Digital Literacy for Kindergarten

by

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Bachelor of Education, Simon Fraser University, 1995

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Abstract

Digital technology is interwoven into many aspects of our lives. In British Columbia (B.C.), there is no escaping the necessity for teaching children how to use Information and Communications Technologies (ICT) safely and responsibly. For many early childhood educators, the question of whether digital literacy education truly needs to begin in kindergarten persists. The purpose of this paper is to examine this question through a review of the relevant literature. The review seeks to find the why and the how of incorporating ICT into early learning. Some of the research reveals a resistance to using ICT with children, citing the expense of purchasing and maintaining technology, and the negative effects of screens on children's health and social growth. Other research acknowledges that problems exist but can be offset by the manner in which educators use ICT. Technology used to enhance learning in a thoughtful and appropriate way can have many cognitive, social, and physical benefits for children. The research also addresses the question of why digital literacy education should begin early as there are already vast differences between children's digital skills, beliefs, and habits even before they enter school. Some of the studies in this review find that educators are in need of professional development opportunities that allow them to learn how to teach the digital skills learners need to make ICT use a positive addition to the curriculum. As a result of this review, this project was created to include an educator's guide for introducing digital literacy to kindergarten students. It is grounded in B.C.'s curriculum and *B.C.'s Digital Literacy Framework* (B.C. Ministry of Education, n.d.). It is a simple, scripted guide that any educator should be able to apply regardless of their own skill level as they work toward incorporating ICT into their own practice.

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Acknowledgements

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Dedication

I dedicate this work to my family, friends, and colleagues who encouraged me to start this

endeavour, and to Sean, Taylor, Noah, and Olivia who supported me all the way through.

Chapter One: Introduction

Research Focus

The most recent iteration of the British Columbia (B.C.) curriculum (B.C. Ministry of Education, 2018) includes digital literacy for all children in kindergarten to Grade 12; however, many kindergarten teachers are not implementing it. Educators know that using Information and Communications Technologies (ICT) with learners has become a priority for the B.C. Ministry of Education and, subsequently, school district administration. It appears that not all teachers feel prepared to properly integrate digital tools into their classroom practices and some report that they are not convinced that they should; teachers who have not been adequately trained to use ICT tend to feel strongly that ICT's only place in kindergarten is in the teacher's administrative work (Zaranis & Oikonomidis, 2016). Most people will concede that digital technologies have infiltrated the social and educational lives of children. Because of the B.C. Curriculum, educators can no longer continue to avoid digital technology and steps need to be taken to ensure that digital tools are used safely and responsibly by learners. Feeling the push to infuse elementary school classrooms with ICT, educators need to know the arguments that support educational technology in schools and those that do not. It is important for educators to understand the why and the how of ICT in schools if they are to incorporate it as the B.C. Curriculum demands. What are best practices when it comes to ICT in kindergarten?

My Perspective

As a parent and educator, I have seen the way children embrace technology as well as the push-back that stems from the threats of too much screen time. I have always appreciated how a screen captures the attention of a child and how digital games can engage a child to persist in tasks for long periods of time. When thinking about the best ways to incorporate the magical attraction of technology into a kindergarten classroom, several questions arise. What do four and five-year-old learners really need to

know about ICT? How can ICT help me teach other curricular areas such as numeracy, literacy, and social learning? How can I use ICT for meaningful learning in kindergarten? How much ICT is too much?

In my own elementary school setting, I have seen how other educators struggle with the integration of ICT. Some of my colleagues embrace technology and actively seek new and interesting ways to use it with their classes. Others collect random ICT ideas and software applications (apps) and use them with their learners in superficial ways. Still others declare that they do not understand technology, need training, or do not agree that it is necessary, so they do not use it at all. I have always sought to share what I know about ICT with my colleagues and support them as they try new ways of integrating it into their programs. I am experimenting with new ways myself and I understand their hesitation as we have so much curriculum packed into the school year; it is difficult to reconcile the time it takes to experiment with technology. I believe increased professional development with ICT is needed but not necessarily forthcoming as district budgets continue to tighten.

My personal belief is that there is an appropriate balance of ICT-infused and off-screen learning in kindergarten. This balance will allow for early learners to gain a basic understanding of how to use digital devices, applications, and the internet while beginning to understand appropriate behaviours to regulate their use. I believe that learners need not be encouraged to use digital tools for the sake of using digital tools, but instead to enhance their engagement in meaningful learning, including social learning. In order to reach this ideal use of ICT, learners need to understand foundational concepts that they can later apply to their own inquiries. They also need to learn when to put the technology down and engage in other activities.

I see there are now people of every generation who have rapidly come to use digital technology without regard for its safe and balanced use. The wondrous invention of easy-to-use tablet and smartphone technology has allowed more people to engage with apps and the internet than ever before. People are

using these digital devices before they know anything about internet safety, cyber-bullying, netiquette, digital footprints, or data capitalism. Parents are handing these devices to their children, even pre-school children, to play games and watch videos as an easy digital babysitter. I have also seen the opposite where parents are very aware of the negative consequences of screen time, so they avoid it altogether and their children have no experience with ICT prior to entering school.

I believe that given the varying levels of knowledge about the positive and negative aspects of using ICT, at any age, it is necessary for educators to teach all children about their safe and responsible use. I also believe that education in digital citizenship should begin in kindergarten as it goes hand in hand with many other areas of early learning. For example, why not teach about digital intellectual property at the same time as teaching about not stealing toys from classmates? Why not teach about being kind in an online community when teaching about being kind in the school community? Why not teach about appropriate online communication while teaching about appropriate in person communication?

Project Description

The purpose of this project is to support early childhood educators with integrating technology into their practice by reviewing the key factors that determine their adoption and appropriateness for early learners and then, providing examples for practical application. Chapter Two is a review of the literature that explores the effects of ICT integration on early learners and how to integrate ICT successfully. It will attempt to answer the questions of why and how to integrate basic ICT skills and knowledge into kindergarten practice in a balanced way. In Chapter Three, I will develop a foundational resource for integrating ICT into the curriculum of early learning. I hope to guide early childhood educators with concrete and scripted examples of lessons that will prepare young children to become able and responsible digital citizens both at home and at school. As such, it is intended to give those educators, who are unsure of their own digital literacy, a place to start and hopefully build upon, especially when professional development opportunities are lacking. For the project, I will use *B.C.'s*

Digital Literacy Framework (B.C. Ministry of Education, n.d.) as a guide as it represents the curricular guidelines of British Columbia's Ministry of Education.

Theoretical Framework

Kindergarten educators in B.C. are increasingly encouraged to embrace the new British Columbia Early Learning Framework (B.C. Ministry of Education, 2019a). This framework asks educators to adopt several principles:

- Children are strong, capable in their uniqueness, and full of potential;

- Families have the most important role in contributing to children's well-being and learning;

- Educators are researchers and collaborators;

- Early years spaces are inclusive;

- People build connection and reconnection to land, culture, community, and place;

- Environments are integral to well-being and learning;

- Play is integral to well-being and learning;

- Relationships are the context for well-being and learning; and

- Learning is holistic. (p. 17)

The framework acknowledges that digital technology has a place in the everyday life of learners as consumers and creators as it offers, "new and exciting possibilities for children to experiment with images, print, gesture, sound, and video that can contribute to multiple modes of literacies and communication" (p. 90). It recognizes the role of technology in making classrooms inclusive to those who would otherwise be at a disadvantage. The framework also stresses that children and adults both need to learn to be ethical and critical when using digital media. In exploring digital literacy in

kindergarten, the principles of the B.C. Early Learning Framework can be aligned with the learner-centred theoretical frameworks of play-based learning, social constructivism, and humanism.

Play-Based Learning and Socio-Cultural Theory

With the B.C. Early Learning Framework at its foundation, the province of B.C. has published the *Play Today: B.C. Handbook* (B.C. Ministry of Education, 2019) for parents and educators of young children. The handbook credits play with improvements to many important skills including communication, problem-solving, critical thinking, reading, writing, numeracy, collaborative, social, and citizenship skills. It also notes that play can enhance digital literacy skills. The handbook cautions educators not to exclude popular culture, including commercial culture, from their learners' play as these may be the most engaging and intrinsically motivating elements. Figure 1 shows the handbook's adaptation of the continuum of play-based learning from Pyle and Danniels (2017). The continuum runs from child-directed play to educator-guided play to educator-directed play, further labeling the types of play as free play, inquiry play, collaborative play, playful learning, and learning through games. Pyle and Danniels (2017) differentiate between play and play-based learning since they argue that children can play without learning anything while play-based learning will have some degree of adult intervention to ensure some learning occurs. This view coincides with Vygotsky's social constructivism and sociocultural theory.

Figure 1

B.C. Play Today Handbook's Continuum of Play-Based Learning

Note. Reprinted from "Pedagogical Strategies for Play-Based Learning" by B.C. Ministry of Education, 2019, *Play Today B.C. Handbook*, p. 38 (https://www2.gov.bc.ca/gov/content/education-training/early-learning/teach/play-today). Copyright 2019 Province of B.C.

According to McLeod (2018), Vygotsky believed that adults and peers are able to transmit their cultural values, beliefs, and problem-solving strategies to children through social interaction that allows for social perspective taking. McLeod suggests that adults, peers, and even some digital programs can be representatives of what Vygotsky would call more knowledgeable others; these more knowledgeable others would engage in social interactions that create opportunities and scaffolding within the zone of proximal development, allowing children to learn. Bodrova and Germeroth (2013) examined how the social interactions advocated by Vygotsky measure up with the realities of more modern play. Their studies have found that Vygotsky's theories of play were more social and role-based than modern play

behaviours. For example, simply building a tower with blocks would not qualify as play for Vygotsky unless the builders were engaged in role-playing characters, following a set of rules associated with the imaginary situation. Bodrova and Germeroth (2013) referred to this concept of play as make-believe play and suggest that the quality and quantity of play has declined since Vygotsky formed his theories, becoming less mature. They concluded that adults have a critical role in engaging children in more frequent play and supporting that play to become the more mature form that Vygotsky would say offers learners the opportunity to advance in the optimal zone of development.

Humanistic Learning Theory

Like constructivism, humanistic learning theory, developed by Abraham Maslow and Carl Rogers, is learner-centred, asserting that learning cannot be true or significant without considering the person as a whole (Hollis, 1991). "Advocates of humanistic learning theory believe that the most important learning in the modern world is the learning of the *process of learning*" (Hollis, 1991, p. 52). According to Hollis, computer technology should be used to enhance the process of learning and provide learners with opportunities to guide their own educational experiences. Humanistic learning theory gives learners great input into the curriculum, methods, and timing used in their own instruction, assuring that it meets their own needs, states of development, and personal styles, while it allows educators to assume the role of facilitator, helping learners become self-actualized (Hollis, 1991).

Search Methods

For the literature review accompanying this project, searching for articles began in the University of Victoria library database to locate scholarly and peer-reviewed journal articles filtered by Boolean search keyword sets that included: '(kindergarten OR early childhood) AND (technology OR digital OR ICT OR iPad OR tablet OR computer)'; 'digital AND (literacy OR competence) AND (kindergarten OR "early childhood" OR "preschool")'; '("young children" OR kindergarten OR

preschool) AND "internet safety"'; ("young children" OR kindergarten OR preschool*) AND ("screen time" OR "screen-time") AND technology; "young children" OR "early learners" OR "early childhood" OR kindergarten OR preschool AND digital AND coding; and finally, "young children" OR "early learners" OR "early childhood" OR kindergarten OR preschool AND "online safety". The results were, therefore, not confined to kindergarten, as discussing children in the surrounding age-groups could yield relevant information. I also explored the references cited by the authors in the initial searches, especially if a claim needed further clarification.

Chapter Two: Literature Review

B.C.'s Digital Literacy Framework defines digital literacy as "the interest, attitude and ability of individuals to use digital technology and communication tools appropriately to access, manage, integrate, analyze and evaluate information, construct new knowledge, and create and communicate with others" (B.C. Ministry of Education, n.d., para. 3). For educators, the key word in this definition is *appropriately*. What aspects of digital literacy are appropriate for schools? Is it appropriate to use digital technology at all with four- to six-year-old children in kindergarten classes? Is our time and money better spent on a more traditional education? These are questions important to educators and may influence their decisions to integrate digital literacy into their early learning programs. This literature review seeks to examine the relevant issues that may contribute to this conversation.

The debate about technology in schools is not new. Clark (1994) asked educators to critically examine media and whether or not it was the media or the pedagogy that was facilitating student achievement. Clark suggested that media was merely a more expensive means of achieving the same educational goals as other means. More recently, attention is given to the claims of Cordes and Miller (2000), who claimed that computer use has a negative impact on children's social, emotional, cognitive, and physical development. Cordes and Miller argued against a high-tech agenda that pushes young children to learn how to access ideas and images instead of creating their own. Harkening back to Clark, Cordes and Miller contended that the considerable amount of money spent on technology would be better spent on the critical needs of public schools and the "low-tech imperatives of childhood" such as good nutrition, safe housing, and high-quality health care (p. 95). Magan-Nagar and Firstater (2019) raised the issue of internet content that is often inappropriate for children and time spent on devices that is believed to interfere with free play. The study by Zaranis and Oikonomidis (2016) found that many teachers believe that arts and crafts, outdoor activities, and free play are more important to the development of young children than learning how to use technology. Judge, Puckett, and Bell (2006)

discovered that children with low achievement in reading did not show significant improvement with frequent use of computer reading programs. They concluded that the quality of the program needed greater investigation and that such children would be better off spending less time with drill-and-practice type reading programs and more time with direct reading instruction with the teacher. Counter arguments point to the important role of teachers. Kozma (1994) disagreed with Clark (1994) stating, "If media are going to influence learning, method must be confounded with medium" (p. 16) and "the task of the designer is to use the capabilities of the medium to create objects that generate interesting and effective conversations-ones that influence learning" (p. 17). In other words, the educational applications for media are only as good as the pedagogical design behind them. Eighteen years later, Hardersen (2012) applies the same belief to ICT, concluding that on its own, it does not improve the quality of kindergarten unless it is relevant and motivating to the students as well as secure. Kazakoff (2015) added that research shows that access to ICT is not enough on its own to develop an understanding of it; the social context is also important. In their literature review, Hsin, Li, and Chin-Chung (2014) concluded that most of the studies they reviewed found that using ICT for learning had positive effects on children's performance in all developmental domains: cognitive, social, emotional, and physical.

The debate over the potential benefits and detriments of using ICT with young children is likely the cause of many teachers' hesitation in implementing technology with students; therefore, this review will explore the relevant research in order to clarify why and how educators should add ICT education to their kindergarten programs.

Technology and Young Children at Home

According to Ponti (2019), the Canadian Pediatric Society states that digital media use can have positive and negative effects on development, mental health, and physical health of school-aged children depending upon the nature of how it is used. Ponti noted an association between depressive

symptoms and recreational, sedentary screen-time in young children. Ponti found that excessive screen time is linked with weight gain; she found that along with increasing sedentary behaviour, tv watching can suppress satiety signals and impact children's diets by increasing snacking and fast-food consumption while reducing consumption of fruits and vegetables. She noted that some screen activities such as exergaming, geocaching, and fitness tracking can contribute to physical activity. Ponti also found that screens in the bedroom often interfere with sleep by causing emotional arousal, inhibiting melatonin release, and disrupting sleep rhythms. Ponti points out that the Canadian Pediatric Society recommends four principles: well-managed screen time with no more than one hour of recreational screen time per day; meaningful screen use that emphasizes educational, active, or social uses; modelling of healthy screen use by parents; and monitoring for problems that include being bored without screen time or having negative emotions while online.

Findings of a study by Hosokawa and Katsura (2018) suggest that regular and routine use of mobile devices is linked to emotional and behavioural problems in children. They add that preventing excessive use should reduce the likelihood of developing these problems. In the United States, the Fred Rogers Center (FRC) for Early Learning and Children's Media and the National Association for the Education of Young Children (NAEYC) issued a combined position statement that states that when considering screen time limits, estimations should include the total amount of time spent on all screens including television, computers, video players, tablets, and smartphones, both at school and at home combined (*Digital Media and Learning*, 2012). According to the FRC and the NAEYC, when digital media is used properly and screen time recommendations are respected, it can enhance creative play, physical activity, outdoor experiences, and exploration, without replacing them. Further, they believe that digital media can support children's relationships with adults and peers when they share digital experiences that are engaging and enjoyable opportunities to learn and develop.

According to evidence reviewed by paediatricians, Radesky and Christakis (2016), parents have a key role in modelling digital media habits by co-viewing and interacting with media alongside their children.

> Given the potential benefits of digital technology as a tool to enhance early childhood development, creativity, and social connection, it is important that parents proactively think about using media for these purposes while also preserving time for unplugged learning, physical, social, and emotional experiences. (Radesky & Christakis, 2016, pp. 834-835)

Parents must teach their children how to use ICT to create and connect rather than consume media, as well as how to limit the time spent attending to screens.

In a study of children's online safety, Zilka (2019) found that it is not enough to lay out the rules for children's media use; children are afraid of criticism and punishment by their parents so they often do not seek the guidance of an adult when they run into trouble online. She concludes that the significant adults in children's lives must establish trust and dialogue about online happenings. Lazarinis et al. (2020) found that teaching internet safety is best done with parental intervention, school activities, and peer support. They found that it is also helpful to use mediums that children enjoy and trust, such as digital games and stories, to initiate conversations between learners and educators. Educators can make suggestions to children's caregivers about the appropriate use of ICT at home but, ultimately, the only place educators can really make ICT benefit children is in school.

Technology and Young Children in Schools

Couse and Chen (2010) shared positive results for technology use for learning, citing multiple studies that showed that using ICT improved motivation and engagement in learning tasks for young children. They also found studies that claimed children demonstrate greater gains in intelligence, structural knowledge, problem solving, and language skills when using ICT for learning than those who did not.

In their own study, they found that children between the ages of three and six quickly learned how to use a tablet for drawing and writing. They noted that the children persisted as they became more independent with the technology, experimented with it, and became more adept at creating and representing their thinking. A study by Yuksel-Arslan et al. (2016) concluded that children showed more motivation, persistence, and patience because they had a role in creating the final product, a digital story, from start to finish. Knauf (2016) conducted a case study in which the classroom teacher was highly comfortable and competent in using ICT with her kindergarten class; observations showed that children were able to incorporate digital technology as easily as a book or a worksheet, just a normal part of their day. This shows that children can learn to use ICT at a young age and with relative ease.

The important thing in using technology with young children is how to use it appropriately to get the most developmentally appropriate benefits. How technology is used is critical. Who does the thinking? ICT that encourages thinking gives children active control and opportunities for problem solving while allowing teachers to assess their development. Educators must select applications that allow children to explore, discover, imagine, problem solve, make choices, and understand the impacts of those choices, as well as support children's emotions, thoughts, and physical well-being (Beschorner & Hutchison, 2013). Kazakoff (2015) suggests that educators use ICT to engage children in interactive and meaningful problem-solving experiences through constructivism. Kazakoff also points out that there is research to suggest that children who experience Science, Technology, Engineering, and Math (STEM) while young, experience fewer gender-based stereotypes and more STEM career opportunities when they are older. "Research specifically on computer programming environments supports the argument that children's computer programming with age-appropriate materials allows them to learn and apply concepts such as abstraction, automation, analysis, decomposition, and iterative design," (Kazakoff, 2015, p. 45). Kazakoff credits the touch screens of tablets such as the iPad with allowing digital

technology to be far more interactive; through new technologies, apps, and programs, children are capable of producing digital content as well as consuming it. Used thoughtfully and effectively, ICT can encourage creativity, curiosity, exploration, collaboration and problem solving positively affecting kindergarten play, learning, and cognitive development (Magen-Nagar & Firstater, 2019). To be more specific, Magen-Nagar and Firstater cite a study by Saharon and Kerlitz that shows, "ICT has been found to improve children's cognitive functions, such as visual, analogical, abstract, and mathematical-logical, and their creative thinking, memory, literacy development, motor-visual coordination, vocabulary, and metacognition" (Saharon & Kerlitz, 2011, as cited in Magen-Nagar & Firstater, 2019, p. 166).

Social Learning

Looking at the social domain in particular, Hsin et al. (2014) found that technologies enhanced collaboration and interaction with others. Kazakoff (2015) cited studies that found children are more likely to interact with their classmates when sitting at a computer than when they are doing other learning activities, and more likely to ask a peer to help rather than an adult. Knauf (2016) also cited studies that claim digital tools promote social learning because children are excited to use and talk about them with each other. Beschorner and Hutchison (2013) suggested that the iPad is a promising instructional tool for young children and that the mobility of a tablet makes it easy for children to see what is on the screens of other children, which inspires social interaction, cooperation, and conversation. Hsin et al. show that many preschool-aged children already understand how ICT is used for social purposes such as communication, maintaining social ties, entertainment, study, and adult jobs, because they often join with or observe others in their home and community. This demonstrates an increase in social interaction rather than a decrease as feared by opponents. Hatzigianni and Margetts (2012) conducted a small study with young children from which they concluded that ICT use

can positively affect self-esteem. They added that ICT frameworks, which include goals in personal skills such as self-esteem development, may lead to fewer adults who are afraid to use the latest technology.

The New Digital Literacy

Not only are children coming to school with varying individual abilities in terms of social skills, numeracy, and literacy but also in terms of digital literacy. Beschorner and Hutchison (2013) contend that, in addition to examining what children know about reading and writing, educators may also need to consider what they know about digital reading and writing. They further assert that, to be considered fully literate, children must be proficient in the new literacies of modern ICT. Readers and writers will need to be able to use and adapt to the ever-changing nature of ICT. On a tablet, these new skills include identifying icons, digital navigation such as drop-down menus, digital terminology, using a pop-up keyboard, user controls such as swiping, double clicking, and scrolling, using hyperlinks, storage, and retrieval (Neumann et al., 2017). It is important to provide children with many varied opportunities and guidance to explore and make sense of both digital and traditional text (Neumann et al., 2017). Wohlwend (2015) argues that play should no longer be regarded as a precursor for writing but, when connected with open-ended apps that facilitate animation and live-action video, as a literacy in itself: "filmmaking and digital puppetry now offer children an opportunity to produce their own animated stories, significantly in ways that encourage collaboration, build upon their play interests, and support their emerging digital literacies" (p. 158). Working with models designed for older children and analyzing them with young children in mind, Kazakoff (2015) shared six components of digital literacy in early childhood: understanding and utilizing digital interfaces; non-linear navigation, critical thinking and problem solving skills in digital domains; cooperative learning and play afforded by digital tools in early childhood; creative design afforded by digital tools in early childhood, and

digitally enhanced communication in early childhood. Together, these components targeted the following developmental areas: symbol understanding, fine motor skills, hand-eye coordination, linguistic, social-emotional, social-cultural, and cognitive.

Another lens for defining digital literacy is that of coding using the programming languages to create computer software. Educators teach children to write in order to organize, voice, and share ideas. Now, educators must recognize that coding, in addition to exercising logic, problem solving, and computational skills, presents a new medium for organizing, expressing, and disseminating ideas (UNESCO, 2018).

Emergent Literacy

A small study of kindergarten children by Maureen et al. (2018) showed that non-digital storytelling and pre-recorded digital storytelling that included text, pictures, voice, and sounds presented using a projector both contributed to superior improvements in literacy skills compared to teacher-led, literacy-focused classroom activities. They examined alphabet knowledge, phonological awareness, and print awareness. In this study, digital storytelling also had the effect of enhancing digital literacy skills.

A case study by Beschorner and Hutchison (2013) not only supported the use of tablets for digital literacy skills, but also for teaching emergent literacy in the early childhood classroom; tablets offer unique ways to read, write, listen, and speak within a single context. Dobler's (2011) article features a grade one class in Kansas which demonstrates how young children can use various apps for differentiated literary practice without extensive assistance from the teacher. Neumann et al. (2017) found support for positive relationships between tablet use and emergent literacy skills such as print awareness, print knowledge, letter sound knowledge, and name-writing. However, Neumann et al. also found other studies that show no significant enhancement of literacy skills. Likewise, they found mixed results when it comes to electronic books (ebooks), possibly due to varying qualities of ebooks and

varying levels of adult mediation. It is possible to provide ebooks that simulate reading aloud fluently and may be accompanied by sequentially highlighted text. Neumann et al. claim that digital texts have the ability to engage auditory, kinaesthetic, and tactile senses, as well as the visual senses. On the other hand, they also caution educators to beware of features such as advertisements, hyperlinks, and games that distract children's attention away from the text and potentially interrupt comprehension. Arrowood and Overall (2004) collected the reflections of pre-service teachers tutoring struggling writers and concluded that most children feel better about themselves and their creative writing when the physical act of handwriting is removed from a task. The act of handwriting, staying between the lines and forming legible shapes, can be challenging and time consuming for children who are still working on fine-motor skills; technology can improve motivation in the creative writing process (Couse & Chen, 2010).

Numeracy

A study by Miller (2018) explored the use of interactive mathematical learning apps on iPads with kindergarten children. Results showed small, but not significant, gains for children in the experimental group compared to the control group. Miller concluded that using iPads does not hinder early numeracy learning. The study also found that the children were more engaged, collaborative, and persistent if the apps were perceived as play, creative, fun, and not too challenging. The study showed that learners needed direction to choose the high-quality apps as they tended to prefer the more entertaining apps even if they were low in educational value. It is important to know that the digital activities were encouraged in balance with other play-based activities.

According to Zaranis et al. (2013), mobile devices have considerable advantages for teaching mathematics to young children; these advantages include attractive features, ease of use, affordability, and wireless portability. They conclude that digital learning software can contribute to young children's

learning of mathematical concepts particularly if it has certain characteristics. It must be user-friendly without adult help, must not require reading and writing skills, and must have animation and sound, particularly for giving instructions.

Creativity and Play

Similarly, technology offers appealing features for fine-motor-challenged children tasked with drawing. Trepanier-Street, Hong, and Bauer's study (2001) found that, using the different fine motor and visual-spatial skills required to operate a computer with a mouse allowed children to create more advanced and more detailed self-portraits than they did with paper and pencil. They further suggest that, for some children, the computer is a more interesting and, therefore, more motivating tool. Couse and Chen (2010) found multiple studies that showed how drawing with a stylus on a tablet was even better received, particularly with young children.

The motivating qualities of technologies and their contributions to writing and drawing may signal a need to rethink what teachers believe about creativity. Hardersen and Guðmundsdóttir (2012) remind us that the nature of children's play and culture change frequently, and adults should not expect their own childhood experiences to mirror those of today's children. The first generation of iPad is twice the age of some of today's kindergarten children. Parents report that even though their zero to six year old children are immersed in technology, play continues to be the most frequently engaged in activity (Hardersen & Guðmundsdóttir, 2012). Parent participants in a small study of 33 families by Slutsky and DeShetler (2017) reported that preschoolers spent most of their day playing activities that were not technology-based followed by an average of two hours with technology, with outdoor play lagging behind both. Lindhal and Folkesson (2012) identified a problem of "norms" where traditional beliefs about play-based learning were disconnected from the reality of children's relationships with technology. A study of 195 Kuwaiti kindergarten teachers showed that even though they were not

technophobic and did not lack access to technology for their classrooms, they were content with their existing play-based pedagogy which characterized play as a physical activity, with children moving around and exploring with their senses; teachers did not believe digital devices had a natural place in play-based learning (Aldhafeeri et al., 2016). Nuttall et al. (2015) conducted a small focus group study in which three Australian kindergarten teachers without a workable theory of digital play demonstrated a tendency to position ICT as a tool to support their existing concepts of play; for example, a child that likes to play with toy dinosaurs could be encouraged to use an iPad to research information about dinosaurs, or an autistic child could use ICT as a means through which he could make a social connection with peers. Edwards (2016) suggests that those in the field of early childhood education need to rethink the concept of play. She defines converged forms of play as those in which a child's play activities are so deeply connected with the digital or corporate media where they originated, it is difficult to separate them. With this new concept of play in hand, Edwards suggests research can be directed toward creating a knowledge base that helps teachers use ICT, digital media, and popular culture alongside modern play-based learning. She introduced a tool for conceptualizing play, called web-mapping, that integrates ICT, digital media, and popular culture. This reconceptualization of children's play allowed teachers in the study to understand and accept the children's real interests and create play-based learning opportunities, both traditional and converged, that were personally meaningful to the children (Edwards, 2016).

Global Citizenship

While the concept of global education has been the subject of research for many years, it is becoming increasingly prominent in the field of early childhood education (Bell et al., 2015). Bell et al. state that for learners to become global citizens, they must learn global skills, knowledge, and attitudes, and they must be comfortable living, participating, and working in the digital age. They encourage educators to

teach young children how to use technology to learn about people, the environment, and communities around the world by setting up communication, relationships, shared cultural events, and cooperative activities with children from other cultures.

Digital Natives and Digital Divide

Do children nowadays know more about technology than adults do? Prensky coined the term *digital natives* to refer to young people who appear to understand modern ICT because it has been present in some form their entire lives (Prensky, 2001). According to Livingstone et al. (2017):

> Children are not, however, 'digital natives' who need little support in making the best of digital media. Few have received much guidance from school or home, too many lack skills other than basic functional skills, with particular gaps in their critical information literacy skills that merit urgent attention, especially as part of any programme that uses digital media to meet its objectives. (p. 2)

It may be true that children have exposure to digital technologies right from birth, but there are factors that contribute to wide variations in what these children have learned about ICT prior to attending kindergarten.

Educators know that children who come into classrooms are bringing a huge variety of experiences and abilities. It is becoming clear that this also applies to their knowledge, experiences, and abilities with digital technology. The digital divide is a term that refers to the great differences in access to digital technology and the internet. Kazakoff (2015) and Scherer and Siddiq (2019) support the belief that when it comes to digital literacy, the rich get richer and the poor get poorer; children from low-income families are typically at a disadvantage compared to higher-income peers when it comes to access to new technology. Kazakoff adds that children in low-income homes are less likely to choose educational apps and websites to use as they often receive less parental influence. Children from low-income families are faced with extra challenges including access to high-quality childcare and early education

(Tawfik et al., 2016). In a study of 1351 Western Australian children, Harris et al. (2017) noted that 98.9% of the children had some kind of computer access at home. While they report participants from high socio-economic neighbourhoods had more experience with educational software, reading, playing musical instruments, and physical activity, participants from lower socio-economic neighbourhoods had more experience with television, electronic games, mobile phones, and non-academic computer activities at home.

Dolan (2016) put forth that access to technology for kindergarten to Grade 12 students is more complicated than simply who has a device and who does not; issues have expanded to include internet connectivity, bandwidth, software availability, location, and cultural differences. Regardless of economic status, children could be starting school with vast differences in their digital experiences simply because of their geographic location.

Hsin et al. (2014) found that children were coming to preschool with varying levels of digital literacy, with many being able to take pictures with digital tools, play computer games, resize windows on a computer, type letters, and use remote controls. They also found that children with greater prior knowledge and more access at home made more progress in their performance after using technology. Hsin et al. found computer access at home correlated positively with reading performance, cognitive development, math skills, computer skills, and computer confidence. In their study based on responses from 1277 parents of Norwegian children under seven, Hardersen and Guðmundsdóttir (2012) found that over one-third had not used computers or touch screen technology at home. They concluded that these children may be missing opportunities to develop experience and the associated learning strategies.

Why do we need to start teaching digital literacy in kindergarten? Why not wait until the later grades? With knowledge of a child's digital culture and environment outside of school, a kindergarten teacher can meet the needs of each child and begin to combat the digital divide as soon as possible (Hardersen

& Guðmundsdóttir, 2012). In a 2016 survey of 250 professional media and instructional technologists, nearly all respondents indicated that digital citizenship education should begin in preschool and kindergarten, particularly since many elementary school students are already carrying cell phones and have, therefore, been "creating digital footprints with each snap, click, and tap" (Hollandsworth et al., 2017, p.529). Kazakoff adds that even when children have opportunities to use ICT tools at school, the digital divide may narrow somewhat, but never fully close due to the differences that persist because some children have near constant access while others have very limited access.

In 2016, the United Nations declared that access to the internet is a human right for all, including women, girls, and others who are impacted by the digital divide (Howell & West, 2016). Rowsell et al. (2017) point out that when students have no access to ICT and the internet at home and no access at school, the threat of a widening gap is increased. They argue that all learners must have equitable and meaningful access to ICT along with the internet, plus high-quality instruction in schools. They encourage educators to advocate for ongoing professional development in digital literacies and increased funding for digital access outside of school, in out-of-school programs, public libraries, and community centres.

Tawfik et al. (2016) point to studies of the television show Sesame Street as an example of a widely accessed educational technology successfully targeting social inequality issues related to conceptual and social knowledge. Their meta-analysis of 24 studies across 15 countries showed positive impacts on reading, math, and vocabulary, including for children in low-socioeconomic households. They add that surprisingly little research has been done on how to increase access to early education of these underserved children with more interactive technologies.

Educator Beliefs and Professional Development

There appears to be many compelling reasons to incorporate ICT into early childhood education so the next step may be to get teachers to agree. Mertala (2019) asserts that it is important to consider the

beliefs of educators when shaping a plan to educate teachers in educational technology and that

negative beliefs must be addressed but not automatically denounced as unreasonable. Kerckaert et al.

(2015) pointed out that there are important differences between educators' use of ICT to support

learning ICT skills and attitudes versus ICT use to support content learning and individual differences.

Professional development needs to span both uses and is crucial for stimulating educators' ICT

integration with content learning and serving the individual differences between learners (Kerckaert et

al. 2015). Hutchison and Reinking (2011) also emphasized the difference between technological

integration and curricular integration. They assert that technological integration could be as simple as

using a digital projector to present media while curricular integration could involve a higher-level

intertwining of technology and curriculum that transforms instruction. Hutchison and Reinking's

survey of 1441 literacy teachers showed that a relatively high number of the teachers' concepts of ICT

integration would be characterized as technological rather than curricular. Less than 10% of these

teachers identified with concepts that were consistent with curricular integration. More recently,

Zaranis and Oikonomidis (2016) conducted a two-phase survey of Greek kindergarten teachers that

concluded that teachers had a more positive attitude toward technology if they were confident and

knowledgeable about educational software; these teachers also tended to use computers regularly at

home and at school for other teaching related reasons. Zaranis and Oikonomidis suggest that more ICT

courses for pre-service teachers and more in-service training for active teachers will increase teacher

support for incorporating educational technology into their practice by increasing their competence and

confidence with it. The study by Hsu (2016) also emphasized that teachers need more training and time

exploring how ICT can be effectively used in educational settings.

In addition, Knauf (2016) found that parents, especially if they were users of social media themselves,

placed a lot of trust in the teacher's knowledge when it came to age-appropriateness, internet safety,

and privacy. It would follow then, that educators should be sure to understand internet safety and

privacy before they take on that responsibility. Findings by Danby et al. (2015) agree that pedagogy and the moral work of culturally appropriate decision-making are more important than technical competence when it comes to digital technology and young children. However, it seems that many educators are not as confident in their own knowledge. In a small study of 107 kindergarten to grade 12 teachers, Martin et al. (2019) discovered that participants generally wanted to know more about digital citizenship; educators wanted to know more about internet safety, copyright issues, cyberbullying, parental involvement, legal ramifications, and how to teach digital citizenship by considering students' perspectives. Hollandsworth et al. (2017) surveyed 250 American media specialists and instructional technologists, and interviewed some key stakeholders asking how digital citizenship has changed in schools, what grade levels digital citizenship education should begin, and what the overall state of digital citizenship in schools was at the time. They concluded that educators and administrators needed to improve awareness of digital citizenship and to continue to focus on the misuse and abuse of technology. They added that online dangers, etiquette, and digital footprints are not the first thing parents and students think about when engaging with the internet, possibly because they think it is unlikely to happen to them. In a United Kingdom study of 29 children aged six to ten, Zhao et al. (2019) concluded that the children in their focus groups were able to understand notions of inappropriate content and the risks associated with strangers and revealing their identities, but struggled to see the problems associated with personal data tracking and pop up advertising attached to online videos and games. They added that "children who interacted with certain technologies and experienced no implications before, they would tend to be more (over-) confident with technologies" (p. 8). These children were also over-confident if their friends recommended media or if content was posted by familiar people. Zhao et al. recommended that tools for facilitating children's safe use of technology should serve to scaffold children's learning about online safety and help parents become actively involved in this learning rather than simply restricting access.

The pathways for preparing educators for this important work have been laid out by various authors for quite some time. Chen and Price (2006) outlined six principles that Chicago schools follow in order to help educators develop the attitudes, skills, and practices they need to maximize the benefits of technology integration in classroom practice:

- hands-on experience, extensive practice, instructor feedback, and opportunities for reflection;

- the opportunity to co-construct knowledge by allowing educators to provide feedback and requests to instructors/mentors as well as share their own successes with others;

- exercises in connecting software with classroom activities so educators can practise integrating technology into literacy, numeracy, inquiry, and other curricular goals;

- training in using technology to meet educators' instructional needs such as creating their own resources;

- opportunities for educators and educational assistants to interact and learn to integrate technology into the classroom together; and

- opportunities for peer role models to share their successes and inspire other educators.

The FRC and NAEYC have also been advocating for increased training for educators, declaring in their joint position statement:

Digitally literate educators who are grounded in child development theory and developmentally appropriate practices have the knowledge, skills, and experience to select and use technology tools and interactive media that suit the ages and developmental levels of the children in their care, and they know when and how to integrate technology into the program effectively. Educators who lack technology skills and digital literacy are at risk of making inappropriate

choices and using technology with young children in ways that can negatively impact learning

and development. (*Digital Media and Learning*, 2012, p. 4)

The need for appropriate training for educators has had its advocates for many years but the journey to

digitally literate educators has been a slow process and still has a long way to go.

Developmentally Appropriate Technology in Early Childhood

In order for ICT to have a positive effect on early learners, it must have its developmental

appropriateness considered, be supported by attentive adults, and be integrated into the curriculum

(McManis & Gunnewig, 2012). According to the United Nations Educational, Scientific and Cultural

Organization (UNESCO), the Developmentally Appropriate Technology in Early Childhood (DATEC)

project identifies nine general criteria for determining the appropriateness of ICT tools. They should be

educational, encourage collaboration, support integration, support play, leave the child in control, be

transparent and intuitive, avoid violence and stereotyping, support development of awareness of health

and safety issues, and support the involvement of parents (Kalas, 2010, pp. 26-27).

According to the FRC and the NAEYC position statement (*Digital Media and Learning*, 2012),

integrating technology with learning appropriately requires that ICT activities enhance and strengthen

interactions with others including co-viewing and interacting with adults, discussing what children see

and do, connecting with real life experiences, and building vocabulary and language skills. ICT

activities must support creative thinking, media creation, and mindfulness using high quality content.

The statement adds that, as models for the appropriate use of technology, adults must be mindful of

their own ICT use, limiting recreational use when children are present. Pre-service and in-service

professional development opportunities are important in helping educators develop the digital skills and

literacy they need to be able to select, integrate, and evaluate ICT for young learners (Donohue &

Schomburg, 2017).

Technology, Pedagogy, and Content Knowledge (TPACK)

According to Koehler and Mishra (2009), there is no single ideal method for educators to use in integrating technology into practice but, instead, good educators must creatively design and structure integration efforts to suit the content and context of the learners. They propose educators use the Technology, Pedagogy, and Content Knowledge (TPACK) framework (Figure 2) to guide the incorporation of the three core components of high-quality technology-infused education: technology knowledge, content knowledge, and pedagogy knowledge. Technology Knowledge is complicated by the fact that technology changes frequently, but Koehler and Mishra (2009) recommend that educators continuously interact with technology in order to understand enough about it to be able to use it productively and adapt to its changes. Content knowledge is what educators know about the content they are teaching. Together, technology knowledge and content knowledge combine to define technological content knowledge as understanding how they affect each other. For example, how does a right-click digital dictionary function affect how one teaches reading? How does the increase in producing written work using a word processor affect the decision to teach cursive writing? Pedagogical knowledge is what educators know about the best practices for teaching and learning. Combined with content knowledge, pedagogical knowledge becomes pedagogical content knowledge, which is the concept of how to interpret and prepare the content for effective teaching and learning. Technology knowledge and pedagogical knowledge merge into technological pedagogical knowledge; this is an understanding of how technology should or should not be used to affect teaching and learning.

Figure 2

The TPACK Framework
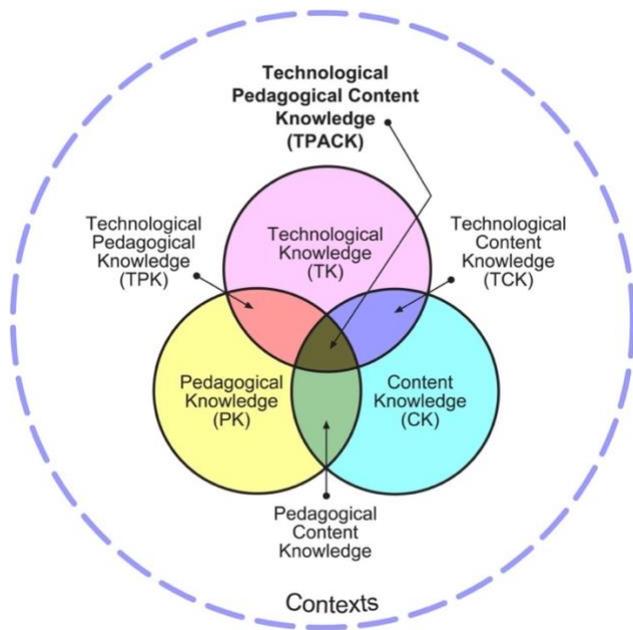
Note: Reprinted from "What is Technological Pedagogical Content Knowledge (TPACK)," by M. Koehler & P. Mishra, 2009, *Contemporary Issues in Technology and Teacher Education, 9(1), p.63.* Copyright 2009 by M. Koehler & P. Mishra.

Koehler and Mishra's final combination is all the components:

> [TPACK] is the basis of effective teaching with technology, requiring an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones. (Koehler & Mishra, 2009, p. 66)

While the TPACK Framework refers to the interrelation between Technology, Pedagogy, and Content

Knowledge, the SAMR Model seeks to classify and evaluate learning activities based on a hierarchy.

The SAMR Model

The SAMR (substitution, augmentation, modification, redefinition) Model illustrated in Figure 3 was

developed by Dr. Ruben Puentedura in 2006, and classifies technology use for learning activities into a

framework with substitution and augmentation capable of enhancing learning, while modification and

redefinition are capable of transforming learning (Romrell et al., 2014).

Figure 3

The SAMR Model
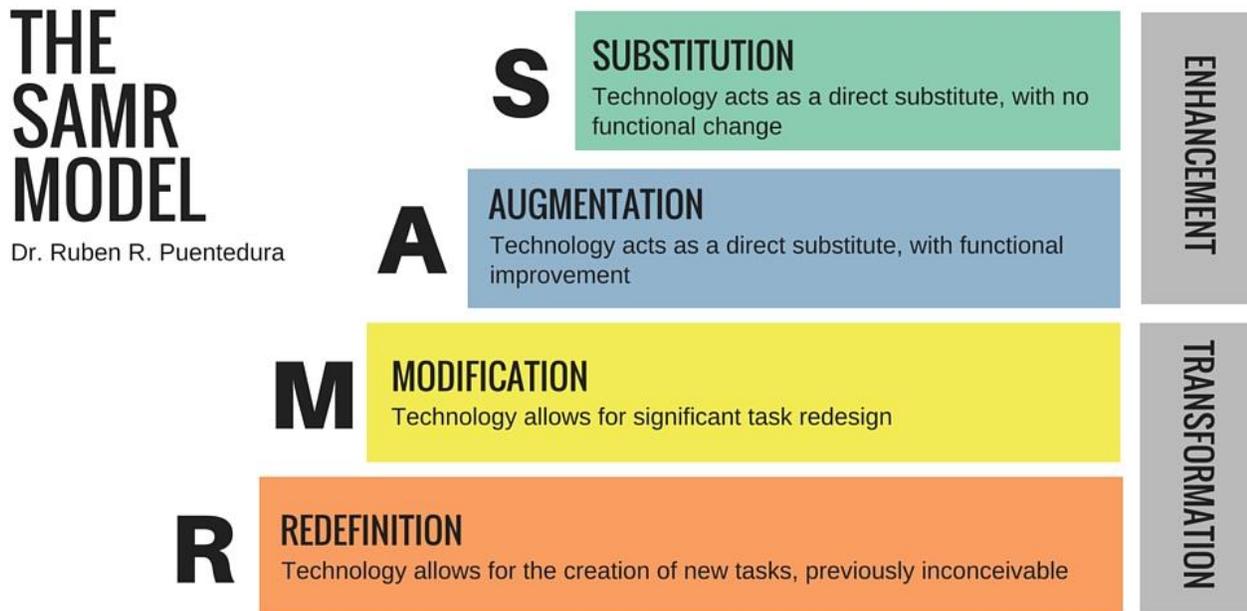
Note. "File:The SAMR Model.jpg" by Lefflerd is licensed under CC BY-SA 4.0

Romrell et al., suggest that educators should strive to design mobile learning (mlearning) activities using mobile devices at the modification or redefinition levels of the model in order to transform learning. They add that educators designing activities, especially at the substitution and augmentation levels, need to weigh the potential learning benefits of using a mobile device against the potential difficulties of using the technology with learners.

Issues with Integrating ICT

It is important to recognize the limitations of ICT in schools. Romrell et al. (2014) point out that educators need to be wary of technical, pedagogical, and management issues when using mobile technology for learning. One concern with integrating tablets into kindergarten stems from a small study conducted in Taiwan by Lin et al. (2017). In this 24-week study, the researchers instructed the parents of 40 preschool-aged children to have them use various fine motor apps on a touch screen tablet for 20 minutes daily while instructing the parents of a different 40 preschool-aged children to have their children do 20 minutes of traditional fine motor activities daily. The results showed that children in the non-tablet group made significantly greater changes in fine motor precision, fine motor integration, manual dexterity, and pinch strength than children in the touch-screen-tablet group (Lin et al., 2017). This subject may need further research but, in the meantime, this study may serve as a reminder that tablets should not be used to replace fine motor activities, but rather to supplement.

Mark and Nguyen (2017) state that it is important for parents and the community to be involved in creating rules, policies, and action plans for internet safety. They add that, "many adults are not up-to-date with changing technological developments, nor are they prepared to have Internet safety and ethics discussions with young technology users" (Mark & Nguyen, 2017, p. 62). In a survey of 19 parents and educators, Mark and Nguyen found respondents generally agreed that, in order to decrease internet-related problems in schools:

- internet safety education must be available for all ages;

- communication between administrators, teachers, students, and families must be honest, open, and regular;

- technology-use rules must be implemented consistently at school and at home, involving students in the rule-making process; and

- inclusive collaboration time for parents and educators should be planned and ongoing (Mark & Nguyen, 2017).

The Edward Snowden affair and the more recent Facebook and Cambridge Analytica scandals have served to increase public awareness about the collection and capitalization of user data (Knox, 2019). Educators and parents are increasingly wondering about surveillance, privacy, and the value of data, "shifting towards the idea that the technology industry might not be entirely governed by a benevolent interest in connecting people and improving social life" (Knox, 2019, p. 361). Some school districts are beginning to put tighter controls on what apps students may use in schools. The rapidly changing nature of educational technology and its unexpected consequences make it necessary to teach educators, parents, and children how to be critical and vigilant digital citizens.

Conclusion

B.C.'s New Curriculum (B.C. Ministry of Education, 2018) includes a new section entitled *Applied Design, Skills, and Technologies* (ADST) that states, "The ability to design, make, acquire, and apply skills and technologies is important in the world today and key in the education of citizens for the future" (para. 1). The ADST curriculum requires that young learners explore technologies and use them safely, developing skills through play and collaborative work. The B.C. Ministry of Education created *B.C.'s Digital Literacy Framework* (n.d.) to provide more detail for scaffolding ICT skills and knowledge for learners. This has been a difficult addition for many kindergarten educators, especially if

they are not confident with technology themselves or have strong feelings about the potential negative effects of excess screen time and sedentary activities on children. The purpose of this literature review is to identify why many kindergarten educators have yet to integrate digital technology into their kindergarten programs, explain why it is necessary, and recommend the best practices for doing so. The potential consequences of children spending too much time with digital technology are well-known to parents, physicians, and educators. News media reports that, for children, excess screen time has been linked to obesity, as well as delayed social skills, problem-solving skills, and motor skills (Young, 2019). Over the past 20 years, Cordes and Miller (2000) have been cited by many authors as supporters of traditional education over technology-infused education. It is tempting to conclude that Cordes and Miller based their conclusions on old technology and that somehow new ICT will address their concerns. However, some more recent studies showed that technology without the proper guidance may result in those well-known negative effects or neutral effects. Therefore, consideration must be given to tools being used, the quality of the apps or programs being used, and the pedagogy behind the assigned tasks.

This literature review has discussed the importance of making sure ICT is implemented appropriately for the age and stage of learners. Academics such as Kozma (1994), Hardersen (2012), Kazakoff (2015), and others claim that when children are doing the thinking, ICT has the potential to benefit many areas of child development including STEM skills, literacy skills, critical thinking, problem-solving, memory, motor-visual coordination, communication, and cooperation. Organizations such as FRC and NAEYC agree that screen time should be limited at home, especially when responsible adults are not involved in their use. On the other hand, they also recognize that ICT has great educational potential, and a healthy balance of screen time and physical activity can be achieved. They point to the need for improved training for educators.

Adequately trained teachers may be less intimidated by technology and more capable in designing lessons that effectively integrate technology with the curriculum. They may be more likely to reconsider their own personal beliefs about technology and the concepts of creativity and play. Accepting that technology and pop culture already have an important role in children's play gives teachers another opportunity to use children's own interests to motivate their learning. Studies discussed in this review show that children are capable of using technology as tools quite easily and naturally, motivating them to persevere with tasks and bypass fine-motor difficulties that affect their creative work.

Issues with participating in an online community are a growing concern for everyone. Privacy invasion, online predators, cyberbullying, inappropriate content, *Fake News*, digital identity theft, targeted advertising, and the monetization of data are scary things and it is no wonder that educators want to protect their learners. The problem is that our learners will encounter these issues, even in kindergarten, regardless of filters and restrictions. They need to learn how to deal with them and keep themselves safe.

Today's children arrive at school having already been immersed in technology at varying levels. They are learning about technology, digital literacy, and internet safety from people with varying levels of digital literacy. Several studies supported the idea that the digital divide should be addressed as soon as possible and in British Columbia, that means kindergarten.

Chapter Three: Digital Literacy for Kindergarten

A web-accessible PDF version of *Digital Literacy for Kindergarten: An Introductory Guide for BC Kindergarten Teachers* has been uploaded to UVicSpace. This document was uploaded in May 2021 and contains the original version as it appeared on that date. Current editions will be updated and made available through my web page, Digital Literacy and Kindergarten (https://twestwood-med.opened.ca/digital-literacy-for-kindergarten). This web page also includes a quick introduction explaining how to use the guide. Current editions will be maintained in the following formats:

- Digital Literacy for Kindergarten [web accessible PDF]

- Digital Literacy for Kindergarten [printer-friendly PDF with full URLs displayed]

- Digital Literacy for Kindergarten [editable Word]

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Chapter Four: Reflections

Summary of Learning

The decision to join this master's program so late in my career was not an easy one, especially one focused on educational technology. I do enjoy learning and I have never feared messing around with computers, but I was definitely worried that I would not have the skills I would need. My school district was embracing iPads and I was on the lookout for ways to use them with my kindergarten class. I thought surely there was something more than phonics and math apps. I decided to give it a go.

It turns out that my notion of educational technology was completely askew. Adding technology to my practice was not merely about which are the good apps and how can I teach young learners how to use them. Also, like many of my colleagues, I wondered how much of a role technology really needed to have with young learners. I discovered B.C.'s Digital Literacy Framework (B.C. Ministry of Education, n.d.) for the first time. According to one of the minds behind it, Dr. Tim Winklemans, the framework is more than ten years old, which is baffling because I had never heard of it before 2019 (personal communication, March 10, 2020). As soon as I saw the framework, I knew I had to do something about incorporating it into my practice. This would be the first inkling of what my project might be.

Through the courses in this master's program, I learned about evaluating research and considering perspectives. I learned that I need to be wary of my Euro-centric perspective. In fact, it was the time we spent listening to Dr. Shauneen Pete, Dr. Christine Younghusband, and Colin Madland during our first semester that made me realize just how much I had to learn about decolonization and reconciliation. This was the second direction I considered for my project. In the end, I decided I needed more self-study before I could produce something as a resource for others. Importantly, I learned that I must actively seek this knowledge and not wait for it to trickle down from administration.

I have added Dr. Shauneen Pete, Dr. Christine Younghusband, and Colin Madland to my Personal Learning Networks (PLN). Interacting with my PLN through social media is where I have the most

trouble. I have always been more of a listener than a talker, even on Facebook with family and friends. I do see the value in developing my personal learning network. I am very happy with the new voices I have begun to follow since starting this program, especially those who bring attention to areas I am pursuing for my own growth, such as racism and indigenous issues. I am always willing to think on other's opinions and ideas, but I have no desire to involve my voice in a debate. I think this might be even more so since listening to Dr. George Veletsianos talk about women in social media. If sharing my ideas out into the Twittersphere is already risky and outside my comfort zone, why would I want to venture in at all, knowing that women are subject to trolling even more than men. On top of all that, social media is enormously time consuming. I can barely keep up following 100 tweeters, I cannot imagine keeping up with 5000.

I learned that the Clark-Kozma debate may be 20 years old, but its arguments still persist. I agree with Clark that using technology in schools for the sake of using technology in schools is a waste of money. I agree with Kozma that the role of the educator is the key to enhancing learning using technology. I have always appreciated the way children will play and persist with digital tools for much longer than with a piece of paper and a box of crayons. Children who cannot sit still at carpet time and roll on the floor can be magically transformed into upright, frozen, attentive watchers by a video projected onto the big screen. When it comes to kindergarten, the ability to retain a learner's attention for five or ten minutes is never a waste of money. The question then comes down to what is on the screen and why. I learned how the TPACK Framework and the SAMR Model provide educators with the means for designing technology enhanced educational activities.

Along these lines of enhancing learning, I was very interested in the Pacific School of Innovation and Inquiry (PSII). I was already familiar with the work in inquiry-based learning by Trevor Mackenzie and Rebecca Bathurst-Hunt, but the notion of breaking down the walls of the school in a sort of free-range learning model was inspiring. I was curious what I could take from this and adapt for elementary

school. I surmised that we could start with our kindergarten team, building the skills learners would need to engage in inquiry or project-based learning. What if students could move freely between our three kindergarten classes, focusing on the basics in one space, getting small group help in the second space, and following their own path in the other? This was the stirring of my third master's project idea.

I learned about open education and open educational resources. In searching the internet for open educational resources for kindergarten, I discovered them to be quite limited. Ideas are more easily searchable on sites like Pinterest or Teachers Pay Teachers, and while these sites are not technically open source, they do have ample free content to inspire most elementary school teachers. I have learned that while I have the ability to use Canada's Fair Dealing rules to borrow things from the internet for my own classroom, if I want to create an open resource of my own, I need to take care to find appropriately licensed resources (Canadian Association of Research Libraries, n.d.). Using only Creative Commons licensed images is a lofty goal, but often, finding exactly what I have in mind is challenging. If it is possible, I would rather take my own photos and I often wish I knew how to create my own clip art. Of course, then time becomes the issue. On the bright side, if I create something, I generally have no problem sharing it with anyone who finds value in it. This project marks the beginning of my own contributions to open resources.

The online semesters of this master's program itself have taught me much about distance learning but, I have learned more about it than I ever thought I would with Covid-19 restrictions pushing much of the world into remote learning situations. It did not take long to understand that the many faces of the Zoom classroom would not work well with kindergarten students without an extended period of establishing routines and expectations. The unprecedented events of Spring 2020 did not provide an opportunity to establish these procedures, nor did it provide a true distance learning experience as parent and student participation was largely voluntary and there was no requirement for true

assessment. With just four at a time, one day a week, I only saw my students for about 20 minutes a week. I took many bouncy, Blair Witch tours of different houses, bedrooms, and vegetable gardens. I discovered how reluctant young children are to share their thoughts with parents nearby. It made me wonder about the dynamics of weaving the two dominant relationships, family and teacher-student, into one confined space. It was clear that building that confidence in an online environment would be challenging.

When asked to contribute to a resource for online teaching, Heather Crossley and I saw a clear priority in the need for teachers to establish positive relationships with online learners. Heather is also an elementary school educator, so we had similar concerns. Together we compiled resources for our post, [Building Community With And Between Learners](#) (Crossley & Westwood, 2020), on our cohort's [Remote Teaching Resources](#) ("Remote Teaching Resources," n.d.) site. It turned out in September, that B.C. elementary schools returned mainly to in-class learning, so I did not have a chance to test out many of the tips we had amassed. However, with returning to remote learning a distinct possibility, I decided to create and maintain an interactive Bitmoji page (Figure 3). My theory was that if I used the Bitmoji page in class daily, right from the beginning, my students would be very familiar with it along with its many links. Then, if we did go into a remote learning situation, it would be an easier transition. Now, it is nearly Spring and we have managed to avoid remote learning thus far, but I have still found the Bitmoji page really useful. I use it to collect all my online resources for each day, and I sent the link to parents at the beginning of the year, so they know what we are working on daily. I have several students who watch and re-watch the video stories as part of their bedtime routine. In our current situation, parents do not have physical access to the school and classroom, so parents have reacted positively to the connection that the Bitmoji page provides. This was unexpected and would have been

Figure 4

Mrs. Westwood's Bitmoji Page

a good addition to our second post, Tips for Supporting and Connecting with Families (Westwood &

Crossley, 2020).

The Bitmoji page and the remote learning experience has really raised my Google Drive game. It is a

very useful tool, but as I have learned more about digital capital and the need for awareness of big data,

I am not sure where I stand on using it. As an educator, my concern needs to lie with protecting

children as well as I can and fostering the development of humans who are critical of the information

that travels back and forth on the internet. While governments and privacy activists battle the purveyors

of data, I will teach digital literacy to my students and take care to maintain their privacy, safeguarding

their digital footprints as well as possible. If I must publish their work, let it be on a password protected

site storing its data in Canada. If schooling needs to be communicated over distance, let it be over

district approved, data-stored-in-Canada video conferencing site or email. I will do the best I can with

what I know and keep looking to expand what I know so that the trust parents have in my judgement is not misplaced.

In this program, we have spent a lot of time talking about privacy and intellectual property, licensing, and safeguarding data under Canada's Freedom of Information and Protection of Privacy Act (FOIPPA). We have talked about openly sharing and opening oneself up through social media. Some of these topics are about keeping to yourself, while others seem like the exact opposite. I think the important thing to remember is that how much one puts out there should be a personal choice. There is no right or wrong for an adult making a decision for themselves as long as they know the implications for that decision. On the other hand, children are not yet ready to make that decision for themselves and so it falls to the parents to make decisions for now and to the educator to make sure the children are ready for the future.

The Research and My Perspective

My literature review focused on technology and young learners. Why do children need to start learning about ICT and the internet in their early school years? Before the literature review, I believed that young learners would benefit from ICT education mainly because they would be expected to have research and coding skills established before their intermediate elementary school years. I had previously taught grade 4 through 7 and, back then, I wished I could spend less time teaching students the basics and more time getting creative. The research points out there are even better reasons to start early. The general belief that young people know more about technology because they are digital natives is not true. The digital divide evident between learners upon entering school can be wide and varied. There are issues with digital equity that stem from social economics, geography, physical ability, and family beliefs. Some children have high quality experiences with digital technology, while others have low-quality experiences, and still others have no experience at all. Educators need to provide high quality experiences with ICT that contribute to learners' digital literacy and enhance

learning. I have come to believe that combatting the digital divide as early as possible is the duty of kindergarten teachers, or even preschool teachers.

The research in my literature review identifies several criteria for integrating developmentally appropriate, high quality ICT experiences into education. All of the models emphasized the word appropriately. Before this research, I believed that a one-to-one distribution of iPads was necessary, and that drill and skill applications were appropriate to support learning in kindergarten. I also agreed with many other parents and teachers that ICT, including television, should be minimized for young children. My research suggests that while recreational ICT use should be capped at one hour per day because of the potential negative effects, developmentally appropriate educational use can have positive effects. Among other things, developmentally appropriate ICT use should be educational, intuitive, encourage collaboration, and support play, so I now distribute iPads to pairs or small groups so they can take turns, peer tutor, and talk about what they are doing. I specify their choices for iPad related activities, but I do give them time to play. For example, my first iPad lesson is how to use the camera. After they have had the initial lesson, I can allow pairs to take the iPads at choice time to take photos and videos of their creations, self-initiated "performances", or imaginary play. Later in the year, I may sit with a small group and show them how to edit and embellish their photos. These are opportunities to reinforce the digital literacy skills they learned in the initial lesson, while monitoring their ICT play, asking questions, and encouraging them to think, plan, and incorporate their emerging numeracy and literacy skills. I am fortunate that my technological content knowledge of iPads allows me to be less formal in my approach. If, for some reason, my school switched to different tablets, I would need to do some exploring of my own. Fortunately, I have the basic skills that I can adapt for changes in technology.

What are the basic skills educators need children to know about ICT and the internet? The research suggests that basic skills would need to include the ability to operate simple digital devices, otherwise

known as the new literacies of modern ICT. This includes navigating features such as icons, double clicking, scrolling, hyperlinks, and pop-up keyboards. The research also shows that internet safety education must be available for all ages and must involve parents. It is not enough to restrict access to the internet. Children need adults to explore the internet by their sides and teach them how to be good digital citizens. Digital citizenship skills are necessary as children are increasingly being equipped with their own cellphones and are establishing digital footprints at a very early age. These basic skills are the focus of my project.

Why are some educators reluctant to incorporate ICT for their learners? The research indicates this reluctance comes down to educators' beliefs and training. Many kindergarten educators are in the same camp as Clark in that they believe that technology is unnecessary and expensive. They believe that time and money is better spent supporting social, outdoor, loose parts and makerspace, and play-based learning. The research suggests that professional development is needed to address these beliefs, but not dismiss them out of hand. In other words, it is not enough to say the Ministry requires you teach the Applied Design, Skills, and Technologies curriculum. Educators' professional development needs to address the why and the how as well as the what. Studies showed that educators who were comfortable using technology for themselves tend to have a more positive view of integrating technology. This is true for me. They also showed that parents trust educators when it comes to making decisions around technology in school. Just because someone is comfortable using technology does not mean they know how to protect students, promote netiquette, and minimize digital footprints. As an example, it was not long ago that teachers were uploading their students' photos to the Russian aging app, FaceApp, without knowing whether the photos would be retained for other purposes. If I had not been in this program to hear Alec Couros's thoughts on it, I might have been one of them. Professional development needs to make sure educators have the knowledge and skills to be worthy of parent and student trust. Many educators, including myself, are eager to learn more. I am more wary now than

before, but I feel I still have room for more growth, especially when it comes to privacy and data. For now, if I am not sure about the wisdom of a new ICT idea, I know I can ask district resource people or my PLN.

How do teachers best integrate ICT into their practice? The research I found also differentiates between technological integration and curricular integration. Prior to this master's program, I think my practice approached technological integration much more readily than curricular. It is much easier to engage with curricular content with older students. I have always believed that our youngest learners need to be introduced to the basic skills early, but I believed that curricular integration could wait until the later grades. Now, I see how ICT can be used to enhance curricular goals including social learning, outdoor learning, creativity, and play based learning while reinforcing the basics. I can do fewer whole class lessons and use more individualized and small group approaches. I agree with the research that says professional development needs to address curricular integration as well as technological integration. Tools such as TPACK, SAMR, and Web-mapping should be introduced alongside hands-on experience, time to practice connecting software with classroom activities, instructor feedback, and opportunities for reflection. The research supports collaborative opportunities between educators as well as educational assistants in these professional development opportunities.

This fully supportive approach to professional development should be the norm for any significant change educational practice. If the Ministry wants educators to adopt their digital literacy framework, it should be backed with a plan for making sure every educator knows it exists and has the knowledge to understand why and how to implement it. There should be an explicit guide that any educator can follow until they are comfortable making their own adjustments or developing their own approach. Changes can be made based on the latest research.

I would like to see future research that answers some my many questions. What are successful educators doing with digital literacy in their classrooms, particularly with early learners? What is the

highest quality, most effective, and safest software to use with early learners? How can technology be

used to advance universal design? How can digital technology be used to decolonise education? What

policy changes can be made to reduce the digital divide in B.C., in Canada, and globally? What is

preventing government from implementing policies that address digital equity and exploitation?

I believe that governments have a responsibility to implement policies that provide safe, universal,

public access to high-speed internet and digital tools. I believe that the public education system has a

responsibility to provide high-quality education that promotes good digital citizenship. I believe that

the Ministry of Education and school district leaders have a responsibility to provide high quality

professional development opportunities to educators so every educator can feel confident in

successfully integrating technology and preparing their learners with the digital literacy skills they need

for the future.

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