Intersecting Spaces in Early Childhood Education: Inquiry-Based Pedagogy and Tablets

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Abstract

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This paper is situated within our wider ethnographic study that explored young children's literacy meaning making experiences before and after tablets were introduced into five early childhood educational settings. In this paper, we explore pedagogical and learning implications of tablets in early childhood classrooms as well as intersections between inquiry and mobile technologies. We discuss current literature related to mobile media in early years education and inquiry-based learning, then detail our ethnographic methodology used to examine opportunities for intersecting inquiry-based pedagogies and tablets. Findings are then related to the five phases of the inquiry process (*ask, observe, wonder; explore, investigate, experiment; analyze, create, play, construct new understanding; discuss, collaborate;* and *reflect, share, and feedback*). We conclude by briefly highlighting some of the limiting factors of intersecting inquiry-based pedagogies and technology, and suggest ways of overcoming or circumventing such limitations so that 21st century early years classrooms can support inquiry-based pedagogical approaches.

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Any early childhood educator can attest to the natural curiosity of young children and the barrage of questions they ask each day. From a sociocultural framework, young children learn through their interactions with others and their interface with cultural artifacts and tools (Bakhtin, Voloshinov, & Medvedev, 1994; Vygotsky & Cole, 1978; Wertsch, 1991), which we argue include mobile devices. Aligned with the thinking of other scholars (Kearney, Schuck, Burden, & Aubusson, 2012), in this article we focus on the pedagogical and learning implications of tablet-infused early childhood classrooms and the potential intersection of an inquiry approach and mobile technologies.

An inquiry-based pedagogical approach encompasses a cyclical and recursive orientation to learning, one that centers on opportunities and invitations for active exploration, questioning, experimenting, experiencing, problem solving, and multiple representations of understanding and knowledge (Bruce & Casey, 2012; Chiarotto, 2011; Ontario Ministry of Education, 2011), consistent with the inquisitiveness, imaginations, and learning processes of young children. Canadian frameworks that focus on early childhood education (or early years contexts[1]) also tend to promote a pedagogical approach that is balanced around children's emerging interests, play, queries, and natural curiosities (Best Start Expert Panel, 2007; Manitoba Family Services & Consumer Affairs, 2011; Ministry of Health & Ministry of Children and Family Development, 2008). For example, the Ontario early years curriculum and pedagogy is framed around the thinking and interplay of play and inquiry:

> The focus is *not* on teaching a body of knowledge or a predetermined set of topics.
> Nor is it centred on children's achievement of a specific skill set. In the early years,
> programs are most effective when the content of learning is focused on supporting
> the development of strategies, dispositions, and skills for lifelong learning through
> play and inquiry. (Ontario Ministry of Education, 2014, p. 15)

An inquiry-based pedagogy requires that observant educators be attentive to children's interests and burgeoning questions. Educators and children then capitalize on these *inquiry moments*, fully exploring ideas and concepts (Maloch & Horsey, 2013). We posit that these inquiry moments evolve from either children's interests and/or *provocations* provided by their educators or others (e.g., the school librarian) (Maloch & Horsey, 2013). Concurrent to children's burgeoning questions, educators may intentionally introduce a new concept or revisit a previous query via strategies such as a community visitor, read aloud, experiment, or field experience (Chiarotto, 2011). Most importantly within an inquiry approach, children are provided with ample opportunities to have their questions *honored* and generous amounts of time dedicated to investigating those ideas fully through the use of a variety of resources, tools, and experiences (Chiarotto, 2011). Educators' roles are fluid within an inquiry classroom, as their responsibilities oscillate among diverse roles such as co-learner, facilitator, observer, resource, documenter, and direct instructor (Chiarotto, 2011; Maloch & Horsey, 2013).

Wells (1999) framed our thinking about inquiry as a process, whereby communities of inquiry are enacted to "indicate a stance toward experiences and ideas—a willingness to wonder, to ask questions, and to seek to understand by collaborating with others in the attempt to make answers to them" (Wells, 1999, p. 121). An inquiry approach provides ample opportunities for

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[1] Throughout this article, we use the terms early childhood education and early years contexts interchangeably to refer to educational programs aimed at the provision of care and education for children aged 2.5 to 6 years.

learning: skills in constructing questions, problem solving, investigative strategies, analytic and communication skills, and a deepened understanding of concepts (Edelson, Gordin, & Pea, 1999).

Given the influence and potential of 'smart' mobile media and young children's learning, it seems natural to blend these two worlds (mobile media and communities of inquiry) within early years educational contexts. However, there is relatively little literature available exploring how tablets can be used support these communities of inquiry. In this article, we offer slices of data from an ethnographic study of five early childhood classrooms as a window to understanding the teaching and learning potentials of tablet-infused, inquiry-based classrooms. Thus, by examining the naturalistic experiences of children and their educators using tablets, we offer insights and understandings from the 'lived stories' of five mobile media-infused, inquiry-based early years classrooms.

Influence and Promise of 'Smart' Mobile Media

There is no doubt that technology is a pervasive force in the lives of young people today. Most large-scale studies that have been conducted paint a portrait of children and youth having high levels of access to technologies and daily usage of the Internet (Common Sense Media, 2013; Mascheroni & Ólafsson, 2014; MediaSmarts, 2014). Additionally, children's preference for using 'smart' mobile digital devices (most often smartphones) appears to traverse home and school contexts (Mascheroni & Ólafsson, 2014). Interestingly, these studies have also found that most of this use is related to social networking (Jenkins & John D. and Catherine T. MacArthur Foundation, 2006; MediaSmarts, 2014). The learning potential of these devices has yet to be fully explored within research.

Today's 'smart' mobile media are powerful, adaptable, portable tools that are considerably less expensive and cumbersome than desktop computers. 'Smart' mobile media are portable devices (e.g., tablets, smartphones, iPods) with the capacity for anywhere/anytime access to the Internet and support a convergence of multifunctional activities (Mascheroni & Ólafsson, 2014). Studies conducted in Scotland, the United Kingdom, and Australia provide a beginning glimpse of the educational impact and potential of 'smart' mobile devices (Burden, Hopkins, Male, Martin, & Trala, 2012; Heinrich, 2012; Murray & Sloan, 2008).

Itō and her colleagues (Itō et al., 2010) used the phrase *'new' media ecologies* to help situate the theoretical discussion and appreciation for "the technological and social context in which young people are consuming, sharing, and producing new media" (p. 27). Informed by the work of Jenkins (2006), the term 'new' media helps broaden the discussion beyond any singular media platform to encapsulate the convergence of traditional mediums (e.g., books, music, TV, movies) with digital interactive mediums (Itō et al., 2010). As part of their three-year ethnographic study of the media practices of American youth (aged 12-18), Itō and her colleagues provided a collection of 26 case studies where youth enacted and challenged social norms in novel ways (largely outside of formal learning contexts). Findings from other large-scale studies confirm that children and youth are increasingly accessing new media outside of 'formal' schooling and that their use tends to be primarily social in nature (Common Sense Media, 2013; Mascheroni & Ólafsson, 2014; MediaSmarts, 2014). How new media might foster children's learning opportunities within formal contexts is not readily understood.

Plowman and her colleagues' decade of research of young children's technology use (Plowman & Stephen, 2007; Plowman, McPake, & Stephen, 2008, 2010; Plowman & Stevenson, 2012) helps to dispel several 'myths' associated with the role of technology in young children's

lives (Plowman & McPake, 2013). In contrast to the cautionary argument of technology's dominance (Cordes & Miller, 2000; Miller, 2005), Plowman and her colleagues found that children's use of technology in the home tended to be balanced with other activities. Similarly, we found that young children were quite capable producers of digital texts (Harwood et al., 2014) and "not just consumers of media devised by others" (Plowman & McPake, 2013, p. 29). Thus, the conception of the technologically suffused and naïve child seems to be unfounded (Rowsell & Harwood, 2015). As Marsh and Bishop (2014) also helped to underscore:

> Play for children is a continual process of remixing all forms of texts and therefore their textual poaching (Jenkins, 1992) has always included the different   electronic media since their various points of entry into the lives of the general public. This continuous process of appropriation, accommodation, assimilation, and/or adaption will continue to take place in the future, no matter how far developments in technology change the range of media available to children. (p. 77)

Our own ethnographic study focused on the integration of tablets within the everyday learning and teaching experiences of five early childhood educational contexts (Harwood et al., 2014). We recognize that tablets comprise just one aspect of the *converged media ecologies* in which young children are embedded, but argue that they are an important avenue for exploration given the growing popularity of tablets in educational contexts (Brustein, 2013). We focus our discussion on illuminating the ways in which tablets and inquiry can intersect as a way of honoring children's 'new' media ecologies within educational practices.

Inquiry-Based Learning and Tablets: What Do They Have in Common?

Bruce and Bishop's (2002) framework of the inquiry process is helpful in conceptualizing the fluidity of the learning and teaching process inherent within an inquiry approach. A recent monograph by the Ontario Ministry of Education (2011) also underscored the variability and recursive nature of the inquiry process. Importantly, within an early years context, the inquiry process can begin at any point in the cycle and may not encompass each dimension with every inquiry pursuit. As Casey and Bruce (2011) emphasized, inquiry is more spiral than linear in nature with each of the five dimensions being "overlapping, mutually interdependent and interrelated" (p. 82). Given the central tenant of early childhood education that young children 'learn by doing' in playful encounters and the recursive and reflective nature of learning (Ontario Ministry of Education, 2011), we adapted Bruce and Bishop's framework to reflect these additional ideas (Fig. 1).
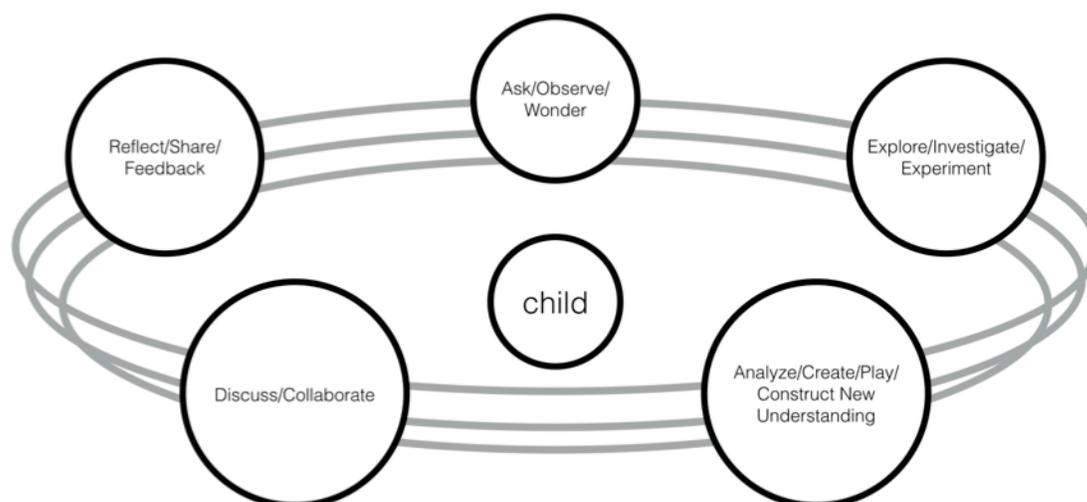
Figure 1. Inquiry process in early years contexts (adapted from Bruce & Bishop, 2002; Ontario Ministry of Education, 2011)

Tablets are small, portable mobile devices that offer a range of interactive tools on multi-touch screens. Tablets can provide young children greater control and agency over their own learning, as they are more able to negotiate the intuitive and touch-based technology (Geist, 2014). Although often associated with game play and social interactions, tablets have been successfully used to support university students' inquiry learning in a field setting (Finkelstein, Winer, Buddle, & Ernst, 2013) and science inquiry pursuits with primary school age children (Looi et al., 2011). For us, the *intersections* between the inquiry process and tablets seem obvious. Below, we briefly highlight some of these intersections as potential positive outcomes for infusing tablets with an inquiry approach.

- Tablets offer the opportunity to blur the boundaries between formal and informal learning, a central tenant of inquiry.
- Inquiry is an active process that involves experimentation or fieldwork as queries are tested, investigated, and explored. Tablets are portable devices that can be used to capture, record, and communicate in any context.
- Young learners can be empowered by their ability to use tablets, fostering their sense of agency as they pursue an inquiry of their own choosing.
- Tablets can be integrated readily into children's interactions with others throughout the class as well as the global community.
- Tablets offer engaging learning opportunities for young children.
- Tablets, like inquiry, help converge the lines between play and learning for a seamless integration of the two.

Description of the Study

This ethnographic study focused on exploring young children's literacy meaning making experiences both before and after tablets were introduced into five early childhood educational settings. The overarching aim of the study was to explore the holistic and authentic ways that young children thought about their worlds, positioned themselves and others, and interacted with

a range of communication and literacy tools, both traditional mediums as well as digital modes. We were interested in qualitatively exploring the dual and fluid nature of children's literacy journey and the question of if/how young learners traversed both worlds. A sub-question of the research explored in this article focused on, *how can tablets support communities of inquiry in early childhood educational contexts?*

A group of university-based researchers collected data over a school year (November to May), culminating in 120 hours of classroom observations, 2,000 photographs, 200 video recordings, and 500 sample artifacts from the children. Seven educators, 71 children, and 24 parents also participated in the study (completing an online survey related to literacy practices and beliefs in the home). An inquiry framework guided the curriculum of the five contexts, informed by several governmental policies (Best Start Expert Panel, 2007; Ontario Ministry of Education, 2010, 2011, 2014).

Two researchers were assigned as the lead investigators in each of the five sites and completed bimonthly visits to their specific classrooms. After several initial visits to each site, tablets were introduced into the three participating full-day kindergarten classrooms and two childcare programs. All participating children ranged in age from 2.5 to 6 years. The educators of all five classrooms were unfamiliar with tablets in an educational context, thus the research team initially chose the applications (apps) based on initial observations of the children's interests. We also reflected on and considered the six domains established by Hillman and Marshall (2009), seeking out apps that were developmentally appropriate and understandable to the children, as well as apps that promoted child agency and collaboration, fostered critical and creative thinking, furthered digital literacy skills, and evidenced a community or global perspective. We were also cognizant that the apps should be multimodal and cross-curricular in nature, open-ended, with elements that were accessible for diverse learners, with rudiments that fostered curiosity and pretend play (Harwood, 2014).

Throughout the study, apps were downloaded or hidden from view based on children's emerging interests. As such, the research process remained fluid, evolving with and responding to the children and educators' inquiries in each of the five diverse contexts. Although beyond the scope of this paper, elsewhere we discuss the specifics of app quality and specific criteria educators can refer to when deciding upon which app to use and for what purpose (Harwood, 2014). Additionally, an annotated bibliography of the apps used throughout the research project can be found on the website developed and informed by the study (Di Cesare, 2013). The tablets were used in various ways, including independent play by individual children or groups of children, one-on-one learning, and whole-class, educator-led sessions. One-on-one, whole class learning was not possible since a maximum of eight tablets were available with any research visit.

Discoveries

In this article, we focus on the observational data and accompanying photographs and videos to explore the question, *how can tablets support communities of inquiry?* In the analysis process we utilized the adaptation of Bruce and Bishop's (2002) inquiry cycle framework to help examine the elements of the five phases of the inquiry process (*ask, observe, wonder*; *explore, investigate, experiment*; *analyze, create, play, construct new understanding*; *discuss, collaborate*; and *reflect, share, feedback*) that offered opportunities for intersecting inquiry-based pedagogies and tablets.

Ask, Observe, and Wonder

Inquiry pursuits appeared balanced between children's interests and questions and ideas proposed by the educators. The introduction of the tablet had little effect on this dynamic and balance. Children's interests and inquiry pursuits were diverse and included foci such as map making, 'city' building, volcanoes, 'saving the earth', movie making, mail processing, babies and bodies, space, and baking. Educators relied on their observations of children's emerging interests and foundational knowledge of early childhood to provoke inquiry ideas in the classroom.

> *The educator shows the researchers the sand area where there are "roads" and boxes inserted throughout. (The boxes are decorated to represent buildings and cities). The educator explains that during outdoor play this week, some children wanted to build a city. They were encouraged to develop a city plan and replicate it in the sand box – which the children are continuing to do as a collective. The educator indicates that she read a book about construction workers to the children and that they also found a box of wood in the classroom that they are using for their construction activities.* (Pre-tablet classroom A)

Children's impromptu questions were capitalized upon often, with educators noting the benefits of tablets in terms of immediacy of being able to respond and support children's questions. The tablet appeared to support and enhance a "responsive learning community" (Ontario Ministry of Education, 2013, p. 2). Inherent within inquiry-based learning is the process of educators and learners alike extending upon and reflecting on children's emerging ideas and 'working theories' (Hargraves, 2011). Clearly, educators in this study foresaw a role for tablets in supporting this aspect of the process.

> *If we could access the Internet it would be a very useful tool for showing clips/videos/accessing information about questions that arise during play. It is an excellent way to capture inquiry as it is happening and then be able to share it with others.* (Educator C)

Likewise, the tablets offered the advantage of immediate access to a wide range of multimodal tools such as digital photos, filming, animation, and sound (Fig. 2).

Figure 2. Child-initiated inquiry – filming, singing, and dramatizing the Disney film *Frozen*

Explore and Play

Exploring, investigating, and experimenting with ideas, questions, materials, and concepts is a foundational notion within early years classrooms. The opportunity for children to analyze, create, and construct new understandings is also inherent within a play-based inquiry approach (Chiarotto, 2011). Thus, we discuss these two aspects of the inquiry cycle jointly. Two examples from the data help highlight these two phases of the inquiry process: (a) *exploring, investigating, and experimenting*; and (b) *analyzing, creating, playing, and constructing new understanding* from a pre-tablet environment (Figure 3) and a post-tablet context (Figure 4). In Figure 3, a photo captured the children's explorations with snow. Through play and dialogue, the children were able to test their working theories about snow. They created new shapes by using water, various tools, adding more snow, and experiencing the phenomenon of cold. Children constructed a new understanding of the concepts of melting snow and ice formation, as well as a shared knowledge of 'how to warm up cold hands.' While this learning was accomplished with a 'real' and 'concrete' experience with snow, this group of children later would extend and apply their understandings of the properties of snow within an app (*Max & Ruby: Science!*), demonstrating a type of 'converged space' for playing and learning (Edwards, 2013). Similarly, we noted many instances of this type of play convergence with other apps such as *LEGO*, *Grandma's Kitchen*, *ColAR Mix*, *Puppet Pals*, and *Pet Doctor*. Thus, the tablet offered many opportunities for the children to blur the boundaries within their play (Di Cesare, Harwood, & Rowsell, in press), ultimately promoting the construction of new understandings.

Figure 3. Exploring the properties of snow

Figure 4 depicts the use of the *ColAR Mix* app in extending the children's understanding of 2- and 3-dimensional objects. The children in classroom A were interested in 'making their pictures come alive' and this app was introduced to illustrate concepts of dimension, perspective, reality, and animation. Groups of children experimented with the app, examining and analyzing the effects of tablet placement, limits of the animation, and placing concrete objects into the view. The children adopted a repertoire of 'new' terms that initially were modeled by the educator and researcher, later using these terminologies and new understandings to demonstrate their animations and instruct a peer on using the app. For example, the teacher when using the app Fluidity modeled the terms *viscosity* and *momentum*. Later, the children appropriately applied these terms in their peer teaching or sharing encounters with the app.

Figure 4. Exploring concepts of 3D and animation

In terms of exploring, analyzing, and creating, tablets appeared to offer an additional resource and lens. In some instances, tablets provided a conduit to explore complex ideas such as 'boy and girl apps', 'what is real', and 'what is a liquid', as well as offered multimodal tools (e.g., movie making, animation) for experimentation and expression of new understandings. Educators qualified the importance of training, support, and time for using tablets effectively and consistently throughout all aspects of the inquiry process. As two of the educators noted:

> *"You need time to practice, to train your brain to think in this way. You have to start to think, how can I use this?" Both teachers agreed that professional development is crucial and that "iPads need to be put in the hands of teachers first."* (Educators D and E)

Discuss and Collaborate

Discussion and collaboration among the children were evident across the five classrooms both before and after tablets were introduced. We noted few changes to the composition of peer groups after the introduction of tablets, although different children assumed leadership positions. These leaders tended to act as resources for other children who were less experienced with tablets. Similar to Looi et al. (2011), we also observed a shift in children's autonomy after the tablet introduction with children serving as resources for each other during problem-solving initiatives and while operating the tablets and apps.

> *One 4-year-old boy asks another what he is doing. The boy responds, "I'm playing Max and Ruby." The initiator of the question watches the first boy play for about three minutes just standing over his shoulder. Eventually he sits down and grabs an iPad for himself. He begins looking for an app, and tells his friend that he wants to play the same game he is playing. He then asks his peer if he could find it for him. The friend responds, "Yes, I can find it for you." The friend proceeds to help the boy find the app in the appropriate folder on the second device.* (Classroom B)

Additionally, in the childcare contexts the children independently decided upon the process of how to share the limited number of tablets that were available. In this sense, the children contributed to the collaborative nature of learning in the inquiry classroom. They also tended to self-regulate and monitor others when waiting for a turn.

Reflection, Sharing, and Feedback

Reflection, sharing, and feedback is an important element of the inquiry cycle, and can include children discussing their findings, sharing varied representations of their understanding, identifying new questions and/or celebrating new learning (Ontario Ministry of Education, 2011). Although more formal processes of reflection and feedback appeared to be less evident than the other four aspects of the inquiry process, children often shared their learning with each other in impromptu exchanges. And while we did observe some instances of reflection, sharing, and feedback involving tablets (e.g., Fig. 5), the process of making sense of learning, continuing learning, or revisiting learning so that new questions could emerge appeared to happen randomly and unevenly across the five contexts.
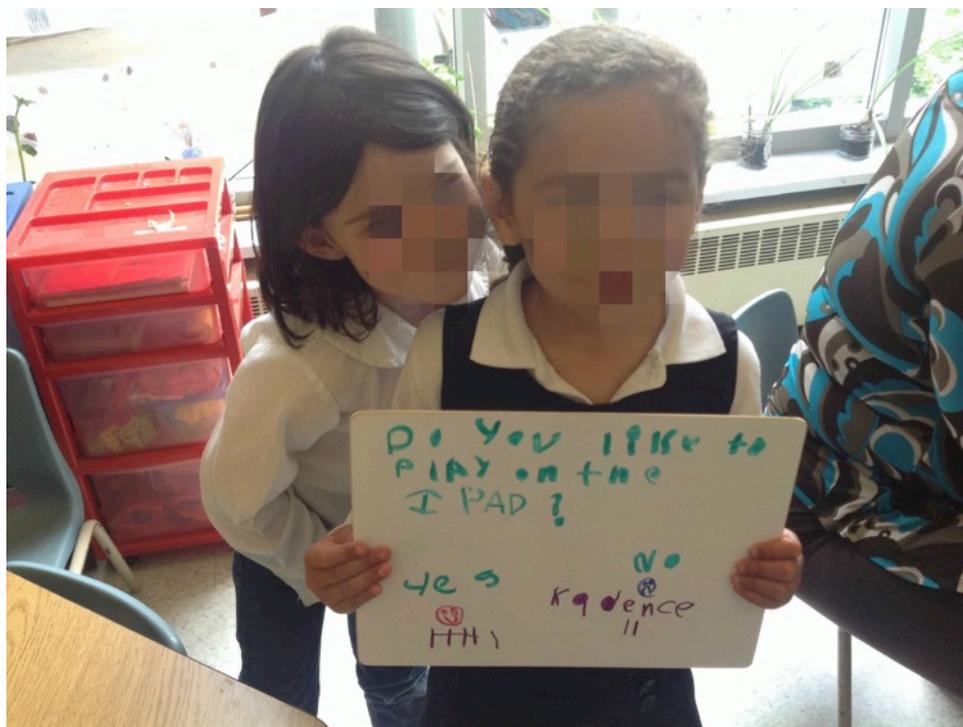
Figure 5. Children's self-initiated survey related to liking/not liking the tablets

Discussion and Conclusion

The newness of the tablets in these five contexts or the nature of the research methodology (ethnography) may have limited our ability to observe complete cycles of inquiry. Thus, we are cognizant that our findings here are incomplete. However, thinking about how tablets can be utilized to support inquiry processes seems important given the tool's flexibility, adaptability, and portability. It is unclear how certain restrictions associated with the research process (e.g.,

number of tablets, Internet connection) impacted each phase of the inquiry process. For example, one limiting factor of the tablet-infused kindergarten classrooms was the unreliability of the Internet connection (connectivity was not an issue with the two childcare classes). Children and educators' ability to fully explore or investigate concepts, represent new understandings, or reflect was encumbered by this lack of connectivity. Another important consideration involved restrictive school policies (e.g., weekly wiping of data on school-owned tablets, lengthy permission wait times for apps). In order to be responsive within an inquiry approach, flexibility is key. This appears particularly important when inquiry is infused with tablet technology. The children's inquiry pursuits were fluid and evolved and changed over time. The research team was able to respond to this fluidity by uploading and downloading apps as deemed appropriate by the educator and research team. This flexibility was not reflective of school policy. Perhaps, as Teichert (2014) suggested, it is time to critically analyze policies and curricula developed in the 20th century in light of the nature of the 21st century learner.

A growing body of literature is beginning to provide insights into the learning and educational value of technologically infused classrooms (Falloon, 2013; Looi et al., 2011; Lynch & Redpath, 2014; Saine, 2012). However, the value and utility of mobile technology on children's learning is dependent on a complex interplay of many factors, including, but not limited to, the content and design of the apps used (Falloon, 2013), institutional and policy contexts (Lynch & Redpath, 2014), and the quality of the digital interactions (Neumann, 2014). Inquiry learning requires flexibility and time for an inquiry to take root, develop, and be revisited. As the cycle of inquiry never truly closes, 'space' within curricula and pedagogies must be made to accommodate the somewhat unpredictable nature of the inquiry process. Tablets can support this flexibility and unpredictability. Tablets are also multimodal in nature and thus provide multiple opportunities for children to demonstrate and apply their learning, complementing an inquiry stance.

Currently, many practices within education are in contrast to children's out-of-school learning and mobile experiences (Lynch & Redpath, 2014; Marsh, 2011; Plowman & McPake, 2013). Intersecting inquiry-based pedagogies with mobile technologies (tablets) appears to honor children's agency and previous knowledge while providing teachers with a framework to scaffold learning. We suggest that early learning contexts in the 21st century allow room for individual preferences in using tablets while continuing to ensure a pedagogical approach that honors children's queries about the world around them.

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