Reading Horizons: A Journal of Literacy and Language Arts

Volume 59
Issue 3 *December 2020*

Article 2

2020

Sparking Reading Engagement through Tablets: An Early Intervention Reading Program and Parent Workshop for Tablets at Home

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READING HORIZONS

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Abstract

Research on this intervention program aimed to address whether digital technology (i.e., apps on tablets) contributes to struggling early readers' (4–6 years old) on-task behavior and level of engagement while learning prerequisite emergent literacy skills (e.g., phonemic awareness, phonics, word recognition and decoding). The research also investigated whether parents/guardians of these students garner new knowledge about the potential of using multimodal applications to support their children's literacy learning. Students struggling with early literacy worked one on one with a tutor alternating between activities on and off the tablet. Data were collected from two iterations of this program in the winter (n = 18) and spring (n = 19). Qualitative observation scales were used to rate students' on-task behavior and level of engagement. A student questionnaire and parent survey were also administered. Results indicate that the nature of the features embedded within tablets seemed to enhance or hinder students' level of on-task behavior or level of engagement. A relationship between students' on-task behavior and level of engagement was also discovered. Parents/guardians reported being involved with their children, and this interaction positively impacted the child's enjoyment of reading. Implications for educators point to the importance of a blended learning model for early reading intervention and the importance of pre-settings in reading apps.

Keywords: ***reading intervention, struggling early literacy learners, on-task behavior, engagement***

For young learners, emergent literacy skills such as phonemic awareness, phonics, and word recognition and decoding are essential to support reading acquisition. These components of early reading education are prerequisite for reading fluency and comprehension. There is a growing body of knowledge on the challenges that some students experience during the learning-to-read phase (Reutzel & Cooter, 2009). Early intervention programs are often the key to ameliorate for these effects by providing a

literacy learning environment that is developmentally appropriate and instructionally differentiated (Walpole & McKenna, 2007). When early intervention programs are coupled with parent and family support, the impact is even more pronounced. Accordingly, this article is situated in the social cognitive framework that contends that learning is influenced by cognitive, behavioral, and environmental factors (Bandura, 1986). This view holds that even the youngest of learners actively engage and process information in their learning contexts and begin to develop a sense of self-efficacy for learning. It is integral that when learners begin to struggle interventions are deployed.

Multimodal Learning

In schools, home, and tutoring environments, research is pointing to a pedagogical shift from traditional print-based materials to multimodal digital technologies (Cordero, Nussbaum, Ibaseta, Otaiza, & Chiuminatto, 2018; Cumming & Draper Rodriguez, 2013; Neumann & Neumann, 2014). Multimodality encompasses a wide range of modes including senses, speech, images, and writing (Kress, 2000). Each of these modes has the potential to offer unique affordances for children while learning (Kress, 2000). Some studies have suggested the important role tablets may play in facilitating the development of emergent literacy skills (Larabee, Burns, & McComas, 2014; Neumann, 2016; Neumann & Neumann, 2014; Northrop & Killeen, 2013). Neumann and Neumann (2014) suggest that the specific features or modes in tablets have the potential to foster and enhance students' emergent literacy skills. However, education has been slow to adopt these new technologies in the context of intervention and remediation (Cumming & Draper Rodriguez, 2013). There has been scant research looking at how digital technologies have the potential to support young children struggling with early reading difficulties (Chai, Vail, & Ayres, 2015). In addition to this reality, education in general has adopted mobile technologies and integrated these devices before fully considering the educational implications (Cumming & Draper Rodriguez, 2013).

It is timely to consider how to support the early literacy learning of students most in need and how to incorporate different forms of literacy into early reading interventions. It is integral for contemporary learners to possess some fluency in the digital language of multimodal and online learning environments such as websites, videos, apps, and so on. Why? Children must be technologically adept given that technology will dominate their future lives (Plowman & McPake, 2013). Children may be able to manipulate tablets with a level of fluidity because of the multimodal operating features and tactile features that are unique to these devices (Neumann & Neumann, 2014). *Multimodality* is a term used to describe the various modes embedded in digital technologies (Rowsell & Walsh, 2011; Serafini, 2012). Modes can consist of images, sound effects, music, gestures, movements, texts, animations, spatial dimensions, or hyperlinks (Rowsell & Walsh, 2011; Serafini, 2012). Multimodal learning contexts involve learners using digitized content, which is present in both static and interactive ways and has explicit and implicit goals. With the multitude of modalities in touchscreen devices, learning becomes more differentiated and has the potential to support a variety of learning preferences and needs. Moreover, multimodal learning can occur in virtually any context, including the home, where parents can scaffold their children and promote family digital literacy (Marsh, Hannon, Lewis, & Ritchie, 2017).

Mobile devices like tablets are one form of digital technology offering touchscreen interfaces with attractive icons, symbols, letters, words, and numerals (Neumann & Neumann, 2014). Domingo and Garganté (2016) have categorized tablet apps into three

categories: learning skills, informational management, and content learning. Learning skills apps provide a platform for students to design and create their own knowledge (Domingo & Garganté, 2016). Informational management apps provide a space for students to organize work in different contexts (Domingo & Garganté, 2016). Content learning apps support the reinforcement, rehearsal, practice, and assessment of curricular content (Domingo & Garganté, 2016). Researchers agree that providing explicit (Holtzheuser & McNamara, 2014; Johnston, 2019; Schlesinger & Gray, 2017), multisensory, and engaging instruction during reading intervention programs can lead to success among struggling readers (Johnston, 2019). Furthermore, Reeves, Gunter, and Lacey (2017) found that explicit instruction through the use of mobile apps leads to increased phonological awareness. For this reason, the apps in this study were primarily content learning apps.

Other research suggests that it is just as important to look at the quality of time spent with apps as it is to consider the quantity of time (Neumann, 2014). Researchers emphasize how integral it is to provide explicit instruction, modeling, close monitoring, and guided practice before students learn with digital devices (Ciampa, 2016; Roskos et al., 2011). The current study therefore considered the quality of apps and whether they offer unique affordances to personalize the learning environment and provide scaffolding through explicit instruction. Research has pointed to the improvement of self-concept (i.e., identity, self-evaluation, and self-agency) through personalized features in tablets (Kucirkova, 2018). For instance, students may be more reflective of their abilities if they have the option to change the difficulty level within an app. For this reason, the current intervention placed importance on selecting quality apps and providing explicit instruction of technology use before and during digital reading activities. Furthermore, a blended learning approach was adopted as an instructional design that allows children to learn in a traditional print-based model while also integrating digital technologies because this combination produces greater academic success (Means, Toyama, Murphy, & Baki, 2013).

Tablets at Home

Educators and parents are now thinking beyond the classroom when it comes to tablet use for educational purposes. Research has found a positive relationship between students' tablet use at home and the development of emergent literacy skills including print awareness, print knowledge, and sound knowledge (Neumann, 2016). In comparison to reading traditional print-based books, emergent readers using electronic books (e-books) have better comprehension of narrative structure and details and can further identify characters and events (Parish-Morris, Mahajan, Hirsh-Pasek, Golinkoff, & Collins, 2013).

Parents tend to believe that children benefit from digital devices in the home environment to support reading development (Cheng & Tsai, 2016; Neumann, 2016). However, researchers caution about the dynamic between parents and children while reading at home and how this can change when using devices to learn (Cheng & Tsai, 2016; Krcmar & Cingel, 2014). For example, Krcmar and Cingel (2014) found that parents tend to talk more about the e-book format than the learning opportunities related to comprehension and vocabulary development that are inherent in the e-book. On the other hand, Cheng and Tsai (2016) found that parents who dominated the parent-child interaction while reading electronically disregarded their child's distractions, which in turn may have led to less cognitive attainment. Some parents see e-books as teaching tools or substitutes for parents, which leads to less parent engagement and interaction in reading activities at home (Cheng & Tsai, 2016). It is therefore important to acknowledge an appropriate role for parents while using devices like tablets at home. Parents should consider their role as

a mediator to provide less control and more guidance during digital reading activities at home (Cheng & Tsai, 2016).

Neumann (2018) suggests parents can be coached to use a wider range of strategies while supporting their children's learning on digital devices such as tablets. As illustration, Lacour, McDonald, Tissington, and Thomason (2017) found that after attending parent workshops on reading techniques, parents felt an increase in their self-confidence when supporting their children in reading. Furthermore, parents identified an increase in their children's interest in reading (Lacour et al., 2017). Overall, there is the potential for parent workshops on reading techniques to increase parents' positive attitudes toward reading, which in turn may increase students' attitudes toward reading.

On-Task Behavior and Engagement

There are unique affordances that digital technologies have to direct students' behavior and enhance engagement while learning to read (Chai et al., 2015; Ciampa, 2016; Cumming & Draper Rodriguez, 2013; Larabee et al., 2014; Northrop & Killeen, 2013; Roskos et al., 2011). The following terms are the foci of this research.

On-task behavior refers to students' answering questions, listening to instructions, waiting for instructions or explanations, concentrating, attending to tasks, and using learning resources appropriately (Larabee et al., 2014; Skinner, Kindermann, & Furrer, 2009). According to Skinner et al. (2009), on-task behaviors are initial markers of student engagement. *Engagement* generally refers to students' participation in learning tasks using energized, focused, and positive emotions throughout the activities (Skinner et al., 2009). *A high level of engagement* refers to the use of on-task behaviors while also showing nonverbal or verbal behaviors (e.g., smiling at the screen; saying, "Yay! I got another point!") that indicate a sense of enjoyment or positive attitudes toward the reading activity (Ciampa, 2016). This has also been described as a state of being caught or held in the current learning activity; students show enthusiasm, interest, and enjoyment toward learning (Skinner et al., 2009).

Off-task behavior refers to the absence of engagement or persistence; students are disengaged (Skinner et al., 2009). Off-task students may be playing with learning resources, talking about unrelated topics, lacking effort, acting passive, giving up, or fidgeting (Larabee et al., 2014; Skinner et al., 2009). *A low level of engagement* refers to the use of off-task behaviors while also showing nonverbal or verbal behaviors (e.g., no facial expression; saying, "When can I switch activities?") that point to a sense of dislike, boredom, or frustration toward the reading activity (Ciampa, 2016). Low levels of engagement also include disaffected emotions, which include "enervated emotions (tired, sad, bored), alienated emotion (frustration, anger), and pressured participation" (anxiety; Skinner et al., 2009, p. 496). These disaffected emotions will be used as key markers when identifying low levels of engagement.

When considering on-task behavior and engagement, some researchers contend that the level of focus increases while learning through digital devices (Chai et al., 2015; Northrop & Killeen, 2013). Getting and Swainey (2012) noted a 15%–20% average increase in on-task behavior when their first-grade reading groups used tablets throughout two consecutive years. In a study conducted by Larabee et al. (2014), three students were observed while working on tablets; their percentage of on-task behavior increased while working on the tablet compared to working with standard materials. Although students showed varying levels of increased engagement, Larabee et al.'s study suggests that tablets may have the potential to support overall sustained levels of task engagement. However,

it is important to not assume that learning is always happening even when students are working on digital devices. Northrop and Killeen (2013) note that one kindergarten student who worked well and seemed on-task while independently learning on a tablet was racing through the app, clicking to select the right answer, and not paying attention to the actual reading task. With regard to engagement, other researchers have noted that digital devices can lead to a level of frustration and boredom if the app is not challenging or at the right level of difficulty (Neumann & Neumann, 2014).

Present Study

Taking into account the affordances in touchscreen devices, tablets have the potential to support young children with early reading difficulties because interventions can be differentiated. Our current study attempted to determine whether an early intervention reading program (focusing on phonemic awareness, phonics, and word recognition and decoding) can enhance students' on-task behavior and engagement by blending the use of multimodal tablet apps and print-based materials.

The research also investigated whether students' parents/guardians garner new knowledge about the potential of using multimodal applications for the integration of tablets at home to further engage children in emergent literacy activities. Accordingly, the following research questions were the focus for the study:

1. How do struggling emergent readers (4–6 years old) engage when using early literacy skill apps on tablets as compared to learning early literacy skills during traditional activities in an early intervention program?
2. What do parents/guardians who participate in a workshop learn about the potential of using multimodal applications to support their (4- to 6-year old) children's literacy learning, and what are their perceptions of their children's reading and technology use?

Program Description

The emergent literacy intervention program targeted students 4–6 years old who struggled with early reading difficulties. Based on a screening process conducted by the Learning Disabilities Association of Niagara Region (LDANR), these students were demonstrating reading acquisition delays. Many of them also lacked integral literacy background experiences to support their language development (Morrow, 2015). The LDANR recruited the students and their families for the 8-week program (either in the winter or spring). The LDANR also provided parents/guardians with resources and workshops on early literacy skills with technology. Sessions for both the students and their parents were run out of the LDANR's community sites (two elementary schools) at no cost to the families.

Students received one-on-one instruction in early literacy skills twice a week from trained LDANR tutors who had experience working with students with literacy needs, and their training included delivery of a common early literacy curriculum (focused on phonemic awareness, phonics, and word recognition and decoding). Fidelity of training and program implementation was verified by observations made by the second author documenting the tutors' adherence to the program's curriculum.

The reading activities followed a blended learning instructional approach where students received instruction with the tablet (once per week for 10 minutes) and without the tablet. Students ranged in their reading abilities, and the tutors ensured that all activities

were differentiated based on students' individual learning needs. Tutors also proactively redirected students with attentional needs to the immediate activity requirements. To keep the activities consistent, the instructor chose learning games or tablet apps that could be easily modified. Specifically, each week students worked on similar skills (e.g., sight words), but these skills were practiced at different difficulty levels based on each child's abilities. The first week of instruction consisted of preassessments conducted to provide the tutor with a starting point for providing explicit instruction; the final session was a postassessment (for reporting to parents/guardians). Table 1 provides an overview of the curriculum for weeks two to six of the program (both iterations) describing the instructional activities with the students.

Table 1
Summary of Student Activities by Week for Both Sessions

Week 2 **With tablet** February/March *ABC Ninja or Sight Word Ninja Apps*	ABC Ninja and Sight Word Ninja are learning games that resemble the popular game Fruit Ninja. Students swipe the letter or word called out to them as though they are a ninja. There are different difficulty settings to narrow in on certain letters names, letter sounds, letter names and sounds, or words.
April/May *ABC Genius and Doodle Buddy Apps*	Students worked on the app ABC Genius through an interactive lesson targeting specific letters. ABC Genius has a lesson for every letter to practice the letter name, sound, and formation (tracing). Some students used Doodle Buddy, which is a digital white board app. Students freehand wrote the upper- or lowercase version of the target letters or words for that day.
Week 3 **Without tablet** February/March *Hidden Letters and Words*	Students completed an activity called Hidden Letters and Words. Students wrote letters or words in little boxes with white crayon. They then colored in the box with a maker, which made their letter or word appear "magically."
April/May *Rainbow Writing*	Students completed an activity called Rainbow Writing. The activity required students to print either letters or sight words in one color of crayon and then trace over that letter or sight word in three or four more colors.
Week 4 **With tablet** February/March *Little Writer App*	Students began tracing letters or words with the Little Writer app, which provided pictures to guide students with the direction of their tracing. It also helped to scaffold students by prompting them with a sound if they went outside the lines.
Apr./May *Phonics Island or Sight Word Games Apps*	In Phonics Island, students traced letters, listened to sounds, and matched sounds to pictures. In the Sight Word Games app, students chose to play two or three games from the five games in the app (e.g., memory, bingo, spelling). It could also be set to focus on one list of sight words or choose from multiple lists of sight words.

Table 1 Continued

Week 5 **Without tablet** February/March *ABC or Sight Word Flashcard Game (PIG)*	Students played PIG, where they rolled dice and selected the number of letters or sight words as seen on the dice. They had to read the word or name/sound of the letter. Once they read the word/letter, they were able to keep it in their pile. If a student picked up a stop sign, they had to stop and put down any words they had not already read. If a student picked up a pig, they had to put the whole pile back.
April/May *Hidden Letters or Words Printing*	See Week 3 February/March session to describe Week 5 April/May.
Week 6 **With tablet** February/March *Phonics Island or Sight Word Games Apps*	See Week 4 April/May session to describe Week 6 February/March.
Apr./May *ABC or Sight Word Games Apps*	See Week 2 February/March session to describe Week 6 April/May.

One parent workshop was offered during each of the winter (February/March) and spring (April/May) sessions and run based on voluntary participation. During the parent workshops, the first author discussed current research on tablets in education and reading engagement. The aim of these parent workshops was to provide parents with an understanding of different apps and explicit instruction on how to use them while working with tablets. Parents were encouraged to use the apps and continue using tablets for learning at home after the reading intervention program ended. The first author had access to 20 rented tablets and let parents explore the variety of apps used in the intervention program. Strategies for differentiating the settings within different apps were discussed, and strategies for scaffolding their child while learning to read on the tablet were provided. Discussions on how to find apps in the app store based on quality developers were explicitly covered. Lastly, modeled demonstrations and an open question/answer session consolidated parents' learning.

Research Design

This mixed methods research design documented the findings from two iterations of the intervention program and reported on the findings from the qualitative and quantitative data collected. For the qualitative portion, case study is used as an exploration of a bounded system including multiple participants within the same study (Stake, 2006; Yin, 2013). This case study was an inquiry into the educational activities (for both students and parents) that were offered as a function of a program (Merriam, 2001). Specifically, the purpose of the case study was evaluative, or to analyze whether the use of digital technology (i.e., apps on tablets) contributes to students' level of engagement while learning prerequisite emergent literacy skills. The research also investigated whether parents/guardians garnered new knowledge about the potential of using multimodal applications to support their children's literacy learning.

Participants

The participants were identified through purposeful sampling given that they were recipients of the program. To be eligible for the LDANR's reading programs, a child needed to demonstrate reading challenges due to a diagnosed or suspected reading disability. The LDANR did not require a formal diagnosis to access the programs, but it did look for early indicators of a learning disability and followed an application screening process to help guide decisions regarding children's eligibility, including the age of the child, their strengths/weaknesses, any therapy (e.g., speech therapy) they had participated in, and any diagnosis that the child had. Additional to the intake form, supporting documents such as the child's most recent report card/progress report, any assessments (if applicable), and their Individual Education Plan (if applicable) were collected. The program also requested a teacher feedback form be filled out by the child's teacher.

All student participants were 4–6 years old and in either junior or senior kindergarten or Grade 1. Based on their age, not all participants were formally identified with a learning disability; however, parents indicated other learning difficulties such as difficulty with letter names, letter sounds, speech, reading, staying focused, printing, memory retention. social skills, and self-esteem. For the winter offering of the program, there were 18 students, five of whom had formal identifications: attention deficit hyperactivity disorder (ADHD; n = 3), ADHD/oppositional defiant disorder (ODD; n = 1), obsessive compulsive disorder (OCD; n = 1). For the spring offering of the program, there were 19 students, four of whom were repeating the program. One student who repeated the program was formally diagnosed with ADHD. A number of students struggled with speech, and one student with a stutter.

Parents of all student participants were provided with feedback on their child's progress and an invitation to participate in the workshop designed to provide ideas to support home-based literacy activities. The parent participants were parents who chose to attend the workshops and completed the questionnaire at the end of the workshop. There were 11 parents during the winter session and 10 parents during the spring session. The tutors in the program were Ontario Certified Teachers or preservice teachers who received training by the LDANR on learning disabilities, emergent literacy, and reading intervention.

Data Collection and Analyses

Our role as researchers was to collect, analyze, and report on the evaluation of the program to a local government funding agent (not associated with the LDNAR). The first author has long-standing experience with the LDNAR as a former tutor and program supervisor; she was present at the majority of the data collection points. The second author was at arm's length to the program; she is an educational researcher at the local university. Neither of us were remunerated to evaluate and report on the program.

Observational data were collected to document the nature of on-task behavior and engagement during students' learning both with and without tablets. We made open-ended observations for 10 (1-minute) intervals during 10 of the 16 sessions that each of the students attended. Our open-ended observation notes were referenced to provide detail on the students' behavior and engagement.

While making open-ended observation notes, we also used an observation checklist to code students' on-task behavior using 1-minute intervals within the 10-minute observation session. This procedure was adopted and revised from Ciampa (2016) and Larabee et al. (2014). For each minute, we would determine whether the majority of the 1-minute time interval (i.e., greater than 40 seconds) was spent on-task. If so, that 1-minute

interval was recorded as on-task. If the student spent most of the 1-minute interval off task, this behavior was subcategorized as either off-task motor, off-task verbal, or off-task passive. We used common definitions (Larabee et al., 2014; Skinner et al., 2009) for on-task and off-task behaviors. At the end of the 10-minute session, on-task behavior and engagement was further coded holistically using a 5-point Likert scale (1 = *never*, 2 = *rarely*, 3 = *sometimes*, 4 = *usually*, 5 = *always*); in this manner, the child's on-task behavior was rated for each of the 1-minute intervals. After all sessions were finished, we compared our open-ended observation notes and coded intervals on the observation checklists for each of the sessions. Interobserver agreement was calculated at 82% using an event-based algorithm (Cooper, Heron, & Heward, 2007) analyzing data from a subsample of two of the student participants.

At the end of the program, participating students (winter session n = 18, spring session n = 19) were given a questionnaire that was orally administered by one of us. The questionnaire was adapted from previous inventories (Ciampa, 2016; Gambrell, Palmer, Codling, & Mazzoni, 1996; Guthrie, McGough, & Wigfield, 1994) to ensure it was developmentally appropriate for the current age group (survey available on request). The questionnaire asked students to evaluate their skills and enjoyment as a reader both with and without technology. There were also questions asking students to comment on their experience in the program both with and without technology. This questionnaire took approximately 10 minutes to administer and was done one-on-one in a quiet location.

At the end of the program, each of the parents/guardians who participated in the workshops was surveyed to evaluate their learning during the workshop and about supporting their children with multimodal applications (survey available on request). This survey provided insight into their perceptions of their child's reading and use of technology in the home environment. This questionnaire took approximately 10 minutes to administer.

Both the students' and parents' 21-question surveys had open-ended and Likert scale questions. The adapted versions of the student and parent surveys were validated by the director of the LDANR and selected tutors from the LDNAR. Data were analyzed with SPSS 22.0 to determine whether students' beliefs and attitudes were aligned with their behaviors while working on tablets and whether parents' interaction with their child were correlated with reading on/off the tablet. Open-ended questions were nominally coded, and nonparametric statistics were run (i.e., Chi-Square Test for Association). Likert scale data were taken as ordinal data, and nonparametric correlations were run (i.e., Spearman's Rank Order Correlation).

Research Results

Following are the results based on aggregated analyses of the open-ended observations, observation checklists, student questionnaire, and parent questionnaire.

Open-Ended Observations

Table 2 presents a summary of the open-ended observations for each week for both the winter and spring sessions.

Table 2
Summary of the Student Observations by Week for both Sessions

Week 2 **With tablet** February/March *ABC or Sight Word Ninja Game Apps*	**Time on-task during reading activities** • Constant eye contact • Distracted with the touch interaction • No fidgeting outside of the tablet • Some students realized if they just keep swiping, they would eventually get the right answer (overemphasis on game)
April/May *ABC Genius and Doodle Buddy Apps*	**Engagement during reading activities** • Initial excitement to use tablet before starting activity • Enjoyed the ability to "slash" letters or words • Excitement toward reward systems (earning stars) and getting the correct answer to questions • A faster speed setting in the game led to more excitement • Repetition of games led to boredom
Week 3 **Without tablet** February/March *Hidden Letters and Words*	**Time on-task during reading activities** • Some fidgeting • Color selection of marker took longer than expected • Taking initiative to keep writing without prompting • Some verbal discussion was off topic
April/May *Rainbow Writing*	**Engagement during reading activities** • Excitement when letters appeared and when choosing colours • Smiles and verbal expressions (e.g., "wow," "cool") • Some students did not show much excitement • Many students expressed a desire to be on the tablet
Week 4 **With tablet** February/March *Letter Tracing and Free-Hand Printing Apps*	**Time on-task during reading activities** • Little Writer tracing app was easy for most children, which led to verbal statements about easiness • The freehand writing app led to off-task doodling and rushing • Some students needed prompting to stay on-task • Used audio repeat button to understand instructions better

Table 2 Continued

Apr./May *Phonics Island or Sight Word Game Apps*	**Engagement during reading activities** • Many students showed initial excitement toward the tablet • Students found the pictures used to help with tracing funny • Enjoyment toward picking out a digital color to print with • Students verbally expressed enjoyment of the literacy games (e.g., "I did it!"; laughing) • Students liked the reward systems built into the apps (e.g., digital stickers after each level was completed) • Some students responded well to the app's positive feedback and enjoyed "upping" the level and challenge of the game
Week 5 **Without tablet** February/March *ABC or Sight Word Flashcard Game (PIG)*	**Time on-task during reading activities** • Some students connected words to their word wall at school • A lot of distraction with the dice • Some students asked about working on the tablet • Distracted by looking at flashcards too soon • Distracted with markers or fidgeting with them
April/May *Hidden Letters or Words Printing*	**Engagement during reading activities** • Some students expressed a desire to work on the tablet • Showed excitement toward the game • Enjoyed the anticipation of potentially getting the PIG for themselves or the instructor • With the Hidden Letters and Words activity, some students enjoyed picking out the marker color • Verbal excitement toward watching the letter or word appear

Table 2 Continued

Week 6 **With tablet** February/March *Phonics Island or Sight Word Game Apps*	**Time on-task during reading activities** • Took their time answering questions and focusing • Used the speaker repeat button to relisten to letter sounds or words and answer correctly • Some students made connections to their word wall at school • Pictures promoted some off-task talking • Many students were focused intently on the activity • Some students started guessing to get the correct answer • Some students seemed bored with the repetition
April/May *ABC or Sight Word Ninja Game Apps*	**Engagement during reading activities** • Excitement toward the reward systems (e.g., points, earning stickers, learning on the tablet) • Excitement about number of game options to choose from • The game apps led to verbal and nonverbal excitement and enjoyment of the activities • Some students were worried or nervous about answering questions incorrectly • Intrigued by tactile swiping function to "slash" letters

In summary, any off-task behavior while on the tablet seemed to be related to the multiple features embedded in tablets, specifically the features in the app more so than the settings. Many students were distracted with different tactile motions that created a certain visual and audio response (e.g., slashing to cut a letter in half). Working off the tablet, students displayed more distracted behaviors like fidgeting, off-task talking, or even languishing while picking out marker or crayon colors. Some students spent excessive amounts of time on creative aspects of the task (e.g., coloring over the white crayon to make the letter or word show up) instead of on the literacy learning task (e.g., printing the letter or word; repeating the letter name, letter sound, or sight word). This off-task behavior may be attributed to students' switching their attention from the reading activity sheet to the manipulatives on the table. Completing activities on the tablet elicited immediate levels of engagement from the initial excitement of getting to use and manipulate a tablet. Students were engaged by the ability to immediately speed

up the game or change to a different game. Without the tablet, students were engaged by flashcard games just as much as app games.

Observation Checklists

Results from both of the winter and spring sessions (combined) are presented in percentages of total observed time intervals. (Note: For these descriptive statistics, it is not appropriate to calculate parametric statistics.) We observed students "actively engaged in task" behavior with the tablet 95% of the time compared to 90% of the time without the tablet. This includes the number of instances or 1-minute segments that students were either actively engaged or presenting off-task verbal, motor, or passive behavior. The results indicate that the majority of students spent more time (overall) exhibiting actively engaged on-task behaviors compared to off-task behaviors.

A score for "time on-task while completing reading activities" was calculated at the end of each 10-minute session. This score was based on our summary of the observation notes and the tracking of 1-minute intervals. These results indicate that students spent more time on-task during reading activities with the tablet (89%) compared to reading activities without the tablet (83%).

A score for "level of engagement while completing reading activities" was also computed at the end of each 10-minute session. This score was based on our interpretation of the observation notes and, in some cases, tracking the 1-minute intervals for level of engagement. These results suggest that students had a higher level of engagement while completing reading activities without the tablet (75%) compared to completing reading activities with the tablet (66%).

Student Questionnaire

At the end of the program, students were orally surveyed about their perceptions of themselves as readers, their learning, and their experience in the program both with and without technology. These data are reported as trends: Students tended to enjoy reading picture books, comic books, and electronic books and dislike reading newspapers and magazines. Many of the children had some form of technology at home (e.g., tablet, computer) and used it for playing games and viewing videos almost every day. At school, students most often used computers almost every day.

Analyses of the Likert scale data produced one strong positive (statistically significant) correlation between how much students enjoyed spending their free time reading and how much they appreciated choosing the kinds of stories to read, $r_s(26) = .961$, $p = .01$. Finally, students appreciated choosing the kind of story they read and getting feedback on how well they were reading.

Statistically significant associations existed for the majority of the students (64%) after attending the program; specifically, they held perceptions of themselves as "OK" or "good" readers. Most of these students (71%) expressed that knowing how to read well is "very important" to them. Students (78%) who stated that they read for fun "some days" also took books out of the library "sometimes." The majority of students (60%) preferred the tablet (instead of paper) for doing activities and being read to by the tablet (as opposed to by an adult), but it should be noted that this latter result was not a statistically significant majority based on the Chi-Square Tests for Association.

Parent Questionnaire

After the workshops, parents/guardians were surveyed about their learning as

well as their child's reading behaviors both with and without technology. With respect to the workshop, there was a strong positive (statistically significant) correlation ($r_s(16) = .542$, $p = .02$) between how much parents/guardians "learned about using technology to help the child's reading skills" and "how useful the workshop was to help them support their child." There was a tendency for parents/guardians to note that they found learning how to individualize app features for their child was most helpful and that their child enjoyed game-type learning apps; again, it should be noted that this latter result was not a statistically significant majority based on the Chi-Square Tests for Association. Overall, parents appreciated that during the workshops there was time to try out the apps and discuss the various features.

These parents/guardians described their children's reading skills as "weak" and expressed that their children tend to read for pleasure only "some days." All parents/guardians stated that their children used technology at home, most often citing that they used tablets to play games on occasion. Prior to participating in the study, many children had experience with mobile devices with various (noneducational) apps and games, and more than half of them were now reading/playing more on a mobile device since they started the program. For both of these findings, it should be noted that they were not statistically significant results based on the Chi-Square Tests for Association.

There was a strong positive (statistically significant) correlation between how much parents/guardians perceived that their child enjoyed reading/learning on a tablet and how much they enjoyed parent interaction ($r_s(18) = .575$, $p = .01$). Similarly, there was a strong positive (statistically significant) correlation between how much parents/guardians perceived that their child enjoyed spending free time reading/learning (without a tablet) and how much they enjoyed parent interaction ($r_s(18) = .483$, $p = .04$).

Discussion

The findings elucidate students' verbal and nonverbal expressions of excitement and engagement for both on- and off-tablet activities. Off the tablet, students were engaged through a natural progression of activities, but they did not show excitement toward the actual practice of learning in general. Students were engaged but did not visibly demonstrate this effect. Visible engagement tended to come after a few minutes into the task, when something interesting or funny happened; this is typical behavior for 4- to 6-year-olds. Completing activities on the tablet elicited immediate levels of engagement from the initial excitement of getting to use and manipulate a tablet. This is consistent with other research pointing to the initial reaction and fascination that immediately engages students with digital devices and is shaped by children's developmental level and prior knowledge of a tablet's interface (Michael Cohen Group & U.S. Department of Education [USDOE], 2011). Larabee et al.'s (2014) study also found that reading activities on the tablet led to a more sustained level of task engagement over time. Some researchers consider this a period of novelty with the tablet when the app is initially introduced, and then eventually engagement wears off with the repetition of tasks (Cumming & Draper-Rodriguez, 2013).

Students' level of excitement and engagement continued to increase through the many reward systems in tablet apps (e.g., digital stickers, stars, points). The apps also provided the opportunity to "up" the game and introduce more learning challenges. Students showed excitement toward the ability to immediately speed up a game or change to a different game. These results are consistent with Neumann and Neumann's (2014) finding that effective apps should provide a developmentally appropriate challenge. In

addition, the Michael Cohen Group and USDOE (2011) found that children preferred gaming apps that were easy to learn and compelling to master. The game elements in tablet games further allow for immediate feedback, clues, error correction, and reward systems to enhance sustained attention and on-task behavior (Flower, 2014). Without the tablet, students enjoyed the fast-paced flashcard games just as much as tablet app games. Overall, the app games and flashcard games provided developmentally appropriate challenges that seemed to foster a personal-best competition in some students.

Students in this study were for the most part focused inside of the app while working. However, the repetition of certain tablet games led to boredom even when there were reward systems built in. Neumann and Neumann's (2014) research found that children who were positive toward the tablet might also experience boredom. It was observed that some students seemed to get bored if the app was not challenging enough, and when the tutors altered the level or switched students to a more challenging app, students responded positively. The Michael Cohen Group and USDOE (2011) noted that the risk of boredom (or frustration) is high unless the game provides a sustained level of challenge throughout reading tasks.

It was also observed that some apps (e.g., letter tracing apps) did not provide students with much creative freedom. This is not surprising given that they were classified as content learning apps, which are limited to providing students with reinforcement, rehearsal, practice, and assessment of curricular content (Domingo & Garganté, 2016). This type of technology is also described as a substitution tool according to the substitution, augmentation, modification and redefinition (SAMR) model where there is no functional change in the learning process (Puentedura, 2014). When completing reading activities without the tablet, students' on-task behavior and engagement were bolstered by a high level of choice and creative freedom. Although off-tablet tasks predominantly led to more distracted behaviors such as fidgeting or off-task talking, these sessions without the tablet were spent doing self-determined, creative tasks. Conversely, a limited number of apps allowed students to draw or build in order to demonstrate their knowledge. Research has shown that providing more creative environments may lead to a greater sense of appeal among students due to their no-fail environments and range of possible outcomes (Neumann & Neumann, 2014). This finding could support the notion that reading intervention needs to be multisensory (Johnston, 2019) and therefore should have a balance between hands-on and mobile technology learning.

The results of the student survey highlight how these early learners perceived themselves as literate and technologically engaged. Most notable is the self-determination that these students expressed for choosing their own reading material and the enjoyment derived from reading when they were permitted to do so. This is in keeping with social cognitive theoretical constructs (Bandura, 1986) that learning occurs when there is an interaction among the students' cognitive, behavioral, and environmental factors. In accordance with social cognitive theory, struggling early literacy learners were actively engaging, processing information, and developing a sense of positive self-efficacy for reading. Based on the survey results, students were most interested in texts with illustrations and multimodal features. These young learners had experience with technology both at home and at school, but the predominant devices and activities in these contexts differed: tablets at home for games and computers at school for learning. When given options, 60% of the participants had a preference for both reading and doing activities on a tablet rather than traditional, paper-based formats. Considering

the developmental level of these children, this preference could be based on initial fascination with the device or on their prior knowledge and experience using devices in the home environment (Michael Cohen Group & USDOE, 2011). Ciampa (2016) found that students were interested in digital devices because of the interactive multimodal features (e.g., audio, animations, touch interaction). Other research points to students' enjoyment of tablet use stemming from immediate feedback to determine accuracy (Flower, 2014).

After completing the program, students had fairly positive self-efficacy with respect to themselves as readers and a heightened sense of awareness of how important it is to read well. With the differentiated features in tablets, intuitive interface, and immediate positive feedback to scaffold, students may experience more success and positive reinforcement through digital devices (Flower, 2014; Neumann & Neumann, 2014). This may contribute to their self-efficacy towards reading.

Parents and guardians participated in a workshop that provided them with ideas on how to support their child's literacy learning at home with technology. Based on their survey responses, they learned about how technology can scaffold, differentiate, and extend their child's literacy learning. Parents were encouraged to continue to employ similar strategies at home that were used in the reading intervention program. Parents recognize the currency in game-type learning apps to engage their child. Lacour et al. (2017) found a positive attitude among parents toward instructional assistance on emergent literacy instruction at home. In the current study, the use of tablets was received positively by parents and deemed useful to support their children's reading development.

Parents still had concerns about their child's reading skills development. However, most children were reading/playing more on mobile devices at home than when they began the program. Parents came to appreciate that tablets have the potential to enhance their child's emergent literacy skills. At the end of the program, it was most encouraging to document that these parents/guardians were involved and spending time with their children and this interaction positively impacted the child's enjoyment of reading during free time and on the tablet. Furthermore, Neumann's (2014) study found that caregivers derived benefits when they were regularly involved in their child's use of tablets.

Limitations and Future Research

The primary limitation to this study is the lack of measurement of the impact of the intervention on student participants' literacy learning. Simply, the pre- and post-assessments were conducted to provide tutors with a starting point for providing explicit instruction and reporting for the parents/guardians. Future implementations should employ quantifiable measures of achievement.

We offer caution with respect to drawing conclusions related to the fact that observed on-task behavior could suggest a level of engagement for students. Because students scored higher for on-task behavior while working on the tablet, their level of focus and attention while working on the tablet app may have influenced their level of engagement. Some of the tablet tasks resulted in a few observations of verbally expressed excitement, which may have led the researchers to perceive students' level of engagement as high. However, less verbal expression could also be a function of less interaction between the instructor and the students. When playing a game off the tablet, students were engaged with the tutors and had an opportunity to express their enjoyment through

face-to-face interaction. More research is needed to conclusively state how a level of on-task behavior is related to level of engagement.

Overall, education has been slow to adopt new technologies for students struggling with emergent literacy. However, mobile devices are being integrated more often into educational settings, including intervention programs (Cumming & Draper Rodriguez, 2013). A caution is warranted as many educational settings are quick to integrate mobile devices into their programming without understanding the educational benefits and drawbacks. Moreover, the utility to engage children and their parents in literacy-related activities on mobile devices is also an area that warrants additional investigation. The current research set out to study the potential that tablet apps might have to enhance on-task behavior and engagement in an early intervention reading program. Results overall suggest that tablets lead to increased levels of on-task behavior in young learners 4–6 years old. However, more research is needed to understand how this on-task behavior and the accompanying intensity of focus could influence students' level of engagement and positively contribute to their continued literacy growth.

Implications for Practice

Any off-task behavior that occurred when on the tablet could be attributed to the multiple features embedded in tablets. It was important for the tutors to preset the tablets ahead of time to ensure an appropriate level of challenge for the tablet task and to reduce the number of features available that overstimulated students. The tablet allowed for more proactive measures to be taken to enhance students' focus (e.g., setting a time limit in the app, setting the app to only focus on certain letters or words, turning off the background music). This finding is consistent with Northrop and Killeen's (2013) research where caution is stressed when integrating certain apps in educational settings. Baird and Henninger (2011) further convey the importance of guidelines for designers and developers so that they have a stronger sense of educational context and meaningful features. This study suggests that it is important for educators to familiarize themselves with apps in order to understand their limitations and identify which features they would like to deploy and which features they would like to disable (Northrop & Killeen, 2013).

Some off-task behaviors in this study had more to do with the operational features in the app than the settings. Many students were distracted with different tactile motions that created a certain visual and audio response (i.e., slashing to cut a letter in half). Many of the gaming apps also posed a problem with excessive tapping to get the right answer. This is consistent with observations made by Northrop and Killeen (2013) where at times a user might have seemed to be working independently, but was actually racing through the app, not paying attention to the reading content, and clicking to try to get the right answer. Interestingly, this contradicts a point made by Larabee et al. (2014) that tablets keep users directly focused on the device and what is being displayed rather than using extraneous materials such as writing tools or even a touchpad. This underscores an important point with respect to the development of emergent literacy skills using tablets and apps. Educators need to take a close look at the app operations instead of just the settings and be aware of the potential inherent distractions associated with tablet and app usage.

The findings of this study also point to a need for students struggling with emergent literacy to have guided practice prior to tablet use. It is crucial that educators

consider the presetting of app content and the level of challenge before providing guided practice for their students. While on the tablet, educators should be available for prompting as necessary to scaffold learning and gear students toward on-task behaviors. This is consistent with Northrop and Killeen's (2013) study that suggests the importance of checking to make sure a student understands how to use the app and the emergent literacy activity before the student starts the activity. Other researchers also emphasize the importance of providing explicit instruction, modeling, close monitoring, and guided practice before students learn with digital devices (Ciampa, 2012; Roskos, 2011). By receiving explicit instruction beforehand, students may be able to focus on the emergent literacy task and not be as distracted with game or off-task activities. Finally, consistent with Northrop and Killeen's guidelines, educators should evaluate the limitations of each app, its features, incorrect information, and developmentally inappropriate content.

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