

## Chapter 6

# Toys or Tools? Educators' Use of Tablet Applications to Empower Young Students Through Open- Ended Literacy Learning

**Monica McGlynn-Stewart**  
*George Brown College, Canada*

**Lisa Hobman**  
*George Brown College, Canada*

**Tiffany MacKay**  
*Peel District School Board, Canada*

**Nicola Maguire**  
*George Brown College, Canada*

**Brooke Gouweleeuw**  
*George Brown College, Canada*

**Emma Mogyorodi**  
*George Brown College, Canada*

**Vicki Ni**  
*George Brown College, Canada*

### ABSTRACT

*This research study examined 27 educators' experiences and comfort levels using open-ended tablet applications to support young children's oral and visual literacy learning. The open-ended applications used positioned students as the producers and creators of the literacy content. While the educators did experience some structural, technological, and pedagogical challenges using the applications, they reported many teaching and learning benefits. They found that using the applications empowered them with additional tools to support children in creating, documenting, and reflecting on their learning. Students were also empowered through being able to represent and archive their experiences in multiple modes and in their own voice. Through viewing the slideshows, parents were able to share in their children's school lives.*

DOI: 10.4018/978-1-5225-2122-8.ch006

*Toys or Tools?***INTRODUCTION**

This chapter will report on a research study that is examining teachers' experiences using an open-ended tablet application to support young children's early literacy skills (aged 3-6 years). The findings reported here reflect the first year of the study's implementation during the 2015-2016 school year. The study is expected to take place over 3 years.

Early findings indicate that all children can experience an increased level of empowerment through the use of mobile digital technologies. This sense of empowerment applies to a wide range of children including those with special learning needs, English Language Learners, and those who come from economically disadvantaged backgrounds. Benefits were also noted for young children's early literacy learning outcomes as they became the creators and producers of knowledge in multimodal ways. This chapter will report on three case studies to highlight examples of empowerment that arose through the development of literacy knowledge, skills, and dispositions while children employed an open-ended tablet application.

While the kindergarten educators came to believe that the mobile technology employed in the study was empowering for their students, they identified several challenges early in its implementation. This chapter will outline these challenges, but also the strategies that enabled the teachers to manage these hurdles. These strategies and the observed benefits of the mobile technology for young children's early literacy development will support recommendations for classroom practice and future research.

**BACKGROUND****Digital Technology for Early Literacy Learning**

While literacy remains the cornerstone of learning (Allington, 2013; Beers, 2003; Booth, 2009; Fisher & Fry, 2012), our literacy practices are undergoing dramatic changes as an array of emerging digital tools extend the boundaries of learning and communication (Kress, 2010). Young children, aged 3-6 years, are exposed to many forms of emerging digital technologies, both inside formal learning settings and elsewhere, yet there are few studies that offer insight into how we might best prepare young children to thrive in an increasingly interconnected knowledge-based society. Educators are being asked to teach literacy in ways they did not experience as students, and most likely did not learn about in teacher education programs (Darling-Hammond, 2006a, 2006b; Kirkwood, 2009). The increasing complexity in how we communicate as a global society means that we need highly skilled teach-

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ers who have a broad definition of literacy, can incorporate digital technologies (DT) into their learning programs, and recognize that literacy is rapidly evolving. Contemporary literacy increasingly requires interacting with digital texts, but insufficient research exists to guide the pedagogical practices of educators seeking to productively incorporate digital technologies into early literacy teaching.

There is no shortage of research demonstrating the countless ways that students, starting at a young age, are engaging with digital media in out-of-school contexts. It is well known that students are actively engaging with YouTube, video games, wikis, blogs, Facebook, and Twitter; the list is extensive and ever-growing (Alvermann, Marshall, McLean, Huddleston, Joaquin & Bishop, 2012; Burke, 2013; Clement, 2010). While some of these out-of-school practices loosely reflect those literacies that have been traditionally privileged in school (e.g., using the Internet as a source of information), other interactions go well beyond traditional literacy practices. Educators must balance the importance of recognizing the skills that students have developed outside the walls of school with the need to draw students into the curriculum and to prepare them for participating in a globalized knowledge society (Wimmer et al., 2012). Certainly when they are used intentionally, new digital literacies can help educators to teach students to question, construct, and develop the skills needed for active global citizenship (Wimmer et al., 2012).

Classroom teachers, who are key to preparing pupils for a digitally complex world, are working to integrate DT into their classroom pedagogy guided by their self-efficacy and attitudes towards technology (Ertmer, Ottenbreit-Lefwich, Sadik, Sendurur, & Sendurur, 2012). However, they are often puzzled about how to balance traditional teaching with new forms of practice (Alvermann & Hinchman, 2012). Educators are unsure how to use DT as a tool for learning (Davies & Merchant, 2009; Selwyn, 2011). The educational community must carefully reflect on traditional instruction techniques and decide how to best incorporate new digital approaches (Radesky, Schumacher, & Zuckerman, 2015; Wimmer, Skramstad, & Khan, 2012).

There are many voices urging caution when using DT with young children but also championing the potential of DT for children's learning. The National Association for the Education of Young Children (NAEYC) warned in 2012, "The appeal of technology can lead to inappropriate uses in early childhood settings" (p. 4). However, at the same time, the NAEYC also asserted, "When used appropriately, technology and media can enhance children's cognitive and social abilities" (p. 7). Pediatricians Radesky, Schumacher, and Zuckerman (2015) express the concern that time spent on digital mobile devices, such as tablets, can displace "human interactions and other enriching activities" (p. 3) in the lives of young children. They also note that interactive media "have great potential to promote learning through joint engagement between caregivers and children" (p. 4). After reviewing the literature on digital technology and young children, and surveying educators from around the

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world, Ernest, Causey, Newton, Sharkins, Summerlin, and Albaiz (2014) concluded there is a multiplicity of views on the value of DT for young children, rendering it important for educators to be knowledgeable about potential benefits and concerns and to advocate for appropriate use in early learning settings.

## **STUDY DESCRIPTION**

### **Methods, Techniques, or Modes of Inquiry**

The phase of the study reported on in this chapter followed 27 educators in 14 full day kindergarten classrooms over the course of the 2015-2016 school year. Approximately 350 children between the ages of 3 years 8 months and 6 years 6 months participated. The full day kindergarten program studied is a publicly funded two-year program (children begin in the year they turn 4 years old and stay for 2 years) that operates within the public school system. The tablet computers used in this study are iPad Air and iPad Air 2 tablets, and the application is called 30hands Pro, which is commercially available. Each classroom was given three iPads with protective covers.

There were four primary sources of data that were collected over the course of the school year: individual educator interviews, research team observations, focus group discussions and artifacts, and children's slideshows created within the app. To begin, the educators, a combination of early childhood educators and kindergarten teachers, were interviewed individually early in the school year. This interview focused on the educators' prior experiences using digital technology and ways in which they were currently integrating digital technologies into their classroom programs.

The research team observed in the classrooms and provided pedagogical and technological support to both the classroom educators and the children for the duration of the study through weekly or bi-weekly classroom visits. On-going e-mail communication between the educators and the research team was also a continuing practice. During classroom visits, the research team strove to respond to the emerging needs of that particular classroom both in terms of the educators' and the children's learning needs. For example, sometimes the classroom educator would request a quick explanation of how to use a feature of the app (e.g., How do I add an auditory recording to this pictures?), and the research team would help to resolve the educator's inquiry. While at other times, a research team member would work one-on-one or with small groups of children to support their learning and use of the app.

Frequently, support for the teachers and students was provided in a single visit. Often these visits took place during open-exploration time, either inside the classroom or outdoors, so the children were engaged in a variety of different learning

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activities rather than whole group lessons or specific assignments. This allowed the children to create slideshows based on their personal interests and learning activities on an ongoing basis throughout the school year. As the children were offered the iPad as a choice for communicating their ideas and were not required to use the app as a part of their classroom program, there was a great range in the number of slideshows created by the children based on their interest in interacting with the app.

All of the educators participated in a focus group session once during the school year. During this session they engaged in activities and discussions with their fellow educators and the research team concerning the use of the app in their programs. This allowed the educators to engage in a learning community with other educators who were also exploring how the app might support their students' learning needs. As well, it provided an opportunity for them to collaboratively work through some of the challenges they were experiencing with the app in their programs. Artifacts and photographs were collected by the research team during the focus group sessions. Samples of student digital slideshows were collected by the research team and analyzed on an ongoing basis throughout the year.

The research approach in this study was qualitative, as defined by Merriam (2009) and Punch (2009). It involved a small sample of teachers who were studied in depth; the interview and focus group sessions were largely open-ended, and the themes emerged as the study progressed. The transcripts and observation data were transcribed and read several times to identify themes or "codes" related to the research questions. A table of themes was then developed and matched to participants. This table was then used to develop a structure for the report. The emerging themes were continually modified through "constant comparison" (Glaser, 1992) with the data. This qualitative approach to the study design and analysis allowed the research team to analyze emerging themes in individual case studies, as well as themes that occurred across participants in their various contexts.

## **WHAT HAPPENS WHEN AN OPEN-ENDED TABLET APPLICATION IS INTRODUCED INTO KINDERGARTEN CLASSROOMS?**

The kindergarten classrooms participating in the study serve populations that are highly diverse in terms of the students' cultural and linguistic backgrounds, income levels, and student abilities. Many students were new immigrants and/or low income, and several special needs children were integrated into the classrooms. Many of the children participating in this study do not have access to digital technology at home. The project empowered the children (and teachers) to engage in our technologically focused world, but the open-ended nature of the applications also empowered their

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learning in a much richer, multi-modal way than the traditional paper/pencil tasks at which these children typically fare poorly. The application that was selected allowed students to take photographs and accompany them with oral explanations. Students could further support their oral explanations by drawing on top of their photographs or on blank slides, or adding video clips. The resulting digital slideshows could be shared with classmates, teachers, and parents. Slideshows could also be archived for documentation of student learning and for assessment purposes. The use of open-ended applications positioned students as the producers and creators of the literacy content.

In this study, the educators' perspectives on the teaching and learning impact of the applications were explored as well as the children's digital productions. The purpose of this study was to determine:

- How do educators experience using open-ended tablet applications in their classrooms to support their students' literacy learning?
- What value do open-ended tablet applications hold for helping educators to support young children's literacy development in the areas of visual and oral modes of communication?
- How can the use of mobile digital technology empower students with respect to their literacy learning and growth?

### **Case Studies of DT-Empowered Literacy Learning**

To position our discussion of findings around the research questions, it is important to understand the work the children engaged in as part of their work in these classrooms. For this reason, we offer three case studies exemplifying the work of the children in their literacy classrooms. A wide variety of literacy knowledge, skills, and dispositions were evident in the children's slideshows. For the purpose of this chapter, we will highlight three specific cases which typify the learning that was observed. In the first case, the creator of this slideshow is at an early stage of formal literacy, while the child in second case is at a later stage of formal literacy development. The third case involves a child with special needs.

#### **Dylan**

Early in the study while learning how to use the app with a member of the research team, Dylan (4 years old) created his first slideshow; a 40 second, six-part slideshow. In his work he combined separate drawings of stick figures of his family members, a photo of the sky, and a video clip of the school hallway. He recorded his narration of the story as he reviewed his slides. Over the slides of his stick figures, he narrated,

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“I love my mommy”. “I love my daddy”. “I love my sister”. Over the photo of the sky, he narrated, “I love the sky”. Over the short video of the school hallway he recorded, “I love everything.” On the final slide he drew with his index finger the words “I love” (he was supported by a researcher who provided the conventional spelling of these words). He then repeated, “I love mommy, I love daddy, I love my sister”. He finished the slideshow with, “I love everything”.

Dylan’s teacher was very surprised by the digital slideshow he created during his time with the research team member. She described him as a child who did not like to sit and draw or write. In fact she reported that he had difficulty grasping a marker or pencil. She had not seen him write legible letters before or tell a cohesive story. She also noted that he took more time and persevered with more steps in this digital story that he usually did with classroom tasks. When he had finished his story, he proudly showed it to his fellow students and offered to teach them how to make a slideshow. Sharing his work and demonstrating this type of leadership was not something his teacher had seen in other areas of his learning. Dylan’s digital story illustrated literacy knowledge, skills, and dispositions that had not yet been demonstrated through other classroom activities.

While Dylan’s story had a simple narrative, he displayed knowledge of the storytelling genre, literacy patterns within a simple narrative, the purpose of letters, and knowledge of how to use visuals to tell a story. He also demonstrated several important literacy skills such as planning his story, organizing information, sequencing, letter formation, matching an oral story to pictures, creating a clear message, and making self-to-text connections. In terms of important dispositions for early literacy learners, he asked for help, persevered when faced with challenges, showed a positive attitude, demonstrated a desire to communicate his ideas, and, finally, exhibited a sense of pride in his accomplishments

### **Justin**

Justin’s (4 years old) slideshow consisted of one slide on which he had drawn a complicated spider’s web in different colors, and a spider sitting on the web. While drawing the slide he produced a long and complex explanation of how spiders make their webs and how they capture and eat their prey. Here is an excerpt from the 1 minute, 30 second narration:

The webbing is connected to each part of the tree branch. It is locked into place. Next, the spider attaches some sticky stuff. As you see, it is attached in many places. And, it can stop a bird or a bee in middle flight. Then the spider comes out and wraps it up for the next two weeks. But before it wraps it, it stops it with a venomous bite. When it is done, it stops to eat it, and then he can do it all over again because sometimes, spiders need to switch webs.

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Justin's teacher was very pleased by the level of detail and the sophisticated language that Justin produced in his slideshow. In the past, she had found it challenging to capture all that he wanted to say about his drawings through scribing with traditional paper and pencil means. She could not always write fast enough to keep up with his oral descriptions, or find as much time as she would like to writing down all that he wanted to say. The audio recording function of the app made it possible for him to have all of his narration recorded completely. In addition, his teacher mentioned that Justin's intonation and enthusiasm were also communicated and documented through the audio recordings, aspects of his explanations that would not have been evident in written descriptions.

Although he is not yet able to write, through the use of the iPad app Justin found a way to communicate and record his considerable knowledge and understanding of spiders, and his enthusiasm, with his teachers and his peers. Therefore, the app provided Justin with an outlet for sharing and recording his interest and demonstrating his early literacy skills in a way that was not possible through traditional means.

Justin's slideshow consists of only one slide and does not have any text, yet he is clearly at a more mature stage in his literacy development than Dylan. In this slideshow, Justin demonstrated a great deal of scientific content knowledge, sophisticated vocabulary, transitional language (e.g., "next", "as you can see"), and knowledge of his audience. Like Dylan, he is skilled at using multiple modes of communication at once, visual (drawing with his finger) and audio (describing his drawing with expression). He also demonstrates a well-developed ability to plan and sequence his explanation. Furthermore, he was persistent, enthusiastic, focused, and passionate in this work. These are all important qualities of a successful communicator.

It was noted by Justin's classroom educators that while Justin felt comfortable communicating his learning orally in other classroom activities, the use of the app allowed them to record his ideas to support the documentation of his learning. Previous to using the app, their primary source of documentation would be to scribe Justin's ideas down on paper for him. This was a challenging task as Justin had so many ideas that it was difficult for them to accurately record them all to paper. Therefore, the use of the app supported the documentation of Justin's idea through a mode of communication that he could control for himself.

In addition to traditional literacy skills, these two young children, Dylan and Justin, demonstrated many digital literacy skills. They were able to navigate the app features to create a digital slideshow that incorporated many modes, (drawing, photo, video, audio, text) while maintaining a coherent narrative. They were empowered by the mobile technology to practice and demonstrate literacy knowledge and skills that led to an increase in their comfort and confidence in kindergarten, and gave their teachers and parents insight into their abilities that they had not demonstrated using conventional literacy means.



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### **Minnie**

Minnie (4 years old) is a child with special needs who is nonverbal and has significant motor and cognitive delays. She spends a large amount of time deeply engrossed in picture books and images that are displayed around the classroom, sometimes pulling them off the wall for closer examination. While the other children in the class often take pictures of Minnie and refer to her positively in conversation, she appears to spend much of her time in solitary play.

A member of the research team invited Minnie to use an iPad as she noticed Minnie had not recorded any slides yet. Because Minnie is so attracted to visual images, the researcher was curious to see how she would interact to the 30Hands application. The educator in the room suggested that Minnie might like to use the drawing tool. The researcher opened a slide and helped Minnie to make some marks on the iPad. She did not seem very interested in this activity so the researcher took a photo of her and showed her how to make marks on the image, thinking the photographic image may be more appealing. Minnie still did not appear to be very interested in drawing and instead pushed the home button. She uses an iPad at home, so she may have been trying to access an app she is familiar with. The iPads for this study are kept in 'guided access' mode, which prevents users from leaving the 30Hands application. After several unsuccessful attempts to push the home button, Minnie grasped the researcher's finger and used it to push the home button.

Thinking video might be more appealing, the researcher switched to the video option, reversing the camera and thus placing it in 'selfie' mode so Minnie could see herself being filmed. She appeared to be interested in this and began banging her shoe on the ground in excitement. The researcher began saying "one shoe, two shoes", pointing to Minnie's shoes as she banged them on the carpet. Minnie began smiling and appeared to be quite excited. When she saw the video played back for her, Minnie became even more excited, stiffening her body and squealing with delight. They made a second video with the researcher moving the iPad close to Minnie saying "hi" and then moving it away saying "bye". Minnie began waving at her image on the iPad screen as it moved towards and away from her and again became very excited. Together, they watched the videos several times, the researcher laughing and Minnie squealing.

Another child came to join in and watched the videos a few times. He asked the researcher if she would take some pictures of him with Minnie and then asked if he could have a turn with the iPad. The researcher handed the iPad to the boy, who then began taking pictures of himself and Minnie, putting his arm around her and hugging her several times.

While Minnie's use of the open-ended app was quite different from Dylan's and Justin's, she also demonstrated several literacy and digital literacy skills, as well as

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some positive social-emotional behaviors. With adult support, Minnie, who often played alone, was able to engage in the interactive shoe banging and waving games through the mediation of the video feature of the app. She used gestures, facial expressions, and vocalizations to communicate her ideas and reactions. She showed her initial disinterest in using the drawing mode by pushing the home button on the iPad, and her later interest in the video mode by smiling and squealing. Her enthusiastic performance drew in another child who at first was an audience for her video production. He then became a character in the video/photo slideshow when the adult took photos of both children, and finally became a creative collaborator as he took photos of himself with Minnie. This process ended not only with a collaboratively created visual production, but with a very positive peer social encounter.

These three case studies illustrate the range of work the students produced in terms of the purpose, variety and complexity of their creative processes and products. Dylan used the open-ended app to document his feelings about his family. For Justin, the app provided the means for him to communicate and record his considerable scientific knowledge. With an adult's support, Minnie was able to have a positive interaction with others on her own terms in a way that was playful and enjoyable for all of those involved.

### **Supports, Expectations, and Routines**

A wide variety of supports and strategies for managing the challenges associated with digital integration have been identified in this study. Interestingly, while many of these supports and strategies were initiated either by the research team or the classroom educators through both individual problem solving and collaborative dialogue, at times, supports and strategies also arose from the children.

Early in the study it was clear that educators who effectively and efficiently set up expectations and routines in their classrooms experienced a greater level of success with the integration of the iPads into their programs. Some of these expectations and routines included addressing when, where, and how the iPads would be used with the students, as well as preparatory routines such as when the iPads would be charged so that they would be ready for student use. In these classrooms, the children were observed using the iPads with a greater level of independence and in a wider variety of contexts more quickly than in those classrooms where the educators had not set up similar routines and expectations.

### **Inquiry and Exploration-Oriented Learning**

A focus on inquiry and exploration also proved to have beneficial outcomes in terms of the early implementation of the iPad app. When the educators and the children

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provided time for open-ended exploration of the app to occur, before moving towards more focused and intentional uses, there was a more effective start to this initiative for both the children and the educators.

It was also noted that some of the educators were quickly able to investigate the affordances of the technology and align these with their own personal educational philosophy of student learning and current practice. This proved to be easier for some educators than others. The educators who were already practicing open-ended exploration or inquiry-based teaching and learning had a relatively easy time determining how the open-ended app could fit into their program. As might be anticipated, this alignment supported these educators in bringing this technology into their programs in a way that they felt was beneficial to student learning.

### **Child and Research Team Initiated Support**

The children participating in this study demonstrated their ability to develop support strategies for themselves as learners. In particular, many of the children demonstrated an eagerness to work collaboratively with their peers on the iPads, even when their educators had set the expectation that they should work independently. Through collaboration with their peers, the children were able to support one another as they began to explore the possibilities of this technology.

Many of the educators noted that the support provided by the research team was very important in the implementation of the iPads into their classroom programs. The amount of time the research team spent working one-on-one with individual children or with small groups helped to scaffold the learning for the children and allowed the educators to focus on other aspects of the classroom program. In addition to supporting the children's learning, members of the research team were able to respond to the educators' questions and learning needs with respect to the technology. Furthermore, the researchers worked collaboratively as a team as they experienced their own learning challenges. Together they were able to find many creative solutions, which in turn they shared with the educators and children they supported.

### **Adult Dispositions**

In the initial individual interviews with the educators, they were asked to self-report their pre-study comfort level using technology for teaching literacy to young children. All but one participant identified herself as either "comfortable" or "very comfortable". Furthermore, they all believed that digital technology could provide a "good level" or a "great level" of support in relation to young children's literacy learning. However, after the introduction of the iPad app into the classrooms, the

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research team noted through their classroom visits that many stated that they were uncomfortable with the process of integrating it into their programs. The technology that the educators had access to in their classrooms before the study began varied greatly. While almost all of the educators had access to a desktop computer, only 11 out of the 27 participants used an iPad or other tablet to support the children's literacy learning. And for many of these educators, the iPad was used by the adults in the classrooms and not by the children.

Although all of the participants reported themselves as being comfortable with the use of digital technology, there appears to be particular dispositions, that in combination with this comfort level, support an effective integration of technology into educational programming for young children. It was noted that certain dispositions among the research team members, educators, and children led to a smoother transition in some of the classrooms. These dispositions included demonstrating a willingness to experiment, perseverance, and a general positivity towards the possibilities of the technology in supporting children's learning. When these particular dispositions were in place, in combination with a strong comfort level in using technology, the integration of digital technology for the purposes of early literacy learning occurred more smoothly.

### **Early Challenges with DT Integration**

As with many new initiatives, the educators in the study experienced a variety of challenges when they introduced the tablets and the open-ended application into the kindergarten classrooms. This section of the chapter will outline these challenges and then identify supports and strategies that the educators found helpful in managing these obstacles. It is important to note that many of these challenges were short-lived and had been resolved by the end of the first 8 weeks of implementation. Furthermore, not all of these challenges were experienced by every child, educator, or classroom program. However, they were encountered by multiple participants across classroom contexts and were therefore noted as an emerging theme in the study.

### **Environmental Challenges**

At the outset of the study, many environmental challenges were encountered. Some of these were technical in nature and included the number of electrical outlets required to charge the iPads or the location of outlets within their classrooms. Simply finding time to charge the iPads while not in use by the children during the day also presented a challenge. Without consistent charging routines in place, the iPads were sometimes not ready for children to use when the educators had intended or when a research team member arrived to support the program.

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Physical environmental challenges were also identified. For example, the large number of children sharing a small space made it challenging for them to find a quiet location to create their slideshows, which resulted in a high level of background noise that interfered with their audio recordings. Furthermore, in many of the classrooms there was limited secure storage. Some classrooms required combination locks to be purchased for cupboards or other classroom items to be moved out of secure cupboards in order to create space for the iPads.

### **Social Challenges**

A number of social challenges arose in the early stages of the research. The program design and physical arrangement of the classroom environments in this study encouraged the children to engage in a wide variety of activities throughout the day based on their individual interests and learning needs. Therefore, children could choose to work independently or in small groups with their peers on a wide variety of self-chosen tasks during large blocks of time during the day. During these learning periods, the educators circulated around the environment, overseeing the classroom while also interacting with individual children or small groups of children to support their learning.

As one can imagine, this requires the educators to be quite skilled at managing the classroom environment while also supporting students' learning needs. The children were initially trained on the basic functions of the app by a member of the research team in small groups. Later, the children explored the more complex functions on their own and taught their peers. Many educators noted that the children required one-on-one support when they began interacting with the iPad early in the study, and as a result, they found it challenging to meet the technological learning needs of these children while still attending to the other needs of the children in the room.

Challenges were also present in peer interactions, for example when the children struggled to wait their turn to use the iPad and required an educator's assistance in fair turn-taking. At times, the children also needed to be reminded of the importance of respecting other children's work. Children would sometimes try to draw on a slide that another child was creating or delete another child's slideshows from the iPad without permission. While this could certainly happen without ill intent, it is no less upsetting to the child whose work was interfered with or deleted. Therefore, helping the children to learn to work within their own files was necessary and an important early lesson for the children in digital citizenship.

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### Technical Challenges

A variety of technical problems were also encountered during the initial stages of the integration of the iPads and app into the classrooms. These included many glitches within the app, both the free version, as well as the upgraded “pro” version, including access permissions and the app “freezing” while in use or refusing to open. The free version also only allowed for three student slideshows to be saved within the app at one time, requiring the educators to save student work to the camera roll frequently. The “pro” version of the app proved to be less problematic in terms of saving student work and allowed for more enhanced drawing tools, as well as the option to record videos.

Both the educators and the children became frustrated with these technical challenges, particularly when the app needed to be re-installed and student work was lost. The research team has been working with the app developers to address the freezing and crashing problems. According to the app developers, the way in which young children interact with the app, pressing buttons quickly and/or repeatedly, and completely filling and erasing screens, was overtaxing the app software. The developers responded to the team’s feedback by putting a “fix” up on the iTunes App Store. This “fix” has almost entirely eliminated the problem.

### Developmental Challenges

Due to the young age of the children participating in this study, it is not surprising that there were challenges related to their early stages of physical, cognitive, and social-emotional development. Certain physical challenges resulted from the small size of the icons on the iPad screen, as well as the location of particular icons on the screen. For example, when a child wants to take a picture or record a video they are required to hold the iPad while simultaneously reaching with one finger to the photo icon. At this young age, many children’s fine motor control may not be sufficiently developed to select the icon they wish to press, and therefore they may accidentally press the wrong icon. A certain level of coordination is required to follow through with this task. This situation proved to be very frustrating for some of the children.

Challenges related to differences in children’s cognitive development have also been noted. There are many steps required to create a slideshow in an app that includes multiple modes (drawing, photo, audio, video, etc.). Therefore, it is necessary for the children to have the cognitive capacity to hold a number of steps in their memory while they are engaged in the creation process. This proved to be challenging for some of the children, particularly the youngest ones.

In addition to the social challenges already presented, children in the study at various stages of social-emotional development experienced some struggles around

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their ability to control their impulses. This could be seen in their ability to wait for their turn to use the iPad but also in their ability to maintain their attention and to stay within the app. As this app is a series of tools and has little content, it places the child in the position of the creator of the content and knowledge builder. It is not an app that is overly stimulating or one that can be passively watched by a child. Therefore, some children wanted to leave the program in favor of apps that were more passively stimulating and placed fewer cognitive and creative demands on them. This was particularly evident in the early days of the implementation of the project when the children were still learning how to create their own slideshows. Fortunately, all of the educators persevered with the study through the school year, despite these technical challenges.

### **Parent Concerns**

A few parents expressed some safety concerns related to the project in the very early days of implementation. These were resolved by reassuring parents that photos of the children would not be publicly shared and that the app did not require their child to be on the Internet. Some parents also questioned how much time their child would spend using the technology as they wanted their child to explore a wide variety of learning materials. Again, these concerns were resolved through conversations with the educators who reassured them that the iPads would only be one of many learning experiences available to the children.

### **Pedagogical Challenges**

The educators in this study are strong professionals who are reflective in their classroom programming and their instructional practices. As such, during the early weeks of the study they questioned how and when to best fit the implementation of the iPads and the app into their programs. The educators questioned the purpose of technology in programs for young children, and whether this technology would replace components that were already present in their program. Furthermore, they wondered how this project could complement the goals they had already identified for the children's learning or if it would create new goals entirely. They also considered how to balance the technology integration with other initiatives already present at their locations.

### **A New Understanding of Students of Mobile Digital Technology**

Despite the challenges encountered during the early weeks of the iPad app implementation, over the course of the school year common themes began to emerge in

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the research data suggesting that the use of mobile digital technologies could be very empowering for both classroom educators and children. We will first highlight the positive outcomes that were observed for the educators before exploring those that arose for the children.

The educators in the study reported many teaching benefits of the tablet applications, above and beyond what they had experienced with traditional teaching methods and resources. For example, they appreciated the opportunity to see their program through the children's eyes. When the children used the slideshows to tell stories from their lives, to explain how they built a structure, to describe an event or a process, or to experiment with the features of the app, the educators had a new window into the students' interests and abilities. For some children, the level of knowledge and skill that they demonstrated in their slideshows far exceeded what they had demonstrated using traditional literacy tools. The educators were able to use this knowledge to plan lessons and experiences that would further develop their students' literacy skills.

#### **A Tool to Motivate Early Literacy Learners**

The educators reported that the iPad app was an effective tool they could use to motivate children to document their learning and their experiences. Children who were comfortable and confident using traditional literacy tools and processes such as painting, drawing, early writing, and oral storytelling, as well as those who were reluctant to use some or all of these modes, were interested in trying the app. As was illustrated in the case studies presented earlier, the app was particularly motivating and effective for children who had the most difficulty with traditional reading and writing tasks.

#### **A Tool for Assessment and Communication**

Using the children's digital slideshows for assessment purposes and for communication with parents was very effective, according to the educators. While the educators continued to use traditional methods for assessment of student learning such as collecting work samples, making anecdotal notes, and taking photos, they also archived students' slideshows that illustrated the children's learning and progress. These archived slideshows were also used to communicate with parents about their child's activities within the program and their literacy progress.



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### **Tablet App Supports DT Integration**

The use of the tablet application allowed for a natural integration of technology into the classrooms in a pedagogical useful and developmentally appropriate way. The open-ended nature of the app used in this study was a good fit for these kindergarten programs which emphasize learning through play. The children were free to explore and experiment with the features of the app. There was no correct answer or ideal way of communicating their ideas. On their own, with peers, or with adult support, they created unique products that reflected their interests and abilities.

Integrating this form of digital technology into their programs dispelled the concerns that some of the educators had prior to the beginning of the study. Some had thought that the children wouldn't be careful or responsible with the technology, or that they would no longer be interested in other forms of learning once the iPads were introduced. Seeing that the children were capable of using the new technology in a responsible manner, and that they continued to be interested in the other aspects of the program, changed their mindset towards using digital technologies with young children.

### **Equitable Access**

Many of the sites participating in the research were situated in low socioeconomic neighborhoods where the children did not have consistent access to digital technology in their home environments. Through site-based participation in this research, all of the children in the classrooms were given access to the iPads and the app, although data was only collected for children whose parents had completed the consent form (>80%). In this way, all of the children were provided the opportunity to access a technology they had not necessarily been a part of their previous literacy learning.

### **The “Undo” Button**

One particular feature of the app that seemed to support the children in their risk taking was the “undo button”. It was observed by the research team that some of the children relied heavily on this feature while creating their slideshows. At first, this was seen as frustrating to their adult observers as they witnessed the children erasing much of their carefully crafted slideshows. However, upon deeper reflection, it became evident that this feature empowered the children as they were placed in charge of their learning and their literacy productions. This simple feature allowed the children to take risks and to make choices in the way that they represented their thinking and also supported them in taking responsibility for what was included in the final draft of their work. It was noted that this “undo” feature is a much cleaner

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way of erasing or revising unwanted features in one's work than the more traditional method of erasing pencil lines on paper which often leaves some remnants of the previous work and can be laborious. In this way, the "undo" button supported the children in the revision of their ideas and proved to be a very empowering feature for the children in their learning experience.

## **English Language Learners**

This study took place within a large urban area with very diverse populations. As such, many of the children in the participating classrooms are learning to speak multiple languages, and often English is not the primary language spoken at home. During one of the focus group sessions, the educators shared that they had witnessed very empowering learning situations for some of the English Language Learners (ELLs). In particular, they had seen children who shared the same first language or home language choosing to converse in their shared language with one another while working collaboratively with the app. This was surprising to the educators as they had not seen these children speaking together in their first language in other learning situations within the classroom program. At this time it is still unclear to both the research team and the educators why the children would choose to collaborate in their first language only in this particular learning situation, although as a research team we have hypothesized that this app allowed for a certain comfort level that helped to facilitate this situation.

For other ELLs, the app provided them with an opportunity to practice their English skills. For example, one child would take the iPad to a corner, record himself speaking English, listen to the recording, erase it, then start again. The app provided him with a private means to get immediate feedback on his language learning progress. Other ELLs supplemented their emerging English language communication of their ideas in their slideshows with photos and drawings.

## **Children with Special Needs**

As was highlighted in the case study describing Minnie, this research has illustrated that the use of an open-ended app can lead to empowering experiences for some children with special needs. Specifically, allowing a child to choose the mode of communication helps educators to differentiate learning experiences based on that child's particular interests and level of cognitive and physical functioning. Non-verbal children can record their ideas visually with drawings, photos, or videos, while children with motor impairments who may have difficulty drawing or typing can orally record their ideas. When children of all ability levels, including those with special needs, are provided with a range of tools to represent their ideas, it

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can lead to very empowering experiences as they are put in a position of power as producers of knowledge and meaning.

## **DISCUSSION AND FUTURE RESEARCH DIRECTIONS**

This study was limited by a modest sample (27 educators in 14 early learning classrooms) and a relatively short timeline (one school year). However, it led to the following considerations which are presented for ongoing debate, and further research.

There is a great deal of literature warning of the dangers of DT for young children and about the concerns that educators have regarding its use in early learning settings. This study helps us to understand how educators of young children experience using open-ended tablet applications in the classroom for literacy learning. While the educators in this study did have some reservations about DT use by children in general, they were confident and eager when asked to try open-ended tablet applications with their 3-6 year old students.

Even when educators are relatively ‘tech savvy’ and eager to try using technology for pedagogical purposes, there can be significant structural, technological, and pedagogical barriers. Ensuring that there are enough tablets, that the software is compatible, and that there is adequate secure storage are all important considerations. Furthermore, teachers need to have the time and support to learn how to use the applications in educationally effective ways.

The results of this study suggest that there is value for educators, students, and parents in incorporating open-ended tablet applications into early learning settings. They can empower educators with additional tools to support children in exploring, creating, documenting, and reflecting on their learning in both visual and auditory modes. Students are able to represent and archive their experiences in multiple modes and in their own voice. Through viewing the slideshows, parents can share in their children’s school experiences.

The tablet application used in this study, *30 Hands*, was open-ended. There was little content other than the photos, drawings, and audio recordings that the children produced in their slideshows. It was a user-centered, inventor-driven application. The children were empowered by being in control of what they chose to represent visually, and how they chose to speak about it. According to a recent study, only 2% of the best-selling applications for young children could be considered open-ended (Goodwin and Highfield, 2012). While these types of applications can be more challenging for children to use than more structured educational applications, the findings in this study suggest that they offer rich learning potential.

Digital technologies play a key role in nearly all aspects of our globalized society. Young children are being exposed to these technologies both inside and outside of

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formal schooling environments. This study suggests that DT can be used in early learning classrooms to empower students in ways that are pedagogically sound and which contribute to early literacy learning.

Future research, including the remaining two years of this research project, could more fully explore the range and complexity of digital work produced by young children in particular classes and across classes. In addition, it would be useful to explore the factors that support teachers and students to move from free exploration of mobile DT, to guided experimentation, to a more purposeful implementation of mobile DT within their programs. Third, future research could explore when and how open-ended mobile apps are empowering as an activity in themselves, and when they are empowering as a way to process learning and/or to document learning that occurs using traditional learning means.

## **CONCLUSION**

This study set out to explore what happens to literacy teaching and learning when iPads with an open-ended applications are introduced into kindergarten programs with young children. More specifically, the study explored the experiences of the educators and the value for their students' literacy learning. Findings from the study illustrated that the integration of the digital technology application was challenging initially for nearly all educators in one way or another. For weeks, or months in some cases, there was a considerable learning curve for the educators, children, and the research team as all sought to deal with the structural, technical, and pedagogical challenges they encountered. All of the parties needed to find ways to effectively incorporate this DT into the kindergarten programs. However, quite quickly the educators, researchers, and the children began to develop strategies to address the challenges and shift the focus to the learning potential of the app. This points to the importance of allowing a considerable amount of time and patience when introducing open-ended mobile technology apps into programs for young children.

Support, both technical and pedagogical, was seen as essential for the successful implementation of the mobile DT app. In addition to the initial adjustment period when all were learning to navigate the iPads and the app, technical issues arose throughout the year that necessitated technical support such as updating the iPads and the app, deleting excess material when the memory was full, and communicating with the developer with the app crashed. All of these would have been difficult for the educators to navigate on their own given their busy schedules. The research team was able to support the educators with theses and other technical issues during their weekly or bi-weekly visits. Moreover, collaborative discussion of pedagogical issues such as how, where, and when to use the iPads was facilitated by the focus

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groups the research team arranged. This points to the importance of having a support team in place when introducing mobile DT into young children's programming.

Within classes and across the 14 participating classes, there was a range of interest and expertise among the educators and the children with respect to this initiative. This appeared to be related to the educators' previous pedagogical approach and their willingness to persevere with the introduction of the mobile DT. Perhaps not surprisingly, in the classes where the educators were the most invested, the children demonstrated the most interest and ability in their use of the app. This is a reminder that while mobile DT may be seen as a pedagogically useful tool by some, it may not be a good fit for all educators or children. It may be most effective when it is offered as one of a range of tools to meet the differing learning and teaching needs in the kindergarten classroom.

With the appropriate supports in place, this study has demonstrated that open-ended apps on mobile digital technology devices have significant empowerment potential for both educators and young children, particularly those children who face low socioeconomic status, English language learning, or special learning needs challenges.

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## **KEY TERMS AND DEFINITIONS**

**Differentiated Instruction:** The practice of providing a variety of classroom learning experiences in order to meet the individual learning needs of the children.

**Digital Technology:** A wide variety of technological tools including, but not restricted to, computers (i.e., desktop or laptop), tablets (e.g., iPads), mobile phones, digital cameras.

**English Language Learners:** Children whose first language is a language other than English, or is a version of English that is significantly different than the version primarily spoken during instruction in the school context.

**Literacy Production:** Communication that is created by an individual or a group of individuals to convey meaning.

**Modes of Communication:** Different forms of representation used to communicate including (but not restricted to): verbal, written, gestural, pictorial.

**Multi-Modal:** The use of two or more modes of communication used in combination to represent meaning (e.g., a picture that is used in combination with verbal communication).

**Open-Ended Tablet Applications:** Software for tablet devices that do not have a pre-set outcome (such as a game); rather the user of the tablet is responsible for creating an outcome through the use of the application (e.g., a slideshow).

**Special Needs Learner:** A child whose learning needs require accommodations or modifications to the regular classroom program.