with little variation including embedding the use of handheld devices into traditional print-based literacy activities, numerous unanticipated negative affordances (that disrupted or inhibited literacy learning) and an impact on students' social experiences as learners that was both positive and negative.

Sub-assertion 1: Case study teacher #2 used the handheld devices and apps consistently as an activity embedded in a traditional print-based literacy block: a small group, independent practice of phonics skills with QR code scanning apps or game apps for 12-minute increments with a required paper-and-pencil task. There was little variation in the structure of the activity students approached the tasks in unique and creative ways, solving problems as they encountered them.

Paper and pencil. While Marcy reported assigning a paper and pencil task at the iPod center a couple of times a week, "Usually on the third day we are using an app" (Marcy, Interview, 1/16/14), students were completing a paper and pencil task in conjunction with the apps all but one of the times I observed Marcy's literacy block. Marcy described the practice of having a paper and pencil task as a measure of accountability for students and a means by which she could further monitor their time at the iPod center. Marcy shared that she often reviews their worksheets from the iPod center before the end of the day, expecting students to show how they used their time at the center. When she found incomplete worksheets she required that students finish the

task later in the school day during the time designated for "free choice." Marcy found students' paper and pencil work from the iPod center to be an informative source of information. She recounted a story during two different interviews. She had required students to select a word from Endless ABCs, write the word and draw a picture conveying the meaning of the word. One student wrote the word "Settings" and drew the cog icon for "Settings" on the iPod Touch. Marcy laughed both times she recounted this story, stating that this boy "told on himself, he wasn't doing what he was supposed to be doing" (Marcy, Interview, 11/22/13; 1/16/14). Interestingly, this student was exploring the device, and found a word and an image, just not from the assigned app.

QR code worksheet. I observed students completing a pencil-and-paper worksheet when using the QR code scan app. The QR code activity required students to record the letter revealed by each QR code (See Figure 4.28). Marcy had introduced, model and distributed worksheets for this activity the previous day. Some students could not locate their worksheets from the day before, and these children were instructed to write the numbers 1-14 on a piece of blank paper to record the letters revealed by the QR codes. Some students finished early and were directed to write the letters in lower case. One girl passed her paper to a peer and informed me, "She did the lower case for me, I don't know lower case" (Field Notes, 11/1/13). Most students completed this worksheet in the 12 minutes allotted for the center and swiftly deposited their work in a red plastic in-box for Marcy's review.
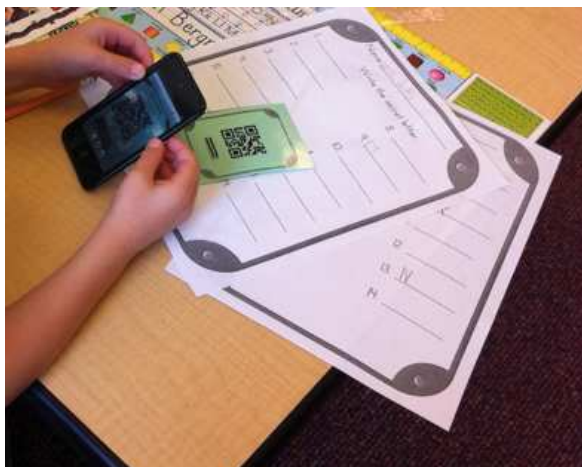
Figure 4.28: QR Code worksheet

Spelling worksheet. The other paper-and-pencil task I observed was a worksheet with boxes for six words to be used with the app Spelling Magic. Marcy reminded students, "You guys, I have to tell you, when you go to the iPod station fill out that form and then when you're done just use the app, we're not writing or coloring" (Field Notes, 11/22/13). The worksheet included boxes for four-letter words and three-letter words (See Figure 4.29), which created a quandary for several students.
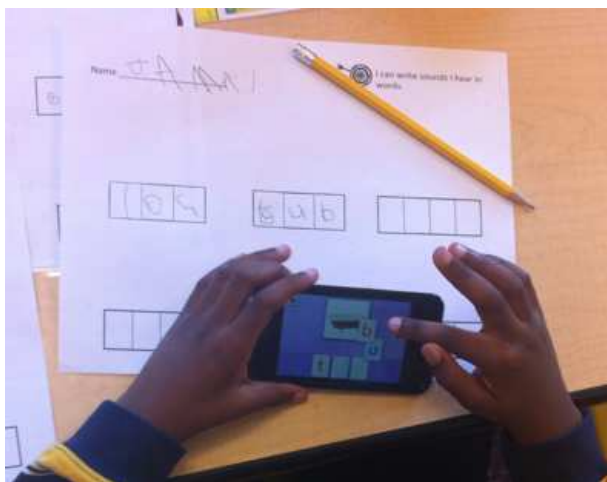
Figure 4.29: Spelling worksheet

I observed one boy who was placed in a middle-ability reading group spell the word "bus" and pause when he realized he did not have any more three-letter word boxes. He thought for a moment and then carefully printed "b-u-u-s" in one of his remaining sets of boxes. I observed as he proceeded with the app. After spelling a few more words without recording any of them this boy spelled "cut" and paused to write it down. This time he wrote "c-u-t" and left the fourth and final box empty (Field Notes, 11/22/13). The way this student approached problem solving was interesting and suggested that this activity may have been strengthened by providing a written task that accurately corresponded to the digital spelling task so as not to confuse emergent and beginning readers as they practice spelling.

Students' approaches to completing the worksheet varied in intriguing ways. Some students moved one letter into place on their device and then recorded it on their worksheet before turning back to the device to move the second letter. One girl completed all six words this way, a letter on the device followed by a letter on the paper. Most students spelled the complete word on the device before recording it on the paper. One girl wrote the word correctly on her paper using the scrambled letters displayed on her device and then rearranged the letters on the device (Field Notes, 11/22/13). Two of the five small groups did not follow Marcy's directions and after recording six words they turned their papers over and began to draw. A few students in another group drew their own boxes on the back of the paper and continued to record words from the app. One boy completed his six words, set the device aside and began to write Thanksgiving themed words, spelling "akrn" (acorn) and "trk" (turkey) on his paper. The paper and

pencil task yielded interesting and varied approaches and behaviors from students, suggesting a range of engagement and efficacy with the paper-and-pencil task.

Sub-assertion 2: Multiple negative affordances of using handheld devices and apps in early literacy instruction were observable in case study teacher #2's classroom, including several unanticipated negative affordances.

Air server: For modeling and mischief. Marcy used the air server, a tool that allowed her to mirror the display on her iPad on the SMART board, to model how to use an app the first few times students used a new app. She would model locating the app icon, tapping it to launch the app and demonstrate using the app, whether it was a phonics game or a QR code scanner. Marcy offered a humorous anecdote about an unexpected problem with the air server. To project the display of a device on the SMART board using the air server the user must select the teacher's name from a list. Some of the 3rd grade students who each had their own device for classroom use figured out how to access the air server. Thus, a kindergarten reading lesson or a 1st grade math lesson would suddenly be interrupted, the teacher's SMART board display bumped for the mirrored display of a 3rd grader's iPad. When the adults in the school caught on the technology staff locked the air server names with passwords. However, this story exemplified students' natural inclination to explore ways to use the devices and the unanticipated affordances that may manifest themselves in a 1:1 handheld device integration initiative.

"Mine doesn't work!" The negative affordance of a constant need for teacher supervision. Marcy deliberately used the rectangular table closest to her kidney-shaped guided reading table for the iPod center (See Figure 4.30).

Figure 4.30: iPod center with guided reading small group table positioned close by

She anticipated that this center would require a great deal of supervision and she felt strongly that she needed to position herself close by to carefully monitor student use of the handheld devices. This arrangement was necessary in practice; during every classroom observation three to five students would get up from the iPod center and walk the few feet to the kidney table, interrupting the guided reading lesson to ask for help with the device they were using. Sometimes the student was stuck after scanning a QR code and required a gentle reminder from Marcy to "Just touch the X when you're done." Or a student may approach the kidney table announcing, "Mrs. S, I can't turn it on" or "It's not working!" Marcy would pause her guided reading lesson and turn her attention to the child with the misbehaving device, helping them exit the app, or otherwise solve the problem. During one observation there were students bringing their devices to her for help during every group's turn at the iPod center. Marcy shared during the post lesson

interview that the apps were "Just crashing, just quitting, and the kids aren't sure how to get back on them" (Marcy, Interview, 11/22/13). Marcy's App of the Day display did not eradicate this problem; students consistently needed help getting back to their assigned app following an unexpected quitting of the app. This physical arrangement allowed Marcy to manage students from the kidney table as she: (a) redirected students who loudly announced the words they were spelling ("Cat! I got cat!"), reminding them not to distract their peers, (b) noticed and addressed students who were off task, and (c) assisted students missing the materials required for the pencil and paper task that went along with the iPod center. Additionally, students spoke to Marcy in louder voices without getting out of their seats at the iPod table, reporting each others' misdeeds: "Somebody wrote on mine!" "He took my pencil!" or "Someone turned the volume all the way up!" (Field Notes, 11/1/13; 11/22/13; 1/16/14). The proximity of Marcy's guided reading lesson to the iPod table also led to an interesting phenomena of students pausing in their use of the devices to watch the guided reading group. Marcy's group of lowest developed readers in particular would occasionally pause their device use and observe the small group instruction occurring at the nearby table until she redirected them and they would re-engage with the technology.

   Negative affordances of equipment. Marcy did not have a rule that students had to use earphones when using the devices. She shared with me that several of her students had not brought personal earphones to school as suggested on the kindergarten school supply list; that she believed many of her students' families did not have funds available to purchase earphones for school. Further, Marcy observed that most of the students who had brought earphones to school rarely used them. She believed the students viewed

finding their own earphones in the small wire bin of plastic bags as a hassle they did not

want to take on. She stated,

> They didn't all bring headphones to school. It was on the school supply list, but
>
> they didn't all bring them, so I just leave them low and if they have headphones-
>
> some of them have headphones and they just chose not to use them because it's
>
> too big of a hassle to go over there and plug them in and put them away again"
>
> (Marcy, Interview, 11/22/13).

My classroom observations verified that the majority of students did not use earphones

when they used the devices. In fact, of each group I watched rotate through the iPod

center over the course of several days, only one or two students would begin the center

time using earphones, and usually they would remove them mid-center. This was

interesting, given that the phonics apps Marcy used named letters or sounds, or dictated

words for students to spell. Further, the apps she used included celebratory sound effects,

playing "Hail to the Chief" when students spelled a word correctly, a cheerful bell

sounding upon completing a level, or in the case of the QR code scanner a loud beep to

indicate the code has successfully been scanned. Although Marcy always set the volume

at "three bars" at the beginning of the literacy block, I noticed that the devices became

increasingly loud with each subsequent center rotation. Students rarely complained or

commented on the sounds from their neighbors' devices. I observed that students moved

the devices close to their ears to hear the words and sounds, before moving them back

into their sightline to spell the words (Field notes, 11/22/13; 1/16/14). Since Marcy did

not structure the use of headphones as a requirement to using the devices she did not

generate an equity issue among her students. Further, although using the devices without

headphones made for a louder center, the sounds did not pose a significant distraction to students' learning at the iPod center nor at the other literacy centers.

Marcy offered the very pragmatic insight that the small size of iPod Touch devices was not ideal for kindergartens' developing fine motor skills. Marcy asserted that iPad minis would be preferable, being large enough that students could fairly accurately manipulate images on the touch screen, but not so large that the weight became too much for little hands (Marcy, Interview, 10/15/13). She elaborated on this idea during a later interview stating,

> Whoever came up with this idea that kindergarten should have iPod Touches thought, "Oh they're littler, it will be better," but really the older kids would do better with the smaller devices. Realistically the little kids don't have the dexterity to push the little buttons sometimes, its easier on a little bit bigger screen" (Marcy, Interview, 11/1/13).

Marcy also described the difficulty of attempting to have students use a stylus to navigate the touch screen. A well-meaning solution to reducing the spread of germs across six devices shared by 24 kindergarteners, in practice students would pop the rubber tip off the stylus leaving a sharp point that scratched the touch screen (Marcy, Interview, 10/15/13).

Negative affordances of apps. Marcy encountered challenges with using apps for instruction when new versions were consistently released. For example, Marcy had two different version of the Spelling Magic app: the newer version displayed only the letters needed to spell a word for the user to manipulate into order, while the older version displayed all 26 letters, leaving the users to select the correct letters from the

entire alphabet. During my observations the students with the newer version of the app that only displayed the necessary letters to spell the word finished the worksheet task much faster than their peers who had to select letters to spell each word from the entire alphabet. Interestingly, students with the older app that showed the whole alphabet approached the task with different strategies. Some students repeated the words, carefully segmenting each word to guide their selection of letters. Other students tried every letter of the alphabet one by one, until the app locked a letter in place instead of bouncing the letter back (a self-correcting feature). Still other students paired up with a peer using the newer version that displayed only the needed letters, and collaborated to spell each word using the peer's device to eliminate all but the three letters required to spell the word.

Another problem with the Spelling Magic app was with the images displayed as the word was pronounced. Often the pictures were difficult to decipher. When asked, "What is this?" by students as they held out their device for me to examine, I frequently found myself confused as to what word they were supposed to spell. For example a picture of a construction worker in a neon yellow safety vest is supposed to prompt the user to spell "job," a woman holding a baby was "hug," and a small thatched structure was "hut," an unknown word to several of the students (Field Notes, 11/22/13). The audio feature read the word to the user, but given the volume of the classroom in practice this was not always helpful to students.

Word Wizard, a spelling app Marcy used with her most advanced group of readers, also had unique negative affordances. Marcy was able to assign students a word list that complemented the current language arts assignment: a letter to a family member.

Word Wizard included numerous themed word lists including "Family Members." Word

Wizard did not offer the user a picture; rather the word was pronounced and could be

played repeatedly as the user spelled the word moving letters in blank spots when given

the entire alphabet. Given that some of the words were long and more complex (for

example, "granddaughter"), I was curious about how even the most advanced

kindergarteners were spelling these words. I observed that there was a "Hint" button that

would give the user the next letter. When tapped enough times the entire word would be

spelled using the hint button rather than the reader's mind and strategies. The hint button

was both a positive and negative affordance, as it provided "just-in-time" assistance, but

also created a potential situation where students were doing nothing more than tapping

the hint button. During my observation of Marcy's highest reading group at the iPod

center the students did not overly rely on the hint button; most students were able to spell

the family-themed words with minimal hints (Field Notes, 1/16/14).

Sub-assertion 3: Teaching and learning with handheld devices and apps in case study teacher #2's room demonstrated specific, consistent patterns of social interactions among the kindergarten students. The presence and use of the devices shaped students' social experiences in impactful ways. The experiences of two specific students, one receiving special education services and one learning English as a second language, suggested that structuring app use as developmentally differentiated and collaborative tasks may be an effective use of apps for literacy learning. Students demonstrated an inclination and curiosity to explore unique uses for the handheld devices.

Isolation and collaboration. I was particularly interested in how the ways Marcy structured her use of the devices impacted human relationships in the classroom among grade-level peers. There were incidents during each observation where students glanced at a peer's device, showed their neighbor their screen, or shared one device and use the app cooperatively, or held their devices together and helped each other spelling the word presented on the screen (See Figure 4.31). Interestingly, just as frequently students turned away from each other or ignored each other (See Figure 4.32). Based on my observations it was difficult to determine if Marcy's structure for using devices increased or decreased interactions among students. For some students using the devices seemed to reduce their awareness of their peers. Their eyes rarely left the screen; they seemed unaware of their surroundings including peers, completely fixated on the device. However, I also observed students collaboratively practicing literacy skills using the devices. These students were also engaged in learning and interacting with peers to accomplish a shared goal on the devices. Interestingly, there were not discernable patterns to which students were ignoring peers or collaborating with peers. Some of the students I noted were unaware of peers would begin to collaborate with others a few minutes later. I did note during all my classroom observations that there was less peer interaction at the iPod table than the nearby word work center.

Figure 4.31: Students voluntarily collaborating at iPod center

Figure 4.32: Students fixated on devices and unaware of surroundings

Observations of two specific students' experiences using handheld devices and apps for literacy learning suggested that that teachers must carefully consider specific students developmental cognitive and social needs when selecting apps and design structures for students to engage in literacy learning with handheld devices. The experiences of these two students, Jarrick, a student receiving special education services for his learning disabilities, and Antonio, an English language learner, are revealing and noteworthy.

Jarrick. Jarrick was an African American boy in Marcy's class. Placed in the lowest-ability reading group, he was pulled out of Marcy's class daily during the literacy block to work with a special education instructor. Jarrick was a high energy, cheerful student with two neatly plaited thick braids. During literacy centers Marcy regularly redirected Jarrick, reminding him, "Jarrick, what are you supposed to do?" or commenting, "Jarrick, you don't have your paper in front of you, so I have a hard time believing you're doing what you're supposed to be doing" (Field Notes, 11/1/13). She even credited him with turning the volume up on the devices as loud as possible on a daily basis:

> It does seem that the one (device) he's at that the next kid who's there says, "That this one is way too loud!" And then he will go there and he says, "I can't hear this" and I say, "You can turn it up," and he's like, "I don't know how," and I go, "Oh yeah, you do, you pretty much turn that thing up everyday, don't tell me you don't know how! (Marcy, Interview, 1/16/13).

Jarrick was redirected and received more negative feedback than his classmates. Jarrick's behavior at the iPod center revealed interesting patterns. During the QR code activity he was unclear about his task and did not have the opportunity to engage in literacy practice or learning:

> Jarrick asks, "What are you supposed to do? Play?" The other two boys have started scanning right away. One glances up, takes the device from Jarrick who doesn't know what to do, telling him, "You can't do that, get started." He switches devices with him. Jarrick stands up and moves to another chair. He begins playing a game on the device. The boy who switched devices with him

looks at the other boy's screen with games and says, "You can't do that" loudly.

Marcy comes over as Jarrick is reaching across the   table grabbing at the yellow

QR code cards. "Use the green ones, they're right in front of you" she directs as

she hands him a few of the cards. "I can't do it!" he responds as her attempts to

scan one of the green cards. Marcy helps him, suggesting, "You have to move

your fingers out of the way. Look at it. Next to 14 write that letter." She returns

to the kidney table. He continues to struggle with scanning the QR codes. As I

move closer her looks at me and says, "I can't do it." He is holding the device

way too close to the QR code (Field Notes, 11/1/13).

Jarrick spent 12 minutes unclear about what he was supposed to do, playing games on the

device and struggling to complete the scanning task even with Marcy's help. His

experience did not afford him the opportunity to interact with peers, receive appropriate

scaffolding from adults or develop any sense of self-efficacy as a reader or technology

user. Overall, these twelve minutes were frustrating and unproductive for Jarrick.

During my next observation of Marcy's classroom when Jarrick rotated to the

iPod center and he loudly voiced his discontent, stating, "I don't want to use iPads!" with

a whine in his voice (Field Notes, 11/22/13). When Marcy asked him what he was

supposed to be doing he responded, "I don't know," but proceeded to pick up and unlock

his iPod. As minutes went by Jarrick struggled with using the app (Spelling Magic):

Jarrick is talking to one of the other boys and is half standing with one leg bent on

his chair. His paper has drifted to the floor next to the table. He does not seem to

notice that his worksheet is not longer at the table. Without getting up from the

kidney table, Marcy says, "Jarrick, I really need you to have that on that table,

you're supposed to be writing words on that piece of paper." She watches him for

another brief moment before getting up from her small group. She comes to the

iPod station, bends over Jarrick, gently putting her hand on his back. She

whispers inaudible directions to him. She gives him a smile as he sits down and

begins working on the app (Field Notes, 11/22/13).

Although Jarrick did not complete the paper-and-pencil task he spent the remaining five

or so minutes of the center spelling words on his device. He used a process of

elimination to figure out where each letter belongs and from time to time he repeated the

sounds for the letter made by the device.

Jarrick's experience at the iPod center was notably different when Marcy

differentiated the center, assigning different developmentally appropriate apps for each

small group. Jarrick's group was assigned the Little Writer app. Marcy shared that they

needed practice naming letters because they did not know all their letters yet. The Little

Writer app displayed a letter with small icons (fish, flowers, fruit and so on depending of

the theme the user selected) that when traced made an upper or lowercase letter and then

audibly named the letter. During my observation of the differentiated iPod center Jarrick

was engaged, confident and collaborative in his learning:

As the students move to the next center, Jarrick arrives at the iPod center while

the previous group is still putting things away. He starts to pull the iPod from a

boy. Marcy tells him, "Jarrick, let's let him be done first, you don't need to take

it." Jarrick stops grabbing for the device, but he is clearly excited to use the iPods

and he is bouncing and moving with excited energy. He says, "I'm gonna push

the button!" as he leans over to touch the device, "Awesome, look!"…Jarrick and

the other boy are sitting close together, leaning in towards each other. They hold

their screens close together. They are talking to each other and it is clear they are

talking about the app and on task. Occasionally, Jarrick will make a fist and pull

his arm in exclaiming, "Yes!" He pumps his arm twice like this and continues

to use the app (Field Notes, 1/16/14).

Jarrick had a more engaged and positive experience using the devices during this

observation than the previous observations. Marcy attributed increased engagement, both

Jarrick's and the class overall, to the differentiation of apps for each group:

It has helped with them all having different ones because I think they feel like

"She picked this just for our group!" You know, like, "This is what she wants us

to do," instead of here's some random one that everybody is going to do…I feel

like they all kind of feel like just they get to do this one, you know? So I think that

does help keeping them on task (Marcy, Interview, 1/16/14).

Having an app that was selected by the teacher especially for each group and within

students' zone of proximal development made a notable difference in Jarrick's

experience using the devices. Further, Jarrick's voluntary collaboration with his peer to

complete the literacy task (See Figure 4.33) seemed to increase his engagement with

naming letters and helped him remain focused on practicing this critical skill.

Figure 4.33: Jarrick and a peer collaborate to name letters on the Little Writer app

Jarrick's earlier experiences with the devices included some concerning trends: he was redirected and given negative feedback, he struggled with the task and was not able to engage in the same learning as his peers. However, when the task was developmentally appropriate and he was able to work with a peer his learning was dramatically different. This suggests that apps ought to be developmentally appropriate for specific students and that collaborative learning structures may enhance literacy learning with handheld devices and apps.

Antonio. Antonio was another student in Marcy's class who had experiences with the devices that reveal noteworthy and significant patterns. Antonio was an English Language Learner. His family spoke Spanish at home. While Marcy reported that Antonio knew his letters and sounds, and could read, but struggled with oral language and "won't talk, it's like he's still processing the language" (Marcy, Interview, 11/1/13). During the QR activity a concerning incident occurred that illuminated how the structure of device use in Marcy's classroom left Antonio alienated and isolated as his peers completed the activity:

Antonio doesn't have his paper. He sits quietly holding one of the pink QR code cards. He flips the card around his fingers and makes his fingers into scissors around the card. Another boy grabs his device, turns it on and finds the app. He hands it back to the boy. One of the girls inquires, "You don't have yours?" The boy without his paper nods "no" but doesn't speak. "You lost it?" the girl asks. The boy puts his elbows on the table and then puts his head in his hands and starts to cry. The girl doesn't seem to notice he is crying, she has gone back to her scanning. The rest of the students do not notice, they are focused on the activity and the devices. They continue to scan QR codes and write down the letters on their sheets. Marcy notices and comes over and kneels next to the boy. She immediately puts her hand on his back. "Didn't they give you your paper?" she asks, "You just have to ask them; they'll give you your paper." She puts her arm around him. Her face is very soft and kind. She is clearly concerned about the little boy. Her demeanor is comforting and she gives him a hug with both arms. She has retrieved his paper from the other end of the table. She helps him start scanning. "Now it's all ready, you can do it," she says. He happily begins the task. (Field Notes, 11/1/13).

I asked Marcy if she felt that this incident would have been the same if students had been engaged in a traditional print-based activity, if they would have noticed that Antonio didn't have what he needed and have helped him more than they did. She responded, "They might have, yes, they might have." (Marcy, Interview, 11/1/13). The next time I observed Antonio at the iPod center he was cheerful and engaged, but still did not interact with his peers:

Antonio, the student who cried last time I observed, is very engaged and focused on his device. He seems unaware of the other students, but he has a slight smile on his face,   which grows into a grin when he successfully spells a word and "Hail to the Chief" begins to blare from his device (Field Notes, 11/22/13).

Although Antonio was engaged and successful in his practice of spelling words during this observation, he would arguably benefit from a collaborative, shared experience practicing letter sounds, segmenting and blending with his peers. This could potentially be a rich opportunity for Antonio to form connections with peers and practice oral English.

An inclination to explore. One of the most compelling patterns of student behavior I observed in Marcy's classroom was the students' exploration of the affordances of the handheld devices. During the QR code activity I noted that two different groups of students realized that the scan app was somewhat like a camera; it displayed whatever the camera on the device pointed towards. When students realized this they held the device up, pointed at a peer, directing them, "Smile" or "Say cheese!" The peer obliged, freezing in a pose with a big smile, or sticking out a tongue playfully (Field Notes, 11/1/13). Although they were not assigned to use the device this way, the students figured out this capability, and in one case actually took a picture with the device during the center.

Students also experimented with the devices by spinning them on the table. During an observation one boy realized that the slight curve and smooth polished back of the device afforded a nice spin on the tabletop. Noticing their peer's innovative discovery, the rest of the group began experimenting until Marcy noticed and threatened

the entire group with the loss of technology privileges (1/16/14). Students also experimented with the sounds they could produce using their devices: since a feature of Spelling Magic was that the device pronounced the word to be spelled when the user tapped the picture, students realized they could tap the image quickly and repeatedly, making the device say, "cap, c, c, c, ca, ca, ca, cap," a sound which they found to be delightful. A few boys realized they could do this and spent several minutes trying this trick with different words, exploring all the unique sounds they could produce with the device (Field Notes, 1/16/14). Students seemed to have a natural propensity to explore affordances of the devices. Although they were not assigned to do so, the students explored the devices discovering new and unique, sometime humorous and sometimes potentially destructive, ways to use the devices. Students' inclination to explore ways to use the devices could be potentially be leveraged to enhance student learning and increase engagement in literacy practices.

Clear patterns of what teaching and learning looked like with handheld devices and apps in Marcy's room were evident from analysis of data. Without fail students were assigned an App of the Day to use for 12 minutes as their reading group (determined by development) rotated through the iPod center. Students would rarely use headphones, often removing them midway through the center, if they used them at all. Students interacted less at the iPod center than at the word work center, but several incidents occurred when students collaboratively used the devices even though Marcy did not structure the activity as a shared learning experience. When Marcy differentiated apps by students' literacy developmental stages students were more engaged and on-task, in

particular, special education students. The experiences of a special education student and an EL using the devices suggest that the integration of handheld devices amplified the importance of differentiating to meet the needs of diverse learners. Students demonstrated an inclination to explore ways to use the devices other than that assigned by Marcy.

RQ#4 Assertion: Case study teacher #2 's beliefs, knowledge, planning and instruction were impacted by her experiences, observations and reflections on teaching and learning with handheld devices and apps in that she consistently felt ambivalent and conflicted about the value and affordances of teaching early literacy with these technologies.

Fraught with frustration and pressure, both real and perceived, Marcy's experiences with planning and teaching with apps and handheld devices shaped her ambivalent perspective. For Marcy, there was an ongoing tension related to using apps to teach literacy: she felt torn between what she perceived to be positive affordances for learning (engagement) and the increasing presence of technology in society, and her frustrations with attempting to use the technology in meaningful ways despite the numerous obstacles she encountered. Marcy's perspective was also shaped by her coursework in her reading specialist licensure program and her own experiences observing how her own children and grandchildren used and responded to technology.

Sub-assertion 1: Case study teacher #2 's strongly held beliefs about personal connections with students and traditional print-based literacy instructional practices

informed her critiques, concerns and strategies for using handheld devices and apps in

early literacy instruction.

Marcy conceptualized herself as a learner in her approach to integrating the handheld devices into her literacy instruction stating, "Just like anything else, you learn as you go" (Marcy, Interview, 11/1/13). Her knowledge and beliefs grounded in traditional print-based literacies served as a lens for her learning. As an educator Marcy highly valued personal connections with students and expressed her concerns that technology may inhibit these critical relationships. She stated, "My philosophy of education starts with relationships with my students and I feel like that's kind of what the technology piece takes away is that there's not a relationship, and so that part of it is what bothers me" (Marcy, Interview, 10/15/13). Marcy maintained this underlying belief and limited students' use of handheld devices to 12 minutes of literacy learning a day. Marcy described her beliefs about literacy instruction during our first interview:

> I guess my philosophy about early literacy would be that you just kind of inundate them with literacy and have words and letters all around them…and I read probably two or three, two for sure, sometimes three, stories every day. One of those stories is tied with our theme or whatever were working on that week or that month and then they do some sort of a response to the books whether it is a written response or draw pictures or whatever (Marcy, Interview, 10/15/13).

I observed these practices in action during every classroom observation. Based on interview and observation data analysis, traditional, print-based approaches to early literacy instruction were the foundation of Marcy's beliefs, knowledge and practices. Her experiences with the devices did not alter these foundational beliefs. Rather, Marcy

assimilated the devices into her traditional literacy block as a center. This was

manifested in her comment about planning literacy instruction using the handheld

devices: "In kindergarten because it's a station, it's not like it's a main part of our

curriculum, so yeah, I think it's (instructional planning) mostly stayed the same…it

hasn't changed other than now I'm planning something for the technology" (Marcy,

Interview, 10/15/13).

Marcy's relegation of the handheld devices to a 12-minute center within a

traditional print-based literacy block was further explained by her beliefs about the

importance of interacting with a teacher in literacy learning. Specifically, Marcy

described her personally held belief in the value of a teacher reading aloud to students:

> I feel that if you rely too much technology on that you're losing your personal
>
> relationship with the kids, that there still has to be an interaction, there still has to
>
> be somebody reading, you know? Because I don't think having a video recording
>
> or an audio recording reading a book is the same as having a person reading that
>
> can stop and interject comments or talk about a word or you know, the pictures in
>
> the book (Marcy, 10/15/13).

Marcy maintained her commitment to limiting students' technology use for fear of

eroding her interactions as a teacher with students. She asserted,

> I do feel like they need interaction with me and they need feedback, like other
>
> than from the device, you know what I mean? Like, yes, it makes a little picture
>
> or it colors something in on some of those different apps…and I really feel like if
>
> they were in front of them more than that (12 minutes) I would feel bad, like I

wasn't doing my job, like they need more (attention from the teacher)… (Marcy,

Interview, 1/16/14).

Grounded in her deeply held beliefs about early literacy learning in traditional print-based

texts, Marcy approached using the handheld devices and apps for literacy instruction with

great caution and concern for the potential to detract from the social and cultural aspects

of students' learning, specifically their literacy interactions with her as the teacher.

Sub-assertion 2: As case study teacher #2 gained experience teaching literacy with

handheld devices and apps she drew upon her knowledge and beliefs about teaching

literacy in traditional print-based forms and became increasingly convinced that to

effectively utilize these learning technologies she needed to differentiate for students'

individual developmental instructional needs; that the potential to differentiate using the

devices was one of the most significant positive affordances.

As Marcy gained experience teaching with handheld devices and apps and

reflected on her observations of student learning she identified the need to differentiate

instruction for students with the devices and she imagined various potentials or

possibilities to use the devices to meet each students' specific literacy instructional needs.

Marcy referenced her traditional print-based understandings of unique student needs to

make sense of why she was observing varied comfort and familiarity with using handheld

devices among students in her class. She stated that some students have used the same

apps she selected for instruction at home on a family members' handheld device, a

contrast to other students in her class who had never used these technologies and made

statements like, "It won't turn on" early in the school year when she first introduced the

devices into her instruction. Marcy equated this varied exposure to technology her students brought to school with varied exposure to traditional print-based texts students bring to school: "It's just like reading, there are kids that don't know the alphabet letters and kid that are reading at a second grade level, so it's like to just meet them all where they are at" (Marcy, Interview, 11/1/13). Marcy contemplated using apps to differentiate instruction following a lesson during which all her students used the same Spelling Magic app as she noted, "It's clearer that they all need different apps to do over there (the iPod center)" (Marcy, Interview, 11/22/13). During a post instruction interview she elaborated on this idea:

> The more I think about that, the more its like, I'm not going to find one app that's going to do what I want it to do for all these different groups, so it's going to have to be different apps for the groups…which only makes sense, I wouldn't use the same book for guided reading for each group so why would I think the same app? When I think about it for some reason that seems a little bit different than the books and stuff, but yet it's really not, they can only do so much (Marcy, Interview, 11/22/13).

This statement revealed how Marcy's approach to integrating the handheld devices and apps was understood through a framework of her beliefs about traditional print-based literacies. By comparing apps to guided reading books while reflecting on her lesson Marcy was making sense of how she could use the devices to differentiate and meet the varied developmental needs of her students.

As the school year progressed Marcy used the handheld devices and apps to differentiate by assigning each small group a different app to use for their 12 minutes at

the technology center (Marcy, Interview, 1/16/14; Field Notes, 1/16/14). Marcy shared

that she felt there was additional potential to differentiate using the handheld devices, but

the limitation of having access to only six devices prevented her from fully realizing that

potential. As Marcy reflected on a literacy block during which students used different

apps according to their abilities she mused,

> I still do think that it's unfortunate that kindergarten only has six (iPod Touch
>
> devices) per class because there's a lot of things that I think would be easier if
>
> they each had their own. Because I could see going in and changing the settings
>
> on each kid's, and yes, that would be time consuming, but you would only have to
>
> do that as they advance…so if they each had their own device it would be more
>
> personalized, where this way (only having 6 devices to share among the class) it's
>
> like I'm still trying to accommodate everybody (Marcy, Interview, 1/16/14)

Marcy took this idea even further, imagining a literacy block with multiple centers or

stations utilizing the handheld devices:

> (If there was one device per student) I could see that they wouldn't even have to
>
> change stations, like they would have a listening center book (on the handheld
>
> device), they would have a book on there to listen to and follow along, they would
>
> have, you know, an app to physically do something on there, they would have a
>
> guided reading book on there (Marcy, Interview, 1/16/14).

Marcy identified the potential to differentiate instruction as a significant affordance of the

handheld devices and apps through her experiences teaching, observing students'

learning and reflecting on instruction with these learning technologies. She believed that

access to a larger number of devices would allow her to use these tools for learning in

more innovative and comprehensive ways. Her ideas about potential ways to use the devices were firmly grounded in her knowledge and beliefs about a traditional print-based literacy block in a kindergarten classroom.

Sub-assertion 3: Case study teacher #2 perceived pressure to use the handheld devices daily for instruction because they were made available to her and because of the role she perceived technology playing in the lives of children currently. While she questioned her use of the devices, she concluded that using the handheld devices and apps for literacy instruction ultimately offered positive affordances of exposure to technology and student motivation and engagement.

During an interview earlier in the school year Marcy shared that she often questioned whether she ought to be using the handheld devices and apps if she did not have an innovative approach to integrating them into literacy teaching and learning. Despite her misgivings, Marcy perceived that Silver Lake Point School district expected her to use the handheld devices and apps daily in her instruction. Marcy stated,

> I do think sometimes that if I don't have some great thing I shouldn't even be
> using them (iPod Touch devices), but I do feel like I'm supposed to have the kids
> using them everyday, like that's a requirement or an expectation from the district
> (Marcy, Interview, 11/1/13).

Marcy consistently structured learning in her classroom to include a 12-minutes center using the handheld devices and apps, evidence of her enacting the perceived expectation from the district.

Marcy's beliefs about the value and importance of using technology in learning were informed by her perspective as a mother and grandmother. Marcy believed that a primary benefit to using technology in learning was exposure to the technology itself, as opposed to meaningful, substantive learning experiences. Marcy described how, when her adult daughter (currently 31 years old) would spend time in the computer lab as an elementary student, Marcy would comment to her spouse,

> I never saw anything come out of that computer lab that was worth a darn, it's like so they go in there and they play some games and like whatever, they're getting experience on the computer, you know, familiar with it and stuff, which I do think that's valuable, but at the same time it's like they spend time each week in the computer lab and I just didn't see the value of it (Marcy, Interview, 11/1/13).

Marcy connected her beliefs from a mother's perspective to her work as a kindergarten teacher tasked with the challenge of integrating handheld devices and apps into her instruction, "I mean I think it's valuable for them to have experience on a device because they are going to have to have that" (Marcy, Interview, 11/1/13). Marcy expounded on her beliefs about the value of exposure to technology from her perspective as a mother and grandmother. She described her hesitancy 20 years ago to allow her older children to use the costly computer when she and her husband first purchased a home computer. Conversely, her youngest child, who is currently in high school, used Jumpstart Toddler, a computer program, in their home at a very young age. At the time of the study Marcy had two toddler-aged grandchildren who upon arriving to visit her in her home asked, "Where is your iPad, Grandma?" and were familiar with numerous apps for children

(Marcy, Interview, 11/22/13). For Marcy her personal experiences as a mother and grandmother shaped her beliefs, knowledge and practices as a kindergarten teacher using handheld devices in instruction. Reflecting on the increased prevalence of technology in the lives of children Marcy asserted that experience using technology and exposure to such devices held educational value in and of itself. Marcy's commitment to daily use of technology in her classroom was shaped by her beliefs and understandings about the increasing presence of technology in society. She argued, "It's kind of like that's the world that these kids are in, so like things have to change and I feel like it is kind of we're on the cusp of a big change" (Marcy, Interview, 10/15/13). This belief manifested in her instruction as she consistently used the handheld devices daily in her kindergarten classroom.

While Marcy questioned the value of using handheld devices and apps in literacy learning she repeatedly cited the positive affordance of engagement she observed from her students as evidence that using the devices had instructional value. During Marcy's final interview she stated,

> I don't know if doing the little spelling quiz thing (app), that's necessarily the best way to do that, but I know that they are engaged with it, they are doing it and I feel like they're learning from it, so then I think well, okay (Marcy, Interview, 1/16/14).

In this statement Marcy did not link evidence of student learning to the use of the devices, rather she drew on her observations that her students are engaged in using the devices when they are assigned to do so. Marcy concluded that using handheld devices in literacy instruction ultimately was beneficial for her students as she asserted,

Overall I think they're beneficial, I think the kids are learning when they're using

them, like I said, sometimes I feel like when I'm frustrated and I'm trying to

download apps on 6 of them and I think it's not worth it, you know, its… but after

they're all on there and they're working right it's like, okay, this is

good…(Marcy, Interview, 1/16/14).

Marcy consistently cited her observations of students' active engagement with the

handheld devices as evidence of the motivation and engagement afforded by using the

devices in instruction.

Despite the tensions she experienced as she questioned the value of using

handheld devices and apps for literacy instruction, Marcy maintained her commitment to

brief, daily usage of these learning technologies in her literacy instruction. As the school

year proceeded Marcy's instructional practices changed very little because of her

experiences, observations and reflections. Although she altered her use of the devices to

differentiate for students' literacy development, she did not vary the time, structure or

content that she used the handheld devices and apps for.

Cross-case Analysis

By conducting analyses across the cases of Tracey and Marcy I found patterns of

both strong similarities and notable variations between these two cases in their

experiences and approaches, practices and beliefs using handheld devices to teach early

elementary literacy.

RQ#1 Assertion 1: The ratio of devices to students (1:4) significantly limited teachers' perceptions of how they could use the devices in their literacy instruction, which translated into similarly structured uses across the cases.

Although Tracey had more variety in the apps she assigned students to use than Marcy did, both teachers' instructional use of the handheld devices was limited. Given that Silver Lake Point kindergarten teachers were issued one iPod Touch device for every four students, the availability of devices imposed what the case study teachers perceived to be a challenge that limited the possible ways to use the devices. In her open-ended survey response Marcy described this obstacle to implementation: "(My use of the devices is) limited to small groups as I have 5 iPods for 24 students" (Marcy, Survey, 9/23/2013). While Tracey did not explicitly describe this challenge like Marcy did, her instructional practices always used the devices as part of a literacy center for a small group of students. During a post instruction interview Tracey shared her enthusiasm for what she could do instructionally with one-to-one devices in her classroom: "I think that would be pretty awesome…then you would be able to differentiate and have it be so individualized even within the word work or within the writing…that would be really cool!" (Tracey, Interview, 11/8/13).

The difficulties of sharing learning technologies have been documented in studies of shared computers. Warschauer (2008) states, "The potential of new educational technologies is far from being realized because logistical, administrative, and pedagogical obstacles make it difficult for teachers to effectively deploy shared computers" (p. 53). Similar to previous research on shared computers, this study found that the necessity of

sharing the handheld devices in these kindergarten classroom significantly limited the ways the teachers believed they could use these tools for learning.

The teachers' perceived limitations due to the number of devices they had access to contributed to similarly structured use of devices across the cases. Both case study teachers delivered fairly typical kindergarten rotating literacy centers instruction. Both teachers organized their classes into similar-ability small groups of three to six students who rotated through four or five centers spending 10-15 minutes at each center. One center was a guided reading group with the teacher and the remaining centers included literacy tasks such as listening, writing, spelling or word work. There was often a seasonal or content theme to the centers (apples, dinosaurs, Halloween, Thanksgiving, etc.). The handheld devices and apps were substituted for the listening center or the word work center. Neither teacher used the handheld devices or apps in ways that fundamentally altered the nature of literacy and literacy learning for their students. In other words, students were not engaged in digital literacy learning that developed students' skills, strategies and abilities to understand and represent "ideas using a range of modalities enabled by digital tools" (O'Brien & Scharber, 2008, p. 66-67). Rather, these technologies were used to support the development of traditional print-based literacy through drill and practice of skills such as letter naming and sounds, rhyming, blending and segmenting.

RQ#1 Assertion 2: Case study teacher #1 implemented more variety of apps and activities than case study teacher #2 did, but ultimately both case study teachers embedded students' use of apps into a rotating literacy centers grounded in

traditional print-based literacy learning, rather than engaging students in understanding or representing ideas using multi-modalities afforded by the technologies.

Although Tracey and Marcy used the devices in very similar ways to teach literacy there were noteworthy differences between the two teachers' classrooms. Tracey's approach to teaching with apps demonstrated more variety and opportunities for student choice than Marcy's approach. This pattern was attributable to characteristics of Tracey as a pedagogue including her eagerness to explore and test apps and her firmly held belief that technology is "The best way to learn" (Tracey, Interview, 10/8/13). The devices in Tracey's classroom had significant more apps loaded than the devices in Marcy's room: screen after screen of folders compared to Marcy's devices that had two screens of apps, none of which were organized into folders.

Additionally there were variations between the willingness either teacher expressed to expend time downloaded, testing and organizing apps on their set of iPod Touch devices. Tracey shared, "I'll take it (box of iPod Touch devices) home for a weekend if I don't have much going on and then that way I can just kind of plug away at it" (Tracey, Interview, 10/8/13), while Marcy lamented the required time investment asserting, "Even if it took five minutes (to download an app), it's like, well, that's 25 minutes (to put the app on all the devices) that I just spent downloading an app" (Marcy, Interview, 10/15/13). There was a stark contrast between Tracey's excitement to find new apps to use in her classroom and Marcy's trepidation about the loss of her time inherent in finding apps.

Interestingly, Tracey's students seemed to spend longer increments of time locating apps to use than Marcy's students, although both teachers displayed visual guides indicating what apps students were to use. Marcy's students always had one assigned app they were to use, while Tracey often structured her iPod center as student-directed choice of apps within teacher-set limitations. When Tracey used the handheld devices as a listening center students had about seven folders, each with five or more "story book" apps in them to select from (Field Notes, 10/25/13). This contributed to the pattern of students seeking assistance from their peers locating and selecting apps. Perhaps students often selected the same story as their peers because the sheer number of choices was overwhelming. Conversely, in Marcy's class if students helped a peer locate an app it was one specific app that Marcy had assigned; there was no student choice involved.

Although I observed more variation in how Tracey used the devices in comparison to Marcy, there was little variation between the two cases in how firmly they both grounded their instruction in traditional print-based literacy. Although Tracey's students engaged in listening centers, phonics skills practice games and QR code activities, and Marcy's students primarily used the devices to practice letter names, sounds and spelling, neither teachers' instructional practices addressed understanding or representing meaning through a multiplicity of modes, interactivity and hypertextuality (Coiro, Knobel, Lankshear and Leu, 2008; Roswell & Lapp, 2011). Rather both teachers' uses of handheld devices and apps were intently grounded in traditional print-based early literacy.

RQ#2 Assertion 1: Although both teachers drew upon their knowledge of best practices for literacy instruction as they reviewed and selected apps, both also demonstrated misconceptions or inaccuracies in their knowledge of best practices. Both teachers considered factors outside of effective literacy instruction (cost, design) as they determined which apps they would use for early literacy instruction.

Given that Marcy was concurrently enrolled in a reading specialist licensure program through a local college during the time of my study, I theorized that she would draw upon her developing knowledge of best practices for literacy instruction more than Tracey. However, data disproved my theory, indicating that there was not a notable difference between how Marcy and Tracey described their knowledge of best practices for literacy instruction as they completed verbal protocols and interviews. Both intimated that they drew upon their knowledge of best practices and their beliefs in a balanced approach to literacy instruction. For example, Tracey described her appreciation of listening apps with a tracking feature that lit up each word as it was read to develop students' understanding of directionality, a concept of print (Tracey, Interview/Verbal Protocol, 10/8/13). She also discussed her disillusionment with the lack of comprehension features on apps, asserting that a balanced approach to literacy learning must develop comprehension skills in addition to decoding skills. Since Marcy primarily used apps that practice phonics skills her selection of apps drew somewhat upon her knowledge of best practices for teaching segmenting and blending. For example, during a verbal protocol procedure Marcy stated, "This is going to be great because they're sounding out the word and moving it on the spot," revealing that she understood the importance of word building practice for early literacy learners, much like Elkonin boxes

(Marcy, 10/25/13). Although both teachers demonstrated accessing their knowledge and beliefs about best practices for literacy instruction, both exhibited also misconceptions or inaccurate perceptions about phonology, phonics and spelling patterns. These inaccuracies may have inhibited either teacher's ability to evaluate apps for literacy learning.

I observed a noteworthy example of how despite Marcy's study of reading education and literacy she failed to identify a disconcerting phonics feature of a favorite app. Marcy was quite enthusiastic about Endless ABCs, a well designed, visually appealing app that posed several negative affordances for literacy learning. Specifically, although this app was visually appealing-charming even-the way the app mispronounces certain phonemes is potentially confusing, misleading or even damaging to an early reader's development. However, Marcy's evaluation of this app emphasized the visual design and interest vocabulary words, while failing to note the mispronounced phonemes. Similarly, during a lesson on "Super E" (CVCe words) in Tracey's room a student pointed out the word "have" as a Super E word, to which Tracey replied, "You're right!" Although this incident did not occur as Tracey reviewed an app, it is worth noting because the depth of a teachers' content or disciplinary knowledge of phonics, language and reading impacts their instructional practices (Cunningham, Perry, Stanovich & Stanovich, 2004; Moats, 1994; Moats & Foorman, 2003). Limitations in teachers' content knowledge of reading and language, specifically phonics, phonemic awareness and spelling patterns, compounded the obstacles to effective use of handheld devices and apps. Teachers lacked the content knowledge to critically evaluate apps for phonics practice. Neither teacher articulated an exceptionally well-developed schema for of

reading and language content knowledge, literacy development, assessment and instruction verified by educational research. Thus, neither teacher was able to base their evaluation of apps on the accuracy of phonics and spelling patterns and phonemes afforded by the apps.

Finally, factors of visual appeal ("cuteness") and cost (or lack thereof) played an influential role in both Tracey and Marcy's selection of apps for instruction. As survey findings indicated, the 25 survey respondents were most concerned with identifying free apps; while literacy instructional value was a concern of respondents when selecting apps, finding free or low cost apps was even more important. This pattern was apparent in the cases of both Tracey and Marcy. As Tracey swiped through the multiple screens full of folders of apps she proudly declared, "These are all free!" (Tracey, Interview, 10/8/13). During my final interview with Tracey she maintained that she still exclusively used free apps. She mused that perhaps a goal for future instruction (i.e., next year) would be to identify paid apps to try and complete the requisite district paper work (Tracey, Interview, 1/22/13). Similarly, Marcy also limited her app selection to those that were free of charge. During our initial interview she shared, "You have to look at the free apps because we're not going to buy $2.99 apps for each device!" Further, Marcy lamented that fact that a favorite app upgraded from free to paid. Thus, since the app was previously installed on only four of her six devices she was unable to use it for instruction (Marcy, Interview, 11/22/13). An external barrier, in this case study cost associated with app purchase significantly shaped how teachers approach selecting apps. Throughout the study I did not once observe a paid app used in either classroom.

Both Tracey and Marcy shared their appreciation of a visually appealing app, especially if they felt that the graphics and design would grab their students' interest and attention. During a verbal protocol procedure Tracey mused, "As ridiculous as this is I think the graphic, the picture of it, is more attractive than the other pictures (on other apps)…they weren't as attractive as the cute little caterpillar" (Tracey, Interview/verbal protocol, 11/8/13). Marcy made a similar comment when completing a verbal protocol procedure of an app called "Rocket Speller": "I think they (students) are probably going to like it (the app) because it has a little spaceship and it's colorful… so far it looks cute and they'll like it so." As she proceeded to explore the app she shared her belief that, "It has to be visually appealing to the kids or they probably aren't going to be really interested in it to begin with" (Marcy, Interview/verbal protocol, 10/15/13). Data across cases showed that the visual appeal of an app, the "cuteness," was a characteristic teachers noted, considered and integrated into their selection process. Although outside of the field of education, research in the area of user experience has validated that user experience ought to be strategically designed as new technology systems and products are developed (Adikari, McDonald & Campbell, 2011; Korhonen, Montola & Arrasvuori, 2009). Both Tracey and Marcy integrated visual appeal, an aspect of user experience, into their selection of apps for early literacy instruction.

RQ#2 Assertion 2: The teachers alluded to the potential multimodal affordances of the devices, but did not demonstrate or implement digital literacies teaching and learning into their instructional practices.

Both Tracey and Marcy described ways they would like to use the handheld devices and apps that would utilize the multi-modal affordances of the technologies. In fact, both teachers described ways they had used technology during previous school years for students to engage in multi-modal representation of ideas. Tracey described a research project she had engaged her kindergarten students in the previous year (in a different district in a different state) that culminated with students creating a video recording presenting their research findings with words and images. These recording were shared electronically with students' parents. Although Tracey suggested she hoped to complete a similar activity during the current school using the handheld devices and recording apps, at the time of this report she had not done so (Tracey, Interviews, 10/25/13; 1/22/14). During multiple interviews Marcy mentioned a math project her students had completed the previous school year using the handheld devices. Students were organized into groups and assigned roles (director, camera person, narrator, etc.) as they wrote, represented with manipulatives and solved an addition or subtraction word problem. These recordings were presented to the whole class using the air server on the SMART board and students practiced solving the word problems. While Marcy was clearly proud of this project she did not attempt to recreate it or similar projects during the time of this study (Marcy, Interviews, 10/15/13, 1/16/14).

Interestingly, both of these examples used a simple video recording app that came installed free of charge on the handheld devices. Therefore, the financial expense of such uses of the devices was not the barrier inhibiting these teachers from implementing such uses they had previously attempted. Both teachers' failures to attempt these instructional practices were attributable to their specific individual internal barriers. Inan & Lowther

(2010) found that teacher readiness (knowledge, skills and confidence to teach with technology) and beliefs (perceived value of technology) strongly predicted the outcomes of technology initiatives and Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur & Sendurur's (2012) name teachers' internal barriers, such as deficits in these areas, as the "true gatekeepers" that must be addressed if the learning and teaching potential of technology integration is to be fully realized. Marcy continuously questioned the value of these specific learning technologies in kindergarten classrooms. Additionally, her struggles with passwords, downloading and other technical factors frequently led her to abandon her efforts to find and use new apps. She repeatedly described her use of the handheld devices and apps as "substitution" according to Puentedura's (2010) Substitution Augmentation Modification Redefinition (SAMR) Model, the model of technology integration that Silver Lake Point teachers learned at the beginning of the handheld device implementation. Substitution involves using technology "to perform the same task as was done before the use of computers" (Puentedura, 2010). Further, Marcy expressed her acceptance of her lack of confidence and knowledge about using the devices in innovative ways in her statement: "I don't know if this (spelling app) is necessarily the best way to do that, but I know that they are engaged with it, they are doing it and I feel like they're learning from it, so then I think, well, okay" (Marcy, Interview, 1/16/14). Marcy's ongoing questioning of the value of the devices in her students' learning and her lacking knowledge, skills and confidence to use the devices in more innovative ways exemplified Ertmer and colleagues concept of internal barriers.

Tracey's internal barriers were different than Marcy's internal barriers. Tracey's enthusiasm for filling her devices with as many apps as they could store, her continual

search for new apps and her self-proclaimed "blog addiction" allowed Tracey to feel she

was knowledgeable, capable and confident in her technology use. However, the

abundance of apps on her devices and her flurry of activity searching for new apps

effectively inhibited her from seeking more unique and innovative ways to use the

devices; ways that would have engage students in representing ideas multi-modally.

What Tracey lacked was what Mishra, Koehler & Kereluik (2009) describe as "Flexible

and robust knowledge frameworks that are not dependent on the specific affordances of a

particular technology, but rather connect to powerful ideas about teaching and learning"

(p. 49). Tracey was focused on the wide variety of available apps, a specific affordance

of handheld devices, rather than approaching her instruction with these devices with a

robust, well-developed framework of knowledge about teaching and learning.

Although Tracey and Marcy had notably different internal barriers neither teacher

designed opportunities for their kindergarten students to use the devices to multi-modally

represent or share ideas and information. Neither teacher engaged in these processes,

despite the fact that both described having delivered such instruction to previous classes.

This was attributable to either teachers' specific individual internal barriers: for Marcy, a

lack of knowledge and confidence coupled with a perceived minimal value of the specific

technology for her teaching and for Tracey, a focus on the affordance of handheld

devices of an abundance of apps rather than approaching designing her uses from a robust

framework of knowledge about teaching and learning.

RQ#2 Assertion 3: Teacher colleagues were an important resource to teachers when

selecting apps for literacy instruction, although teachers recommended apps using

electronic means rather than collaborated in person to evaluate apps and plan instruction.

Survey results indicated that other educators were the primary resource consulted by teachers to identify apps for instruction. This pattern was evident in interviews with both Tracey and Marcy. During multiple interviews Tracey described consulting teachers' blogs to access their recommendations for apps (Tracey, Interviews, 10/8/13; 11/8/13; 1/22/14). Tracey herself filled the role of app recommender for her colleagues. She shared, "I'll email my colleagues: "Look at what I found…this is a great app…this is how I'm using things"" (Tracey, Interview, 1/22/14). Marcy described a similar sharing of app recommendations through email among her kindergarten colleagues:

> It's always great…the other teachers…if they see something we all send out an e-mail to each other, "Oh, here I found this, it's great" and that's super helpful because it's like, okay, that just saved me 30 minutes of my time checking through all that (Marcy, Interview, 10/15/13).

There was an interesting pattern of app recommendation occurring electronically rather than during in-person collaborative settings. Whether consulting a blog or an email from a colleague, app recommendations were received in electronic form. Neither teacher described any experience sitting with colleagues face-to-face and collaboratively testing and evaluating apps for literacy instruction. Although teachers primarily sought the counsel of their colleagues to identify apps for early literacy instruction; collaborative evaluation of apps and instructional design planning were not reported by either case study teacher. Sell, Cornelius-White, Chang, McLean & Roworth's (2012) meta-synthesis of research on technology initiatives found that effective professional

development must include collaboration or cooperative learning among teachers.

Therefore, increased opportunities to collaborate and learn together, rather than email

recommended lists of apps, would increase teachers' confidence, knowledge and self-

efficacy to use the handheld devices in early literacy instruction.

RQ#3 Assertion 1: The use of handheld devices in literacy teaching and learning yielded unanticipated negative affordances.

In both Tracey's and Marcy's classrooms multiple negative, often unanticipated,

affordances were observed. As described previously, Marcy's students frequently

interrupted her small group guided reading instruction in need of technical help with the

handheld devices. Since Marcy's students were not required to wear earphones the

volume of the devices became increasingly loud as the reading block period continued, a

problematic occurrence given the importance of students being able to hear words and

phonemes to use the apps Marcy selected. In Marcy's classroom the apps she selected

displayed negative affordances such as newer versions of an app being easier or harder

than the originally released version thus creating unequal tasks among students or

difficult to decipher images of words students were supposed to spell.

In Tracey's classroom her expectation that students use headphones created

inequitable experiences among students. Despite this expectation, noise from the devices

proved to be disruptive to students both at the iPod center and other adjacent centers

(Field notes, 10/25/13). Further, students in Tracey's class spent significant amounts of

time digging in the bin to find their earphones and navigating the numerous screens and

folders to find an app to use (Field notes, 10/25/13; 11/8/13). These patterns revealed

lost instructional time that would be better spent in engaged literacy learning. My

observations in either teacher's classroom revealed negative affordances of the devices

and apps that slowed or inhibited students' literacy learning. Although these negative

affordances were mostly unanticipated, they are fortunately external barriers that may be

addressed and remedied.

RQ#3 Assertion 2: Teaching and learning with handheld devices shaped students'

social interactions while using these tools in kindergarten classrooms.

During observations in Tracey's classroom I found that her required use of

earphones further served to isolate students from peers and reduced peer-to-peer

interactions (Field notes, 10/25/13; 11/8/13). Further, during the dinosaur "Hunt around

the Room" QR code activity in Tracey's classroom, student interactions were notably

hostile; this activity proved to generate tension among kindergarten peers rather than

fostering cooperative learning (11/15/13). During my final interview with Tracey she

shared that she often observed students helping each other when they encounter

"glitches" while using the devices. She felt her students were more inclined to ask a peer

for help with a malfunctioning home button or other difficulty navigating the devices

instead of a teacher (Tracey, Interview, 1/22/14). Similarly, in Marcy's room I observed

students glancing at a peer's device, showing their neighbor their screen, or sharing one

device and use the app cooperatively, or holding their devices together and help each

other spell the word presented on the screen. However, I just as frequently observed

students turning away from each other or ignoring each other. I noted that during all my

classroom observations in Marcy's room that there was less peer interaction at the iPod

table than the nearby word work center. Across either embedded case I found that the presence of the handheld devices impacted the ways students interacted socially while engaged in literacy learning. Significantly, students in both classrooms consulted one and other when they found themselves in need of technical assistance with the technologies. However, in both classrooms I observed minimal shared and collaborative literacy learning, and on occasion, negative or hostile interactions among students. In Marcy's classroom the critical incident of ELL Antonio's isolation from peers was particularly concerning. Given the limitation of the device to student ratio, I began my study theorizing that the teachers would structure collaborative learning opportunities for students to use the devices. Many researchers have verified the potential of learning technologies to foster students' development of critical collaborative skills (Argueta et al., 2011; Ertmer et al., 2012; Sell et al., 2012). However, neither teacher deliberately structured learning tasks to engage students in cooperative learning. Thus, the impact of the handheld devices on students' social and collaborative literacy learning was at best limited to technical assistance or brief sharing of spelling activities and at worst, a source of conflict among students.

RQ#4 Assertion 1: The teachers' experiences, observations and reflections teaching literacy with apps and handheld devices reinforced their existing beliefs about the value added and affordances of handheld devices and apps in early literacy instruction, therefore their knowledge and instructional practice remained static.

While Tracey and Marcy's beliefs varied notably, their experiences, observations and reflections effectively served to reinforce and maintain the beliefs they expressed at

the beginning of the study. Ertmer and colleagues (2012) argue that teachers' internal

barriers, including beliefs about technology and instruction, must be addressed if the

learning and teaching potentials of technology integration are to be fully realized.

Therefore, not surprisingly, since neither Tracey nor Marcy demonstrated shifts in their

beliefs about technology and teaching, neither demonstrated any observable shifts in their

knowledge nor in their instructional practices.

Sub-assertion 1: Case study teacher #1's enthusiasm for learning technologies led her to

modify her practices to include a "back up plan" for unanticipated technical problems.

Case study teacher #1 remained committed to overcoming obstacles so that she could

continue her current instructional practices with the handheld devices. Her beliefs,

knowledge and practices did not significantly change.

During my initial meeting with Tracey I was struck by her excitement and

enthusiasm for integrating technology into her teaching. During each subsequent

interview she continued to express her passion for technology in the classroom.

Although Tracey described some of the obstacles she was encountering during our final

interview, she maintained her belief in the value added and positive affordances of the

handheld devices and apps. Tracey stated that she had to have a back-up plan when she

designed her instruction in case she experienced technical difficulties, that this practice

has become a part of her routine when planning lessons (Tracey, Interview, 1/22/14).

Despite this, she asserted, "They are so engaged with technology" as she

described how using the devices added to her instruction and enabled her to better meet

her instructional objectives (Tracey, Interview, 1/22/14). Tracey's beliefs about the

benefits of technology integration remained steadfast; thus her instructional practices and knowledge also remained stable. Although she sought out new apps to try, her instructional designs and learning objectives were firmly grounded in traditional print-based literacies. Tracey accumulated a large number of apps on her handheld devices, but her beliefs, knowledge and practices did not expand to include new definitions of literacies that afford students opportunities to engage in "socially situated practices supported by skills, strategies and stances that enable the representation and understanding of ideas using a range of modalities enabled by digital tools" (O'Brien & Scharber, 2008, p. 66-67). Her beliefs did not change, nor did her knowledge and practices.

Sub-assertion 2: Case study teacher #2's experiences, observations and reflections furthered her feelings of conflict and sustained her ongoing weighing of the values and drawbacks of handheld devices and apps in early literacy learning. Case study teacher #2 primarily focused her attention on the challenges, thus inhibiting her willingness to use handheld devices in innovative ways that were unfamiliar or uncomfortable.

Marcy maintained her ambivalent, questioning beliefs about using technology in her early literacy instruction, and thus her knowledge and instructional practices remained static. For Marcy, there was an ongoing tension related to using apps to teach literacy: she felt torn between what she perceived to be positive affordances for learning (engagement), the increasing presence of technology in society, and her frustrations with attempting to use the technology in meaningful ways despite the numerous obstacles she encountered. She continued to experience this tension across the course of the study.

During our initial interview Marcy shared that she often questioned whether she ought to be using the handheld devices and apps if she did not have an innovative approach to integrating them into literacy teaching and learning (Marcy, Interview, 10/15/13). Despite these misgivings, she continued to use the devices daily, assimilating these learning technologies into her traditional print-based literacy instructional practices. During each interview with Marcy she reflected on some of the negative affordances and obstacles she encountered using the devices. Sometimes she described challenges from the lesson she had just taught, for example, apps displaying an advertisement that students needed help exiting from that interrupted her guided reading group (Marcy, Interview, 11/1/13). Other times she would share with me an obstacle she had encountered a few weeks or months ago that she felt illustrated the challenges she faced, for example, a student who had been assigned to illustrate a word from an app who wrote "setting" and drew the setting wheel icon (Marcy, Interview, 11/22/13). Despite these challenges, Marcy maintained her commitment to brief, daily usage of these learning technologies in her literacy instruction. As the school year proceeded, Marcy's instructional practices changed very little and she did not demonstrate increasing knowledge of digital literacies or technology integration. Although she altered her use of the devices to differentiate for students' literacy development, she did not vary the time, structure or content that she used the handheld devices and apps for. Similar to Inan & Lowther's (2010) finding that teacher readiness (knowledge, skills and confidence to teach with technology) and beliefs (perceived value of technology) strongly predicted the outcomes of technology initiatives, Marcy's continual questioning of the value of

technology in kindergarten literacy learning, contributed to what I observed to be her steadfastly maintained knowledge, beliefs and practices.

The findings presented in this chapter from survey data, case study data and cross case analysis suggest implications for practioners, school leaders, policy makers, teacher educators and professional developers. These findings are summarized in Table _below. These implications directions for future inquiry will be explored in Chapter 5.

	To what extent and how are Kindergarten-3rd grade elementary teachers using technologies in their classrooms to teach early literacy?	To what extent and how are teachers choosing apps or web tools based on their knowledge of best practices for literacy instruction?	When teachers and students use apps during instructional cycles, what does teaching and learning look like? From the perspective of teachers, what are the actual positive or negative affordances of using these apps to foster early literacy instruction in practice, including unanticipated affordances?	How are teachers' beliefs, knowledge, planning and instruction impacted by their experiences planning and teaching with apps and web tools, their observations of students' learning with these technologies and their reflections on classroom lessons?
Survey	Overall, respondents did not rate their own confidence or the support and training available as high as possible, but their ratings were more positive than negative. The majority of respondents used apps for comprehension strategies or vocabulary instruction monthly or a few times a year, as opposed to weekly. Survey respondents reported the most weekly use of app use for phonemic awareness development and phonics/decoding. The most common responses were student pairs, small, teacher-led groups and individual students. The majority of teacher respondents felt that apps and web tools amplify their literacy instructional practices Training: initial 2 days, range from extensive to minimal, tapered off, collaborate w/other teachers	Generally, teachers will spend about ten minutes reviewing an app and they will test about three apps before making an instructional decision to use an app in their literacy teaching. The cost associated with apps is reported by survey respondents to be the criteria with the most significant influence Teachers rely first and foremost on the suggestions and reviews of apps by other educators when they seek apps to download and test for possible instructional use. These data demonstrate that the 25 survey respondents are most concerned with identifying free apps, followed by the literacy instructional value of potential of apps. While the survey results indicate that literacy instructional value is clearly a concern of respondents when selecting apps, finding free or low cost apps is even more important. These data suggest that the teachers surveyed prioritize the specific students in their classrooms and their instructional needs, suggesting that although cost is a significant factor, teachers maintain a student-centeredness when they select apps for literacy instructional use.		

		Challenges: The most common responses referred to the cost involved in obtaining apps and concerns with the quality of apps available		
Case study teacher #1	**RQ#1 Assertion: Case study teacher #1 used handheld devices and apps 10 minutes daily in her literacy instruction by integrating the learning technologies into traditional print-based literacy practices such as a listening center, practicing skills such as rhyming, letter names and sounds, segmenting and blending, and using QR codes to answer questions or check answers.** *Sub-assertion: Case study teacher #1 used handheld devices and apps as a replacement of the traditional practice of an independent listening or reading center during a kindergarten literacy block.* *Sub-assertion #2: Case study teacher #1 used handheld devices and apps to have students practice phonics skills independently or with guided practice including letter names and sounds, rhyming, segmenting and blending.* *Sub-assertion 3: Case study teacher #1 used QR codes in her literacy instruction as a question and answer activity or as a self-check measure with a traditional print-based literacy worksheet.*	**RQ#2 Assertion: Case study teacher #1 occasionally drew on her knowledge and beliefs about developmentally appropriate best instructional practices for literacy instruction as she reviewed and selected apps for instructional use, although she did not use this knowledge to critique apps and she also considered factors unrelated to literacy learning such as cost and visual appeal, or adopted activities from colleagues.** *RQ#2 Sub-assertion 1: Case study teacher #1 selected listening apps based on her belief that early in the kindergarten year her students were "not really reading," rather "working on foundational skills," and thus would benefit from listening to fluent reading. She sought apps that modeled directionality of text, offered "just-in-time" features and modeled fluent reading.* *RQ#2 Sub-assertion 2: While Case study teacher #1 described the instructional potential of "free writing" apps (apps that are not a ebook or game, rather are open-ended for creating multimodal texts), she did not select these apps for instruction; rather, she sought out apps with characteristics such as free of cost, a motivating game element, visual appeal and the possibility students may use the app at home, as opposed to drawing on her knowledge of best practices for literacy instruction.* *RQ#2 Sub-assertion 3: Case study teacher #1 did not draw upon her knowledge of best practices for literacy instruction to evaluate the QR code*	**RQ#3 Assertion: When case study teacher #1 and her students used handheld devices and apps in the classroom literacy teaching and learning included minimal social interaction among kindergarten students, numerous unanticipated obstacles to literacy learning and varied levels of student engagement.** *RQ#3 Sub-assertion 1: When handheld devices and apps were used in literacy teaching and learning in case study teacher #1's classroom students' interactions with their peers where rare and usually involved one student asking another for help navigating the handheld device.* *RQ#3 Sub-assertion 2: Case study teacher #1's requirement that her students to wear earphones when using the devices yielded unanticipated negative affordances including the isolation of students from their peers while using the devices, incidents of wasted instructional time and an inequitable learning environment.* *RQ#3 Sub-assertion 3: When handheld devices and apps were used in literacy learning in case study teacher #1's classroom there were lost instructional opportunities including time lost trying to locate the correct app, students not utilizing certain features with positive affordances such as "just-in-time" assistance or word tracking and students off-task.* *RQ#3 Sub-assertion 4: The literacy tasks involved in the QR code "Hunt around the room" task were too difficult for students to*	**RQ#4 Assertion: Case study teacher #1's knowledge, beliefs and planning were impacted by her experiences, observations and reflections in that her lesson planning now includes new components and objectives, and her beliefs about the social impact of technology and enthusiasm for finding technology resources are more deeply experienced.** *RQ#4 Sub-assertion 1: Based on her experiences teaching with handheld devices and apps and the multitude of "glitches" she's experienced case study teacher #1's instructional planning changed to include a "back up" alternative plan in the case that the technology does not work as expected.* *RQ#4 Sub-Assertion 2: Case study teacher #1's planning of instruction with handheld devices and apps seeks to balance predictability with novelty. Based on her reflections she structures students' use of handheld devices and apps as a rotation through the uses previously described (listening center, phonics games, QR codes).* *RQ#4 Sub-assertion 3: Although Case study teacher #1 questioned the impact of technology on human interactions and relationships in the classroom, her experiences, observations and reflections led her to more strongly conclude that the devices did not have a significant impact either positive or negative on the quality of human interactions.* *RQ#4 Sub-assertion 4: Case study teacher #1 maintained her enthusiasm for searching and locating*

		activities she used; rather these activities were shared with her by a colleague or reused from an enrichment program she had previously taught for older struggling students.	*complete independently, although they were able to successfully use the technology to scan the QR codes and a few students practiced strategies like invented spelling.* *RQ#3 Sub-assertion 5: When case study teacher #1's students engaged in literacy learning with handheld devices and apps they appeared engaged, but at times were not engaged in literacy learning.*	*apps and other resources to integrate into instruction; her experiences, observations and reflections on instruction inspired her to continue to seek digital resources for instructional and to share these with her grade-level colleagues.*
Case study teacher #2	**RQ#1 Assertion: To case study teacher #2, the technology was a piece of her literacy block; she assimilated the devices into her current practices that were very much grounded in traditional print forms of literacy.**	**RQ#2 Assertion 1: Case study teacher #2's selection of apps for literacy instruction was fraught with unexpected obstacles she encountered. However, she integrated her knowledge of students' developmental needs and her beliefs in the positive affordances the handheld devices offered of student engagement into her selection process.** *Sub-assertion 1: Case study teacher #2 encountered numerous difficulties selecting apps for literacy instruction many related to the investment of her time downloading and reviewing apps.* *Sub-assertion 2: When selecting apps Case study teacher #2 integrated her knowledge of her specific students' literacy development with element she perceived to be interesting, visually appealing or otherwise engaging to students.* *Sub-assertion 3: Case study teacher #2 often drew upon the suggestions of her colleagues or the site technology coordinator to identify apps and methods of app use in early literacy instruction.* **RQ#2 Assertion 2: Case study teacher #2 drew on her knowledge of best practices for early literacy instruction, grounded in traditional print-based texts, to critique, select or plan instruction with**	**RQ#3 Assertion: In case study teacher #2's classroom teaching and learning with handheld devices followed specific patterns with little variation including embedding the use of handheld devices into traditional print-based literacy activities, numerous unanticipated negative affordances (that disrupted or inhibited literacy learning) and an impact on students' social experiences as learners that was both positive and negative.** *Sub-assertion 1: Case study teacher #2 used the handheld devices and apps in consistently as an activity embedded in a traditional print-based literacy block: a small group, independent practice of phonics skills with QR code scanning apps or game apps for 12-minute increments with a required paper-and-pencil task. There was little variation in the structure of the activity students approached the tasks in unique and creative ways, solving problems as they encountered them.* *Sub-assertion 2: Multiple negative affordances of using handheld devices and apps in early literacy instruction were observable in case study teacher #2's classroom, including several unanticipated negative affordances.* *Sub-assertion 3: Teaching and learning with handheld devices and apps in case*	**RQ#4 Assertion: Case study teacher #2's beliefs, knowledge, planning and instruction were impacted by her experiences, observation and reflections on teaching and learning with handheld devices and apps in that she consistently felt ambivalent and conflicted about the value and affordances of teaching literacy with these technologies.** *Sub-assertion 1: Case study teacher #2's strongly held beliefs about personal connections with students and traditional print-based literacy instructional practices informed her critiques, concerns and strategies for using handheld devices and apps in early literacy instruction.* *Sub-assertion 2: As Case study teacher #2 gained experience teaching literacy with handheld devices and apps she drew upon her knowledge and beliefs about teaching literacy in traditional print-based forms and became increasingly convinced that to effectively utilize these learning technologies she needed to differentiate for students' individual developmental instructional needs; that the potential to differentiate using the devices was one of the most significant positive affordances.* *Sub-assertion 3: Case study teacher #2 perceived pressure to use the handheld devices daily for*

		apps. Her approach to using apps was firmly grounded in traditional print-based literacy instruction and the devices were assimilated into those frameworks. *Counter example: An app case study teacher #2 consistently named as an example of a high quality app for kindergarten literacy instruction demonstrated several negative affordances for early literacy learning that did not dissuade case study teacher #2 from praising the app.*	*study teacher #2's room demonstrated specific, consistent patterns of social interactions among the kindergarten students. The presence and use of the devices shapes students' social experiences in impactful ways. The experiences of two specific students, one receiving special education services and one learning English as a second language, suggested that structuring app use as developmentally differentiated and collaborative tasks is an effective use of apps for literacy learning. Students demonstrated an inclination and curiosity to explore unique uses for the handheld devices.*	*instruction because they were made available to her and because of the role she perceived technology playing in the lives of children currently. While she questioned her use of the devices she concluded that using the handheld devices and apps for literacy instruction ultimately offered positive affordances of exposure to technology and student motivation and engagement.*
Cross Case	**RQ#1 Assertion 1: The ratio of devices to students (1:4) significantly limited teachers' perceptions of how they could use the devices in their literacy instruction, which translated into similarly structured uses across the cases.** **RQ#1 Assertion 2: Case study teacher #1 implemented more variety of apps and activities than case study teacher #2 did, but ultimately both case study teachers embedded students' use of apps into a rotating literacy centers grounded in traditional print-based literacy learning, rather than engaging students in understanding or representing ideas using multi-modalities afforded by the technologies.**	**RQ#2 Assertion 1: Although both teachers drew upon their knowledge of best practices for literacy instruction as they reviewed and selected apps, both also demonstrated misconceptions or inaccuracies in their knowledge of best practices. Both teachers considered factors outside of effective literacy instruction (cost, design) as they determined which apps they would use for early literacy instruction.** **RQ#2 Assertion 2: The teachers alluded to the potential multimodal affordances of the devices, but did not demonstrate or implement digital literacies teaching and learning into their instructional practices.** **RQ#2 Assertion 3: Teacher colleagues were an important resource to teachers when selecting apps for literacy instruction, although teachers recommended apps using electronic means rather than collaborated in person to evaluate apps and plan instruction.**	**RQ#3 Assertion 1: The use of handheld devices in literacy teaching and learning yielded unanticipated negative affordances.** **RQ#3 Assertion 2: Teaching and learning with handheld devices shaped students social interactions while using these tools in kindergarten classrooms.**	**RQ#4 Assertion 1: The teachers' experiences, observations and reflections teaching literacy with apps and handheld devices reinforced their existing beliefs about the value added and affordances of handheld devices and apps in early literacy instruction, therefore their knowledge and instructional practice remained static.** *Sub-assertion 1: Case study teacher #1's enthusiasm for learning technologies led her to modify her practices to include a "back up plan" for unanticipated technical problems. Case study teacher #1 remained committed to overcoming obstacles so that she could continue her current instructional practices with the handheld devices. Her beliefs, knowledge and practices did not significantly change.* *Sub-assertion 2: Case study teacher #2's experiences, observations and reflections furthered her feelings of conflict and sustained her ongoing weighing of the values and drawbacks of handheld devices and apps in early literacy learning. Case study teacher #2 primarily focused her attention on the*

				challenges, thus inhibiting her willingness to use handheld devices in innovative ways that were unfamiliar or uncomfortable.

Table 4.1: Summary of findings from survey data, case study data and cross case analysis

Chapter 5

Conclusions, Implications and Future Directions

In this study I sought to describe how early elementary teachers (kindergarten-3rd grade) integrate technologies into the teaching of literacy when presented with new handheld devices from upper administration. I also examined how (and if) teachers integrate their knowledge of best practices for early literacy learning with multimodalities, affordances and value added literacy opportunities when reviewing and selecting handheld device apps for early literacy instruction. My goal was to describe what happens when handheld devices are actually used in early literacy instruction, focusing on app affordances, or "What each app offers or how it presents for the learner opportunities for learning or…to devise activities that enable literacy practices" (Beach & O'Brien, 2012). To achieve these objectives I considered the following research questions:

1. To what extent and how are Kindergarten-3rd grade elementary teachers using technologies in their classrooms to teach early literacy (reading, writing and word study)?

2. To what extent and how are teachers choosing apps or web tools based on their knowledge of best practices for literacy instruction? (What characteristics of apps or web tools do teachers see as positive affordances, negative affordances and value added, a belief that it does a better job at the literacy practice than any known technology?)

3. When teachers and students use apps during instructional cycles, what does teaching and learning look like? From the perspective of teachers, what are the

actual positive or negative affordances of using these apps to foster early literacy instruction in practice, including unanticipated affordances?

4. How are teachers' beliefs, knowledge, planning and instruction impacted by their experiences planning and teaching with apps and web tools, their observations of students' learning with these technologies and their reflections on classroom lessons?

Grounding this study in a theoretical framework that blended constructivism, pragmatism and social cognitive and social constructivist theories of learning, I employed naturalistic inquiry and case study methodologies. The case was a mid-sized suburban school district in the upper Midwest with embedded cases of two individual kindergarten teachers. My data collection included two phases:

1. I conducted a survey consisting of likert, multiple choice and open-ended items with a selective survey of 25 K-3rd grade teachers from the school district to generate descriptive data about teachers' school demographic information, access to learning technologies, beliefs about early literacy instruction and approaches, and thoughts and processes engaged in during app selection;

2. I purposively sampled two information-rich cases of kindergarten teachers, collecting data through interviews and verbal protocol procedures, classroom observations and photographs.

Likert and multiple choice survey item data were analyzed using simple descriptive statistics, and open-ended survey items and embedded case study data from interviews, verbal protocols, classroom observations and photographs were analyzed using open

coding and axial coding. Data across sources were analyzed in an ongoing manner using

constant comparative analysis to identify categories and patterns.

Findings indicated that teachers used apps most frequently to teach early literacy

lessons that emphasized phonics, phonemic awareness and word work, and rarely or

never for literacy instructional that required students to engage in higher-order thinking.

Further, apps were used primarily for independent activities in ways with limited or no

interaction among students. When teachers selected apps for instructional use, the cost

associated with apps was reported to be the most significant factor. Additionally, student-

centered approaches to teaching blended with beliefs about literacy best practices

moderately influenced teachers' search for and selection of apps. Teachers believed that

the most significant positive affordance of app use in early literacy instruction was an

increase in students' motivation and engagement in literacy learning. Survey respondents

and the two embedded cases of kindergarten teachers reviewed apps with a framework of

traditional print-based literacy and used apps in instructional practices that were firmly

grounded in traditional print-based literacy. Teachers did not use handheld devices to

create instruction that took up new definitions of literacies or fostered the development of

21st century skills; the devices were used in instruction firmly grounded in a traditional

print-based literacy framework.

Results surrounding the use of handheld devices yielded a variety of negative

affordances that inhibited or detracted from learning, several of these unanticipated by

teachers. Further, the presence of the devices in the learning environment impacted and

shaped students social interactions and experiences in their kindergarten classrooms, both

in both positive and negative ways. Teachers' experiences, observations and reflections

teaching literacy with apps and handheld devices reinforced their existing beliefs about the value added to instruction and affordances of these technologies, thus their knowledge and instructional practices did not change significantly during the course of the study. Teachers who believed that technology added value to literacy instruction demonstrated greater tenacity and willingness to persevere when faced with technical complications related to the handheld devices and apps.

From these findings I am able to draw conclusions about how teachers implement handheld devices into their literacy instruction, review and select apps for classroom use, and how the impact of these experiences on teachers' beliefs and practices. I put forth implications based on my findings. I discuss implications of my study with an emphasis on concerns and issues to address so that a technology initiative is structured to create ongoing opportunities for teachers to successfully use handheld devices to develop both students' traditional print-based literacy and digital literacies and critical 21st century skills.

Conclusions and Implications for Practice and Policy

The findings of the current study have several important implications for educational leaders and policy makers, app developers, teacher educators and professional developers, and of course early elementary teachers, who are working towards successfully implemented handheld device initiatives in early elementary literacy teaching and learning environments.

Considerations when acquiring devices. School and district leaders considering a handheld device initiative in early elementary grades are encouraged to make deliberate

and strategic decisions about type and quantity of handheld device they will purchase. The findings of this study suggest a ratio of one device per students is preferable. A rationale for this that a ratio of 1:1 expands instructional possibilities and eliminates obstacles to sharing devices, such as teachers' perceptions that they are inhibited in how they can use handheld devices in their instruction. However, with comprehensive professional development, teachers of early elementary students would be prepared to structure collaborative literacy learning tasks for their young readers and writers. Additionally, participants in this study indicated that midsized handheld devices (e.g., iPad mini) are most developmentally appropriate for young learners.

Optimal ratio of devices to students. Even as early as kindergarten a ratio of one device per student is ideal. This ratio allows the most innovative uses of these specific learning technologies. As Warschauer (2007) observes, "The computerization of schools has not achieved its goals because a range of logistical, administrative, and pedagogical obstacles make it difficult for teachers to effectively deploy shared computers" (p. 2512). Tracey, Marcy and their kindergarten colleagues in Silver Lake Point Schools struggled daily with the limitation of having one iPod Touch device for every four students in their class. This struggle manifested itself in the teachers' practice of limiting use of the handheld devices to a rotating reading center activity, to the exclusion of alternative, more innovative, uses. Further, teachers were not able to realize the full potential to differentiate instruction using the devices because they had shared devices.

Neither teacher offered any insight into why the school district elected to purchase devices for kindergarten at the 1:4 ratio, when 1st grade through 12th grade had a 1:1 ratio of devices to students. If a school district decides to invest in a technology initiative that

includes handheld devices in early elementary classrooms teachers are more likely to successfully use the device in instruction if the implementation includes a ratio of one device per student. Data from this study indicate that teachers perceive that a 1:1 ratio affords increased instructional possibilities, greater opportunities for guided practice and enhanced capability to use the devices to differentiate instruction and meet unique needs of individual students. This finding is supported by previous research on the limiting effects of shared computers on teachers' abilities to use technology in instruction (Cuban, 2001; Warschauer, Grant, Del Real & Rousseau, 2004). Sharing handheld devices presents similar obstacles to sharing laptops or desktop computers.

Although a 1:1 ratio is optimal, if teachers do not have access to one device for each student there are potentially authentic, rich opportunities for cooperative learning using handheld devices. However, if a district purchases handheld devices at a ratio other than 1:1, teachers require support and training if they are to be successful in structuring learning tasks that require students to share and collaborate with the devices. Although Tracey and Marcy did not deliberately structure learning activities to require students to share a device, I observed students taking the initiative to slide over to a peer and share a device to practice literacy learning. For students like Jarrick, who are developmentally behind their peers and qualify for special education services, and students like Antonio, who are learning English as a second language, the opportunity to collaboratively learn with handheld devices presents a valuable experience for literacy development and peer social interaction. While Tracey and Marcy perceived the device to student ratio of 1:4 be a constraint that inhibited the possibilities of their instruction with the devices, in practice the students occasionally shared devices and, unprompted, they engaged in

collaborative learning. Therefore, I would posit that teachers' *perception*s of the barrier of ratio of devices to students are a greater obstacle than the actuality of the 1:4 ratio. This suggests that teachers need to be provided with training or professional development that equips them with the knowledge and ability to structure cooperative learning tasks using the handheld devices, regardless of the ratio of devices to students.

   Ideal size for small hands. A school district considering a handheld device initiative in early elementary grades needs to not only consider the ratio of devices to students, but also which specific devices to purchase for the youngest students. Data from the current study indicate that the logic behind purchasing the smallest handheld devices (iPod Touch devices) for the smallest students and increasingly large devices for older students (iPad Minis for 1st grade and iPads for 2nd grade through 12th grade) is erroneous. Katherine, a survey respondent, shared that she noticed that several apps were difficult for her 1st grade students to navigate given the size of the iPads (Katherine, survey response, 10/9/2013). Specifically, the size of the device was problematic because some students lacked the manual dexterity to precisely touch a small, specific area of the screen. Case study teacher Marcy mused,

> Whoever came up with this idea that kindergarten should have iPod Touches thought, "Oh, they're littler, it will be better," but really the older kids would do better with the smaller devices. Realistically, the little kids don't have the dexterity to push the little buttons sometimes. It's easier on a little bit bigger screen (Marcy, Interview, 11/1/13).

In case study teacher Tracey's classroom I observed that students preferred to use her "teacher iPad" when given the option between the iPad and an iPod Touch device (Field

Notes, 10/25/13; 11/8/13). During a post instruction interview Tracey agreed with

Marcy's assertion that the iPod Touch devices were not the ideal size for small

kindergarten hands:

> The devices are fun and they are fine for reading. It's tricky with the games; they
>
> are so small. It's much easier when they work on my iPad, they prefer it, it is
>
> more comfortable…iPad minis would be best, a full iPad is a little too big
>
> (Tracey, Interview, 11/8/13).

These teachers' observations of their students led to the pragmatic conclusion that the

smallest learners are not ideally suited to use the smallest devices; rather an iPad mini

would better meet the needs of kindergarten students' developing fine motor skills

because it offers a larger touch screen for young learners to navigate, in addition to being

compact and light enough for students to use comfortably.

      User experience and accurate literacy content. The findings of the current

study have implications for app developers. Data indicate that teachers are greatly

influenced when selecting apps by design features that enhance the visual, auditory or

otherwise appeal to students. Similarly, learning technologies researchers Wijekumar et

al. (2006) suggest that learning technologies may be designed to engage students through

"game affordances," that offer and enable entertainment. These elements of the user's

experience of an app, appealing multi-modal features and entertaining game-like

activities, influenced teachers' selection of apps for early literacy instruction because they

perceived that these elements attracted and engaged students in literacy learning. Survey

respondents overwhelmingly cited motivation and engagement affordances as a highly

valuable aspect of using devices to teach. Case study data indicated that teachers seek

out "cute" apps they feel their students will like to look at and be able to easily navigate. App developers need to attend to user experience if teachers are to select and use their apps for literacy instruction. Thus, apps should include multi-modal elements, including visual appeal and auditory features. Further, teachers gravitate towards apps that create a user experience of a game-like task and reward (for example, a sound or "sticker" earned). However, app developers can equally attend to the accuracy of literacy content in apps. Based on the findings of this study, I argue that an ideal app would include motivation affordances such as an engaging game or visually appealing design, coupled with accurate literacy content, for example, correctly produced phonemes.

Apps for a range of traditional print-based literacy components *and* digital literacies. Apps and handheld devices should be used to support *both* the development of traditional print-based literacies and digital literacies in early elementary classrooms. As findings of the current case study indicate, teachers primarily used apps and handheld devices as "replacement" (Hughes, Thomas and Scharber, 2006) or "substitution" (Puentedura, 2010) for traditional tools within instruction firmly grounded in traditional print-based texts. Further, data indicate that there are an overwhelming abundance of apps available to practice early print-based literacy skills such as letter names and sounds, rhyming, blending and segmenting, and that these are the types of apps early elementary teachers gravitate towards, review, evaluate, recommend to colleagues and integrating into their literacy instruction. The great potential of handheld devices and apps to teach and develop new literacies and 21st century skills is untapped by early elementary teachers at present.

Figure 5.1 below demonstrates teachers' disproportionate use of handheld devices for only a few components of literacy instruction by juxtaposing survey responses to two items: (a) in blue, the components of literacy instruction during which teachers most frequently used handheld devices and (b) in red, the components of literacy instruction to which teachers dedicated considerable instructional time. Survey respondents devoted considerable instructional time to comprehension, but most frequently use handheld devices for phonemic awareness, phonics and word work. This pattern was evident in findings from both embedded case studies. Further, survey respondents frequently used devices for components of literacy to which they dedicated little instructional time, such as handwriting and spelling. Teachers disproportionately used devices for phonics and phonemic awareness within their balanced literacy instructional framework. In one case study reported in this dissertation, handheld devices were assimilated into a balanced literacy instructional framework in the components of literacy instruction that require lower order thinking and/or are low priorities to teachers. At first glance, it may seem that apps and handheld devices are appropriate tools for learning these few specific components of literacy instruction; a teacher would not attempt to use Elkonin boxes for a comprehension lesson because the instructional tool does not match the instructional goal or objective. However, handheld devices and apps are tools with unbounded potential affordances for literacy learning. Thus, I conclude that the use of handheld devices and apps for the practice of a narrow range of literacy skills is like using a blender to chop an onion. The tool (blender or handheld device) holds far more potential than this limited use. Further, the objective (chopping an onion or practicing blending

phonemes) may be better accomplished by simpler means (chopping an onion by hand with a knife or having students use Elkonin boxes).
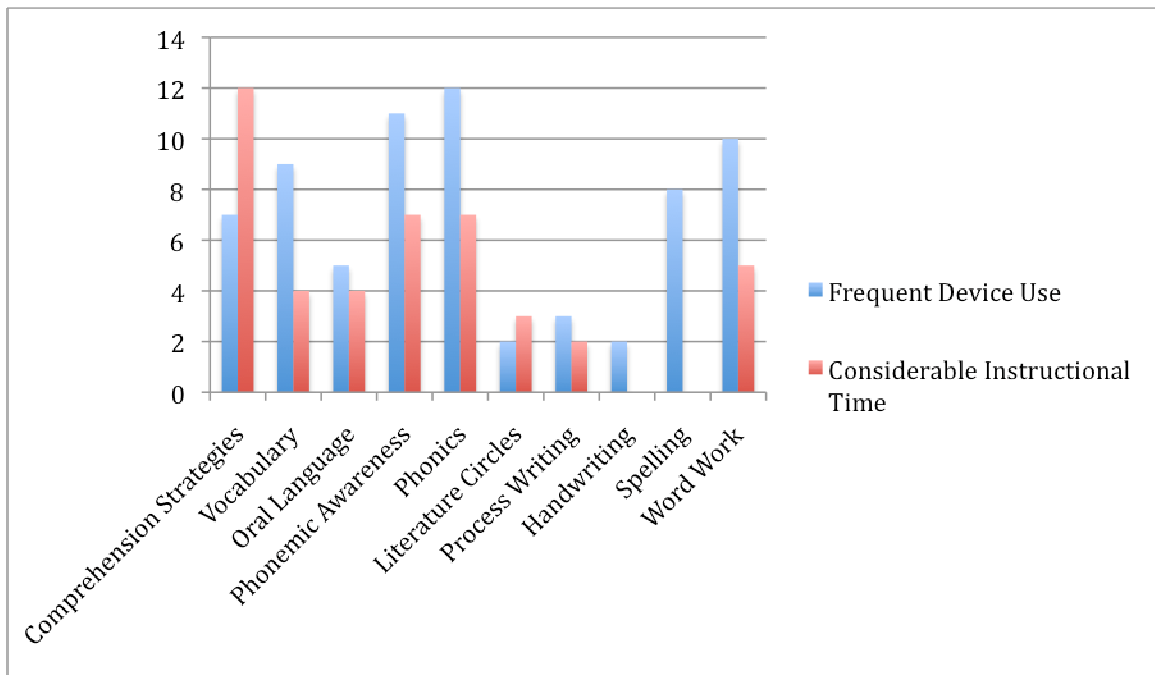
Figure 5.1: Instructional time and frequency of device use for range of literacy components

I speculate that there are numerous contributing and explanatory factors to this pattern of teachers using devices primarily for literacy learning of phonics, phonemic awareness and word work to the exclusion of other more complex literacy learning. My analysis of programs and their use in classrooms suggests that the majority of apps advertised and recommended to teachers practice phonics and phonemic awareness, and the comprehension apps are often the lowest quality apps. Additionally, teachers are unsure how to integrate handheld devices into their comprehension instruction, particularly with early readers. I theorize that teachers prioritized comprehension instruction as the most critical aspect of their literacy teaching and may have felt strongly

that a handheld device could not adequately deliver this instruction. The potential of handheld devices and apps to engage students in meaningful literacy learning and higher order thinking can become a goal of teachers. Further, if handheld devices are to be worth the expense associated with acquiring them for classroom use, accompanying professional development will support teachers in expanding their use of devices for literacy learning to include comprehension and composing, specifically with in multi-modal digital forms. Comprehending and composing multi-modal texts is a critical 21st century skill students will need to develop. I propose that if teachers create learning opportunities for students to develop strategies for understanding and representing ideas in multi-modal forms with handheld devices, then these experiences could serve to improve students' abilities to successfully use comprehension strategies when reading traditional print-based texts, and also to represent ideas in traditional print-based forms.

One of the reasons I sought to engage in the current research study was my curiosity about what digital literacy skills might consist of in early elementary classrooms. Having studied innovative research about the demands of digital literacies, such as signifying meaning through a multiplicity of modes, interactivity and hypertextuality (Roswell & Lapp, 2011), or "socially situated practices supported by skills, strategies and stances that enable the representation and understanding of ideas using a range of modalities enabled by digital tools" (O'Brien & Scharber, 2008, p. 66-67), I wondered what these alterations of literacies meant for the earliest literacy learners. I undertook this inquiry theorizing that early elementary teachers would take up digital literacy practices in their instruction, by teaching, modeling and structuring guided practice of comprehension strategies for multimodal texts and multimodal composing or

writing. While I did not see these instructional practices, survey and interview data suggested that some early elementary teachers saw the potential in these new practices and would like to move in these directions. But at the present, a myriad of obstacles to implementation inhibited the teaching of digital literacies strategies and practices from becoming a reality. It was almost as if teachers saw these potential practices through an obscured pane of glass: they had a hazy, vague sense of the potential of digital literacies learning opportunities as presented by handheld devices. They may have even attempted iterations of these practices as Tracey and Marcy allude to, but they lacked clarity, direction and strategies to regularly and consistently enact these transformative literacy teaching practices.

Based on my findings I argue that handheld devices in early elementary classrooms can be utilized not only to instruct and develop traditional print-based literacy skills and strategies, but also engage students in digital literacies practices. When handheld devices are used solely to practice early traditional print-based literacy skills they functionally become exorbitantly priced "digital flashcards" (Murray & Olcese, 2011). Therefore, in my opinion the cost of investing in handheld devices for early elementary classrooms is warranted *if* teachers are supported to use the devices to both develop traditional print-based literacies and to deliver transformative instruction of digital literacies practices, skills and strategies. If teachers offer early learners both guided and independent practice--making sense of and creating multi-modal texts--these students will be successful learners in the 21st century prepared to learn and work in increasingly information and technology driven environments. For teachers like Tracey, Marcy and their colleagues, this means that to be successful in their literacy instruction

with handheld devices they need to broaden the components of literacy they use these devices to support and enhance. And they need to enact transformative teaching, modeling and guided practice of comprehension strategies for multimodal texts and multimodal composing or digital writing. Effective professional learning opportunities would assure that these practices become a reality in K-3rd grade classrooms. A discussion of these professional learning opportunities is forthcoming.

Teachers' knowledge is imperative. As Warschauer and colleagues argue (2004) "new technologies serve as an amplifier that can magnify preexisting strengths and weaknesses (p. 535). The increasing prevalence of handheld devices in early elementary classrooms makes teachers' thorough understanding of literacy development, processes and best instructional practices even more critical than it has been historically. There are serious implications of this fact for teacher educators and professional developers. Marcy's high praise of the Endless ABC app and failure to notice the mispronounced phonemes demonstrated that despite her concurrent study of literacy education she was unable to identify the potentially negative consequences this misleading feature could have, particularly on struggling readers and English language learners. Tracey's approach to using the handheld devices consisted of loading her devices with as many apps as they could hold, seeking features such as visual appeal, familiar or traditional stories and apps that students' parents may use at home. Data indicated that Tracey did not critique the quality of the retelling on story apps or the content of segmenting and blending game apps. While Tracey demonstrated a well-developed repertoire of teaching strategies and activities, songs and characters to teach

early literacy, she also lacked a deep understanding of domain literacy knowledge, including phonics, phonology and spelling patterns. During her verbal protocol procedures she did not verbalize any thoughts pertaining to these elements of literacy learning as she selected apps for instruction. Neither did Tracey critique the quality of retelling of classic stories in the eBook apps; she simply expressed appreciation that the app allowed her to "expose" students to classic tales. Marcy did not verbalize thinking about phonics, phonology or spelling patterns during her verbal protocol procedures. The introduction of handheld devices and apps into these classrooms amplified the teacher's deficits in domain knowledge of early literacy. Neither teacher critiqued the phonology, spelling pattern or quality of literature afforded by the apps they reviewed. At first glance their focus on elements such as visual appeal or potential student motivation suggests they lacked the knowledge and insight to critically evaluate the more technical literacy aspects of the apps. However, it is possible that both Tracey and Marcy focused more on technology and design aspects of the apps during the verbal protocol procedures because they understood that my inquiry and interest was in how they were using the apps. They may have focused more on technology than literacy in their responses.

However the introduction of the devices and apps amplifies existing gaps in teachers' domain knowledge in a way that a cohesive traditional print-based basal literacy system would not. Handheld devices and apps increase the responsibility of teachers to include critically and strategically evaluate the content of apps. This is a daunting task that teachers may lack the content knowledge to successfully complete. While this lack of knowledge may be compensated for when using a curriculum-developed word work activity, with apps this is not the case. The boundaries are nearly limitless. Apps require

more evaluation and critique on the part of teachers than a basal reader series. Therefore, given the increasing prevalence of handheld devices and apps in early elementary classrooms, teacher preparation and ongoing professional development should offer teacher candidates and practicing teachers opportunities to develop high levels of literacy domain knowledge including phonemic awareness, phonics and children's literature, as well as strategies to critique the literacy content of apps before using them for instruction. If teachers bring a thorough understanding of literacy development, processes and instruction to their teaching with handheld devices and apps, that knowledge, a professional strength rather than a weakness, will be amplified by the use of technology. Teacher educators and professional developers are responsible for ensuring that teacher candidates and practicing teachers possess a well-developed schema of literacy development and processes that will allow them to effectively evaluate and critique apps for literacy instruction.

Professional development needs. The findings of this study have several implications for professional development needs if a handheld device technology initiative is to be successful and transformative in early elementary literacy learning. Teachers need a deep understanding of digital literacies, opportunities to collaborate, and support and coaching that challenges internal barriers. Professional learning is an indispensable component of a success handheld technology initiative. Teaching literacy with handheld devices and selecting apps for instruction are a new task with which teachers are not experienced or familiar. The thinking processes outlined by Vygotsky (1978) for children as they learn parallel those for adults as they learn new tasks that are

beyond their range of expertise; learners internalize processes through engagement in problem-solving dialogues with others. Therefore, there is evidence from this study that strategic, effective and ongoing collaborative professional development is a critical component of a handheld device technology initiative. Further, an ideal professional development program would challenge teachers to expand their understanding of literacy to include new ways of thinking about literacy and digital literacies, include frequent and meaningful opportunities for collaboration and a focus on surmounting teachers' internal barriers, such as negative beliefs about the value-added to instruction by learning technologies.

New ways of thinking about literacies. Teachers are unsure of how to teach digital literacies in early elementary classrooms. This is evident in the finding of this study that teachers used handheld devices to teach a narrow focus of a few components of traditional print-based literacies. Therefore, professional development that accompanies a handheld device implementation in early elementary classrooms might offer teachers ample opportunities to learn about digital literacies, multi-modal representation of meaning, digital literacy practices, research-based strategies for digital literacy instruction and the concept of affordances of new technologies. Professional development could equip teachers with understandings of these concepts and definitions of literacies, such that they widen their perspective to include digital literacies, in addition to traditional print-based literacies.

Foster collaboration. Findings of the current study indicated that teachers relied heavily on one another to identify apps to use in instruction, albeit most often through electronic communication such as blogs or email. Survey respondents named other

teachers as their primary resource for findings apps to use for instruction and both Tracey and Marcy extensively described app sharing among colleagues through emails or blogs. Ongoing professional development might create ample opportunities to foster these collaborative efforts both digitally and in person. Effective professional develop would include significant time reserved for teachers to work together to review, critique and evaluate apps, as well as plan strategic ways to use various apps in transformative literacy instruction. Similar to Argueta, Huff, Tingen & Corn's (2011) finding that professional development must be sensitive to the needs of teachers to collaborate with colleagues, findings from this study strongly suggested that effective professional development would foster collegial collaboration. Even in the absence of systematic, regular opportunities to collaborate with colleagues, teachers in this study relied primarily on each other to identify apps for literacy instruction. Teachers' inclination to collaborate and share instructional possibilities may be fully realized in the context of supportive, collaborative ongoing professional development.

Focus on internal barriers and teacher beliefs. While cost of apps was overwhelmingly reported by teachers to be a barrier to implementation, this was an external barrier that may be more easily overcome than internal barriers such as "teachers' beliefs about teaching, beliefs about computers, established classroom practices and unwillingness to change" (Ertmer, 1999, p. 48). While districts cannot neglect to address external barriers, such as the cost of quality apps, an effective handheld device initiative includes professional development designed to overcome internal barriers. For example, the findings of this study demonstrated that Marcy focused on obstacles or challenges inherent in technology integration, a prohibitive internal barrier.

Therefore, professional development teams are encouraged to challenge and disrupt teachers' fixation on obstacles if teachers like Marcy are to be successful in their implementation of handheld devices. As Ertmer and colleagues describe, teachers' internal barriers, such as beliefs, must be addressed if the learning and teaching potential of technology integration is to be fully realized.

Findings suggested that more positive beliefs increased teachers' likelihood to persevere when challenges arise. Tracey's placing of high value on the use of technology in education manifested in her tenacity and willingness to continue to seek new apps and new ways to use the devices in the face of challenges beyond the scope of her control (faulty wifi, broken home buttons, regrouping of students by ability). Conversely, Marcy continued her practices for using the handheld devices across the course of the study. She did not seek new ways to use the devices. Drayton et al. (2010) connected how teachers use technology to their judgment of the benefits afforded to their teaching; a finding verified by the two embedded case studies. Research has documented that professional development has a strong effect on teacher beliefs and readiness (Lowther, 2010). For teachers like Marcy to be successful, professional development should challenge ambivalent views and ongoing questioning of the value of technology in significant ways. Research has demonstrated that professional development that breaks down internal barriers, such as focusing on obstacles encountered and questioning the value of technology, ought to include "Relevant hands-on training, [and] collaborative or cooperative learning among teachers" (Sell et al., 2012, p.28). For teachers like Tracey to be successful, professional development must foster the development of "Flexible and robust knowledge frameworks that are not dependent on the specific affordances of a

particular technology, but rather connect to powerful ideas about teaching and learning"
(Mishra et al., 2009, p. 49). Similar to previous research findings, teachers need
collaboration and the opportunity to observe exemplary uses of technology to enhance
learning and alter their beliefs and thus increase their ability to implement learning
technologies. For a district like Silver Lake Point, professional development would be
most effective if teachers received regular opportunities to share and plan instruction with
apps, work release to observe colleagues' innovative, transformative and successful use
of handheld devices, and ongoing systematic opportunities to develop and deepen their
knowledge of research validated instructional practices for both traditional print-based
and digital literacies.

Future Directions

The study reported in this dissertation concludes with a multitude of remaining
questions and quandaries; there is much more work to be done in the area of early digital
literacies instruction and best practices for handheld devices implementation in K-3rd
grade classrooms. The findings of the current work are but the beginning of many
possible directions for future study.

Impact on social interactions and development. This study demonstrated that
the introduction of handheld devices into early elementary classrooms affected students
peer interactions and social experiences, although how the presence of the devices shaped
social relationships varied throughout the study. I observed students aiding one and other
with technical problems or device navigation, or sharing devices and completing literacy
learning tasks collaboratively of their own volition. I also documented students' isolation

and unawareness of peers when using the devices, as well as incidents of hostility, arguing or aggressing towards peers while using the devices. My findings were inconclusive about the value added and impact on students' social interactions through the technology initiative. Future research may include studying the impact of teaching and learning with handheld devices on students' social experiences and learning. Tracey posed an intriguing question of whether her current class would demonstrate less developed social skills at the end of kindergarten than other classes she had taught, given the daily use of handheld devices. Future research in this area could examine inquiries such as this.

Furthermore, the potentials of using handheld devices in ways that foster student collaboration and shared learning warrant study. Neither information rich case kindergarten teacher structured their students' use of the devices to include cooperative tasks or collaborative interdependence (Lew, Mesch, Johnson & Johnson, 1986), despite the fact that the device to student ratio was conducive to shared learning experiences. Future studies could explore methods and strategies by which teachers could structure literacy learning with handheld devices to engage students in collaboration, a critical 21st century skill.

Early digital literacies instruction and assessment strategies. An additional pressing question to emerge from this study relates to instructional and assessment strategies for early digital literacies. Given the potential of handheld devices for students to both comprehend and interpret, create and compose multi-modal texts, there is a need for research-documented best practices for digital literacies comprehension and writing instruction and assessment for early learners. Like Leu, Coiro, Castek, Hartman, Henry

& Reinking's (2008) argument for online reading comprehension instruction and assessment, and model of "online reciprocal teaching," an adaptation of traditional reciprocal teaching practices (Palinscar & Brown, 1984), future research could examine developmentally appropriate strategies for teaching and assessing the youngest literacy learners' digital literacies skills such as interpreting multimodal texts and representing ideas using a range of modes. Further, scholars and educators might to determine what skills and concepts 21st century young learners will require for successful literacy learning and how these could to be taught and assessed in developmentally appropriate ways. For example, do kindergarten teachers need to teach students about "the cloud"? How much instruction and modeling do students need to be able to successfully navigate handheld devices? Are early elementary teachers responsible for teaching students vocabulary, concepts and technical aspects of learning technologies such as servers, applications, software, motherboard, cache memory, bytes, universal series bus (USB) or binary code? Are these concepts becoming central and necessary to students' future learning, or are they less important than broader, flexible 21st century skills such as problem solving, critical thinking, adaptation and collaboration? With the increasing presence of a wide variety of technologies in early elementary classrooms, future research will need to address questions such as these.

Significance of the cost barrier. Teachers in Silver Lake Point District limited their selection of apps to those that were free of charge. Although they described the challenge of finding quality free apps, this external barrier limited their possibilities, to the extent that cost took prevalence over authentic reading and writing tasks afforded by an app. The current study did not document the impact of early elementary teachers

prioritizing cost over authentic reading and writing tasks as criteria for identification of apps. Future scholarship in this area could answer this question. Additionally, the impact of the removal of this external barrier is an interesting consideration for future investigation. If teachers were given sufficient funds to purchase apps how would teaching and learning look different than when teachers limit their app selection to those free of charge?

Motivation and engagement affordances. Teachers in Silver Lake Point District repeatedly emphasized the positive motivation and engagement affordances of using handheld devices and apps in their early literacy instruction. Tracey and Marcy both reiterated this sentiment time and again throughout the course of the study. Marcy even asserted that she felt the affordance of motivation and engagement would never run its course: "I think about myself…when they come out with new phone or device, I like it and want to have it, I'll spend hours on new piece of equipment" (Marcy, Interview, 11/1/13). She argued that given the ever-increasing number of available apps, the novelty of using apps for learning would never cease. However, the technology initiative was in the early days during this study. Further, I observed students navigating away from the assigned app frequently throughout my time in Tracey and Marcy's classrooms, seemingly bored with the assigned app. Therefore, research might examine the ongoing motivation and engagement affordances of using handheld devices and apps in early elementary classrooms. A longitudinal study would allow researchers to determine if this often-cited, frequently championed affordance is long lasting and significant.

Identification and removal of barriers. A final concern to emerge from the current study is the barriers, both internal and external, that prevent early elementary

teachers from engaging students in using handheld devices and apps for more complex cognitive processes, such as creating or composing, or responding to literature or informational texts, and how these barriers may be successfully removed through effective, transformative professional development. Existing research on technology integration, barriers to successful implementation and effective professional development offers a strong foundation. However, future research could examine specifically how to support teachers working with early literacy learners in classrooms with handheld devices. Given the documented tendency to emphasize lower-order skills in early literacy learning to the exclusion of more authentic, higher-order reading and writing tasks (Pressley, 2006), there is an urgent need for research if teachers are to avoid replaying this historically established pattern as early elementary teachers move from traditional print-based text instruction and take up digital literacies instructional practices. The stark fact is that the majority of apps available afford game-like (often inaccurate) "practice" of lower-order early literacy skills. Given the vast potential for multi-modal digital literacies practices inherent in new technologies, there is a clear need for research into these transformative instructional practices in early literacy learning. The barriers that lead teachers to structure isolating, brief and less meaningful practice of letter naming and sounds, rather than collaborative, multimodal representation and communication, warrant close study.

The current study utilized case study methodologies to describe and document current uses of apps and handheld devices in early elementary literacy learning in a case study district, providing baseline data for future inquiry. If future inquiries are to identify effective professional development practices and effective early digital literacies

practices, researchers might employ alternative methodologies. Design-based research (DBR) methodologies will allow future researchers to move beyond the limitations of case study methodologies. Engaging in DBR would allow future researchers to surpass understanding what is happening in early elementary literacy learning with handheld devices to develop deep insight into effective professional development practices that translate into innovative and transformative research-based teaching practices with handheld devices and apps in early elementary literacy classrooms.

In conclusion, given the increasing prevalence of a variety of learning technologies in early elementary classrooms, it is critical that literacy researchers identify best practices for professional development to support educators as they select and implement apps and handheld devices, and best instructional practices for using these tools for early literacy instruction. Clearly, educators need to "meaningfully integrate new literacies into their literacy instruction if they wish for reading experiences to be relevant and authentic to contemporary students" (Morrow et al., 2011, p. 79). As Leu (2000) asserts,

> Research time might be better spent on exploring issues of how to support teachers' efforts to unlock the potentials of new technologies, and not demonstrating the learning gains from technologies we already know will be important to our children's success (p. 3).

This study has important implications for teachers, policy makers, school leaders, professional developers and researchers. As John Dewey reminds us, we must discover how to create fully transformative teaching and learning opportunities using new

technologies for early literacy learning, if we are to avoid the perils of clinging to yesterday's pedagogy to the detriment of our children's futures. There is work to be done and boundless possibilities to be explored!

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Appendix A

Table of App Store Searches

Search Terms	Sort By	Number of Apps Found	Apps Reviewed and Description
Early literacy	Free Education Popularity	9 apps	• Online library apps • eFlashcards
Early literacy lessons		No apps	
Concepts of print		No apps	
Phonemic awareness		24 apps	• Several had "phonics" in title • One app offered website to go get "free worksheets" to go with pay app • www.SpeechPathologyApps.com: pay apps, some speech research base offered on web page, "auditory bombardment" of sounds, leveled series, combines phonics and phonemic awareness, adjustable speed-long and short vowels, rhyme, blend • One app was a $49.99 speech pathology app
ebooks for children	Free Education Popularity	989 apps	• There are an overwhelming number of "eBooks for Children" (989 apps found) • Many are cartooned retellings of classic fairytales, fables or Bible stories. • Many are linked to TV shows or children's movies (Madagascar, The Princess and the Frog, Dora the Explorer, Toy Story, Sesame Street). • Many of them give you a free book or 2 and you have to purchase beyond that. • Music, coloring, animation-do these have engagement/playfulness affordances, or are they negative affordances because of distraction? (Kids may be more interested in "coloring" than reading) • **Mibblio**: stories have "Story and Music by_____" and "Illustrated by_____." You get one free story. The music is distracting, the user manipulates the music, adding or taking away instruments, there is a piano keyboard and percussion to manipulate too. The narrator sings, and the only way to silence it is on the device, not within the app. • **Storia**: Scholastic's eBook shelf app. Allows personalization of bookshelf, computer read alouds (music, sound effects, highlighted text), just in time vocabulary, note taking features, some books have games/puzzles/quizzes-not essential to comprehension (paint tool other than a paint brush in Clifford, who has the least amount of hair?) or "What starts with C? Sequence events, synonyms, vocab can generate report for parents/teachers, wish list/recommendations, younger

			and older readers. eBooks of books also available in print.
			• **Ms. Spider's Tea Party**:- available in print, can read (narrator-can be turned off), music can be turned off too, can "watch" it-illustrations are animated, words highlight, match game (memory), paint (coloring book)-can save image, puzzle-jigsaw.
			• **Booksy**:-records stats for numerous users, touch word to hear it, turn recording on or off (does the narrator read with prosody?), Level 0="Hello Bunny," Level 1="Humpback whales…" could have child retell the bunny story,
			• **Dr. Seuss ebooks**:-could have child retell, "Lite" version is free (first part of text, have to pay for entire story
			• **MeeGenius**:-book previews, can have narrator read or read it yourself, words highlight when narrator reads, book club capacity-share and get recommendations,
			• **Kindle**: does not have as many classic children's lit as nook
			• **Nook**:-need Barnes and Noble account-all eBooks have a cost
Alphabet	Free Education Popularity	966 apps	• **ABCmouse.com**: music videos, one video per letter, show letter upper and lower case, song, can view lyrics, uses names, objects, verbs in song-glossary included-can read or listen to definition, have to pay for all the videos, tickets-allow you to access videos, can buy or earn tickets my watching videos
			• **Photo Touch**:-shows 3-4 letters, directions to touch one of them, can replay directions
Letters	Free Education Popularity	720 apps	• **Letter Quiz:** flashcards with upper and lower case, touch them and they flip to a picture of object that starts with letter, and says letter name and object, in alphabetic order, "Touch the A..."connect upper and corresponding lower, trace upper case letters-says name of letter, trace has to stay on line or it doesn't register and move to next letter, saves all written letters, upper case only
			• **Endless Alphabet:** cute monster cartoon characters, select word to spell, letters make sound and/or say name as you drag them to word (inconsistent, inaccurate, element of silly), cartoon explains meaning of word, no option to insert words, music-distracting
			• **ABCMouse.com** (see above)
			• **The Alphabet Song:** Sings alphabet song-delay so letter appears on screen before it is named in song-confusing! Free version just had song
			• **Ice Land-iLearn with Biong:** Options=phonics, letters, words, all games, time limit to complete task, makes sound when letter is touched, can move letters out of order (basically Elkonin boxes with seals and a whale), win gifts-play with them, can just match letters without attending to blending, no segmenting if used child on their own

Rhyme	Free Education Popularity	121 apps	• 121 apps found • Many already reviewed • Some nursery rhyme themed games
Alphabetic principle		No apps	
Phonemes	Popularity	64 apps	• **K12 Phoneme videos**: video of mouth only, makes sound and says a word with that sound-reference for teacher? Has long, short vowels, consonants, digraphs, vowel digraphs, r controlled vowels, mouth video is kind of creepy…hard to use during instruction • **Pocket Charts:** Long and Short Vowel-looks like traditional classroom pocket charts, match vowel sounds with pictures, pay app • **Letter Sounds**:-pick a letter, pick from 6 pictures which one starts with it, confusing-onsets only, audio directions-pronounces word emphasizing phoneme • **Phonics with Fred the little Ted:** image of bear with alphabet on chest, touch letter-it makes sound, only one sound per letter, O-names letter rather than makes sound • **All About Sounds**:-matching game, pick phoneme (5 choices with free version), option to have "lesson"-says word when card is picked, or "Free play"-student can say word • **Phonics with Letter Lilies**:-narrator has British accent, bee-Belinda-asks question-can't do task without hearing directions, if give wrong answer immediately says "this is the right answer," 3 difficulty levels • **Phonics App**: Learn the Sounds: displays grapheme, touch to hear sound-flips over to display picture of object that starts with sound, Practice Words-touch letter hear sound-slide across word to hear whole word-blends phonemes, digraphs grouped together to make one sound, no option to select phonemes, no game aspect
Word Families	Education Popularity	145 apps	• **Word Families:** Music plays constantly in background, Options=flashcards (speak or spell), spelling words, name letters and say word-no phonemes, unscramble words-hint puts one letter in place at a time, Playland-puppy-touch it and it barks • **Word Family:** Gives rime, and choice of onset, says word and shows picture of it, user drags onset to rime, narrator says word, then match words to picture, dinosaur dances when successful, keeps record for each family completed, can have more than one user and store records, can view letters upper or lower case, CVC, silent E, digraphs, • **Tic Tac Toe Phonics:** Each place on board has phonics question-no theme, focus, pattern-some quite a bit harder than others, have to touch enter for it to register response, no control to select what to practice, designed for 2 players

Sight words	Education Popularity	397 apps	• **Sight Words 2:** select grade 1 or 2, Options: word tour: says word, spells word and says again, find and shoot: "Click on_____" shows word to click on, girl shoots gun after, unscramble-shows where letters go, says letter name when it is touched, does not blend, memory game, bingo-"Click on__," timed, practice words-can select from "Word Tour" words to practice • **Sight Words:** selected grade level (Preschool-3rd) or nouns, displays word only and says word, touch to advance to next word, eFlashcards, can customize cards/word sets, record reading them, too • **Sight Cards:** displays word only and says word, touch to advance to next word, eFlashcards, practice words-can select words to practice, Level options-preprimary-grade 2, can play game-given 4 words, click on_____, hear it only, not see it, "Oopsie" or "Uh Oh" if wrong, "Spectacular" or "Sensational" if right • **Sight Words (Teacher Created Materials):** display word on writing paper, hear word when touched, write word below, can record self reading word-but does not store it • **ABC Writing:** Select letter (given in alphabetic order), touch letter-hear name, touch picture of animal that starts with letter to hear animal sound, touch animal word to hear it, trace letter upper and lower and trace animal word, 4 color options for writing-says color when you touch to change, on lined paper, can turn off sound • **Sight Words 2:** multiple users, flash cards eflashcards, word on front, flip to see image and hear it in a sentence or make sentences-same sentences on flip side of eflashcards, choice of 2 words to fill in blank in sentence, reads sentence to you, can create own content-add sight words, pictures (can upload or draw own) and sentences, but doesn't pronounce it correctly, does not advance to next word-have to navigate through drop down menu
Vocabulary		2,975 apps	
Vocabulary for kids	Education Popularity	348 apps	• **Endless alphabet** (see above) • **Ocean Adventure-iLearn with Biong:** options-vocabulary-free, sentence formation, listening comprehension, vocabulary: find hidden objects, timed, nouns only-can find answer by process of elimination without understandings words, cannot pick words • **Little Mouse:** "help little mouse collect food," tap items in picture, navigate by thumbnail, nouns only (food theme, cleaning items, etc.) narrator gives directions and says word when item is tapped • **Word-A-Licious:** 4 player capacity, shows 4 photos (all animals), tap the____, correct gets a green check mark, repeats animal word, incorrect gets a red x-"That's a _____" displays word in print, too, food and more animal sets of words, all

			nouns, can chose 2 or 4 image display, get stars per correct # of answers, in app purchase more sets of words • **What is it?:** 24 thumbnail photographs, tap one, large image comes up with text "What is it?" audio asks "What is it?" tap and audio and text say "It's a____, in app purchase more words • **Vocabulicious:** music playing in background, 4 player capacity, choice of animals, more animals, fruit, plants, identical to word-a-licious, all caps or lower case options • **Martha Speaks:-**pay app, based on TPT show
Kid dictionary	Education Popularity	106 apps	• Many apps are language learning apps • **Endless alphabet** (see above) • **Curious George's Dictionary** (pay) • **Picture Dictionary:** select letter (in alphabetic order), says word, reads sentence, picture-not always relevant (Able-they are able to climb up, image of rock climber on wall), can only advance through tap • **Animated Verbs:** looks like a book, hippo or pig character on each page, scrabble-like tiles and floating bubble letters, drag bubbles with letters to tile (order does not matter), names letter when bubble is tapped, when all letters are dragged it says the word and the characters do it, no sounds/phonemes, animation not always clear, can do activity in English, French, Spanish or German, can change letter case, turn off narration and letter hints
Reading comprehension	Education Popularity	139 apps	• **1st Grade Reading-I Like Water:** one book, option to read or be read to or auto play, can customize story-record own voice or change story, but have to record whole story to get play back • **1st Grade Fiction:** option to create own lessons-enter story text and multiple choice questions, multiple user capacity, 4 free stories, can buy more, story is one paragraph-displayed as paragraph with one picture, 10 multiple choice questions, tap word to hear it pronounced-no read-to option, no vocabulary support, not much plot, stories are contrived, like standardized tests, many grade levels-texts seem similar across grade levels • **ESL Reading:** Paragraph with repetition of words, read-to-me lacks any prosody, no vocabulary support, task it to listen to a sentence read and type it in-case sensitive, also cloze test to complete while audio playback reads text, no pictures • **Reading Monster:** Units-reads to user, with expression, does not highlight words, no vocabulary or pronunciation support, prompts user to circle a character in picture, picture is animated a little, but does not change during story, then matching picture activity (somewhat confusing-"boy" and "brother" are words, so are "wife" and "mother," pictures could apply to either), then cloze sentences or scrambled

			words to arrange into sentences, some stories have variety of pictures, floating images to drag/throw around screen
			• **Kids Reading 1:** up to 4 users, stores scores, select text from book self, one paragraph with one image, asks multiple choice questions (pay app) • **Reading Comprehension:** 2-5 sentences and a picture followed by 2 multiple choice questions about the passage, questions are literal/recall questions, • **Reading Comprehension-Grades 2-3 Super Reader:** book shelf display, select text, one page story, lines are spaced, multiple choice quiz-can view text while answering questions (pay app) • **A Trip to the Zoo:** 3 "books," photographs, read-to-me option, provides CCS in user guide page, just text and images-no vocabulary, no ?s (some ?s embedded in story, but no prompt to answer them) • **Reflection with Reading:** tool to be used simultaneous to reading, series of images and text (can be listened to as well) that prompt thinking: Read a small passage, What did I learn?, Are there new words to be caught?, Are there any links?, Does anything need clarification?, feature to navigate from this app to text on iPad • **Sir Charlie Stinky Socks:** animated book, sounds, tap and move illustrations, tap word to hear it read with prosody, color black line illustrations-iPad art, shake iPad to move characters, music, record own narration • Lots of grade level options (mostly elementary, though), • Disciplinary options-i.e. 3rd grade science, 2nd grade social studies
English learner			• Nothing related to English language learners
English as second language		20 apps	• Many apps claim to be appropriate for ELL (usually they say "English as second language students) • Grammar apps • Noun-heavy vocabulary games
Writing	Education Popularity	907 apps	• Mostly hand writing apps-trace letters, numbers, words in variety of back drops • Overlap with phonics apps • Also spelling, sentence making apps
Children writing	Education Popularity	124 apps	• **Harper Collins ebooks**-cross listed as "developing children's reading and writing skills," example: It was a Cold, Dark Night-story with music, sound effect and animated illustrations, can read or have it read to user, recall questions quiz-not multiple choice, Story Creator feature; select scenes (backgrounds, objects, characters and insert text to build own story using illustrations, can record own story and play back, manipulate and move objects and text • Several language learning apps (Chinese, Korean, Russian)

			<u>Book Magic:</u> write and illustrate book, free app, themes of images, can add own images, can upload and share book, email it, share on FB, print, add text, no audio feature, drag and drop images, then manipulate size, shape, directionality, etc., **<u>Picture Book:</u>** Prompts title and author on cover page, add pictures easily-drag and drop, no audio feature, cannot manipulate size of images, can pay for extra images, can share by linking email, requires age 13 or older, could teacher coordinate sharing? **<u>iDiary:</u>** pick cover, header color, music plays in background, pass word protected, need email address, can manipulate date, can insert text, drawings, stickers, photos, can share, time stamps entries, limitations without paying for upgrade, can email pages

Appendix B

Grid Mapping Literacy Instruction Best Practices and App Affordances

Concepts of Print Literacy Behaviors	Concepts of Print Best Instructional Practices	Negative App Affordances Concepts of Print	Positive App Affordances Concepts of Print

• Knows that letters make words
• Knows that words are separated by spaces
• Recognizes that words have meaning
• Realizes books have title, author, illustrator
• Understands difference between print and pictures in a book (pictures have meaning, print is read)
• Demonstrates interest in books and reading
• Enjoys listening to and discussing books
• Requests to be read to and retells the same story by looking at the pictures
• Understands that print is read left to right, top to bottom
• Attempts to read and write
• Understands reading is a way to obtain information (Morrow, Tracey, Del Nero, 2011)
	• Read the same text repeatedly
	• Have child retell story they know from looking at pictures
	• Have child pretend to read as they retell, point from left to right
	• Have child point out words they have learned from repeated readings
	• Have child point out letters in their name that are in the book (Morrow, Tracey, Del Nero, 2011)
	• Exposure to variety of literacy materials/objects (Pressley, 2006)
		• **eBook Apps:**
		  o App reads book to child too quickly, without prosody, inaccurately
		  o No option to turn off narration
		  o Animation of pictures distracting, unrelated to story
		  o May disrupt left to right, top to bottom directionality
		  o Game/activity element distracting
		  o Require "Within App Purchase"
		• **Recording Apps:**
		  o
		• **eVersion of Traditional Tools Apps:**
		  o Nothing transformative
			• **eBook Apps:**
			  o App reads book to child
			  o Teacher/adult can read book to child
			  o Track text feature (highlight to indicate word being read)
			  o Ability to pause reading
			  o Option to turn off reading, child reads/retells
			  o Animation of pictures
			  o Game/activity element-engaging/motivating
			  o e-version of traditional print texts
			  o Books published only electronically

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		o Distracting features ("stickers," etc)	• **Recording Apps:**
			  o Teacher or child records reading for play back
			  o Child records retelling-audio and visual elements
			  o Share recorded retelling-on web, with families
			• **eVersion of Traditional Tools Apps:**
			  o Child points out letters in own name
			  o Directionality of text
			  o Hear letter names
			  o Physical manipulation of letters

•			

Phonemic Awareness Literacy Behaviors
• Remember rhyming words more easily than non-rhyming
• Detect odd word in a set of words (ie. *can, Dan, sod*) (Pressley, 2006)
• Hear different sounds in words
• Segment sounds in
	Phonemic Awareness Best Instructional Practices
	• Rhyming poems, songs
	• Clapping parts of words
	• Auditory segmenting, blending, substitution (Morrow, Tracey, Del Nero, 2011; NICHD, 2000; Pressley, 2006)
	• Playfulness (Pressley, 2006)
	• Systematic practice of categorizing words based on
		Negative App Affordances Phonemic Awareness
		• **Rhyming Game Apps:**
		  o Audio function-accuracy of phoneme pronunciation, accuracy of blending and segmenting
		  o Visual picture provided of
			Positive App Affordances Phonemic Awareness
			• **Rhyming Game Apps:**
			  o Audio function-hear phonemes and segment, blend sounds
			  o Teacher can select word families/onset/rime
			  o Visual picture

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words (Morrow, Tracey, Del Nero, 2011; Pressley, 2006)	beginning, middle, end sound (Pressley, 2006)	rhyming words-vocabulary affordance, but may need more vocabulary support than image	provided of rhyming words-vocabulary affordance
• Blend sounds into words (Morrow, Tracey, Del Nero, 2011; Pressley, 2006)	• Sound identification tasks (Pressley, 2006) • Metacognitively rich-discuss when, where, why to use phoneme knowledge (Pressley, 2006)	o May show letters-phonics/letter knowledge affordance, de-emphasize sound/phonemic awareness	o Show letters with sounds-phonics/letter knowledge affordance o Game aspect-engaging, win "prizes" o Audio directions
• Substitute new sounds at the beginning of a word to create a new word with the same ending (onset substitution)	• Encourage invented spelling in writing (Pressley, 2006) • Focused and explicit instruction on 1-2 phonemic awareness skills at a time (NICHD, 2000)	o Game aspect-distracting o Can any app check child's production of sounds/manipulation of phonemes? (Have not found this affordance)	• **eBook Apps:** o Exposure to rhyming within context of story-connect phonemic awareness to real reading
• Learn initial and ending consonant sounds (Morrow, Tracey, Del Nero, 2011)	• Teach phoneme manipulation with letters (NICHD, 2000) • Teach phonemic awareness in small groups	o Require "Within App Purchase" o Speed-timed activity	o Capacity to record teacher or student reading text
• Gain knowledge about long and short vowels (Morrow, Tracey, Del Nero, 2011)	• Help children connect phonemic awareness instruction to reading and writing tasks (NICHD, 2000)	o No connection to real reading and writing	o Narrator reads story option o Navigate pages from thumb nails
• Identify syllables of words	• 5-18 hours of instruction is ideal (NICHD, 2000)	o Apps targeted for speech pathologists, with research	o Sound effects o Connect letters with sounds instruction-highlight letters or words-
• Recognize rhyming words, think of rhyming word when given a word (Morrow, Tracey, Del Nero, 2011)			
• Phoneme deletion (Pressley, 2006)			

		base are costly
		• **eBook Apps:**
		  o e-version of traditional print texts or text only available in e form?
		  o Narrator read story option- accuracy of pronunciation, emphasis on rhyme/phonemes
		  o Sound effects distracting
		  o Require "Within App Purchase"
		  o Emphasize letters over sounds
			phonics affordance
			  o Hear letter names and sounds

Phonics Literacy Behaviors Letter Knowledge
• Identify all upper and lower case letters (Morrow, Tracey, Del Nero, 2011)
• Alphabet Knowledge-know names and sounds of printed letters (NELP, 2008)
• Identify physical representation of 26 letters (Adams,
	Phonics Best Instructional Practices Letter Knowledge
	• Child should learn letters in their own name
	• Start with letters like *S, T, B, P* (frequent letters, hear sound in their name) (Morrow, Tracey, Del Nero, 2011)
	• Teach more than one letter a week
	• Expose children the letters often
	• Tangible/kinesthetic learning: letter manipulatives, make letters in variety of materials,
		Negative App Affordances Phonics Letter Knowledge
		• **Game Apps:**
		  o Game distracting
		  o Teacher cannot select letters to practice
		• **Alphabet Apps:**
		  o Letters only presented in alphabetic order
		  o Inaccurate display of
			Positive App Affordances Phonics Letter Knowledge
			• **Game Apps:**
			  o So many letter name apps- opportunity for frequent exposure to letters
			  o Game element- engaging
			• **Alphabet Apps:**
			  o Music- engagement,

1990)	with body, etc.	grapheme and corresponding letter name
		• **Hand Writing Apps:**
		  o Apps that let child write their name all cost money
		  o Kinesthetic limits-use hand only to make letters
		  o Requires staying within lines
		  o No authentic writing experience
		  o No capacity to illustrate
		• **eVersion of Traditional Tools Apps:**
		  o No transformation-only recreate traditional practice
			mneumonic (Alphabet Song)
			  o Display upper and lower case letters
			  o Connect sound to associated letter
			  o Give word and picture that starts with each letter
			• **Hand Writing Apps:**
			  o Store practice letters
			  o Kinesthetic learning
			  o Practice touch screen usage
			• **eVersion of Traditional Tools Apps:**
			  o Teacher can select/direct letters to focus on (order other than alphabetic)

Phonics Literacy Behaviors Alphabetic Principle/Alphabetic Reading
• Make letter-sound associations
• Blend sounds to produce words
	Phonics Best Instructional Practices Alphabetic Principle/Alphabetic Reading
	• Manipulate phonemes with letters (like phonemic awareness activities with letters)
	• Work with onsets and rimes (word families)
		Negative App Affordances Phonics Alphabetic Principle
		• **Game Apps:**
		  o Audio function inaccurately pronounces phoneme, only makes one
			Positive App Affordances Phonics Alphabetic Principle
			• **Game Apps:**
			  o Audio function creates phoneme when grapheme is touched
			  o Audio function

• Know initial letter-sound associations (Pressley, 2006)	• Match, classify, sort, puzzles, magnetic letters, making words with letter manipulatives • Create books with words and pictures for word families • Picture mneumonics for letter and corresponding sounds (Pressley, 2006) • Teach letter-sound associations • Teach how to blend sounds to recognize words (Chall, 1967) • Read words in real texts that emphasize known graphemic-phonemic elements (Adams, 1990) • Lots of practice in reading and writing words (in isolation and in texts) (Pressley, 2006)	possible sound for letters with numerous sounds ○ Audio function only names letters, does not make sound ○ Game distracting ○ No choice in rimes worked with • **Recording Apps:** ○ Students may not be able to make recordings independently • **eBook Apps:** ○ e-version of traditional print texts or text only available in e form? ○ arrator read story option-inaccuracy of pronunciation, fail to emphasize graphemic-phonemic elements ○ Sound effects distracting	models blending sounds together ○ Game engaging ○ Teacher/child can select rimes to work with • **Recording Apps:** ○ Create, record books with images for word families ○ Share books-publically on web or with parents or classmates • **eBook Apps:** ○ Exposure to rhyming within context of story-connect to real reading ○ Capacity to record teacher or student reading text ○ Narrator reads story option ○ Navigate pages from thumb nails • **eVersion of Traditional Tools Apps:** ○ Teacher can select/direct letters to focus

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		o Require "Within App Purchase" • **eVersion of Traditional Tools Apps:** o No transformation- only recreate traditional practice	on (order other than alphabetic) o Teacher directed making word activities

Word Recognition Literacy Behaviors
Sight Words
• Identify high frequency sight words
• Spelling represented in memory as unit
• Connection of visual stimulus (word) and conceptual understanding of what word means
Decoding by Analogy
• Perceive letter strings that occur in many words as unit (prefixes, suffixes, root words and others)
• Process letter chunks as a whole
• Use analogy to decode unknown words
	Word Recognition Best Instructional Practices
	Sight Words
	• Memorize high frequency sight words *(the, and, but)*
	• Repeated readings (Pressley, 2006)
	• Repeated oral readings with feedback and guidance (NICHD, 2000)
	
	Decoding by Analogy
	• "Systematic elaboration and intensification of powerful natural learning processes" (Pressley, 2006)
	• Teach "key" words, letter combinations
	• Taught flexibly in combination with synthetic phonics
		Negative App Affordances
		Word Recognition
		Sight Words
		• **Sight Word Apps**
		  o Where do the word lists come from?
		  o Mispronunciations
		  o Sentences do not clarify meanings
		  o Not authentic reading or writing practices
		  o No opportunity for oral reading
		  o No choice of words to practice
		Decoding by Analogy
		• **Word Family Apps**
		  o Only rimes, not prefixes, suffixes, other useful strings of letters
			Positive App Affordances
			Word Recognition
			Sight Words
			• **Sight Word Apps**
			  o Numerous apps- opportunities to practice
			  o Flashcard format or game format- engagement
			  o Hear and see words
			  o Model words used in sentence
			  o Child can practice writing words and make audio recording of words
			  o Teacher can create own content
			  o Select specific words to practice
			Decoding by Analogy

			Word Family Apps
			Word Family Apps - Work with strings of letters, word chunks - Connection to synthetic phonics
			o More phonics-based activities than reading by analogy

Language Development Literacy Behaviors	**Language Development Best Instructional Practices**	**Negative App Affordances Language Development**	**Positive App Affordances Language Development**
- Increases and develops listening and speaking vocabulary - Uses language for variety of purposes - Uses sentences of increasing length and syntactic complexity - Tells simple personal narrative - Asks questions - Retells stories in sequence - Pronounces words with ease and accuracy - Experiments with language	- Read aloud to child to build vocabulary - Reading with expression - Ask open-ended questions while reading - Repeated readings - Discuss new vocabulary prior to reading - Have children repeat rhymes, phrases from books read (Morrow, Tracey, Del Nero, 2011) - Important for ELLs (Helman, 2009) - Thematic instruction (science, social studies, art, music, etc)-have objects related to theme for children to talk about	**eBook Apps** - App will not have conversation about book with child - App generated questions are not open-ended, related to theme of story - App reads with flat expression/lack of prosody **Podcasting/Recording Apps** - Labor-intensive to create podcasts of read aloud - Audio only, no visual - Adult assistance needed if children are	**eBook Apps** - Use for shared readings - Child can be "read to" by the app allowing more repeated readings - Just-in-time vocabulary feature - Practice sequence in activities - Audio recording of child repeating phrases from book - Possible to develop theme, explore further through internet browser **Podcasting/Recording Apps**

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		going to make podcasts	o Create audio file of read aloud with expression for children to listen to o Ask open-ended questions o Record student repeating rhymes, phrases o Share audio files (among class, with families, with online public o May be able to record audio and visual
Vocabulary **Literacy Behaviors** • Increases and develops listening and speaking vocabulary • Increases and develops reading and writing vocabulary • Uses new vocabulary • Refines understandings of words • Apply word learning strategies when	**Vocabulary Best Instructional Practices** • Frequent read alouds • Repeated readings • Discuss new vocabulary prior to reading (Morrow, Tracey, Del Nero, 2011) • Create opportunities for children to encounter words, understanding meanings in rich contexts • Internal (within word) and external (sentences) context clues (Pressley, 2006) • Build on oral vocabulary • Teach individual words-definitions and in context	**Negative App Affordances Vocabulary** • **Games Apps** o Nouns only o Graphics unclear-do not define word o Can "play" without understanding-process of elimination o Words not encountered in authentic contexts o Only hear oral word, do not see	**Positive App Affordances Vocabulary** • **Games Apps** o Engaging, fun o Word lists grouped in theme (animals, plants, etc.) o Multiple play capacity o See printed word • **Dictionary Apps:** o Illustrative photographs/images o Hear word o Hear sentence

		printed word	with word in it

encountering an unknown word
• Develop word consciousness (awareness of, interest in, motivation to learn words)
	• Repetition, multiple exposures to words, in different contexts (NICHD, 2000; Graves, 2006)
	• Discuss meanings with students (Graves, 2006)
	• Explicit/definitions
	• Implicit-exposure through reading (NICHD, 2000)
	• Variety of instructional methods used (NICHD, 2000)
	• Important for ELL (Helman, 2009)
		• **Dictionary Apps:**
		  o Photographs/images are not adequately explanatory
		  o Limited words in "dictionary"-could not look up a word encountered in text
		  o In app purchase required for full dictionary
		• **eBooks**
		  o limited books available in eBook format
		  o contrived, inauthentic text written for vocabulary
			• eBooks
			  o Authentic contexts
			  o Just-in-time features
			  o In-text vocabulary "quizzes"

Comprehension
Literacy Behaviors
• Answer literal questions about text (Morrow, Tracey, Del Nero, 2011; Pressley, 2006)
• Answer inferential questions about text (Morrow, Tracey, Del Nero, 2011;
	Comprehension Best Instructional Practices
	• Prereading (picture walk, build background knowledge, vocabulary)
	• Have students make predictions at appropriate moments-discuss whether they were correct
	• Generate/ask question
	• Use graphic organizer
		Negative App Affordances Comprehension
		• **eBooks:**
		  o Too many options/features (music, art, sound effects, animation, etc)-distract from comprehending story
		  o Cost money
			Positive App Affordances Comprehension
			• **eBooks:**
			  o Can preview book, make predictions using thumbnail pages to navigate
			  o Record own reading of text
			  o Engagement

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			(sound effects, music, art activities, animation)

Pressley, 2006)
• Predict outcome (Morrow, Tracey, Del Nero, 2011; Pressley, 2006))
• Retell story (Morrow, Tracey, Del Nero, 2011; Pressley, 2006)
• Engage in discussion of book (Morrow, Tracey, Del Nero, 2011)
• Ask questions about information or events in book (Morrow, Tracey, Del Nero, 2011)
• Make mental images (Pressley, 2006)
• Clarify confusion (Pressley, 2006)
• Summarize; abstracting big ideas in text (Pressley, 2006)
	• Have students use visualization
	• Use Post-It notes to ask questions/record thoughts
	• Have students retell story
	• Have students summarize story
	• Respond to text-can be art work
	• Teach comprehension strategies (predict, question, clarify, mental images, prior knowledge, summarize, interpret) (Pressley, 2006)
		• **Multiple Choice Quiz:**
		  o Display of text can make reading challenging for beginning reader
		  o Limited or no illustrations
		  o Questions are recall only
		  o Cannot view texts while answering a question about it
		  o Difficult to make prediction
		  o Only able to respond in form of multiple choice questions
		  o Can find answer by process of elimination without understanding text or question
		  o Texts not interesting, engaging, authentic
		• **Mind Mapping:**
		  o Difficult to navigate,, create with
			o Take notes (content mark up)
			  o Look up words
			  o Highlight, book mark pages
			  o Change font and size
			  o Zoom in on pictures, manipulate animation (retell?)
			• **Multiple Choice Quiz:**
			  o Answer literal questions about text
			  o Hear words pronounced
			  o Hear text read with prosody
			  o Record own reading of text
			• **Mind Mapping:**
			  o Create graphic organizer
			  o "Map" story structure

Writing Literacy Behaviors	**Writing Best Instructional Practices** • Have students write as	**Negative App Affordances Writing**	**Positive App Affordances Writing**

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• Can dictate ideas to adult who records
• Attempts to write themselves
• Uses letters to represent the English language
• Attempts to connect sounds in a word to their letter forms
• Imitates special language in a book
• Narrative writing
• Informational writing
• Functional writing tasks (Making lists, etc.)
• Uses writing mechanics properly (spelling, punctuation) (Morrow, Tracey, Del Nero, 2011)
	developmentally appropriate (scribbles to random letters to invented spelling, also drawing)
	• Connect writing to authentic purpose (notes, letters, recipes, something shared online, stories, poetry)
	• Give constructive feedback to students
	• Have students share writing (Morrow, Tracey, Del Nero, 2011)
		• **Composing Apps:**
		  o Confusing to use
		  o Costly upgrade to have more options
		• **Handwriting Apps:**
		  o Not authentic context
		  o No sharing of writing
		  o Finger, not traditional writing utensil
		  o Inhibits developmentally appropriate writing experimentation
		  o No composing capacity
		• **eVersion of Traditional Tools Apps:**
		  o Text only, or text and drawing,
		  o No multimodal composing capacity
			• **Composing Apps:**
			  o Multimodal composing
			  o Images-user created and clipart
			  o Text
			  o Recording
			  o Animation
			  o Authentic purpose
			  o Capacity to share writing
			  o Integrated reading and writing
			• **Handwriting Apps:**
			  o Letter recognition, practice (phonics affordance more than a writing affordance)
			• **eVersion of Traditional Tools Apps:**
			  o Allow developmentally appropriate writing
			  o Can sharing writing

Appendix C

Tool for App Evaluation

Can this app be used for multiple instructional goals? For example, many eBooks can be used for instruction in all areas of literacy, some phonics apps can support phonemic awareness instruction, too, etc.

Does this app offer any value-added to my instruction?

Am I looking for an app for students to use independently or with adult assistance?

Lots of apps have a gaming aspect-assess whether the game is engaging or distracting. Is it pertinent to the dimension of literacy you are working on? To other content?

Am I looking for an app to use with the whole class? A small group? Individual students?

Will the multi-modal features of this app be engaging? Motivating? Distracting?

Purple boxes indicate tips for app use

Instructional Objective

Value-added to instruction by using the app/technology

Individual Learners

Selecting Apps Must be Guided by

Questions to ask your self as you review apps

Selecting Apps for K–3rd Grade Literacy Instruction

Concepts of Print

Phonemic Awareness

Phonics

Word Recognition

Language Development

Vocabulary

Writing

Dimensions of Literacy

Letter Knowledge

Alphabetic Principle

Comprehension

Concepts of Print

Types of Apps to Use

eBooks Apps

Work best with guide practice, shared experience to maximize concepts of print instruction

Look for:
- Can the app read to the student? With accuracy? With Prosody?
- Does the app track or highlight text as it is read?
- Can you pause or turn off the read-to-me feature?
- Engaging game or animation element
- Story and illustrations condusive to retelling

Be aware of:
- Disruption of text directionality
- Distracting or unrelated animation or game elements
- Within app purchase required to achieve your goals

eVersion of Traditional Tools

Generally not a transformative app; no value-added to using this technology

Look for:
- Student can identify and manipulate the letters in their own name
- App names letters; student can hear the name of letter
- App displays letter in traditional directionality (left to right, top to bottom)

Be aware of:
- Distracting, unrelated features ("stickers")

Recording Apps

Good to use for student retelling of stories

Most likely would require adult assistance

Look for:
- Easy to use recording capacity
- App can save, store and share recordings
- App can display visual (page of picture book) set to recording

Be aware of:
- Complicated to use
- Limited storage
- No way to share recordings

Phonemic Awareness

Types of Apps to Use

These apps generally don't connect phonemic awareness to authentic reading and writing tasks; the teacher must make that connection for students

Many of this kind of app works with letters and sounds. Clarify for yourself if you are looking to focus ONLY on phonemic awareness, or if you want to work with graphemes and phonemes

There is an abundance of this type of app. They vary in quality–be sure to spend some time reviewing

Apps that assess students' production and manipulation of phonemes do not seem to exist at present

These apps allow phonemic awareness instruction that is connected to authentic reading

These apps have lots of affordances for other dimensions of literacy, too

Rhyming Game Apps

eBook Apps

Look for:

Audio that correctly pronounces, segments and blends phonemes

Allow teacher to select word families, onsets and rimes

Illustrations (vocabulary affordance)

Display letters with sounds (phonics affordance)

Audio directions for game

Engaging game element

Be aware of:

Inaccurate pronunciation, blending, segmenting

Insufficient or misleading illustrations if you are also working on vocabulary

Distracting game aspects

Expensive within app purchases required to meet objectives

Apps that allow limited time to complete task

Look for:

App has capacity to record teacher or student reading or reciting text

Read-to-me or Read-By-Myself options

Engaging sound effects or animation

Narrator's reading emphasizes sounds, rhymes

Be aware of:

Inaccuracies in narrator's reading of text

Distracting sound effects or animation

Expensive within app purchases required to meet objectives

Letter Knowledge

Types of Apps to Use

Alphabet Apps

Look for:
- Mneumonics such as "Alphabet Song"
- Displays upper and lower case letters
- Accurately connects letter to associated sound or sounds
- Gives word and/or picture that starts with letter

Be aware of:
- Letters are only presented in alphabetic order
- Inaccurate display of letter and corresponding sound
- Does not address letters that produce more than one sound

eVersion of Traditional Tools
- Generally not a transformative app; no value-added to using this technology
- Use for traditional letter learning activities in digital format
- Works best with teacher-led activities

Game Apps

Look for:
- Engaging game element
- Allows teacher to select letters to focus on

Be aware of:
- Distracting game element
- Teacher cannot select letters to focus on and practice

- There is an abundance of these apps, which allows for frequent and varied exposure to the letters

Hand-Writing Apps
- Affords kinesthetic practice and learning of letters, but only with hand, not whole body
- These apps generally do not allow authentic writing or illustration of writing. They are limited in value-added

Look for:
- Capability to store students' practiced letters

Be aware of:
- Most apps that let students write their name cost money
- Only allows tracing of print letters

Alphabetic Principle

Types of Apps to Use

Recording Apps
- Using these apps for this type of instruction will most likely require adult assistance
- Use these apps to have students create and record books with images for word families that can be shared with classmates, the internet or families

Game Apps

Look for:
- Audio produces phoneme correctly when letter is tapped
- Audio models blending accurately
- Allows user selection of words or rimes
- Game element is engaging

Be aware of:
- Inaccurate pronunciation or blending
- Audio only names letters, does not make sounds
- Game element is distracting
- Does not allow user to select words or rimes

eVersion of Traditional Tools Apps
- Generally not a transformative app; no value-added to using this technology
- Works best with teacher-led activities

eBook Apps
- These apps afford students exposure to rhyming within the context of an authentic story

Look for:
- Capacity to record teacher or student reading text
- Narrator accurately reading

Be aware of:
- Inaccurate pronunciation by narrator
- Expensive within app purchases required to meet objectives
- Distracting sound effects or animation

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Word Recognition

Types of Apps to Use

Sight Word Apps

There is an abundance of these apps. They vary in quality. Many include sight words that may not actually be high frequency words. For many of these apps it is unclear where the word list comes from

Most of these apps are "eFlashcards," not authentic reading or writing activities

Look for:

Apps that allow students to both see printed word and hear it

Engaging game element

App models using words in a sentence

Allow teacher to add or create content

Allow teacher or student to select specific words to practice

Be aware of:

Word lists that include words that aren't useful for students to practice

Mispronunciations of words

Unclear sentences that do not afford vocabulary learning

Apps that do not allow selection of words to practice

Word Family Apps

These are the only apps at present (other than eBooks) that allow students to develop the ability to decode by analogy

These apps allow students to work with strings of letters and chunks of words, making a connection to synthetic phonics

These apps only include rimes, not prefixes, suffixes or other useful strings of letters

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When working with ELLs language development quality positive affordances can be very valuable

Language Development

Types of Apps to Use

These apps work best for language development as shared reading text. Teacher will need to ask open-ended questions, discuss vocabulary, etc.

These apps can be used for students to experience repeated readings

eBook Apps

Look for:

Audio just-in-time vocabulary

Narrator models read with prosody

Audio recording capacity so teacher can record reading text, or student can record phrases

Be aware of:

Narrator reads lacking expression or prosody

Podcasting/Recording Apps/Web Tools

These apps can be used to create teaching materials (for example. read alouds with open-ended questions)

These apps (and web tools) work can be used to create and sahre examples of students using oral language

Using these apps for this type of instruction will most likely require adult assistance

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Vocabulary

When working with ELLs clear, high-quality positive vocabulary affordances are valuable

Types of Apps to Use

These apps are great authentic contexts for students to encounter vocabulary words

Dictionary Apps

In general these apps do not work like traditional dictionaries where you can look for a specific word. They are more like illustrated collections of nouns

Look for:

Explanatory images for words

Sentences that use word accurately and demonstrate definition

Be aware of:

Confusing images or sentences that do not show meaning of word

Within-app purchase required to access entire dictionary

Game Apps

The word lists in these apps are generally thematically grouped nouns (ex. animals, plants, weather, etc.)

Look for:

Multiple player capacity

Can user see and hear words?

Game element is engaging

Be aware of:

Confusing graphics

Distracting game element

Game can be played with out understanding words through process of elimination

Words are only spoken, not viewed as text, or vice versa

eBook Apps

Look for:

Just-in-time vocabulary features

In-text vocabulary "quizzes"

Be aware of:

eBooks written only for vocabulary purposes, inauthentic or contrived stories

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Comprehension

Types of Apps to Use

These apps have the potential to be powerful tools for comprehension strategies instruction. They must be reviewed for teacher's specific goals and objectives

Many of these apps have a cost associated with using them

These apps generally have a short reading followed by knowledge and comprehension multiple choice questions

Mind Mapping Apps/Web Tools

These tools would most likely require teacher modeling or guided use with beginning readers

eBook apps

Look for:

- Thumbnail view of book to use for previewing and predicting
- Teacher or student can record own reading of text
- Content mark-up is possible (notes, highlighting), can be shared with other readers/teacher
- Engaging features that support comprehension (sound effects, music, animation, etc.)

Be aware of:

- Excessive options/features (sound effects, animation, music, etc) that inhibit use of comprehension strategies
- Within-app purchase required to access complete text

Multiple Choice Quiz Apps

Look for:

- Read-to-me and Read-to-myself option
- Narrator reads with prosody
- Record self reading option

Be aware of:

- How text is displayed; single-spaced paragraph is difficult for beginning readers
- Limited or no images or illustration; do not contribute to comprehension
- Unable to view text while answering question
- Question can be answered by process of elimination without understanding or even reading question
- Dull, contrived, low interest texts

Mind Mapping

Look for:

- Easily navigated tool
- Capacity to add images to mind maps

Be aware of:

- Complicated tool, difficult to use
- Cost associated with use or software purchase necessary

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Writing

Types of Apps to Use

These apps can be used for authentic writing purposes

These apps can be used for multi-modal composing in a variety of genres

Many of these apps allow integration of reading and writing instruction

Composing Apps

Look for:

Be aware of:

Multi-modal affordances

Features are confusing to use, distract from composing process

Animation

Audio recording

Music

Upload images

Draw, create images

Capacity to share writing with classmates, on internet, with families

Combination eBook and composing apps to integrate reading and writing

Expensive within-app purchase to fully utilize multi-modal affordances

Handwriting Apps

These apps are designed for students to practice forming letters, often involve tracing, more of a letter knowledge tool than writing tool

These apps can inhibit developmentally appropriate writing experimentation

Unless these apps afford students the chance to compose they are not appropriate for writing instruction

eVersions of Traditional Tools

Generally not a transformative app; no value-added to using this technology

These apps may be used for students to experiment and writing in developmentally appropriate ways

These apps generally do not have the capacity to share, publish or compose with multi-modalities

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Who students are should inform app selection and use

Students' home and family culture

Students' current literacy developmental stage

Students' motivation

Individual Learners

Expectancy-value

Self-efficacy

Students' interests

English language learners

Vocabulary affordances

oral langauge affordances

Appendix D

**Kindergarten-3rd Grade Teachers Survey of
Selection and Use of Apps for Literacy Instruction**

Directions: Please respond to the following questions about selecting and using apps and web tools for early literacy reading instruction in your classroom.
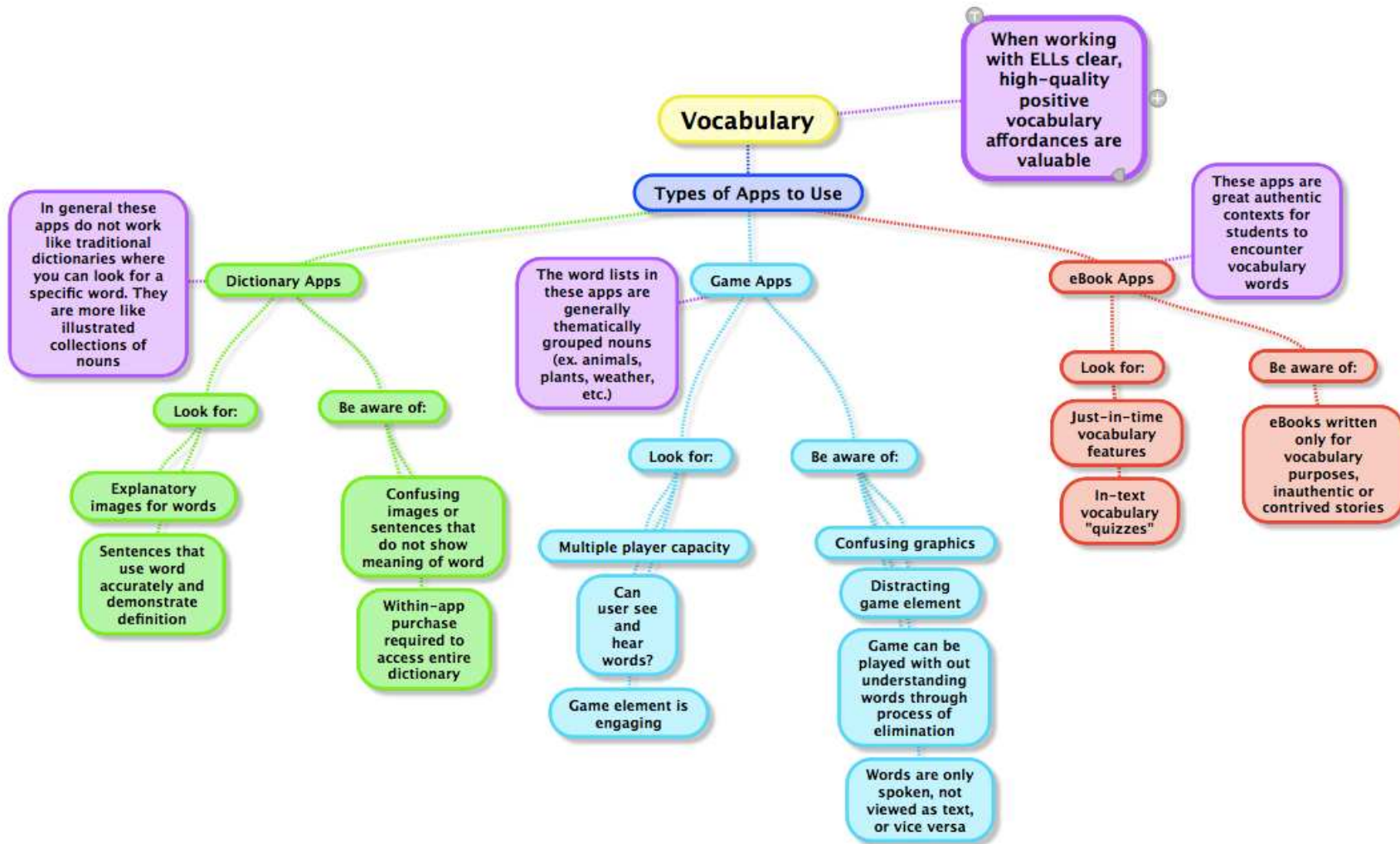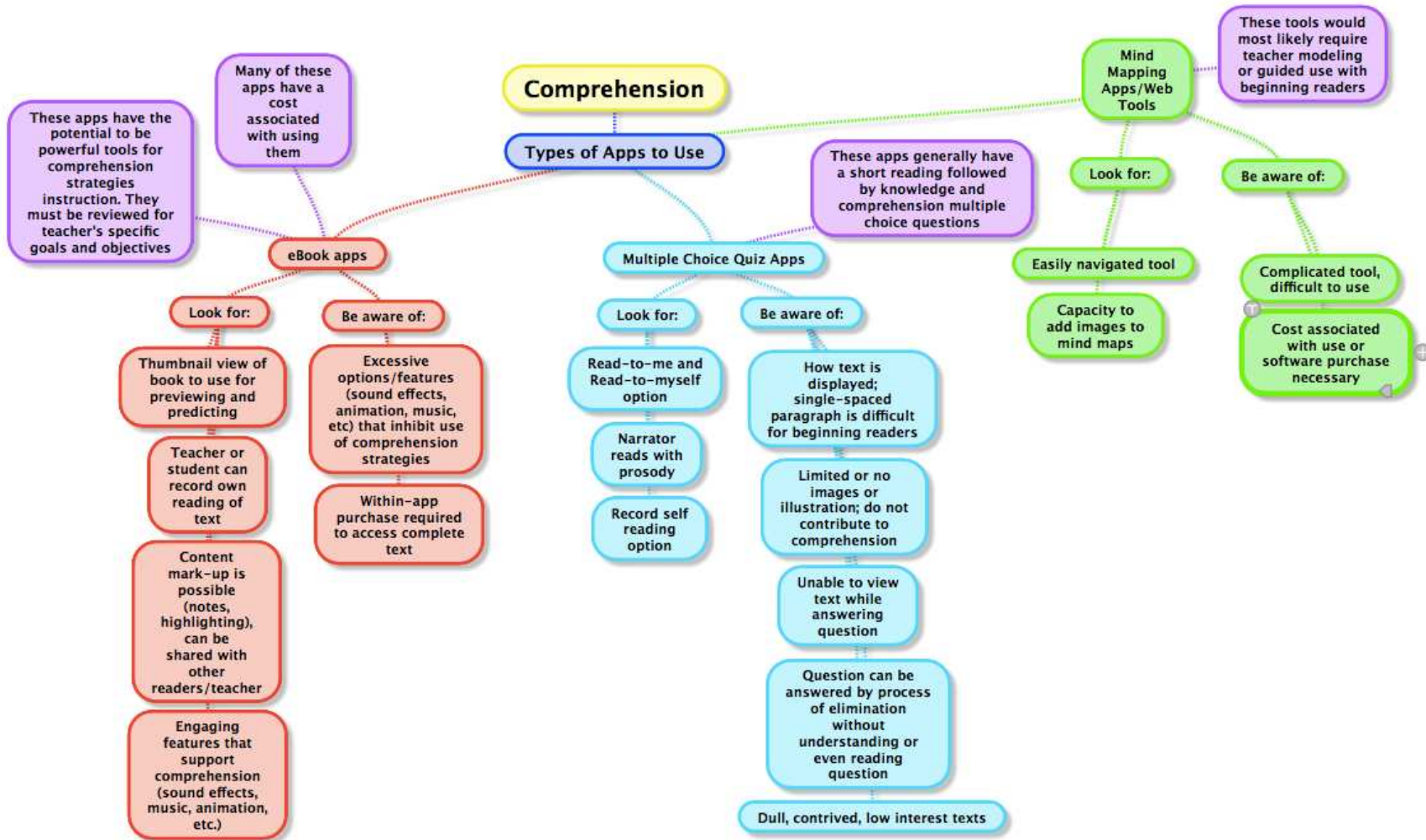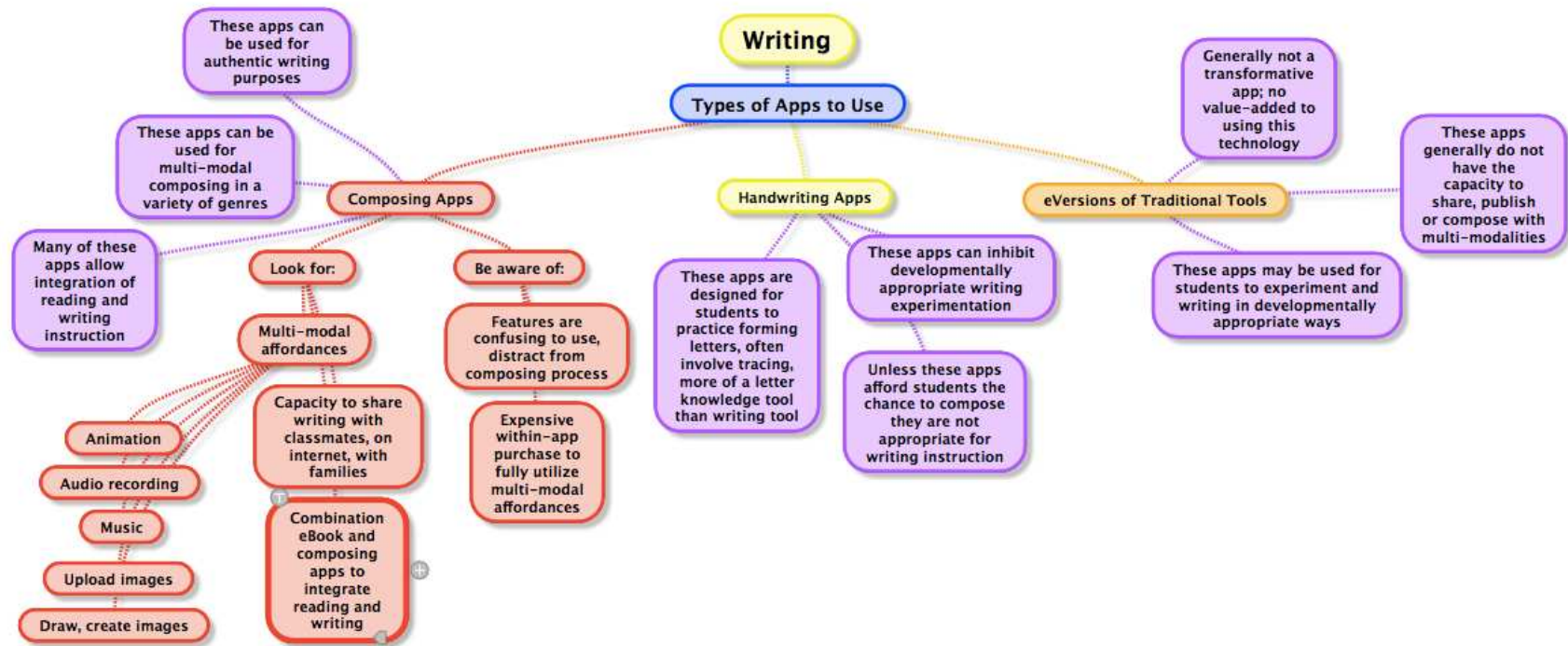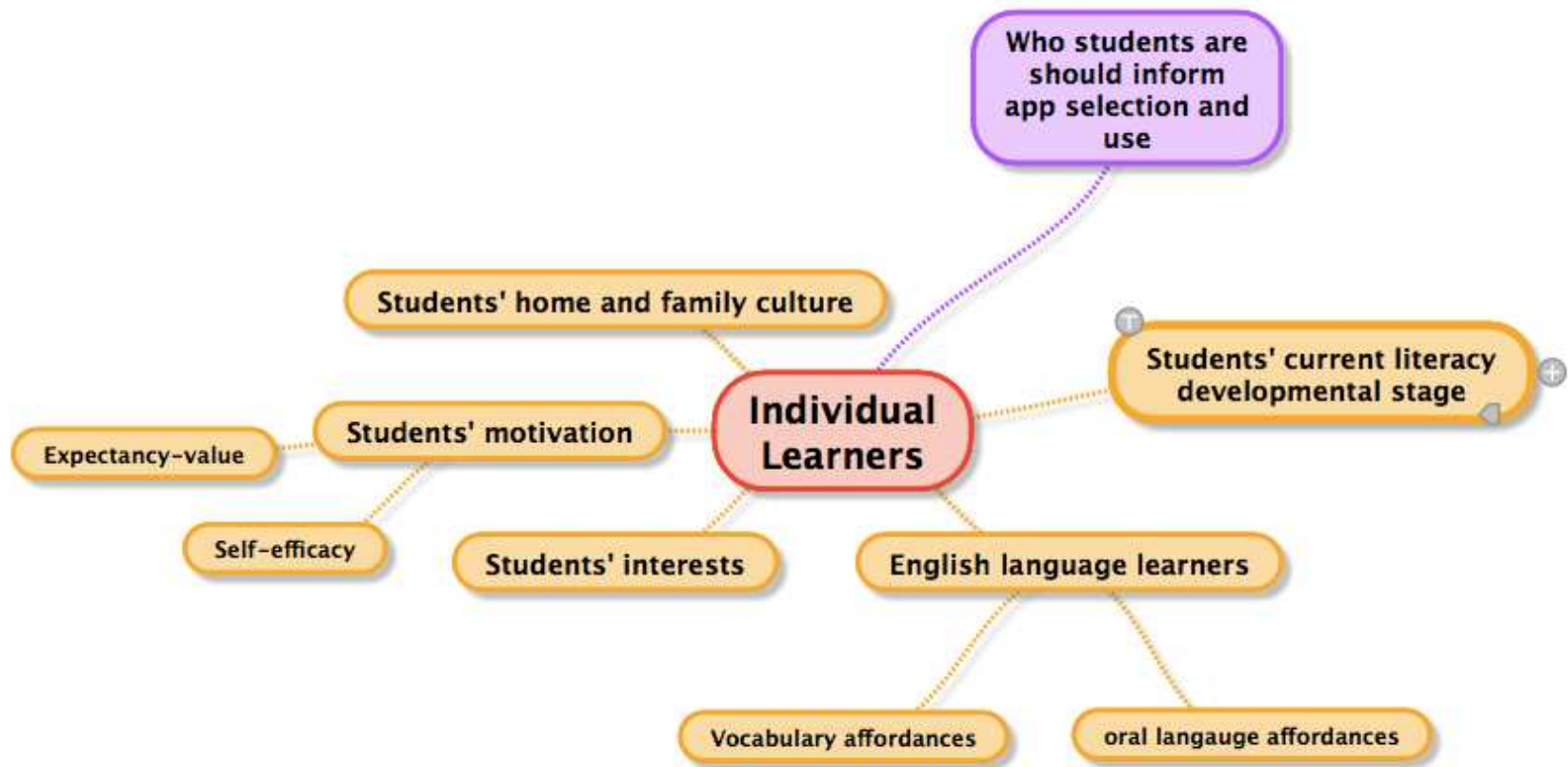
Teacher and School Information

1. What is your current teaching position (circle one)?

- Kindergarten classroom teacher
- 1st Grade classroom teacher
- 2nd Grade classroom teacher
- 3rd Grade classroom teacher
- K-3 classroom teacher in a multi-grade class (I teach grades_____)
- Other (specify position_____)

2. How many total years have you spent as an elementary teacher (include current year)? (Write number of years_____)

3. How would you describe your school? (Circle One)
- Rural in a small town
-
- Suburban, outside of a major city
- Urban, in a major city

4. How many students are in your classroom? (Circle one)
- Less than 15
- 16–20
- 21–25
- More than 25

Learning Technologies Access (Adapted from Vannatta & Fordham, 2003)

5. What technological devices are available to you for literacy instruction (circle all that apply):
- Tablets (iPad, iPod Touch, other)
- SMART Board
- Computer (desktop or laptop)
- Video recording device (flip video, video camera)
- Audio recording device
- Other_____

6.
  A. Do you share devices within your school (as opposed to having classroom sets)? Circle one.
     o Yes
     o No (**Proceed to Question 7**)

  B. Which technological devices are shared within your school building with other teachers and classroom? (Circle all that apply).
  o Tablets (iPad, iPod Touch, other)
  o SMART Board
  o Computer (desktop or laptop)
  o Video recording device (flip video, video camera)
  o Audio recording device
  o Other_____

7. How many of the following each of devices are available to you? Write "0" if you do not have access to a type of device.
  o _____Tablets (iPad, iPod Touch, other)
  o _____SMART Board
  o _____Computer (desktop or laptop)
  o _____Video recording device (flip video, video camera)
  o _____Audio recording device
  o _____Other_____

8. Do students use personal (student-owned) technological devices for learning purposes in your classroom? Check all that apply:
  o Laptop
  o Tablet
  o Smart Phone
  o Flip Video
  o Other (describe_____)

Teacher Beliefs About Literacy Instruction (Baumann, Hoffman et al., 2000)

9. The following statements represent various **perspectives, philosophies, or beliefs** toward the teaching and learning of literacy. Circle numbers in front of **all** of the following statements that apply to you personally (i.e., you
may mark multiple responses).

o I would describe myself as a "**traditionalist**" when it comes to reading methods and materials.
o I have an "**eclectic**" attitude toward reading instruction, which means that I would draw from multiple perspectives and sets of materials when teaching reading.
o I would describe myself as a **whole language** teacher.
o I believe in a **balanced approach** to reading instruction, which combines skills development with literature and language-rich activities.
o I believe that teaching students to **decode** words is one of my most important goals for early reading instruction.
o I believe that **phonics** needs to be taught directly to beginning readers in order for students to become fluent, skillful readers.
o I believe in a **literature-based approach** to reading instruction in which trade books (i.e., children's books or library books) would be used exclusively or heavily.
o I believe that **basal reading materials** are useful tools for teaching students to read, either as the primary instructional material or along with trade books (i.e., children's books or library books).
o I believe students need to be **immersed in literature** and literacy experiences in order to become fluent readers.

10. The following statements represent various **goals or objectives** that teachers might have for a literacy instructional program. Circle numbers in front of all of the following statements that apply to you personally (i.e., you may mark multiple responses).

o It is my goal to develop readers who are **skillful and strategic** in word identification, fluency, and reading comprehension.
o It is my goal to develop readers who are **critical and thoughtful** in using reading and writing to learn about people and ideas, and how they might use literacy to positively affect the world in which they live.
o It is my goal to develop readers who are **independent and motivated** to choose, appreciate, and enjoy literature.
o It is my goal to develop readers who are **knowledgeable** about literary forms or genres and about different text types or structures.
o Additional goal(s) I have_____

11. Estimate the total average time (in minutes) you spend each school day for the following reading and language arts activities:

_____minutes daily specifically for reading instruction (e.g., reading groups, skill or strategy lessons, teacher-guided reading of selections)

_____minutes daily for applying, practicing, and extending reading instruction (e.g., reading aloud to children, students' independent reading or DEAR periods, student-led response groups, cooperative reading activities)

_____minutes daily for language arts instruction and practice (e.g., writing workshop, response journals, spelling, oral language activities)

12. Approximately how much daily instructional time do you devote to each of the following? Check the column.

Component	Considerable Time	Moderate Time	Little Time	No Time
Comprehension				
Vocabulary				
Oral language				
Phonemic awareness development				
Phonics/Decoding				
Literature circles/book club				
Process writing/composing				
Handwriting				
Spelling				
Word work				
Reading aloud to students				
Students reading independently				

13. What is your opinion about teaching Kindergarten-3rd grade students the following **word recognition strategies**? Check the column.

Strategy	Essential	Very Important	Somewhat Important	Not Important
Phonics analysis/**decoding**				
Structural/morphemic analysis/**parts of words**				
Contextual analysis/**Context clues**				
Words by sight/**whole words**				

14. What is your opinion about teaching Kindergarten-3rd grade students the following **comprehension strategies**? Check the column.

Strategy	Essential	Very Important	Somewhat Important	Not Important
Predicting				
Questioning				
Constructing mental images				
Clarifying				
Using prior knowledge				
Summarizing				
Interpreting				

Retelling				
Inferring				

App Selection and Use

15. How would you describe your personal level of confidence using apps for early literacy instruction?

- o Extremely confident
- o Fairly confident
- o Somewhat confident
- o Lacking confidence
- o No confidence

16. What is your evaluation of the quality of training, professional development and/or support for integrating apps into your instruction? Check one.

- o Exceptional
- o Very good
- o Adequate
- o Poor
- o Totally inadequate/none

17. How much time on average do you send reviewing an app before deciding to use it for early literacy instruction:
_____minutes per app

18. How many apps on average do you review before selecting an app to use for early literacy instruction?
_____apps

19. When you search for apps which of the following do you use to narrow your search? Circle all that apply.

- o Free
- o Paid
- o Popularity
- o Ratings
- o Release Date
- o Education Category
- o Other Category_____(list category here)

20. Which of the following resources do you consult to find apps? Circle all that apply.

o   Blogs (list examples if you can_____)
o   Websites (list examples if you can_____)
o   Other educators
o   Pinterest/other digital bulletin boards
o   Search app store
o   Basal teacher's manual
o   Other:_____

21. What search terms do you use when looking for apps? List as many as you can think of:_____

22. When selecting apps how important are the following factors:

Factors	Essential	Very Important	Somewhat Important	Not Important
Specific **students and their needs** (development, language, interests)				
Learning **objectives**				
Value-added by using technology				
Student **grouping**				
Motivation and engagement afforded				
Support **best-practices** of early literacy instruction				

23. As you select apps for literacy instruction, which of the following app criteria are important to you (Adapted from Mesmer, 2006)?

Characteristic	Essential	Very Important	Somewhat Important	Not Important
Gaming element (Task to win reward of some sort, ie points, stickers, etc.)				
Audio (App can read words or text to user)				
Theme or characters (example: Boing the Alien, or a zoo theme)				
User can **record** own voice				
App can support **multiple users**/players				
App can **share texts** produced within it (through email or other				

means)				
App is **free or low cost**				
App allows **content mark up** (notes, highlighting, etc.)				
Multimodal affordances (music, video, animation, audio, etc.)				
Authentic reading or writing tasks (not contrived)				

24. How often do you use apps and/or web tools for the following early literacy instruction:

Early Literacy Instruction	Frequently (weekly)	Fairly frequently (monthly)	Rarely (2-4 times a school year)	Never
Comprehension strategies				
Vocabulary				
Oral language				
Phonemic awareness development				
Phonics/Decoding				
Literature circles/book club				
Process writing/composing				
Handwriting				
Spelling				
Word work				

25. Which of the following instructional groupings do you use apps for? Check all that apply:

- o Whole class
- o Small groups: teacher-led
- o Small groups: student-led
- o Student pairs (no more than 2 students)
- o Teacher and one student
- o Individual student
- o Other:_____

26. Which statement best describes your use of apps in early literacy instruction? Check one. (Hughes, Thomas & Scharber, 2006)

- o I use technology as a **replacement** of traditional learning tools. My instructional practices now use technology tools instead of paper, white board, manipulatives or other traditional materials (for example white board apps, magnetic letters apps, etc.)
- o I use technology to **amplify** my instructional practices. My instruction is more effective through the use of apps and/or web tools. While my instructional goals have not changed, my capability to meet my goals has increased.
- o I use technology to **transform** my instruction. My instruction has new goals, new roles or new structure than before I began using technology tools.

Open-Ended Questions about App Selection:

27. Describe the training, professional development and/or support you have experienced for integrating apps into your early literacy instruction.

28. What challenges have you encountered as you select and use apps for early literacy instruction?

29. What successes have you experienced using apps in your early literacy instruction?

30. Describe your feelings and opinion at present about using apps in literacy instruction.

Appendix E

**Kindergarten-3rd Grade Teachers Interview Guide
Selection and Use of Apps for Literacy Instruction**

Directions: I'd like to ask you to think about how you integrate best practices for early literacy instruction and with apps and web tools in your literacy teaching. I am interested in your perspectives as an educator. By talking with me, I'll be able to better understand how teacher integrate their knowledge of best practices for early literacy instruction with affordances of apps and web tools. This will serve as a springboard for future studies or work that may be useful to educators as they select apps or web tools for their early literacy instruction.

1. Please describe your personal perspectives, philosophies, or beliefs about early literacy instruction. For example, what goals or objectives are the most important to you as an educator? What influences your instructional decision-making?

2. What training and experiences have shaped your personal perspectives, philosophies or beliefs about best practices for literacy instruction, including both your preservice learning and experiences, and any professional development or in-service learning or experiences?

3.   Tell me about your experience with your school's technology integration (Probes: When did it occur? What training was available to you? How many devices do you have access to? How do you feel about it? How would you describe the overall feelings your colleagues have about it?)

4. How do you currently use apps or web tools in your early literacy instruction? (Probes: Do you use these tools daily in your literacy instruction? What component of literacy do you use these tools the most for instruction (phonics, comprehension, etc.)? What student groupings do you use when using these tools?)

5. How do you select apps or web tools to use in your early literacy instruction? Describe your personal process for selecting apps.

6. Tell me about your lesson planning process, both before the technology integration and after. How has it changed? How has it remained the same?

7. Please think about apps that you really like and think are useful for your instruction. Can you give me example of an app that you believe offers positive affordances to your teaching and your students' learning? Explain these positive affordances to me.

8. Please think about apps that you don't like, whether you have used them in instruction or not. Can you give me example of an app that you believe inhibits or negatively impacts to your teaching and your students' learning? Explain why and how.

9. How does your personal knowledge of best early literacy practices help you select apps?

10. Do you feel your thinking and beliefs about literacy best practices has changed or shifted since you began using apps in your instruction? If "Yes" please describe the changes. If "No" why do you think your beliefs have not changed?

Appendix F

Kindergarten-3rd Grade Teachers Verbal Protocol
Selection and Use of Apps for Literacy Instruction

Part I:
1. Verbal protocol will occur concurrently with teacher's planning and evaluation of apps if possible.
2. Instructions to participants will be as general as possible to avoid cuing or prompting.
3. Participant will be asked to describe the lesson for which they are selecting apps or web tools, including instructional goals or objectives, student grouping, individual students' interests, developmental needs, linguistic or cultural background, etc.
4. Participants will be asked to search for, test and select apps as they normally do. They will be asked to think aloud, offer any thoughts, comments or explanations as they do this.
5. If possible audio or video recording of the participant's navigation of app store and apps will be collected. Investigator will note participant's actions with app store and apps.
6. If more than two minutes passed without any verbal comment from the reader, the investigator prompted the participant with the question "What are you doing now?" (Wyatt, Pressley, El-Dinary, Stein, Evans & Brown, 1993).

Part II:
1. Participant will be asked to select an app they have used in instruction that they consider to be exemplary. They will be asked to model using it while thinking aloud about what it affords their instruction and their students' learning. Investigator may prompt participant to discuss value added (what the specific app does better than any other instructional tool) if that is not addressed organically.
2. Participant will then be asked to select an app they tried and decided not to use in instruction. They will then be asked to model using it while thinking aloud about why they decided not to use and why it did not fit well into their instruction.
3. If possible audio or video recording of the participant's navigation of app store and apps will be collected. Investigator will note participant's actions with app store and apps.

Part III:
1. Participant will be asked to review the data collected from their verbal protocol and to identify problems or inaccuracies in the description and analysis of their app review and instructional planning.
2. Any disagreement will be noted and adjusted (Wyatt et al., 1993).

Appendix G

iPod Expectation Handout for Students

iTouch Expectations

Be Safe
*Keep the iTouch on a flat surface
or in your hands
*Remain seated

Be Responsible
*Use only the App of the Day
*Have clean hands
*Speak with the teacher if you have a
problem

Be Respectful
*Wipe your fingerprints off
*Let your teacher know when the battery is
below 50%