A Complex Inquiry into Preschoolers' Multiliteracy Practices at Home

by

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A thesis submitted in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

Department of Elementary Education

University of Alberta

Abstract

The increased use of digital devices in the home for work, communication, entertainment, and information searching makes these devices attractive to young children, who learn to communicate by observing and interacting with family members. This qualitative study examined 11 Canadian and Australian preschoolers' (ages 3 to 5) multiliteracy practices at home and their parents' perspectives of these multiliteracy practices. The following questions guided my study: What literacy practices are preschool children engaging with in their home environments? How are multiliteracy practices influencing the home lives of these children? What are parents' attitudes toward their children's engagement of multiliteracy practices in the home, including "traditional" and "new" literacy practices? How are parents within the study interpreting their children's home literacy practices? Drawing on a complexity-thinking perspective, this study examined the complex phenomena of young children's literacy practices and learning at home. Complexity thinking understands the world as an integrated whole, fundamentally interdependent, interconnected, and intertwined, rather than as a disconnected collection of small parts (Bateson, 1979; Capra, 1996; Maturana & Varela, 1992). I used Green's (1988, 2012) three dimensions (3D) of literacy as a conceptual frame to understand and interpret my data because it views literacy practices holistically. Complexity-thinking perspectives and Green's 3D model provided strong theoretical and conceptual frames, useful language, visual images, and metaphors to explore the complex learning systems of young children in this study.

The data collection tools I used were participant observations, field notes, informal interviews, and conversations with participants. Video and audio recordings of home observations and interviews were transcribed, and field notes were juxtaposed with the video and audio transcripts. I analyzed the data at both macro level, to identify general patterns across

domains, and micro level, to capture details of individual children's engagement with multiliteracy practices at home. Three emergent themes are illustrated in research vignettes which revealed in my study that (a) the children are using a wide range of technology tools within their everyday literacy practices; (b) their multiliteracy practices, learning, and playing are all interconnected and intertwined within their daily lives; and (c) their access to and use of technology tools at home are intricately linked with their parents' attitudes and dispositions toward new technologies. The insights gained from my study have the potential to provide valuable information for early childhood educators, policy makers, and curriculum builders in connecting children's home literacy experiences with in-school literacy practices. A deeper understanding of preschool-aged children's home literacy practices will be central to scaffold their transition from home to formal schooling.

Preface

This thesis is an original work by Suzanna So Har Wong. The research project of which this thesis is part, received ethics approval from the University of Alberta Research Ethics Board, Project Name "A complex inquiry into preschoolers' multiliteracy practices at home", No. 23337, May 7, 2012.

Dedication

This research is dedicated to my grandfathers, who came to Canada to seek for a better life for their family. I also dedicate this research to all my former students who have inspired me to be a lifelong learner and a reflective teacher.

Acknowledgements

Throughout my doctoral program I have had the opportunity to learn from and work with a team of remarkable and dedicated scholars. I would like to thank a network of people to whom I feel deeply grateful for their encouragement and support in my research journey.

First and foremost, I would like to express my sincere and heartfelt thanks to my supervisor, Dr. Linda Laidlaw, who devoted an exceptional amount of time and energy to reading this thesis and providing helpful and constructive feedback. I could not imagine completing this complex and "messy" research journey without working alongside with you. Your thoughtful and supportive guidance, mentorship, valuable advice, and friendship are truly appreciated.

I would like to thank my supervising committee members, Drs. Anna Kirova and Jennifer Branch. I am immensely grateful for your constructive feedback and critical suggestions at every juncture in my research journey. I also wish to express my sincere gratitude to my examination committee, Drs. Bill Dunn, Lynne Wiltse, and Karen Dooley, for reading my work and providing insights.

A sincere 'thank you' to all the participants in my study who opened their homes to me, particularly the children who allowed me to question, play, and learn alongside with you.

I am most thankful for my husband's unconditional love. I thank you for your patience and your understanding of my "little PhD passion project." I look forward to our post-PhD life together.

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Chapter 1: Introduction

It is the speed of electric involvement that creates the integral whole of both private and public awareness. We live today in the Age of Information and Communication because electric media instantly and constantly create a total field of interacting events.

(McLuhan, 1964)

Changes in Literacy Ecosystems

When *Understanding Media* was first published half a century ago, Marshall McLuhan's view of the new technologies in society was considered by some as science fiction fantasy writing. Today, the modes and media we use to communicate with each other lend a certain verity to McLuhan's phrase "the medium is the message" (1964, p. 264).

Screen-based communication is transforming our cultural and social landscape. It is changing the patterns of communication, including the social and cultural lives of many young children. As new technologies continue to become a more integral part of everyday life, young children are starting to incorporate them in their play, literacy practices, and learning at home. More than ever before, attention is being given to the role played by the media and digital technologies at home and in children's literary lives (see, for example, Holloway, Green, & Livingston, 2013; Honan, 2012; Mol, Neuman, & Strouse, 2014; National Association for the Education of Young Children, 2011; Plowman, Stevenson, Stephen, & McPake, 2012; Vasques & Felderman, 2013). New mobile touchscreen devices such as tablets and smartphones are used for meaning making and communicating and are having an impact on many children's home literacy practices (Burke & Marsh, 2013). Such devices may play increasingly important roles in the cognitive and early literacy development of children (Neumann & Neumann, 2014, p. 231).

My Research Journey

As an early literacy educator for many years in a rural community in western Canada, I was always curious about children's literacy experiences at home. At the beginning of every school year, I visited my students' homes as a way of meeting children and families and gathering information about my new students in their home environment. These home visits were an important part of my kindergarten program. During the last few years of my teaching career, I noticed that young children's home literacy practices were changing; they often involved digital devices. These children were arriving to my kindergarten classroom with a wealth of knowledge related to digital literacies and technology tools. These 21st-century students had different literacy practices, skills, and knowledge as compared to the students I had taught a decade earlier, and they were confident and competent in using the technology tools available to them in my classroom. Many of these kindergarten students could operate the classroom computers, navigating within bookmarked educational websites, use the interactive whiteboard, and play online games independently. However, according to the standardized readiness tests that were administered at the beginning of every September to all kindergarten students in my former school district, these techno-savvy kindergarteners were likely to be labelled as "not ready" for kindergarten. They could not demonstrate many of the expected early literacy skills such as holding a pencil, printing their names, identifying letters of the alphabet, or displaying book-handling knowledge. In other words, the children did not possess many of the "traditional" early literacy skills deemed to be required for formal schooling according to the standardized early childhood education readiness assessments used in my former district (e.g., Brigance Early Childhood Screen). Despite being labelled as "not ready" for kindergarten, these students were often the technology experts at the classroom computer centre and could solve minor technical problems for the interactive whiteboard. They could navigate through websites and understood

many of the icons on the screen. I began to wonder why these children were being labelled as not ready for kindergarten and were required to enroll in early intervention programs, such as the early literacy enrichment classes. At the same time, I noticed that my classroom learning environment resembled an artificial ecosystem, like a greenhouse, where the grower (me, the teacher) attempted to control everything, including the temperature, light, water, and even the nutrients in the soil. In my classroom, I attempted to control the quality of the teaching resources, the time students spent at different learning centres, the types and levels of books students might read, and so on. This artificially controlled learning environment was impacting my pedagogical approach to teaching early literacy and was stifling the children's growth, and I realized that it was not meeting the needs of these 21st-century students. I was unfamiliar with much of the literacy knowledge and skills that the students brought with them to my classroom, since they differed from the knowledge and skills of my students from previous decades. I wondered about the literacy practices young children were engaging in at home. In pursuit of answers to my questions, I ventured out of my "balanced literacy" ecological community (i.e., a community in which literacy practices included traditional and the new literacies), curious to explore the home literacy "ecosystems" of preschool children.

My first step of my research journey emerged from my Master of Education research readings and capping paper entitled *"From Squiggles to Story Writing and Nursery Rhymes to Novel Reading"* in 2007, as well as from my own reflections on my teaching experiences and pedagogy as an early literacy educator in the last few years of my teaching career. The development of questions related to contemporary young children's literacy practices and experiences at home emerged from this context.

Literacy Ecosystems

Besides being a passionate early literacy educator, I am also an avid environmental outdoor enthusiast. Often, I wander in the boreal forest ecosystem exploring and attending to the interactions among all living things within it. According to Capra (1996), an ecosystem is defined as a community of living organisms and their physical environment, interacting and networking within the community (p. 33). Documenting and observing the multiliteracy practices of young children in their home setting was for me like meandering and exploring in the natural forest ecosystem. Like the organisms in the forest ecosystem, children are constantly interacting, networking, and building complex relationships with their family members, objects, technology tools, and ideas in their homes.

After choosing the epistemological and ontological paths for researching the children's home multiliteracy practices, I anticipated new uncertainties. As I entered the children's home environments, I could sense that intricate interactions were occurring. The invisible spaces in the children's literacy ecosystems were part of a complex and interconnected "web of life" (Capra, 1996, p. 42).

As an experienced naturalist, I often take detailed notes, photograph unusual sightings, and make sound recordings, both to highlight changes in the forest ecosystem and to share my observations with other naturalists. My habits of observation of the forest ecosystem were useful skills as a participant observer in my study. Still, my everyday observations as a naturalist or teacher had to be distinguished from my research observations in this study. My everyday observations in nature or the classroom were not made with a strong theoretical or conceptual frame (Waltz, 2014). My scientific observations in this research involved a close view of the mundane as well as the "unusual sightings" of the children's everyday home multiliteracy

practices informed by a theoretical orientation, conceptual framework, detailed field notes, and audio and video recordings.

As I entered into the children's home environments, I experienced the same sense of awe as when I was exploring a forest ecosystem: I was full of curiosity and questions. When entering a forest ecosystem, I often made observations from different perspectives—from a bird's-eye view, for example, or from ground level, to see the smaller interconnected life forms. Similarly, in my study, I explored and collected data at both macro and micro levels.

It is important at this point to clarify the terms *multiliteracy* and *multiliteracies.* In this dissertation, I used the term *multiliteracy* to refer to the multiple forms of literacy that are being used in our everyday literacy practices, including all forms of visual, audio, spatial, gestural, and print-based texts. The traditional understanding of literacy is the ability to read and write print-based text; however, this understanding of literacy is no longer sufficient in the current technological world in which a person requires reading and writing skills as well as competence in multiple forms and practices of literacy. *Multiliteracies* was a term coined by the New London Group that refers to the shifting ways people communicate due to new technologies and to shifts in English language usage. The New London Group (1996) argues that the English language is the most common and global language used in the world; however, there are many different dialects and multicultural usage of the English language. Further, they argue that technology and multimedia are changing the ways we communicate with each other. Text and speech are no longer the only ways we communicate. Communication has been extended to include the combination of text with sounds, images, and movement. According to the New London Group, we need to learn a range of different ways we can communicate with each other. That is, we need to use multiliteracies.

Overview of My Study

Research Context

Many young children's home literacy experiences are increasingly mediated by a wide range of digital technologies (Flewitt, Messer, & Kucirkova, 2014; Holloway et al., 2013; Mol et al., 2014; Rideout, 2011, 2013; Yelland & Gilbert, 2014), but many early childhood classrooms are still dominated by traditional print-based literacy practices (Honan, 2009; Lynch & Redpath, 2014). According to Kress (2005), four factors have led contemporary young children to have a "new disposition" toward digital text making that is resulting in new ways of communication with each other: (a) contemporary texts are becoming intensely multimodal, (b) the screens of digital media are replacing the printed page, (c) the structures of authority within writing are changing, and (d) there are new modes and media for text making. However, contemporary classrooms fail to acknowledge young children's "new dispositions" toward digital texts (Kress, 2005). My study addresses this discrepancy by (a) investigating the multiliteracy practices of young children at home, (b) examining their parents' perspectives on these multiliteracy practices, and (c) breaking new ground in understanding and communicating the nature and educational consequences of young children's home literacy experiences with digital technologies.

Increasingly, young children are entering early childhood education as competent and regular users of multimedia and as experienced with literacy practices mediated by technology tools (Arrow & Finch, 2013; Black, Korobkova, & Epler, 2014; Flewitt et al., 2014; Holloway et al., 2013); however, using and producing multimodal texts tends to go largely unrecognized as an area of knowledge and skill in early childhood literacy curricula (Marsh, 2011; O'Hara, 2011). I began to wonder about and question the literacy practices young children are engaged with at home.

Research Questions

The following research questions and subquestions guided my study:

1. What literacy practices are preschool children engaging with in their home environments?
   - How are multiliteracy practices influencing the home lives of these children?
2. What are parents' attitudes toward their children's engagement of multiliteracy practices in the home, including "traditional" and "new" literacy practices?
   - How are parents within the study interpreting their children's home literacy practices?

I entered my research with these questions, curious as to what I would encounter in the contemporary children's homes.

Significance and Purpose

Presently, in many pre-kindergarten to grade 3 settings, literacy pedagogy is based on understandings of traditional and linear print-based literacy. This approach is inappropriate and insufficient for young students in the 21st century (Gee & Hayes, 2011; Government of Alberta, 2010; Honan, 2009; Organization for Economic Co-operation and Development, 2010). Much current literacy instruction in early learning settings still focuses on the print medium of literacy, where the reading and writing of printed texts are still the dominant literacy modes (Burnett, 2010; Davidson, 2009). As Merchant (2005) suggests, "we need to extend our view to include the linguistic and non-linguistic representations of the post-typographic era we are entering. This may mean rethinking the role played by different semiotic systems in early childhood education" (p. 150).

Conversely, many young children's literacy experiences and engagement in the home involved multiliteracy practices such as watching television and DVDs, actively using computers, playing video games, drawing pictures on paper and screen, using mobile touchscreen devices, listening to music, and so on (Holloway et al., 2013; Marsh, 2014; O'Mara & Laidlaw, 2011; Rideout, 2013; Stephen, Stevenson, & Adey, 2013). When formal schooling does not recognize and value the rich multiliteracy experiences of some young children, this gap can be problematic because teachers may not provide opportunities, time, and space to develop and extend such literacy experiences. As well, students who do not have such literacy experiences at home due to family circumstances or poverty can gain important multiliteracy experiences in school. Harrison, Lee, O'Rourke, and Yelland (2009) found that, "as early childhood teachers began to value and build on children's existing knowledge of ICT and explore the multiliteracies pedagogy, they engaged in more authentic conversations with children and families" (p. 469). Marsh's (2004) studies of preschool children in England found that 71 percent of the parents surveyed acknowledged technology and popular culture as important to their child's literacy development, yet the majority of teaching staff interviewed in the early childhood education settings did not consider these practices to be relevant to children's literacy development in school. This is a situation that clearly needs to change if early years settings are to build effectively on children's early learning in the home and incorporate 21st-century literacy practices (Marsh, 2004, p. 59). Children may experience an easier transition between home and school literacy practices when they enter formal schooling if educators rethink the current role that multiliteracy practices play in young children's lives. In my study, I offer the metaphor of the fractal to explore my understanding of the knowledge and practice gap between home and

school. This metaphor can enable researchers and educators to get beyond the limitations of the well-used metaphor of the "bridge" that is often used to connect home–school transitions.

It is important to recognize the role that multiliteracy practices play in children's lives in the home and to identify ways in which schools can use them to promote all forms of literacy learning. If one examines children's engagement in multiple forms of literacy over the last decade, it is clear that involvement in multiliteracy practices is becoming highly significant. Such practices are becoming an important part of young children's daily lives and informal early literacy learning (McPake, Plowman, & Stephen, 2013; Rideout, 2013; Stephen et al., 2013). Many young children link virtual-world and physical-world experiences with school activities (Ito, 2007; Merchant, 2009; Wohlwend, 2013). For example, many young students share their favourite virtual characters in their narrative writing, dramatic role-play, artwork, and social interactions with each other in classrooms. These young students are bringing their "out-of-school" lives into the classroom (see Wohlwend, 2009). Unless educators, policymakers, and parents recognize the benefits and values of these out-of-school literacy experiences, there may be a disconnection and discontinuity between home and school multiliteracy learning (Honan, 2012; Laidlaw, O'Mara, & Wong, 2015; Plowman et al., 2012). As Harrison et al. (2009) note, the discontinuities that typically exist between home and early childhood education "can compromise children's smooth transition to school and hence their long term academic and social development" (p. 466). To ensure young children have continuities between home and school, it is important for early childhood educators to recognize the "funds of knowledge" (Moll, Amanti, Neff, & Gonzalez, 1992) children bring with them to school to inform classroom practices. Marsh (2006) reminds us that, for many contemporary children, their communicative practices at home often involve popular culture, multimedia, and new technologies; she states,

however, that "this discourse has yet to permeate the early years curricula within most countries" (p. 35).

My study addresses this knowledge gap by contributing to understandings of how contemporary young children engage with multiliteracy practices and technologies at home.

Theoretical Framework

According to Guba and Lincoln (1994), it is critical that researchers are clear about which paradigm guides their thinking, because philosophical differences between paradigms have direct implications for both the research methods and interpretation of research findings. Complexity perspectives on learning (Davis & Sumara, 2008; Doll, 1993) informed my study. Complexity thinking is a paradigm that understands the world as an integrated whole, fundamentally interdependent, interconnected, and intertwined, rather than as an isolated and disconnected collection of small parts (Bateson, 1979; Capra, 1996; Maturana & Varela, 1992). Therefore, complex phenomena—including young children's multiliteracy practices, their learning at home, and their interactions and relationships—need to be viewed holistically and as interconnected. My methodology, research questions, and data analysis have all been influenced by my interest in how learning is nonlinear, dynamic, and recursive, as presented through frames from complexity thinking (Davis & Sumara, 2008; Doll, 1993). My theoretical framing is elaborated in further detail in Chapter 3.

Methodology

A qualitative study with an ecological approach is well suited for studying educational innovations because of its potential to reveal insights that affect and may possibly improve teaching practices (Merriam, 2009). This qualitative study was conducted in 7 homes located in western Canada (4 urban, 3 rural) and 4 homes located in southeastern Australia (2 urban, 2

rural). All 11 participants (5 girls and 6 boys, including a set of twin girls) had not yet started their formal schooling at the time the research began (i.e., kindergarten in Canada and preparatory year in Australia). The families had diverse socioeconomic backgrounds and heritages, as well as different family compositions and circumstances. Data were collected from participant observations, informal interviews, and conversations with children; literacy artifacts; semistructured face-to-face interviews of parents; focus group discussions with parents; and field notes. Interviews, observations, and focus group discussions were recorded with digital audio and video recorders, and transcriptions of the recordings were analyzed.

Overview of Dissertation

This dissertation is organized into eight chapters. In Chapter 1, I introduce the nature of my study and I state my research questions. In Chapter 2, I survey the relevant research literature on the literacy practices of young children at home and discuss shifts in the concept of literacy. Chapter 3 situates this study within theoretical and conceptual frameworks by tracing the origins and evolutions of complexity thinking, and addresses complexity in educational research and research conducted in the area of learning. I also discuss Green's (1988, 2012) three dimensions (3D) of literacy as a conceptual framework and how it can be used as an analytical tool to interpret collected data at micro and macro levels. The methodology used is described in Chapter 4. Chapter 5 presents the children's home literacy practices through smaller-scale perspectives, which I illustrate with research vignettes. In Chapter 6, I discuss the relationship between children's interests and multiliteracy practices and the emergence of "islands of expertise" (Crowley & Jacobs, 2002). In Chapter 7, I share my interpretations of parents' perspectives and dispositions toward technologies and literacies. In the final chapter, I discuss some surprises I encountered in my study and share what I have learned about myself in my research journey.

Finally, I suggest some recommendations for future research in the area of early literacy learning and new technology tools.

Chapter 2: Survey of Literature on Literacies

> *There is now a strong body of work that demonstrates how many young children are immersed in the landscape of digital technologies from a young age.*
>
> (Burke & Marsh, 2013, p. 1)

In this chapter, I provide a survey of literature that is pertinent to my research study, specifically, the concepts of literacy and new literacies and the development of multiliteracies and technology use. Chapter 2 is organized into three sections: (a) an overview of literature related to the shifting notion of literacy and the different literacy perspectives during the last two decades, (b) a description of studies of new literacies that have emerged from new information and communication technologies (ICTs) and other global changes, and (c) a review of research that investigates preschool children's home multiliteracy practices. Before I present this research literature review, I clarify several terms I used in my study.

Definition of Terms and Context for the Literature

Some of the terms used in this inquiry have been used widely in a variety of different contexts. I use the term *media* as a plural for medium, and to describe media tools such as laptop computers, televisions, video game players, and other interactive mobile touchscreen devices, such as smartphones and tablets. I use *mode*, following Kress (2003), to describe an organized set of resources for meaning making, representing, and communicating that includes images, gestures, music, speech, movement, and sound effects. For example, a child may choose to use a video, a digital drawing, words and pictures, gestures and body movements, or a piece of written text to convey a particular message. The term *literacy practices* refers to children's reading and

writing of printed and digital texts, viewing of images, presentation of ideas visually and orally, and the cultural ways in which children interact with literacy. The term *literacy event* is from Heath's (1983) description of a distinctive communicative situation where literacy plays a key role. For Heath, a literacy event is "any occasion [where] a piece of writing is integral to the nature of the participants' interactions and their interpretive processes" (p. 23). As mentioned in the preceding chapter, the term *multiliteracies* refers to the New London Group's (1996) definition of texts and practices in their seminal document "A Pedagogy of Multiliteracies: Designing Social Futures." Multiliteracies encompass multiple ways of communicating and making meaning, including visual, audio, spatial, behavioural, and gestural modes (New London Group, 1996, p. 64).

The research presented in this literature review focuses mainly on studies with children ages 3 to 5 who had not yet begun formal early childhood education. Studies based on 3- to 5-year-olds were selected because the age group was closest to the participants' ages in my study, and because current research (Burke & Marsh, 2013; Marsh, 2010a; McPherson, 2011; Pahl, 2006; Wohlwend, 2013; Wolfe & Flewitt, 2010) suggests that 3- to 5-year-olds engage in literacy practices and use new technology tools in ways that differ from those of 8- to 15-year-olds. For example, Alvermann (2010), Beavis and O'Mara (2011), Carrington (2012), and Steeves (2012) found that teenagers in their studies used new communication technologies, including laptop computers, tablets, and smartphones, to play games and music, to send text messages, for social networking, and to watch videos, whereas Hill (2010), Honan (2012), Marsh (2004), Merchant (2005), and Pahl (2003) found that young children used new communication technology tools primarily to draw, write, create pictures, and play basic games. Nevertheless, recent research (Burke & Marsh, 2013; McPake et al., 2013; Rideout, 2013) has revealed that,

like teenagers and adults, children are beginning to use technologies for playing games online, listening to music, and communicating with others. Furthermore, a growing body of research demonstrates change in the way young children use technologies within their literacy practices as touchscreen technologies have emerged (Burke & Marsh, 2013; Mol et al., 2014; Neumann & Neumann, 2014; O'Mara & Laidlaw, 2011). This literature review includes studies conducted in Canada, Australia, the UK, the US, and Finland from 2003 to 2014 because English is the official language spoken in the first four countries, with Finland attracting recent global attention in connection to early education. I limited this literature review to the period from 2003 to 2014 because of the noticeable advancement of technology tools during this time.

Shifts in Literacy Perspectives

The Concept of Literacy

Although "literacy" might appear to be easily understood, the concept of literacy is both complex and dynamic, and it continues to be interpreted and defined in multiple ways (Kalantzis & Cope, 2012; Lankshear & Knobel, 2011). Traditionally, literacy has been defined as the ability to read and write fluently. UNESCO (2004) defines literacy as the "ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with varying contexts" (p. 12). Currently, literacy has moved beyond a simple understanding of basic "technical" reading and writing skills, to a plural interpretation that acknowledges the importance of understanding, interpreting, and creating information in various contexts. The evolving definitions of literacy have created multiple literacy perspectives. Currently, many diverse perspectives of literacy exist in our education systems and education research community (Flint, Holbrook, & Albers, 2014; UNESCO, 2004).

Changes in Literacy Practices

In the last few decades, literacy perspectives suggest that new digital technologies have placed literacy learning at the crossroads of a tectonic shift, where old and new literacy practices are colliding and intersecting with each other (Honan, 2012). Unlike the preschool environments that most educators and researchers experienced in their early childhood, today's homes contain digital devices that young children can interact with daily and often use as play objects (Marsh, 2011; Plowman et al., 2012; Wohlwend & Kargin, 2013). Current literacy practice is not the literacy of two decades ago (Kalantzis & Cope, 2012; Lankshear & Knobel, 2011) and now requires a repertoire of techno-literacy skills (Marsh, 2004). The use of new media forms and changes in literacy practices at home have affected young children's literacy development and influenced their daily lives by encouraging them to become literate beings in an increasingly connected world (O'Mara & Laidlaw, 2011). A wide range of new modes of learning and communication activities exist, and a literate person needs to be able to "read and write the world" (Luke, 2013). Students need to critically think about local and global issues affecting their communities (e.g., climate change, global multiculturalism, conflicts in war-torn countries), and not just master basic literacy skills like reading and writing to increase their scores on standardized tests (Luke, 2013). Yet, many of the literacy teaching practices in early childhood education settings remain deeply rooted in traditional notions of literacy (Pahl & Rowsell, 2012; Rowan & Honan, 2005). Additionally, in some cases, the tendency to privilege traditional print-based literacy in early childhood education settings is intensified by a desire to protect young children from "perceived threats in popular media content and online interactions" (Wohlwend & Kargin, 2013, p. 82). Several researchers have shown that some parents also privilege traditional print-based literacy at home by limiting their preschoolers' ability to freely engage in digital

literacy practices online by using parental controls and surveillance on their home digital devices (Ernest et al., 2014; Wohlwend & Kargin, 2013). Contemporary young children are living in a rapidly changing world that demands increasing abilities to use new technology and communication tools with others. Today's children need to be literate in multiple contexts, or multiliterate (UNESCO, 2004). Multiliteracy practices entail a broad skill set, including conventional literacy practices layered alongside new literacy practices and different modes (Kress, 2010; Luke, 2007; Rowan & Honan, 2005; Street, 2005), and these multiliteracy practices will have a lifelong impact on today's young children's literary lives (Luke, 2013).

Psycholinguistic and Cognitive-Psychological Approaches to Literacy

Different perspectives on literacy shape how it is understood and taught in schools. A psycholinguistic perspective recognizes young children's predisposition to acquire oral language from their environment through exposure and to determine its rules for themselves (Adams, 2004). This perspective on literacy is focused on particular literacy acquisition skills, such as phonemic awareness, phonological sensitivity, letter knowledge, and reading comprehension (Clay, 1993).

A cognitive-psychological perspective on literacy (e.g., Chall, 1983) defines literacy practices as a set of cognitive skills and processes that occur in children's minds, and understands literacy practices as both personal and isolated from children's sociocultural contexts. Literacy pedagogies that are informed by this perspective tend to privilege linear, systematic, and sequenced teaching of reading and writing. Many of the assessment tools used currently in schools still privilege cognitive-psychological and psycholinguistic-based literacy practices that are dominated by a focus on decoding and encoding text through phonological,

morphological, and technical spelling skills and neglect sociocultural perspectives on literacy (Gee & Hayes, 2011; Street, 1995).

Sociolinguistic Approaches to Literacy

Scholars and researchers in sociology (e.g., Gee, 1989; Heath, 1983) and linguistics (e.g., Street, 1984) have challenged a traditional cognitive-psychological approach (Adams, 1994) to literacy. The traditional psychological approach viewed literacy as a "cognitive phenomenon" and understood it as mental processing. Within this approach, a person is considered literate if they have the ability to read and write, and literacy is treated as processes people do inside their heads (Gee, 1996; Street, 1995). However, many scholars looked at literacy in everyday life and saw it as something people did not just inside their heads but inside society (e.g., Barton & Hamilton, 1998; Gee, 1996; Heath, 1983; Street, 1995). Because many researchers used this perspective to study what people do with literacy in everyday life, the concept of literacy began to be rethought. The field of new literacy studies (NLS) began to emerge almost three decades ago, and it argued that literacy was not mainly a mental phenomenon, but a sociocultural one (Gee, 1996; Street, 1995).

In the last two decades of the 20th century, literacy was recognized as a social practice which people do in their homes, at work, and in schools every day. Research in NLS challenged the traditional psychological view of literacy and suggested that literacy is a cultural and social achievement that "varies from one context to another and from one culture to another" (Street, 2003, p. 77). Therefore, literacy needed to be understood and studied in a wide range of contexts, including social, cultural, historical, and institutional contexts (Gee, 2004). NLS has attracted researchers from linguistics, history, anthropology, cultural psychology, education, and other fields (e.g., Gutiérrez & Rogoff, 2003; Janks, 2010; Lankshear & Knobel, 2011; Pahl & Rowsell,

2010), and NLS has broadened our understanding of literacy beyond a set of skills acquired by individuals.

In contemporary contexts, literacy represents a wide range of categories that includes print literacy, digital literacy, critical literacy, cyber literacy, environmental literacy, and techno-literacy, among others. The evolution in literacy constructs has been partly driven by multimodal communication tools, which extended the notion of literacy to include oral, auditory, and visual modes of representation (see Kress, 2003). Contemporary literacy researchers of NLS are interested in digital literacy (Plowman, Stephen, & McPake, 2008), media literacy (Marsh, 2005), critical literacy (Luke & Woods, 2009), multimodal literacy (Jewitt, 2006), and information literacy (McPherson, 2011), as well as the more traditional print-based notions of literacy.

New Literacy Studies

Two of the leading literacy theorists in the field of NLS, Gee (1996) and Street (1995), continue to advocate a move away from the cognitive-psychological theory of human learning that had been dominant in literacy education, toward a sociocultural learning theory that emphasizes the importance of social interactions in human learning. NLS embraced the idea that literacy was ideological and that literacy practices existed within the context of a community, interwoven with and reflecting the values and beliefs of that community (Gee, 1999).

Gee's (1989) work was rooted in linguistics and his focus was on the relationship between identity and literacy practices. He proposed that human beings use literacy as an "identity kit" (p. 7) to associate themselves with a specific group or groups of people, and that each group unconsciously creates and develops particular discourse patterns. He used the term *discourses* (lower case d) to describe the language people use and learn with, through

interactions with each other. These discourses are socialized in early life through the literacies one uses in one's family and community. In contrast, *Discourse* (upper case D) describes "ways of being in the world, or forms of life, which integrate words, acts, values, beliefs, attitudes, social identities, as well as gestures, glances, body positions, and clothes" (Gee, 1989, p. 7). Phrased differently, a discourse refers to the language-in-use, that is, the verbal interactions and sequences of utterances between speakers and listeners, whereas Discourse is the socially accepted ways of using language and other expression (e.g., acting, interacting, believing, valuing, and feeling the patterns associated with a recognizable social network or affinity group). For instance, a rap artist's community has certain lifestyles, speech patterns, clothing and accessories, and body movements that may differ from those of other people. Young children who play online video games often design their avatars[1] with certain images in mind, carefully creating their online identities (Wohlwend & Kargin, 2013). The language used by online gamers is often specific to that community or affinity group, and only the community insiders will recognize the Discourse (Gee, 2009). Gee (1989) suggests that a person needs to be a member of the community to learn the Discourse. Gee's (1989) new literacies work proposes that literacy learning is socially constructed and interconnected with culture, identity, societal power, and literacy practices. Like Gee, Street (1984) argued that literacy is not a set of technical skills, but should be viewed as social practices that are deeply embedded within power relationships (Street, 1984, p. 1). Central to his notion of literacy was recognizing the importance and dependence of cultural contexts. This perspective stems from his research in an Iranian village, where he noticed villagers using literacy in different ways in different social contexts and for

[1]An avatar is typically the graphical representation of a user's alter ego or character in online games or virtual worlds.

different purposes: *maktab* literacy was associated with Koranic schools, *schooled* literacy was related to modernization, and *commercial* literacy was used with the fruit trade (Street, 1984, pp. 133–179). In his study, commercial literacy was seen to emerge from the Koranic literacy practices, rather than from schooled literacy practices, because of the higher status and authority held by the Koranic literacy practices in villages. It was not the literacy skills that mattered; it was the social functions associated with particular literacies that influenced the emergent commercial literacy in the villages. Street (2003) reminds researchers in NLS to remember that "research within this frame requires language and literacy to be studied as they occur in social life, taking account of the context and their different meanings for different cultural groups" (p. 79). One of Street's distinctive contributions to NLS was the encouragement of educational researchers and educators to view the multiple aspects of literacy practices both in and out of school.

At the beginning of the 21st century, NLS is gaining acceptance in North America (Kalantzis & Cope, 2012) and other parts of the world, including the United Kingdom, Australia, and South Africa. This is because of the rapid changes in communication and in our ways of using communication; several fields have emerged within literacy education that address how we can adapt to the shifts in literacy in the 21st century's communicational landscapes. One term that reappears in literature in the field of literacy education is *new literacies* (Lankshear & Knobel, 2003). New literacies signal new kinds of texts, practices, and understandings that have emerged with the increased use and prevalence of technology. The view that literacy is not a decontextualized set of cognitive, linguistic, and intellectual processes or skills is prevalent today among many current literacy researchers (Lankshear & Knobel, 2011; Marsh, 2011; O'Mara & Laidlaw, 2011; Pahl & Rowsell, 2012).

The Emergence of Multiliteracies

In September 1994, 10 literacy and educational theorists from the United States, Australia, and the United Kingdom met for a week in New London, New Hampshire, to discuss how literacy pedagogy might address the rapid changes in literacy resulting from economic globalization, advancing ICTs, and the exponential increase of linguistic, cultural, and social diversity around the world. After a year of meetings, the group published a literacy manifesto in an article entitled "A Pedagogy of Multiliteracies: Designing Social Futures" (New London Group, 1996). These scholars and educators recognized children as literacy designers because they engage in using resources to make meaning and communicate with others. Multiliteracies were understood to involve visual, audio, spatial, behavioural, and gesture modes, including the body-as-text (New London Group, 1996, p. 64). The New London Group (1996) advocated a change in literacy perspective, from the passive consumption of texts to the understanding and enactment of literacy practices. Recent work in multiliteracy pedagogies (Cope & Kalantzis, 2009) can help educators and researchers understand literacy as a dynamic and complex repertoire of social practices that help children participate in their everyday lives. A multiliteracy perspective recognizes digital technologies and other modalities (e.g., music, dance, and visual representations) as valuable tools to support children's knowledge construction and meaning making (Rowsell, 2013).

The New London Group's (1996) theory of multiliteracies has four components:

- *Available designs:* The knowledge and experiences that children bring with them to formal school settings.
- *Designing:* Explicit instruction by teachers or peers (and, possibly, parents and older siblings as well) regarding different modes of meaning; it includes the development of the

metalanguage that helps children understand patterns in meaning making and communication.

- *Designs*: Interpreting meaning making within specific cultural and social contexts; children are required to examine and analyze what is learned to extend and revise.
- *Redesigning*: Applying learning or meaning to other contexts. (pp. 20–26)

Although these four components are interconnected in complex ways, linear progressions or developmental stages do not occur from one component to another, nor is there a hierarchy—they may occur simultaneously and recursively. The New London Group (1996) manifesto echoed the work of Gee (1989) and Street (1984) in their search for a much broader and more fluid view of literacy, that is, literacy as a social and cultural accomplishment rather than an individual mental exercise (New London Group, 1996). The New London Group inspired other literacy researchers, including Kress (1997), a literacy researcher interested in multimodality and literacy practices.

Semiotics is the study of the meaning of systems of signs. Kress (1997) drew on theories of social semiotics to research the multiple ways in which children make meaning and make sense of the world around them. He examined very young children's drawings, writings, collages, and other "play stuff" (p. 35) and concluded that young children are passionate makers and users of language and signs who intentionally use a wide range of semiotic systems when constructing meaning. Young children's selections of modes (e.g., drawing, singing, gesturing, and dancing) are rooted in and controlled by the social and cultural tools available to them (Kress, 1997).

Drawing on social semiotics, activity theory, and discourse analysis, Kress (1997) emphasized that educators and parents should encourage children to express themselves by using

multimodalities. Multimodality is a way of making meaning that allows for different modes. For example, building a village with LEGO bricks and drawing a picture of a village are different forms of communication in which a child might engage. Kress (1997) argued that multimodalities are useful for communication within authentic social situations and that multimodalities reflect the complexity and plurality of literacy practices in young children's lives at home. When people communicate with each other or engage with different texts in a variety of contexts, they make use of more than one mode. Jewitt and Kress (2003) point out that "a multimodal approach to learning requires [educators] to take seriously and attend to the whole range of modes involved in representation and communication" (p. 1). An example to illustrate the multimodal nature of communication in children's lives could be that when they wish to pick up a toy that is out of their reach, they can communicate their message to their parents using different modes, for example, speech, gesture, or facial expression. It is also important for adults to recognize that each mode offers specific constraints and possibilities for children's meaning making, and thus a different potential for learning.

A disconnect often exists between home and school literacy practices (Hill, 2010; Honan, 2012; Lankshear & Knobel, 2011; Levy, 2009) because early childhood educators can be unaware of the wide range of home literacy practices and experiences children bring with them to school and therefore not take them into account. Kress (1997) reminded educators that by the time children attend formal schooling, they are already competent and practiced makers of signs in many semiotic modes. Early childhood educators need to be aware of

> the social, cultural and cognitive implications of the transition from the rich world of meanings made in countless ways, in countless forms, in the early years of

children's lives, to the much more unidimensional world of written language [in schools]. (Kress, 1997, p. 10)

Technology Tools and Literacy Practices

Changes in children's home or out-of-school literacy practices have attracted attention from the literacy research community (Arrow & Finch, 2013; Davidson, 2009; Holloway et al., 2013; Honan, 2012; O'Mara & Laidlaw, 2011). While some literacy researchers examine new technologies in terms of their capacity to enhance the acquisition of traditional print-based literacy skills, such as phonemic awareness (Chera & Wood, 2003), letter knowledge (Brabham, Murray, & Bowden, 2006), and spelling (Barone & Wright, 2008), others have focused on adolescents who engage in digital literacies with online video games (Alvermann, 2010; Beavis & O'Mara, 2011; Gee, 2009). Some researchers have focused on the dangers or risks young children may encounter when the Internet is available to them at home (Holloway & Valentine, 2003; Livingston & Bober, 2006; O'Reilly & O'Neill, 2008). For example, Holloway and Valentine (2003) point to concerns about young children's literacy practices involving the use of computers as "solitary and potentially addictive" activities and the fear that "some children might become so obsessed with the technology that they will socially withdraw from the off-line world of family and friends" (p. 2). Ample literature shows that the common fears about children's use of computers in general and the Internet in particular are often unfounded (Davidson, 2009; Hill, 2010; Honan, 2012; Kucirkova, Messer, Sheehy, & Flewitt, 2013; Marsh, 2011). Many children appear to use new technologies in ways that are balanced and sophisticated to enhance their social development and critical thinking skills, both on- and offline, and to open their minds to a wider world (Marsh, 2011; McPake et al., 2013; O'Mara & Laidlaw, 2011).

Lankshear and Knobel (2003) conducted an extensive literature review of studies that investigated the effects of new technologies on early childhood literacy, especially among children 8 and younger. Lankshear and Knobel (2003) found 904 documents dealing with technologies and literacy; many documents consisted of software or/and hardware reviews and others were commentaries, discussions, opinions, and reflections (Lankshear & Knobel, 2003, p. 65). In their review, they focused on 49 documents that were grounded in empirical research; these included doctoral dissertations, government-funded research reports, and peer-reviewed research articles. Lankshear and Knobel revealed a gap in the research on young children's literacy practices that were mediated by ICTs, despite the visible presence of technologies in homes, communities, schools, and in the daily lives of very young children in many parts of the world. They also found that the existing literature investigating young children's digital literacy practices did not present globally diverse perspectives, and that the research "continues to be swamped by work from the USA" (p. 67). Most of the reviewed literature was dominated by cognitive and quantitative research that focused on how children were taught to read and write by technologies such as the computer. Lankshear and Knobel concluded their review by encouraging and challenging literacy researchers and scholars to conduct more empirical studies using a variety of methodologies and theoretical frameworks to understand very young children's literacy practices in out-of-school settings.

Importantly, Lankshear and Knobel's (2003) literature review was conducted a decade ago, and since then, technologies have advanced dramatically. None of the reviewed studies involved the issue of accessibility to the Internet by very young children or the use of mobile touchscreen digital devices. Lankshear and Knobel's critical review shone a light on a pathway for future literacy researchers to follow, and a decade subsequent to their review, research that

explicitly focuses on young children's literacy practices and new technologies at home is expanding (Linn, Almon, & Levin, 2012; Marsh, 2014; McPake et al., 2013; Rideout, 2013).

Burnett (2010) conducted an extensive literature review addressing young children's (ages 0–8) literacy practices and technologies in educational settings. She distinguished between literacy studies that examined digital literacy practices involving the production and consumption of digital texts, and studies that investigated the use of technology to develop foundational skills associated with alphabetic print-based literacy. She noted that the research related to digital literacy in educational settings seemed to focus primarily on the use of new technologies as tools to support existing literacy curricula. Although Burnett concentrated on technology and literacy in educational settings, her review is included here because she included children of an age group that was comparable to those in my study, and the breadth and scope of her reviewed literature is also relevant. Her narrative review of the literature revealed that the distribution of research across age groups was unequal. Of the 36 papers she reviewed, none focused on children under 3 and only 11 included children under 5 (Burnett, 2010, p. 254). Her review of the literature, however, found that the number of studies related to technology and literacy of young children had increased over a decade. Burnett also noted that studies of literacy and technology for children under the age of 8 were still surprisingly limited. She advocated for more research of literacy and technology for children under 8, with specific investigations of preschoolers' use of a wide range of digital technologies. Furthermore, she stated, "given the continuing predominance of studies of technology used to support print literacy, there would seem to be a need to go further in challenging existing paradigms of research" (p. 261).

Yelland (2005) reviewed literature that focused on research from 1994 to 2004 pertaining to the use of computers in early childhood education. Most of the research examined the ways in

which young children operate technology tools, specifically computers, within traditional curricular paradigms and pedagogies. Similar to Honan (2012), Yelland concluded that many early childhood educators were unaware of the variety of home literacy practices and events reported in the literature. For example, the teachers in these studies overestimated the time young children spent on screens (e.g., television viewing, DVD viewing, and on-screen games) at home.

Yelland (2005) noted that one of the most controversial debates at the time was around the use of technologies such as computers and CD-ROMS in young children's lives. Today, similar debates and concerns continue, focused on a different set of technology tools. CD-ROMS are no longer in everyday use in most households, and mobile touchscreen devices (e.g., tablets and smartphones) are the digital tools that typically have an impact on young children's literacy practices (Wong, 2013). Yelland's (2005) literature review is included here because she covered the period when computers were becoming readily available in many households in affluent societies like Canada, the United States, the United Kingdom, and Australia. As Yelland (2005) explained, "new technologies have revolutionized how we complete even the most basic tasks in life and computers have become a ubiquitous aspect of society, from the local to global" (p. 202).

More recently, Holloway et al. (2013) and the EU Kids Online[2] (2014) critically reviewed literature regarding the impact of Internet usage on preschoolers (0- to 8-year-olds) in the European Union (EU) countries. Their findings include the following:

[2] European Children Safer Internet Program funds the EU Kids Online network projects. It is under the direction of the London School of Economics Media and Communications Department. One of the aims of the organization is to enhance knowledge regarding European children's use, risk, and safety online.

- European preschoolers' usage is noticeably increasing. In the UK, one-third of 3- to 4-year-olds access the Internet with a variety of technology tools, such as laptop computers or tablets. In other EU countries like Austria and Norway, almost half of 3- to 6-year-olds use the Internet on a regular basis (Holloway et al., 2013, p. 8). This drastic increase in Internet use among preschoolers has occurred as tablets and other mobile touchscreen devices were being introduced in EU countries. The recent increases in Internet use among preschoolers in EU countries reflect a worldwide trend, particularly in affluent countries like the US (see Rideout, 2013) and Australia (see Commonwealth of Australia, 2013).
- EU children in the ages 3–6 group treat the Internet as a source of entertainment. For instance, YouTube is the second favourite site for children under 5 in the UK, who also play games online. Older children (i.e., age 5 and above) extend their Internet participation to include using search engines for information seeking, and are beginning to use social networking sites.

- EU preschoolers frequently use tablets as part of their everyday play objects at home.

Holloway et al. (2013) reported that studies addressing topics focused on young children's screen time at home often anticipated the possible dangers, risks, and harm that babies, toddlers, and preschoolers might encounter while using mobile touchscreen devices. Holloway et al. (2013) advocated for further investigation to identify the range of benefits and risks of preschoolers' use of the Internet. The authors' report was extensive and thorough with respect to the international research and literature; however, an undertone of trepidation was present in their conclusion, calling for more research on the dangers, risks, and benefits of technologies and the Internet in young children's lives.

Investigations of young children's multiliteracy practice at home framed within sociocultural theory and using a case study approach include studies of console games (Pahl, 2005), texting (Carrington, 2005), media and popular culture texts (Marsh, 2005), virtual worlds

(O'Hara, 2011), and CD-ROM storybooks (Smith, 2002). Few qualitative studies have used participant observations and unstructured interviews with young children, particularly in Canada. Moreover, many research studies have included large surveys and interviews of parents to obtain their perspectives about their young children's literacy practices at home. Many researchers in this area (Burnett, 2010; Holloway et al., 2013; Kamil & Intrator, 1998; Lankshear & Knobel, 2003; Yelland, 2005) have suggested that research on children's home literacy practices needs to be framed by a wider range of alternative learning theories, should consider using different qualitative methodologies, and should include more studies outside of the United States. Early literacy research interested in multiliteracy practices needs to expand its methodological and physical boundaries to include young children's voices, multiple perspectives, and many countries.

Multimedia and Multimodality

I now turn to review literature focusing on children's home literacy practices involving multimodal communication tools and mediated by multimedia. This area of study is important to consider because the presence of multimodality and multimedia in contemporary children's homes reflects the complexity of culture, as well as local and global contexts of children's learning environments (Cope & Kalantzis, 2000). Studying children's home literacy practices involving multimodality and multimedia requires special attention to the research methodology. Davidson (2009), in her ethnomethodological research, used conversation analysis to study young children's engagement with digital texts and literacies at home. She described young children's "uptake of social practices in ways that make them powerful users of technologies at home" (p. 50). She argued that the distinction between traditional literacy and new literacies was blurred in preschoolers' multiliteracy practices with new technologies available to them at home.

The children in her study used "what was at hand and did not make a distinction between the new (in the sense of digital), and the old (as in a print-based text)" (p. 50). She suggested that young children have considerable knowledge about literacy practices that are important in their home lives and that this knowledge can inform their use of technology tools, such as computers and tablets. The author concluded that it would be beneficial for early childhood educators to develop a more expansive understanding of literacy, encompassing the literacy practices that children bring to formal schooling.

Plowman et al. (2008) conducted two empirical investigations in Scotland, one in the home and one in preschool settings, of 3- and 4-year-old children's literacy learning and their uses of technology. The case studies were framed with sociocultural theory and the participating families were selected according to socioeconomic factors (e.g., the home-based case studies included both disadvantaged and affluent families, as determined by the local authorities). The researchers investigated whether or not socioeconomic disadvantage makes a difference in technology use and in children's digital literacy development. In the home portion of the study, participants (24 families with diverse socioeconomic statuses) were studied in their own homes over approximately 15 months. The research involved a survey of the children's parents, parent interviews, home observations, and conversations with the children. The study investigated the different roles of adult-mentors in technology-mediated and play-based learning activities in the homes and preschool settings. The mentor-guided interaction approach was similar to Gee's (2007) apprenticeship approach to learning and teaching. In analyzing their observations, the research team found that adult-guided interactions in the children's homes were occurring far more frequently and in more diverse ways than those occurring at school, and they concluded that the primary school's staff had limited knowledge of the preschoolers' home literacy and

technology experiences. The early childhood educators had difficulties enhancing and supporting the children's learning because they lacked confidence in using current technology tools. Furthermore, Plowman et al. (2008) concluded, "the kinds of ICT-related skills, which primary teachers choose to develop in their pupils, have little in common with the competencies that children develop at home" (p. 111). These findings are similar to those of Honan (2012) and Arrow and Finch (2013), who found that teachers were unaware of the variety of literacy activities that children are engaging in at home. The teachers in Arrow and Finch's study also overestimated the time children spent at home on practices relevant to school activities, such as writing, drawing, and reading or pretending to read.

Another study of young children's multimedia-mediated and multimodal literacy learning investigated preschoolers' interactions with new technology tools. Kucirkova, Messer, Sheehy, and Flewitt (2013) explored how specific tablet applications affect parent-child relationships, particularly in story-sharing interactions. They used a single case study and multimodal analysis to gain insights into the interactions between a mother and her 33-month-old daughter who shared a personalized iPad story created with an application (app) called Our Story[3]. The app has a "friendly user interface, with big buttons and iconic rather than text-supported navigation" (Kucirkova et al., p. 116). Capitalizing on the affordances of the app, the mother and child could easily add, edit, or remove text and pictures during the activity of story sharing. The research team noted that the multimodal functionality of the iPad app, which allowed both mother and child to manually manipulate the iPad, also encouraged their close physical connection.

[3]Our Story is a tablet-compatible application that was purposefully designed and developed for the creation and sharing of personalized stories with young children.

Kucirkova et al.'s findings suggested that the text-sound correspondence might provide "experience of an early step in understanding the printed word" (p. 119)..

Kucirkova et al.'s (2013) findings also echo some of Davidson's (2009) observations that family members were often in close physical proximity when they used a search engine, and that young children often sit on a parent's lap while the two together on the computer. This finding is significant because it contradicts the common misconception that digital literacy practices are solitary activities that encourage antisocial behaviours in young children (Rich, 2012).

The preschoolers in both Kucirkova et al.'s (2013) and Davidson's (2009) studies were exposed to diverse literacy skills that may provide reading and writing experiences with multimedia and that have multimodal qualities. Given the novelty of the medium, little is known about how specific iPad applications might affect preschoolers' literacy practices and learning at home (Neumann & Neumann, 2014).

In England, Wolfe and Flewitt (2010) investigated how 10 preschoolers aged 3 and 4 developed literacy knowledge and skills using traditional and new technologies in their homes and nursery schools. They used a case study approach that included a questionnaire for parents and nursery staff on home early literacy practices and beliefs about literacy, video-recorded observations of the 10 children at home and in the nursery school, and semistructured and informal interviews with parents of the children. I focus on the home portion of Wolfe and Flewitt's case studies because of its relevance to my study.

Based on the questionnaire completed by the parents, Wolfe and Flewitt (2010) found that parents often carefully controlled young children's access to computers and other technology tools at home. The authors' findings suggest that this "parental policing" of new technology tools reflected parental concerns about the effects of screen-based activities on their children's

development. In addition, Wolfe and Flewitt (2010) illustrated an example of the interactions of a mother and her twin daughters around a traditional puzzle-assembling activity and a second example of the twins' joint engagement in an online visual-matching computer game. In both literacy events, the researchers noted how the participants negotiated meaning through "collaborative multimodal dialogue" with different forms of communication, including gesture, body movement, gaze, and language. Wolfe and Flewitt concluded that the twins appeared to have learned to read and respond to visual images and were beginning to decode, or read, the digital signs and symbols on screen. The participants acquired some understanding of how these semiotic texts are interrelated to produce meaning (p. 395).

Remixing Practices at Home

Over the last decade, Marsh's (2004, 2005, 2006, 2010a, 2011) studies have made valuable contributions to the field of early multiliteracy and to understanding young children's literacy development and learning at home and in school. Her work has also influenced many literacy researchers around the world in the last decade, and international studies are also beginning to emerge (Lynch & Redpath, 2014; Pahl & Rowsell, 2012; Verenikina & Kervin, 2011). In the remainder of this literature review, the emphasis is on research that explores the remixing of traditional and new literacy practices that occur within home contexts.

For many years, Marsh has been one of the preeminent researchers working with young children and technologies. Marsh (2004) researched 2- to 3-year-olds' use of multimedia and technologies at home in the UK a decade ago. Even though her study is somewhat outdated with respect to the use of technology tools, her work has been seminal in challenging literacy researchers to rethink how technologies can influence preschoolers' literacy practices and

meaning making. She coined the term *techno-literacy* to refer to "those literacy practices and events which are mediated by new technologies" (Marsh, 2004, p. 52).

Marsh et al. (2005) surveyed 43 families in disadvantaged communities—working-class families who lived in publicly owned housing in England. The parents' questionnaire and the interview questions focused on young children's literacy practices at home in relation to a wide range of media tools, including books and comics, television and film, environmental print, computer games, mobile phones, and music (Marsh et al., 2005). Parents were asked to state their attitudes toward these multimedia uses and to describe the patterns they noticed in their children's use of each media tool at home. Along with the identified patterns and themes from the surveys, home observations and field notes were collected. The field notes focused on the children's use of space in their family home, literacy artifacts around the home, technological tools that were available, and the children's responses and actions during the home visits. Marsh et al. (2005) concluded that television was the primary source of "textual pleasure" for the children. Marsh's (2004) data revealed that while some children sat quietly while watching television, other children engaged in a wide range of actions while viewing television shows. Often, the children spoke about the program to themselves, and other family members would speak about other things that may or may not be related to the program. The children also spoke directly to the characters on the screen or played, sang, and danced while watching the television programs. Marsh (2004) also noted that the parents in her study were "supportive of their children's play and encouraged playful responses to television narrative, describing how they themselves took active parts in this role-play under the children's directions" (p. 75). The tendency to reenact or re-present the stories from television shows is similar to the research findings for children's experience in reading texts such as picture books (Bazalgette, 2010;

Labbo & Ryan, 2010). This type of media textual experience is important to young children's literacy learning and development because, as children get older, their ability to understand how multimedia and multimodal communication activities work is critical. Rich textual experiences at an early age will also help children to interpret news, advertising, and other persuasive and mass media more critically and will aid them in understanding multiple perspectives presented in mass media and popular culture (Bazalgette, 2010, p. 45). Furthermore, children who struggle with traditional literacy skills may be able to succeed at interpreting, analyzing, and creating video image texts within digital literacy practices. Some children in Marsh's (2004) study, who could not read and write printed texts, were confident in navigating video games.

Marsh (2004) also examined the impact of mobile phones on young children and found that 80% of the children aged 12 months owned toy mobile phones. Even though none of the toddlers used text messaging independently, many were aware of it and knew when a message had been texted (received or sent) by their parents. Some children watched their parents read and answer text messages and were thus acculturated into the digital literacy environment.

Marsh (2010b) also studied older children's (ages 5 to 11) out-of-school techno-literacy experiences in online virtual worlds. She remains one of the predominant researchers in the area of young children's digital literacy practices.

In a study investigating the use of print and electronic media by Finnish children, Korkeamäki, Dreher, and Pekkarinen (2012) studied preschoolers and first graders in Finland. It is important to note that in Finland children do not begin formal schooling until age 7, therefore the preschoolers in this study were 6-year olds and the first graders were 7-year-olds. Korkeamäki et al. noted that many preschoolers and first-grade students experience increased engagement with multiliteracy practices at home. The study was unique in that its main purpose

was to examine young Finnish children's engagement with newer technologies, as well as "more traditional media such as television, radio, and print-based material in the home" (p. 110). In the study, a survey of 857 parents was conducted in families with diverse backgrounds, in both rural areas and urban centres. The survey questions addressed availability of home media and technologies, how often and with whom children used them, and aspects of children's literacy development. Interestingly, the researchers in this study did not visit the children's homes or engage in face-to-face interviews of parents or children, but they sent out questionnaire surveys to 857 parents through the kindergarten and first-grade teachers and these surveys were returned to the teachers. The return rate of their survey was less than 60%, which is similar to the response rate in Marsh et al.'s (2005) study. The Korkeamäki et al. (2012) study's findings indicate that Finnish preschoolers and first-grade children are frequent users of media, and many homes provide these young children with an environment that includes traditional and new media along with newer technologies like cell phones and computers. Interestingly, many Finnish parents encourage their preschoolers to play "more games designed for learning while first graders play more entertainment games [at home]" (Korkeamäki et al., 2012, p. 120). Many of the parents also indicated that games designed for learning were useful, especially before formal schooling. While Korkeamäki et al. provided a vast amount of information about contemporary home literacy and media tools (e.g., computers and televisions), more descriptive observations and interviews with the children about their multiliteracy practices would have made the results more meaningful.

Common Sense Media[4], with Rideout (2013) as the lead researcher, conducted a large-scale, nationally representative survey of 1,463 parents of young children under the age of 8,

[4] Common Sense Media is a nonprofit organization interested in health, families, and education in the US.

following up an initial study in 2011 (Rideout, 2011). The research team was interested in the role of new media technologies in the lives of young children in the US. The 2013 survey used a method of sampling selection for household telephone interviewing via random digit dialing to recruit parents of young children. Rideout (2013) compared the 2011 and 2013 study findings, looking at ownership of mobile devices (e.g., tablets and smartphones) and children's access to such devices at home. Their key findings included the following:

- There was an increased ownership of mobile devices and access to these devices for young children, from 52% in 2011 to 75% in 2013. The surveyed parents reported that their children used the mobile devices to play games, watch videos, listen to music, and read electronic books.

- The average amount of time children spent using mobile devices tripled in 2013, compared to the earlier study findings. In 2013, the average time children spent on mobile devices in a typical day at home was one hour and seven minutes.

- According to the 2013 study, 38% of children under 2 have used a mobile device for media activities.

- Overall, children spent less time per day with "traditional" screen media tools, such as television, DVDs, video games, and computers. The nature of viewing is changing from passive viewing to the situation where many children are watching programs that were recorded earlier, downloaded or streamed, or accessed on demand.

- Minority children and children of low socioeconomic status in 2013 had a much higher access to mobile media devices and apps as compared to access documented in 2011, though a large gap still exists between high- and low-income families. Television continues to be the most widely used platform for children's educational content in lower-income families.

Rideout's (2013) study confirms that some very young children have more access to mobile devices regardless of their socioeconomic status, and they are using mobile devices for

longer periods each day. Many of the preschoolers' viewing habits are also changing, from watching scheduled television programs to viewing "on demand" via the Internet. Game playing by young children on smartphones or tablets is also becoming more common in many homes around the world.

In Australia, literacy researchers have been actively studying young children's literacy practices at home, particularly over the past five years. Verenikina and Kervin (2011) conducted a case study of three families with preschool-aged children (3- to 5-year-olds). Their methods of data collection included video-recorded observations of the children using selected software, and semistructured, audio-recorded interviews with the parents. The authors were interested in the quality of children's experiences with digital technologies and in the value of such experiences in the children's overall development. Their main focus, however, was the emerging phenomenon of "digital play" among very young children. Verenikina and Kervin framed their study with theories of play to investigate children's use of iPads at home. The study examined whether or not such digital play could enhance children's development in ways that might not be possible with traditional play (p. 6). Verenikina and Kervin found that young children's access to the technologies was shaped by their parents' decisions and beliefs, such as technologies being best used for educational purposes. The authors found that young children preferred games that allowed them to engage their imagination and develop their own play. In the study, technical support from family members with more experience using iPads helped the young children to create complex digital play. Also, the data revealed that social interactions within the family increased while they used an iPad. As well, children in Verenikina and Kervin's study often integrate their iPads as part of their play. In the following section, I review literature that focuses on children's literacy practices influenced by new digital devices.

Children's Literacy Practices Influenced by New Technologies

The literature reviewed in this section suggests that the ways in which young children engage with literacy practices at home have changed with the advancement of technology tools over the past two decades. The reviewed literature also reveals the important role played by technology tools in the everyday lives of children.

I conducted a thorough examination of the literacy research environment context in the area of children's home literacy practices, and my literature review indicates there are some studies devoted to preschoolers' engagement with multiliteracy practices at home being mediated by new ICTs. Much of the research dealing with young children's literacy practices and new ICT tools comprises group observations in nursery schools, large-scale surveys of parents' beliefs and interpretations of their children's home literacy practices, and inventories of technology tools in the home. Relatively few studies used the methods of participant observation and direct informal or structured interviews of young children to examine their literacy practices at home with technologies such as tablets and smartphones (Rideout, 2013). Nonetheless, literacy studies that focus on the use of mobile touchscreen devices by young children are starting to emerge (Hutchison, Beschorner, & Schmidt-Crawford, 2012; Kucirkova et al., 2013; Rowsell, Saudelli, Scott, & Bishop, 2013).

Researchers and educators consider technology tools as being able to enhance early literacy development and learning at home and in school (McPake et al., 2013; Mol et al., 2014; Neumann & Neumann, 2014). The multimodal nature of digital literacies means that young children are experiencing meaning making differently than with print-based texts (Honan, 2012; Marsh, 2011; Merchant, 2009). For example, online video games for young children provide narrative structures and cueing systems for beginning readers and writers that differ significantly

from those available in traditional offline print-based texts (Carrington, 2005). In a hypertext environment, young children no longer need to follow a linear relationship with the written texts, but are free to navigate the text on the screen (Plowman et al., 2008). Young children are also developing strategies for acquiring meaning from screen-based texts long before they decode meaning in conventional print (Levy, 2009). Despite growing research on the benefits that young children gain in acquiring early literacy skills in digital online environments, much debate is occurring regarding the impacts of technology tools on children's literacy development and learning in Canada, Australia, the UK, the US, and many other parts of the world. For example, in several interviews with the media about my research, reporters (e.g., Bresnahan, 2015; Heintzman, 2015) often asked me what impacts digital devices may have on young children's overall literacy development. My experiences with media interviews gave me the impression that many people are seeking more knowledge and are very interested in this area of study. Some early childhood educators, parents, and popular media figures consider the newer digital technologies to be a threat to the overall development of young children. For example, according to Linn, Almon, and Levin (2012), working with Campaign for a Commercial-Free Childhood, young children who watch only 20 minutes of fast-paced action cartoons each day can experience negative consequences, including a shorter attention span, inability to delay gratification, and decreased self-regulation (p. 5). Of course, an overconsumption of any type of technology, including books and other more conventional literacy tools, could be harmful. When a child is inactive at home, or is engaged in many hours of reading books, colouring pictures, playing video games, or watching television, the reduction in physical activity could have negative implications. In contrast to the studies that view technologies as a threat to children's development, other researchers (Bearne et al., 2007; Beavis, 2012; Carrington & Marsh, 2005;

Gee, 2007; Honan, 2009; Marsh, 2010a; Merchant, 2005; Plowman et al., 2012) consider the new technologies as being valuable to young children's literacy development.

My review of the literature provides research findings related to young children's engagement with literacy practices at home in different parts of the world within the last decade. Many research studies in this literature review suggest that technology tools play important roles in young children's literary lives and learning, and many of these studies were conducted in formal school settings and with large surveys of parents. My survey of the current literature revealed that ICTs and family members play important roles in shaping young children's overall literacy development prior to formal schooling. The reviewed literature also emphasizes that young children come to know how to use ICTs through processes of play, mediation, and scaffolding by parents and older siblings at home; these contemporary young children develop unique ways of learning.

A growing number of studies have focused on mobile touchscreen devices and their impacts on children's early literacy learning. However, there is less literature regarding the influences of mobile touchscreen devices on young children's engagement with multiliteracy practices and their literacy learning at home. The above literature review found some studies conducted at home, but few had used participant observation, direct interviews of young children, or interviews of parents' attitudes regarding their children's home literacy practices, including some parents' anxiety about the negative effects of technologies on their children. My study was designed to address these gaps. In my study, I participated with and observed young children's engagement with multiliteracy practices in their home learning environment to learn about their meaning making. I also interviewed parents and conducted focus group discussions with parents of the participating children.

Next, in Chapter 3, I provide the theoretical and conceptual orientations that framed my study.

Chapter 3: Theoretical and Conceptual Orientations

So it's like a kaleidoscope: the world is a matter of patterns that change, that partly repeat, but never quite repeat, that are always new and different.

(Waldrop, 1992, p. 330)

This chapter is divided into two sections. The first section discusses how complexity thinking has informed my study, and is followed by Green's (1988, 2012) three dimensions of literacy as this study's conceptual framework. The complexity thinking perspectives and three dimensions of literacy provide me with a useful frame and language to analyze my research data.

Theoretical Orientation: Complexity

In outlining/describing my theoretical orientation, I begin with an introduction to complexity theory and then discuss its origins and diverse historical backgrounds. Several notions of complexity are presented, as they are useful to theorizing about and understanding the complex phenomena of children's multiliteracy practices and learning at home. Complexity theory provided me with a language to think about, describe, and talk about the complex phenomena of children's literacy learning and practices within the context of their homes. Davis and Sumara (2010) remind us that, as educational researchers interested in the educational relevance of complexity theory, we are not obligated to "defend its veracity or rigor" (p. 856). They suggest that "the project has shifted more toward exploring the applicability and utility of its insights" (p. 856). However, the defense of this theory has moved on during the last decade because complexity perspectives have emerged in many educational research studies, particularly in mathematics and technology. I used a complexity lens to analyze my data at both a macro and a micro level.

In the field of complexity research, diverse definitions of complexity can be found, often tuned to the particular interests and focuses of researchers (Davis & Simmt, 2013). In this study, I use the term *complexity thinking* to mean the sensibilities and attitudes of complexity theory (Davis & Sumara, 2008).

Complexity as a Theoretical Discourse

Complexity thinking is a paradigm that challenges positivist perspectives, including the notion that the universe is rationalistic, deterministic, and following Descartes' mechanistic clockwork order (Doll, 1993). Predictability, causality, universality, linearity, continuity, stability, and objectivity are some of the overarching principles of positivism (Kuhn, 2012; Lincoln & Guba, 2000). The positivistic perspective has been increasingly challenged with the rise of complexity, chaos theories, and several other perspectives that emerged in the 1960s (Gleick, 2011; Johnson, 2001; Waldrop, 1992). Complexity thinking has entered the field of social science and suggests alternative ways of conceiving the world, and thus, of researching it (Davis & Sumara, 2006; Morrison, 2006). Mathematics education has embraced the use of a complexity lens for research (Davis & Sumara, 2006) and leads the way in the field. However, a growing body of literacy research has been informed by complexity thinking, including, for example, Laidlaw's (2005) study of young children's writing processes, and Sumara, Davis, and van der Wey's (1998) reader response study with middle school students. Educational researchers who use complexity theory argue that the linear and mechanistic frames of positivism do not adequately reflect the social world of education, and they contend that research informed by a complexity perspective can offer more frames that better reflect the realities of classrooms, learners, and other complex educational phenomena (Davis & Simmt, 2013; Davis

& Sumara, 2006; Doll, 1993; Fenwick, Edwards, & Sawchuk, 2011; Morrison, 2006; St. Julien, 2005).

A complex system is viewed by "complexivists" as a living system that learns (Waldrop, 1992). A complexity perspective suggests that living organisms—including cultural and human systems such as those of schools, classrooms, families, and individual learners—might be better understood as adaptive, emergent, dynamic, and self-organizing (Doll, 1993; Waldrop, 1992). Children's learning is also dynamic and unpredictable, and is constantly changing and adapting to stimuli from the children's external home environments. Thelen and Smith (1998) note that young children's learning emerges from "the multiple, mutual, and continuous interaction of all the levels of the developing system, from the molecular to the cultural" (p. 258). In my study, several notions of complexity, such as *internal diversity, recursion, neighbour interactions, emergence, self-organization,* and *structural coupling*, have helped me understand the complex phenomena of children's literacy practices and learning in the context of the home. I elaborate on how these complex phenomena are related to my understanding of children's home literacy learning in more detail later in this chapter. Next, I present the various complexity perspectives in educational research.

Complexity Perspectives

Epistemologically, I understand that knowledge is embedded in our daily lives, nested within our interconnected lived experiences and relationships. Learning and teaching are complex, and studying human learning experiences is not simple (Davis & Sumara, 2010), especially when the participants are under the age of 5 (MacNaughton, Rolfe, & Siraj-Blatchford, 2010). Through the lens of complexity thinking, I understand children's everyday social lives, education, and learning to take place alongside the interconnected phenomena of the

interactions of family members. Therefore, studying the complex phenomena of young children's multiliteracy practices in their home environment needs to be viewed holistically and cannot be examined by isolating and separating the smaller parts. As Fenwick, Edwards, and Sawchuk (2011) remind us, in educational applications of complexity thinking, "attention is drawn to the relationships among learners and environment" (p. 28). Complexity thinking allows learning to be described in terms of living and social systems, providing a more dynamic interpretative process for understanding learning as emergent from experiences that transform learners (Richardson & Cilliers, 2001).

The works of Doll (1993), Bateson (1979), and Maturana and Varela (1992) have been influential in developing my theoretical orientation. These complexity theorists perceive the world as a network of complex phenomena that are fundamentally interdependent—a "web of life" (Capra, 1996) which continuously changes over time.

In education, my area of focus, several researchers and authors have been significant influences on my study. Davis and Sumara (1997) use complexity in their proposal of an "enactivist" model of cognition to make recommendations for teacher education. Davis and Simmt (2013) apply complexity thinking in complex learning systems in mathematics education. Jörg, Davis, and Nickmans (2007) use complexity thinking to explore the nature of learning and education. Laidlaw (2005) employs complexity thinking in her exploration of writing processes in primary classrooms. Hetherington (2013) suggests that complexity thinking can be used as an educational research methodology. Morrison (2002) draws on complexity thinking to help with the "messy" nature of leadership in educational settings. While educational research in complexity is increasingly diverse, it has in common is the recognition that learning is not a simple process and it does not follow a linear pattern; rather, it is a "complex dance involving

many bodily and non-bodily systems" (Davis & Sumara, 2006). As Hetherington (2013) notes, "in research that takes an explicit complexity thinking approach, it can be argued that complexity thinking should inform both the framing of the research problem and the methodological choices in conducting the research" (p. 72).

In the following section, I introduce complexity as a theoretical orientation and then discuss its origins and diverse historical backgrounds.

What is Complexity?

Etymologically, the word *complex* is derived from the Latin *complexus* from the 14th century, which evolved into the modern French *cum* and *plectere*, meaning surrounding, encompassing, embracing, comprehending, and comprising. Its use in English tends to mean "plaited together, interwoven, and intertwined" (Soanes & Stevenson, 2011). During the last few centuries, the adjective *complex* has conveyed various specific meanings in different contexts (e.g., complex numbers in mathematics, complex sentences in linguistics, or complex notes and sounds in music). The terms *complex* and *complexity* are generally used to mean the opposite of simplicity (Soanes & Stevenson, 2011).

Moving beyond matters of etymology, in the latter half of the 20th century, complexity as an emerging science attracted the attention of scholars and scientists and led to new understandings of nature as a complex adaptive system in "a field of turbulences" (Alhadeff-Jones, 2008, p. 75). This view is different from that of modernists who assumed the study of nature to be simple, linear, and stable (Gleick, 2008). Complexity theory attracted researchers with diverse interests and from diffuse origins (Waldrop, 1992), thus to refer to complexity as a singular body of knowledge or a branch of inquiry is a misrepresentation (Biesta & Osberg, 2010; Davis & Simmt, 2003; Fenwick et al., 2011). According to Gough (2012), "complexity is a

heterogeneous assemblage of concepts and metaphors arising from studies of complex systems in a variety of scholarly disciplines" (p. 41), including research in cybernetics, systems theory, ecology, artificial intelligence, chaos theory, autopoesis, fractal geometry, and nonlinear dynamics (Davis & Sumara, 2006; Johnson, 2001; Waldrop, 1992). Many of these areas of research began to develop in the 1950s and 1960s, emerging mainly from "hard" sciences, for example, mathematics, physics, and biology. In the 1970s, complexity research gained momentum through the use of computer technology, and many hypotheses and questions related to complex systems were tested through computer simulations (Waldrop, 1992). More recently, studies in the social sciences have embraced many of the complexity principles (Alhadeff-Jones, 2008; Davis & Simmt, 2003). Furthermore, complexity thinking has been used to develop new practices and to support innovation in technology development (Johnson, 2010). Digital networks and technologies are frequently cited as examples of applications of complexity thinking (Fenwick et al., 2011; Johnson, 1997, 2001, 2010). As theorists working from complexity perspectives have explored (Gleick, 2011; Johnson, 2001, 2010), digital devices and systems often demonstrate characteristics of complex adaptive systems, such as nonlinearity, emergence, unpredictability, self-organization, and "adaptive-ness" (Patton, 2011, p. 8). I note too that, increasingly, theorists working in the area of digital literacies and multiliteracies are using language, frames, and descriptions of phenomena that are consistent with complexity thinking (Gee & Hayes, 2011; Green & Beavis, 2012; Kress, 2010; Pahl & Rowsell, 2014). For example, educational researchers studying children's engagement with online video games often use terms representing complex phenomena, such as *unpredictable*, *multidirectional*, and *dynamic* to describe observed phenomena. Complexity thinking appears to provide a valuable orientation for researchers who are interested in multiliteracies and digital literacies because it

provides them with a language with which to describe, think about, and talk about the complex phenomena they are studying.

Due to the scope of this dissertation, it is not possible to provide a comprehensive and complete history of complexity. However, I will discuss certain "conditions" associated with complexity which frequently appear in the work of educational researchers who use complexity thinking. As well, some historical background of complexity is helpful to provide context for my own use. I use the phrase *conditions of complexity* in my dissertation because I am aware that complexity thinking has become not just a valuable means to interpret research data, but also a way to understand the emergence of learning communities. Within educational research studies where complexity principles have been applied to understand teaching and learning, Johnson (2001) has articulated general principles for complexity which have been adapted to describe the emergence of a learning community (pp. 76–80). In order for a learning community to emerge, certain conditions of complexity must be present. Davis and Simmt (2003) explain that "certain necessary but insufficient conditions must be met in order for systems to arise and maintain their fitness within dynamic contexts—that is, to learn" (p. 147). However, this does not mean that a teacher *causes* the conditions of complexity for emergent events; rather, the teacher, in understanding the nature of complexity and its possibilities, can provide opportunities for a collective learning community to emerge. Many classrooms have the potential to be self-organizing systems if the teachers attend to necessary conditions as the "consciousness of the collective" (Davis, 2004, p. 178). In a home context, similarly, parents or caregivers do not cause the conditions of complexity for emergent events; however, they can provide opportunities for the emergence of the collective learning community, through, for example, encouraging their

children's interests, setting up a home environment that supports children's learning, and through their responses.

In my study, the phrase "*conditions of complexity"* refers to the complex phenomena that comprise complex systems. Davis and Simmt (2003) explain: "Complexity science has become more relevant to such deliberate social projects as schooling. In particular, complexity science has highlighted that, by attending to particular matters, a teacher can greatly increase the likelihood of complex transcendent possibilities within the classroom" (p. 145). Within my study, I recognize that, similarly, a parent can also increase the likelihood for conditions of complexity to occur at home. Thus, I focus on six conditions of complexity in my study: (a) emergence, (b) recursion, (c) neighbour interactions, (d) decentralized control, (e) internal diversity, and (f) enabling constraints. These six conditions of complexity have not only informed and influenced my study, but they provide useful, multipurpose lenses for examining the "complex dance" of young children's multiliteracy practices at home.

Roots and Branches of Complexity Thinking

Complexity research recognizes a class of phenomena that cannot be understood in terms of simple cause-effect dynamics (Davis & Simmt, 2013). Alhadeff-Jones (2008) traces three generations of complexity thinking when exploring how changes have emerged epistemologically and anthropologically.

According to Alhadeff-Jones (2008), the first generation of complexity thinking attempted to compare the differences between the terms *complex* and *noncomplex*. Weaver (1948) was among the first to contrast the terms, and he identified three categories of problems being addressed in science: *simple*, *disorganized*, and *organized complexity*. He also suggested that a cross-disciplinary collaboration might be the best approach to the study of organized

complexity problems. Cybernetics is one example of a cross-disciplinary approach for exploring systems. According to Gleick (2011), cybernetics meant to "be a field that would synthesize the study of communication and control, also the study of human and machine" (p. 235). Studies of cybernetics were grounded in the understanding of organized complexity and developed the notion of *feedback*: a system that can operate by adapting itself to its environment (Alhadeff-Jones, 2008). *Feedback loops*, part of the recursion process, play an important role in children's literacy practices and learning, which is discussed in detail later in this chapter.

In the second generation of complexity thinking, the focus was on efforts to better understand nonlinear and dynamic behaviours observed in complex systems. System scientists such as von Bertalanffy (1950) used general system theory to study complex systems by examining not only the interactions of many components but also the importance of relationships that bind the observer to a phenomenon (Waldrop, 1992). During the same period, progress in understanding self-organizing phenomena had significant consequences for the study of nonlinear dynamics. The work of Maturana and Varela (1992) on *autopoesis* and *structural coupling* provided new representations of adaptation, evolution, and emergence that informed further understanding of complex phenomena. Meanwhile, the introduction of *fractal geometry* as a mathematical concept demonstrated the natural phenomenon of self-similarity in nature. It is an infinitely complex recursively constructed shape where tiny parts of a system all appear similar, letting the geometrical order be seemingly disordered (Davis, 2004). One example from nature would be a branch of broccoli, where each tiny branch presents a smaller version of the whole. In my study, the image of a fractal was useful, and I used it as a metaphor to articulate my understanding of young children's complex literacy learning process. For example, a child's

retelling of a story can be interpreted as a smaller-scale representation of oral story-telling practices or content that has been shared previously by parents.

According to Alhadeff-Jones's (2008) account of complexity thinking, the third generation began in the 1980s. In the early 1980s, the concept of *complex adaptive systems* emerged, coming from the Santa Fe Institute in New Mexico. Kauffman (1995), along with other scientists at the Santa Fe Institute, emphasized the importance of using a multidisciplinary collaborative approach to understand the common themes that arise in natural, artificial, and social systems. These complexity thinkers "pushed beyond observing and mapping what *is*, and attempted to simulate what *could* be in social, ecological, artificial and organic systems" (Fenwick et al., 2011, p. 20, emphasis in original).

The brief history of complexity thinking presented by Alhadeff-Jones (2008) may give the impression that the development of complexity thinking today has followed a linear path. On the contrary, according to Alhadeff-Jones (2008), "the multiplicity of definitions, trends and fields of study in which they [complexity theories] have taken their roots illuminate the constitutive disorder which shaped their evolution" (p. 76). Complexity research is itself an example of what it studies: an emergent phenomenon in which diverse disciplines emerge into a coherent field of study. In social sciences, complexity thinking has been used to explore phenomena of interconnectedness within multiple disciplines such as politics, health, technology, and education. Explorations using complexity thinking have proven to be useful in understanding complex phenomena such as change, learning, and knowing, which are all at the heart of education (Davis & Sumara, 2010. Complexity thinking has become a useful and valuable theoretical frame to use within educational research (Biesta & Osberg, 2010; Davis & Sumara, 2008).

Doll (1993) was one of the earliest education scholars and researchers to explore the theoretical and practical implications of complexity thinking in conceptualizing curriculum, teaching, and learning, using concepts related to chaos and complexity from the natural sciences. In the 1980s and 1990s, other education scholars and researchers in different parts of the world were exploring chaos and complexity; for instance, Davis and Sumara (1997) in Canada and Green and Bigum (1993) in Australia. These educational researchers and scholars brought complexity thinking into the realm of a theoretical orientation in education and explored several conditions of complexity that were applicable in education and learning.

Complexity Terms

At this point, several terms of complexity thinking used in this study need to be clarified. A *system* refers to a set of interacting or interdependent components that form an integrated whole; it has structural parts that are directly or indirectly related to each other. A *complex system* is understood as any system that is comprised of a large number of interacting components and is characterized by self-organization and "adaptive-ness" (Johnson, 2001); in a complex system, the whole is greater than the sum of its parts. Waldrop (1992) explains that a system is complex if "a great many independent agents are interacting with each other in a great many ways" (p. 11). In a sense, complex systems create themselves, that is, they come into being and remain in existence through their own internal interactions (Waldrop, 1992). A complex system fluctuates between states of order and disorder, without giving in to either state, and it responds to feedback information by changing (Johnson, 2001; Waldrop, 1992). Examples of systems that might be described as *complex adaptive systems* include organizations such as human cells, bodily organs, a human being, various social structures, an economy, a culture, or an ecosystem (Johnson, 2001). *Nested systems* often emerge as an ecosystem, where all members

are bound together in a network of interdependencies. Each individual system is an integrated whole and part of larger systems at the same time, so that changes within one system can affect the sustainability of the systems that are nested within it, as well as impacting the larger systems to which it belongs (Davis & Sumara, 2006). Complexity thinkers often describe such adaptive, self-organizing, and emergent phenomena as *learning systems* (Johnson, 2001), where learning is understood to be ongoing and recursive and learners have the ability to adapt when feedback is received.

Individual Learning as Intricately Bound Within Complex Systems

One of the goals of complexity thinking is to understand and explain general laws of pattern formation (Waldrop, 1992) that suggest changes within the complex adaptive systems. Because complexity thinking is concerned with formations of patterns, the focus of complexity research is on the phase of changes or transformations that provides indicators for growth or learning (Johnson, 2001; Waldrop, 1992). Complexity thinking also focuses on emergent behaviours that result from interactions of the many components within complex adaptive systems (Waldrop, 1992). Throughout my study, I paid close attention to the small changes that emerged within the children's everyday literacy practices while they interacted with their family members, toys, and literacy artifacts. I also observed how some of these changes occurred in recursive patterns. Such patterns of change suggest that the children's literacy learning processes involve feedback loops in which family interaction, artifacts, and other influences contribute to change.

For educational researchers, the study of learning bounded within complex adaptive systems offers an opportunity to understand the conditions that are in place when changes or transformations occur. However, this does not mean that researchers can predict the precise

timing or consequences of certain changes; rather, it provides the observers some clues about the suitable boundaries for the possibility of the subsequent changes or transformations that may occur within the complex systems. These changes or transformations are what I refer to as "unusual sightings" in my study. For example, during my research data collection phase, it was often a surprise when some of my young participants revealed their multiliteracy learning to me by showing me how to use an app to create a digital story. It was not possible to predict what they would be or for me to predetermine when these literacy-learning experiences would occur. David and Sumara (2006) have applied concepts of complexity thinking to learning in school contexts, demonstrating how environment and learners emerge together in the process of cognition. Davis and Sumara (2006) explain:

> [It] is a matter of transformations in the learner that are simultaneously physical and behavioral—which is to say, in biological terms, *structural*. Learning is certainly conditioned by particular experiences, but it is "due to" the learner's own complex biological-and-experiential structure, not an external stimulus. (p. 13)

Several theorists within complexity thinking frames view cognition and learning as complex adaptive systems. For example, Bateson's (1979) and Maturana and Varela's (1992) idea of *enactivism*, which focuses on the relationship between individuals and their environment, is one of the complexity thinking perspectives of cognition and learning. In enactivism,

> the concern is not with how the cognizing agent comes to know the world, but with how learner-and-learned, knower-and-known, self-and-others co-evolve and are co-implicated. Context is not merely a place, which *contains* the student; the student literally is part of the context. (Davis, Sumara, & Kieren, 2006, p. 157)

Maturana and Varela (1992) call this notion where the organism and environment interact with each other and experience co-evolutional changes and transformations "structural coupling" (p. 75) and explain it this way:

> In these interactions, the structure of the environment only *triggers* structural changes in the [organism] (it does not specify or direct them), and vice versa for the environment. The result will be a history of mutual congruent structural changes as long as the [organism] and its containing environment does not disintegrate: there will be a *structural coupling*. (p. 75, emphasis in original)

In other words, the organism and environment both undergo changes in their structure in the process of evolution and this makes them "adapted and compatible with each other" (Proulx, 2008, p. 16). However, this does not imply that the organism and environment are becoming more adapted to each other; rather, it simply means that their structures allow them to interact. In my own research, I am interested in how young children adapt to changes within their home learning environment and, conversely, how the home learning environment changes in connection to children's engagement with multiliteracy practices. Furthermore, the notion of *emergence* is an important characteristic of complex systems to consider in this study, because I am interested in understanding children's literacy learning at a macro level and micro level. Emergence is a process in which collective behaviours arise through the interactions among the properties of smaller parts (i.e., what parts of a system do together that they would not do alone). As Davis and Simmt (2003) explain, "for reasons that are not fully understood, under certain circumstances agents can spontaneously cohere into functional collectives—that is, they can come together into unities that have integrities and potentialities that are not represented by the individual agents themselves" (p. 141). In my study, many children's literacy practices were

often determined by their local interactions within their home environment and community, including interactions with their parents, siblings, playmates, toys, literacy resources, and artifacts. The collective literacy practices of a family often emerged without being predetermined by anyone. For example, during one of my visits to a home in my study, the whole family decided to visit a local aviation museum because the children had just read several books about airplanes and the father was interested in flying paper airplanes. This movement from micro-level events to macro-level collective engagements is what is known as *emergence* in complexity thinking.

In my study, I embrace the provocative idea that individual learning can be viewed as part of a complex adaptive system with feedback at its core, changing and evolving in response to its environment (Davis & Sumara, 2006; Doll, 1993; Jörg, Davis, & Nickmans, 2007; Mason, 2009). Informed by Davis and Simmt (2003) and Davis and Sumara (2006), who propose that a classroom is a holistic learning entity in its own right, I considered how this "emergence of learning" might be possible within young children's literacy practices in their home environments.

Davis and Sumara (2006) argued that educational research needs to be concerned with making sure the conditions are present for the emergence of the "as-yet unimagined" (p. 135) or the "expansive possibilities" (p. 135) for learning. They identified "certain necessary but insufficient conditions [that] must be met in order for systems to arise and maintain their fitness within dynamic contexts—that is, to learn" (p. 147). Knowledge of these conditions has been applied in different areas, including reestablishing destroyed ecologies and, in corporate sectors, improving productivity. This knowledge has also been "adapted and elaborated by a handful of educational researchers to structure classroom and research collectives" (p. 135). Davis and

Sumara selected six conditions for complex emergence within classroom learning systems: (a) internal diversity, (b) internal redundancy, (c) neighbour interactions, (d) distributed control, (e) randomness, and (f) coherence (p. 135). They also considered these six conditions as sets of complementary pairs under the following three headings:

- *specialization*, which involves the existing tension between redundancy and diversity;
- *trans-level learning*, which enables neighbour interactions through decentralized control; and
- *enabling constraints*, which is balancing randomness and coherence (p. 136).

These conditions do not form a hierarchy of importance; rather, they should be viewed as holistic and interdependent. Davis and Simmt (2013), in their work on mathematics education, also considered these conditions of complexity, and they argued that these conditions must be met in order for agents to come together into collectives that might surpass the possibilities of those agents (p. 145).

Complexity thinking has become more relevant to education and the study of classroom dynamics (Mason, 2008). As Davis and Simmt (2013) explain, by "attending to particular matters, a teacher can greatly increase the likelihood of complex transcendent possibilities within the classroom" (p. 145). In my study, I consider these conditions of complexity as notions of complexity thinking. I address some of these notions of complexity thinking in the following section.

Notions From Complexity Thinking That Inform My Study

The emergence of self-organization.

The notion of self-organization first appeared in the early years of cybernetics, when scientists and researchers began to construct mathematical models to represent the "logic

inherent in neural networks" (Capra, 1996, p. 83). In the 1950s, binary scientists observed in their computer models that some spontaneously ordered patterns would emerge, even though the initial state of the network was chosen at random (Capra, 1996; Johnson, 2001). This spontaneous emergence of ordered patterns became known as self-organization, or emergent systems. In the early days of complexity thinking, self-organization and emergence were used to describe somewhat different characteristics of systems; however, today the two terms are often used interchangeably (Laidlaw, 2005). The following example from my study illustrates a spontaneous emergence within a child's home environment. In one of my home observation visits, I documented a group of children at play in their backyard while their mother was preparing lunch in the kitchen while keeping an eye on them. The children played with each other in the backyard and soon a game of imaginary dramatic play emerged. The children created an episode of a "galactic battle" by remixing the plots from several movies they had watched with the video games they had been playing online. They played with impromptu props gathered in their backyard for their game. Interestingly, there was no director, screenplay writer, or producer for this imaginary action battle, but somehow the children knew the role each person had to play. Their spontaneous dialogues were engaging, and this role-play developed as a coherent whole. Complex systems tend to continually self-organize through the processes of emergence and feedback. In other words, rather than being planned or controlled, the agents or parts in the complex system interact in apparently random ways. From these unplanned interactions, patterns emerge which inform the behaviour of the agents within the system and the system itself (Capra, 1996; Johnson, 2001). Emergence is an important characteristic of complex adaptive systems. In this study, children's literacy learning often emerged from their interactions with the many parts in the complex system.

Recursion.

In this study, learning and the processes of knowledge formation are understood to be nonlinear and recursive. *Recursion* is one of the key characteristics associated with complexity thinking. It is useful for making sense of young children's early literacy learning because a complex system tends to use recursive patterns (Doll, 1993). An example of a recursive pattern is the geometric form of the fractal. As Davis and Sumara (2006) explain, a fractal is generated through "(potentially) infinite recursive processes. . . . At each stage in a recursive process, the starting point is the output of the preceding iteration, and the output is the starting point of the subsequent iteration" (p. 43). With an ongoing feedback loop and driven by recursion, the fractal form emerges. Benoît Mandelbrot, a mathematician, coined the term *fractal* and noted that fractals are a "geometry of nature" generated through a recursive process (Gleick, 2008). Gleick (2008) explains: "In the case of fractals, it was the fractional dimension—a constant that could be calculated and used as a tool for further calculations. Allowing mass to vary depending on scale meant that mathematicians could recognize similarity across scales" (p. 162). In other words, fractals are infinitely complex patterns that are self-similar across different scales and can be frequently found in natural phenomena, such as the structure of a head of broccoli, the neural network of a brain, and so on. The geometrical pattern of a fractal provided an intriguing metaphor for me to think about young children's literacy practices and learning in my study. I noted in my study that some children's literacy practices tended to expand in multiple directions over time; however, their expanded literacy practices often maintained a resemblance to the initial practice, similar to a fractal shape. For example, some children often made arts and crafts or drew pictures of their favourite movie or storybook characters, and sometimes they used these literacy artifacts as part of their dramatic role-play. In some cases, the participating children took

images of these literacy artifacts and, with the help of their parents, posted them on their family's social media sites. The collection of images posted on the social media site could be interpreted as a large fractal "branch" and the child's literacy artifacts (arts and crafts and drawings) as the smaller "twigs" of the fractal shape. The family's social media site viewed as a whole could be considered as the fractal "tree." This image of repetitive patterns of children's literacy practices presents an alternative way to consider children's literacy learning as a nonlinear entity. Furthermore, in a fractal geometric shape, all the parts of the fractal are interconnected, branching out from one another, extending from smaller-scale twigs and branches to larger-scale whole trees. As Doll (1993) reminds us, "metaphors are generative; they help us see what we don't see" (p. 169). The metaphor of fractal shapes was helpful in my study because it guided me to closely examine children's literacy learning as a holistic frame for understanding.

Fractal geometry has influenced the work in many fields, including natural sciences, medicine, and economics (Gleick, 2008). Its emergence in the field of educational studies is due to the notions of scale independence and self-similarity, which are useful for making sense of "the leveled and embedded natures of individuals, social collectives, bodies of knowledge, cultures, and societies" (Davis, 2004, p. 192). Fractal geometry is also useful for interpreting the nested systems of children's learning because it can be extended in both micro and macro directions.

The image of a fractal as a frame with which to interpret and understand children's home learning environments may be compared a frame that is well known in early childhood research: Bronfenbrenner's (1979) ecological systems theory of understanding children's learning. Bronfenbrenner's ecological systems theory uses four different types of environmental systems (ecosystems) that can influence human development. A child lives simultaneously in these four

different ecosystems, from the most immediate and intimate home ecological system, moving outward to the larger school system, and further still to the most expansive (macro)system—society and culture. All the ecosystems are interconnected and can influence each other; importantly, they influence every aspect of the child's life.

Bronfenbrenner (1979) argued that a child's learning environment extends far beyond the immediate setting of the home. The child's immediate learning environment, known as the microsystem, is at the centre, the first of four levels. Interactions within the microsystem typically involve personal relationships with family members or caregivers. The second level is the mesosystem; it involves the interconnections between the microsystems, the interactions between the family and school, and the relationship between a child's friend and the family. At the third level is the exosystem, in which Bronfenbrenner (1979) suggests that "a person's development is profoundly affected by events occurring in settings in which the person is not even present" (p. 3). For example, a child's experience at home may be influenced by his or her parents' experiences at work. A child's parent might have to work overtime, which might increase the time a child has to spend with a caregiver. At the fourth level is the macrosystem, or the culture in which the child lives. The cultural contexts involve the family's socioeconomic status and beliefs, and this macrosystem often evolves and changes over time. All four levels of the ecological environment—the microsystem, mesosystem, exosystem, and macrosystem—are interdependent, interconnected, and acting together to constitute the development of the child. Particular aspects found within each level of Bronfenbrenner's ecological systems model are useful in understanding young children's learning at home and beyond. While his theory extended my understanding and thinking about children's literacy learning, complexity thinking and the frames offered by the notion of the fractal offered a model that more accurately

represented the interconnections, recursiveness, and "flow" across systems that I observed in my data.

Davis and Sumara (2005) believe that it seems more relevant to interpret children's literacy practices using fractal images, "especially in the observation that there is a certain scale independence to phenomena at each of these levels [micro and macro levels]. Things do not get simpler as you zoom in or zoom out" (p. 313). As a metaphor for literacy learning, the fractal image "presents a model of interrelation, where systems are layered within systems" (Laidlaw, 2005, p. 46). Thus, the fractal image is a helpful metaphor to view and understand children's home literacy practices, artifacts, and events as they are interconnected within their larger home environment. Complex phenomena, such as children's home literacy practices and learning, are much more fractal-like than they are linear progressions; they are recursively expanded and often surprising (Laidlaw, 2005, p. 43). However, Doll (1993) argues that recursion is different than *repetition*. Repetition is doing the same activity or process over and over again, as in flash card drills for phonics skill or for learning how to spell words. It is important to connect new learning to a prior experience in new ways, in a recursive pattern. Doll (1993) makes a link between recursion and the practice of reflection this way:

> Recursion aims at developing competence—the ability to organize, combine, inquire, use something heuristically. Its frame is open . . . in recursion, reflection plays a positive role; for thoughts to leap back on themselves. (pp. 178–179)

Some young children's literacy practices may appear to be repetitive, such as listening to a favourite story over and over again. However, such a literacy practice ought to be understood as a recursive process, that is, children reflect on each episode of listening to the same story with their previous experiences and build on these experiences. Doll (1993) points out that learning is

never a matter of direct linear progress, and he warns that if educators interpret curricula in terms of a single direction of forward movement, this would suggest an inability to recognize the complexity of learning. Additionally, according to Davis and Sumara (2006), recursion is also a key process in meaning making, cognitive growth, and the emergence of consciousness.

The recursive learning processes of young children can be very complex. For example, children listen to a story and draw a picture of the story. They apply the idea of the story to their drawing as well as the background concepts they had prior and the concepts they gained from listening to the story. The story becomes a different story, "redesigned" (New London Group, 1996) perhaps for a new audience. Each literacy practice and learning process incorporates previous ideas, which continue to change and expand in a nonlinear and recursive process. Children seldom abandon their initial learning; they explore further and deepen their understanding by expanding their previous learning and branching out into new territory in a fractal-like manner.

Neighbour interactions.

A key idea in complexity thinking is that agents such as human beings within a complex system must be able to affect each other's activities, ideas, and behaviours (Davis & Sumara, 2006; Johnson, 2001). In a biological sense, neighbour interactions are concerned with the influence of one organism on another and how such interactions affect the development and behaviours of organisms. Ant colonies, cities, neighbourhoods, and brain cells are examples of where neighbour interactions are critical for their formations and survival. In a sense, these neighbours interact with each other to allow their collective intelligence to emerge. Johnson (2001) gives an example of an embryo development, where each cell somehow can figure out "where it is in the larger scheme of things," to begin to form, for example, an arm or an eye.

Despite the fact that these cells lack a bird's-eye view of the organism that contains them, "they can make street-level assessment via the molecular signal transmitted through the cell junctions. This is the secret of self–assembly: cell collectives emerge because each cell looks to its neighbor for cues about how to behave" (Johnson, 2001, p. 86). Encountering other agents does not affect the whole system unless that encounter has a chance to alter each other's behaviour; and the feedback loop among neighbours is extremely important (Johnson, 2001; Waldrop, 1992). Johnson (2001) suggests that interactions between neighbours are vital because local information can lead to global wisdom. For example, within an ant colony, each ant receives information from another ant and acts according to the neighbour interactions. This is the way that a single ant participates with the whole colony and its survival (Johnson, 2001).

In a learning environment such as a classroom, neighbour interactions could be partly interpreted as peer-peer or teacher-student interactions. Davis et al. (2008) suggest, however, that "the neighbors that come to interact are not necessarily physical bodies but can be ideas, hunches, queries, images, artifacts, and other manners of representation" (p. 198). What might constitute a neighbour in the context of a young child's home? A neighbour could be a parent, sibling, friend, relative, toy, literacy artifact, idea, or concept. When children explore ideas while engaging with multiliteracy practices, the process of their ideas "bumping into" each other can be considered as neighbour interactions. In the virtual world, online digital interactions with others could also involve neighbour interactions. Davis and Simmt (2003), discussing their research, note that "what was important was not the opportunity for direct interaction (which was very limited), but the opportunity of making ideas collide with one another" (p. 156). The notion that our ideas need to bump into one another to create the possibility for new ones opens up new ways of understanding children's literacy learning. Children's literacy learning opportunities at

home could emerge through neighbour interactions among the children's own ideas, queries, peers, family members, and play; children might also revisit, elaborate, modify, or discard ideas due to neighbour interactions within their home environments. The notion of neighbour interactions can be valuable to examining young children's literacy learning and practices at home.

Decentralized control.

Control in complex systems is decentralized. There is no captain to send out orders or commands to each working part; instead, the response of the system depends on the collective interactions of individual agents within the complex system. The notion of decentralized control reflects the idea that the actions of a group (e.g., a human brain or a classroom) and the directions the group takes are shared and distributed. I return to the example of children playing "Galactic Battle" in the backyard: no one seemed to be in charge of the children's play. It self-organized—or, as Varela (1999) explains,

> the whole does behave as a unit and as if there were a coordinating agent present at its center . . . [an organized pattern] emerges from the activity of simple local components, which seems to be centrally located, but is nowhere to be found, and yet is essential as a level of interaction for the behavior of the whole. (p. 53)

As this example has illustrated, there was no supervisor, no director. The collective play emerged and was sustained through the children's shared imaginary game, not through an adult's deliberate planning.

In the context of children's home literacy practices, decentralized control does not mean that the parents or adults give up control in their homes; rather, decentralized control may occur through sharing projects (or sharing various responsibilities for projects) where all agents

(children and parents) together become learners. When a group of children and their parents work together, the direction their projects take can be influenced by ideas that arise locally rather than being directed entirely by adults. The notion of decentralized control should be interpreted as the possibilities and understandings that arise from shared projects, which cannot be predicted or completely planned. Learning through decentralized control can occur at different levels within a complex unity, that is, the focus of learning is neither the adult nor the individual child. Davis and Simmt (2003) explain their perspective of decentralized control:

> For us, then, an important element in effective educational and research practices is the capacity to disperse control around matters of intention, interpretation, and appropriateness . . . within complexity thinking, just as learning is distributed among agents and across levels of organization. (p. 145)

Following the lead of Davis and Sumara (2006) and Davis and Simmt (2003), I suggest that the condition of decentralized control can also exist in a family context where there may be shared ideas, concepts, conversations, insights, and perceptions, creating an emerging knowing and knowledge within the family. Teaching and learning are not about "maintaining control over ideas and correctness, but [about] the capacity to disperse control" (Davis & Simmt, 2003). Davis and Simmt suggest that in order for ideas to be shared in collective contexts such as a family or a classroom, it is necessary to recognize that knowing and knowledge can often emerge from the interactions of group members.

Internal diversity.

Internal diversity refers to the idea that parts or members of a complex system have different qualities and capabilities. The complex interactions among individuals often create knowledge and possibilities not inherent in any specific individual. When there is a high level of

diversity, there are more opportunities for a system to develop new and creative responses to emergent situations. According to Fenwick et al. (2011), "diversity enables the system to generate the possibilities or disorderings required for continual creative adaptation to changing conditions, and diversity enables the resilience allowing the system to sustain itself throughout challenges and losses" (p. 27). In a complex system, however, it is not the presence of diverse talents among its members that provides opportunities for creativity or intelligence to emerge; rather, it is the appropriate interaction of such talents that creates collective intelligence within the system. All healthy systems support and encourage diversity because "internal diversity defines the range and contours of possible responses [within a system]" (Davis & Simmt, 2003, p. 149).

In the classroom, internal diversity is naturally present, but often this diversity is not accepted and rewarded (Davis & Sumara, 2006, p. 138). For example, homogenous age or ability groupings are the preferred practice in many schools in Canada and Australia. Children and family members at home also have various interests, capacities, experiences, abilities, and personalities, which become the collective's source of intelligence. According to Davis and Simmt (2013), diversity in a mathematics class influences how well the class will respond to the external environment (e.g., to the curriculum or assignment). Similarly, internal diversity within children's homes also creates possibilities for response to aspects of children's external environments.

Enabling constraints.

Davis, Sumara, and Luce-Kapler (2008) used the phrase *liberating constraints* to describe "the balance between freedom and restraints that creates conditions for learning and creativity" (p. 85). Their notion of liberating constraints proposes that, when the necessary constraints or

limitations and boundaries for learning activities within a classroom are set, teachers can consider how such constraints can "liberate their students' thinking rather than limit it" (p. 87). Other complexity educational research uses the term enabling constraints to represent the core notion of liberating constraints (Fenwick, Edwards & Sawchuk, 2011). In my study, I adopted the phrase enabling constraints to describe the conditions where restrictions or limitations are set in place, which restricts an agent's freedom in one sense, but the same restrictions allow great freedom for exploration, innovation, and creativity.

Complexity does not advocate "anything goes" or "free for all" in the classroom; rather, the aim is to establish enabling constraints—that is, structures or boundaries that allow rich learning possibilities to emerge. In setting up the structures of classroom activities, teachers need to maintain a balance that allows learning activities to be limited, but at the same time enables possibilities. Doll (1993) described the qualities of an enabling constraint in the context of a classroom as something which had "enough of a burr to stimulate the students into rethinking their habitual methods but not so much of a burr that re-organization would fall apart or not be attempted" (pp. 67–68).

Davis and Sumara (2006) argue that enabling constraints are "proscriptive, rather than prescriptive" (p. 148). Proscription sets boundaries and rules, and describes only what must not happen, whereas prescription clarifies what must happen. For example, in a classroom context, enabling constraints may refer to a task with limitations and guidelines while not overprescribing student actions or interpretations. For example, creating a video in a classroom using an app such as the iMovie trailer, enables the topic to be open ended but the structure of the app sets limits for the activity. Using such an app provides some limits but also allows possibilities for creativity and imagination on the part of the students. Some constraints may be necessary to

reduce the number of alternatives, but at the same time they may create new possibilities. Structuring learning using the notion of enabling constraints can help learners to find the right balance between extreme alternatives and "far-too-narrow" options, creating a space between the tension of fluidity and rigidity, proscriptiveness and prescriptiveness, context and content (Davis & Sumara, 2006). In young children's home contexts, establishing such constraints may be part of an ongoing negotiation between parents and children, where parents and caregivers make adjustments between rigidity and flexibility. In a complex learning environment, Davis and Sumara (2006) assert, maintaining a "delicate balance between sufficient organization to orient agents' actions and sufficient randomness to allow for varied and flexible responses" is important (p. 148).

Literacy Learning as Complex

Literacy learning in an individual involves nonlinear processes that are unpredictable and not predetermined (i.e., characteristics of complex systems). Furthermore, minimal differences in initial early learning conditions can produce very different results in multiliteracy development (Carrington, 2005; Labbo & Ryan, 2010). In other words, in terms of complex learning systems, the smallest inputs can lead to dramatically large consequences, something that complexity thinking labels "sensitivity to initial conditions," or the butterfly effect (Gleick, 2008; Johnson, 2001; Waldrop, 1992). In complex systems, agents (e.g., children and parents) learn from each other, give and receive feedback, and gain experience from practices and change in response to other organisms and their environment (Capra, 1996; Waldrop, 1992).

The acquisition of literacy is a complex, multifaceted phenomenon. When notions of literacy are expanded from print-based texts to include multimodal, semiotic, multimedia texts, we see that young children need to orchestrate not only the graphemic, phonemic, syntactic, and

semantic cues of print literacy in complex way to make meaning, they also need to grapple with the complexities of multiliteracies simultaneously. This involves moving images, sounds, and digital texts (Lankshear & Knobel, 2011; Street, 2005). The processes of reading and writing have become exponentially complex in digital literacy practices (Marsh, 2014). From a complexity perspective, it is increasingly evident that reductive or linear step-by-step frameworks are inadequate in fully representing the requirement for engaging in multimodal and multiliteracy practices. As theorists working from complexity perspectives have explored (Johnson, 2001, 2010; Gleick, 2011), digital devices and systems often demonstrate characteristics of complex adaptive systems, such as nonlinearity, emergence, unpredictability, "adaptive-ness," and self-organization (Patton, 2011, p. 8). As well, theorists working in the area of digital literacies are using language, frames, discourses, and descriptions of phenomena that are consistent with complexity thinking (see, e.g., Green & Beavis, 2012; Gee & Hayes, 2011; Kress, 2010).

Rhizome: A Metaphor for Complexity of Learning

According to the complex poststructuralist theorists, Deleuze and Guattari (1987), our Western thought is dominated by a structure of knowledge they call *arboresence*. This way of knowing is "tree-like," vertical, and centralized. Deleuze and Guattari (1987) opposed this way of knowing and declared that knowledge should be radically horizontal, more like a rhizomatic plant. A rhizome (e.g., a bulb or tuber) has many roots, none of which is centralized, and each offshoot interconnects in random, unregulated networks. As Deleuze and Guattari noted, the rhizome is concerned with surface connections and lines of flight, and "any point of a rhizome can be connected to anything other, and must be" (p. 5). In other words, rhizomatic plants are connected below and above the surface, and change is multidirectional. The work of Deleuze and

Guattari has influenced scholars within the complexity thinking community who often use visual metaphors to illustrate their conceptual understandings in their studies (e.g., Davis & Simmt, 2013; Davis, Sumara, & Luce-Kapler, 2008, Doll, 1993), and the Deleuzian image of a rhizome is one such metaphor that has been taken up by complexivists.

Theoretically, Deleuze and Guattari's concept of rhizome provides a poststructural lens for researchers who are interested in the connections and linkages among different components and patterns across their studies. However, in my study, I use the image of a rhizome, not in a poststructural sense, but positioned as an example of complexity in thinking about the interconnectedness and the interrelationships between children's multiliteracy practices and learning. Young children change and grow as they experience new literacy practices, and their learning becomes part of a multiple, interconnected, and interrelated network, just like a rhizome.

The rhizome can thus be used to describe the ways in which young children learn. Rhizomatic learning (Cormier, 2008) also acknowledges that learners come from different family backgrounds and have different needs for literacy growth and development. Children's literacy learning process resembles the rhizome: it moves and expands in multiple directions, twists, and turns in a recursive pattern and throws down roots and pushes up shoots as allowed in the family environment. Like a growing rhizomatic plant, a child's literacy growth has many characteristics, such as the interconnectedness of ideas, boundless exploration across many different literacy contexts at various starting points, and a tendency to move in many directions. Similar to the rhizomatic forest, each child has their unique learning pattern, but the roots and shoots of their everyday learning are based on their home learning environment.

The metaphor of the rhizomatic learning pattern has some direct implications for understanding children's literacy practices. According to Davis and Sumara (2008), a rhizomatic thinking pattern is essentially a form of complexity thinking since it acknowledges, accepts, and promotes multiple possibilities for the outcomes—learning.

The notions of complexity presented in this section have been used to explain and articulate aspects of the emergence of young children's complex literacy learning at home, and are used at times in a metaphorical sense to interpret and analyze the data from my study. Complexity thinking has also provided a useful theoretical frame for studying the complex nature of young children's literary lives in the digital world, as well as offering opportunities to explore and understand the complex interactions of children's literacy practices that are intermingled with learning, living, and playing at home. In the next section of this chapter, I present Green's (1988, 2012) three-dimensional model as my conceptual framework for this study.

Conceptual Framework: Green's Three Dimensions of Literacy

> *Literacy learning and learning through literacy are interdependent and mutually informing.*
>
> (Green, 2012, p. 12)

For this study, Green's (1988) three-dimensional (3D) model was used as a conceptual framework to interpret and analyze the data at a micro level and macro level. Green's model is conceptually consistent with complexity thinking. I found similarities between Green's model and complexity thinking, presenting learning processes of literacy as interconnected and dynamic, in contrast to many of the North American conceptualizations of literacy that present

literacy as a linear progression across separate areas of skill. Green (1988) suggests that literacy educators should view literacy holistically in terms of three interlocked dimensions: *operational*, *cultural*, and *critical* dimensions. These dimensions are not ordered or hierarchical, but work interdependently and should be integrated simultaneously to engage learners in purposeful literacy practices and literacy learning. The three dimensions function recursively and can be conceptualized as nonlinear learning systems where constant changes and complex interactions are occurring (Green, 2012). In this study, children's complex early literacy learning often occurred recursively within these three dimensions of literacy practices. The 3D model addresses the interrelated knowledge and skills that young learners use as they experience the literacy demands of society (Ludwig, 2003). For the purposes of analyzing my data, this multidimensional, interconnected frame for understanding literacy helped me to make new kinds of connections between children's literacy practices, learning, and everyday living.

With changing demands in response to the emergence of new literacy forms and texts alongside technological changes, requirements have increased for children to become proficient in responding to and creating nonlinear texts and processes, to adapt and respond to constant change, and to address the increasingly complex interactions of literacy and technology. For example, the reading path on a mobile touchscreen device is typically multimodal and multidimensional (Simpson, Walsh, & Rowsell, 2013), and multimodal composition, digital communication, and mixed writing modalities require multidirectional movement. Sheridan and Inman (2010) call this shift in writing "the multimodal turn" and wonder if children's writing has changed due to their constant exposure to screen-based communication (p. 136). As well, when children navigate apps or search engines to seek out information online, this literacy practice is also multidirectional and nonlinear (Plowman et al., 2012). Durrant and Green (2000), to

highlight the importance of information technology (IT) in students' everyday literacy practices, coined the term *l(IT)eracy* to emphasize the merging of literacy and IT. In Australian literacy contexts, the concept of l(IT)eracy has informed the Australian English and literacy curricula since the mid 1990s (Nixon & Kerin, 2012, p. 64).

In his 2012 revised account of his model, Green elaborated on his original 1988 conceptualization of the three dimensions of literacy, expanding the original dimensions into *operational-technical, cultural-discursive,* and *critical-reflexive* to reflect the demands of new literacies mediated by technologies. As Nixon and Kerin (2012) note, Green's revised 3D model is a "productive resource for thinking through the theoretical and practical challenges for literacy education posed by changing technologies of reading and writing, information and communication" (p. 63). Thus, Green's (1988, 2012) model of literacy is particularly useful for my own study when I analyze young children's complex multiliteracy practices and learning processes. Below I explore each of the expanded dimensions of literacy Green (2012) described.

The Operational-Technical Dimension

According to Green's (1988) original notion, the *operational* dimension of literacy addresses a child's competency with regard to the use of language systems. For example, this dimension would involve practices such as using the alphabet and other conventions of text. Green's more recent (2012) extension of this category to *operational-technical* now includes working with technology systems in an operational sense, for example, practices such as turning on a computer or other digital device, or executing an online search for information. According to Green (2012), efficiency in the operational-technical dimension involves multiple competencies, knowledge, and attitudes, including the following:

- competency in reading and writing printed and digitalized texts in a variety of contexts;

- the ability to operate current technology tools available to children, including traditional tools such as pencils, pens, and paper;
- confidence in capitalizing on the affordances of technology to read and write in multiple modes; and
- willingness to explore and experiment with the new possibilities provided by the affordances of new and old technology tools (pp. 35–37).

The operational-technical dimension of literacy provides an important category for examining multiliteracy practices because new ICT and new literacy practices have expanded into many contemporary young children's lives in unprecedented ways (Burke & Marsh, 2013; Holloway et al., 2013; Honan, 2012). Green (2012) notes that "the creation of new technologies continues to change society's concept of literacy" (p. 92) and remarks that "we are moving beyond the constraints of literacy practices that are purely print-based" (p. 92).

The Cultural-Discursive Dimension

Green's (2012) cultural-discursive dimension of literacy involves the meaning aspects of literacy and competency with regard to systems of cultural meaning. This dimension emphasizes how literacy practices and events are not only context specific, but also require a specific content. In Green's (1988) words, we are never simply "literate in and of itself but [are] literate with regard to something, some aspect of knowledge or experience" (p. 160). The cultural-discursive dimension of literacy involves understanding texts in relation to their contexts, that is, to appreciate their culturally specific meanings. Durrant and Green (2000) describe the cultural dimension of literacy in connection to understanding relevant elements of the culture: "to know why one is doing what one is doing now, how to do it, and why what one is doing is appropriate" (p. 22). This dimension includes understanding the people who use language and digital

technologies in context- or site-specific ways for particular purposes, whether, as Nixon and Kerin (2012) suggest, "this is for pleasure, to make meaning or to get things done in the world" (p. 64). In brief, to focus on the cultural dimension of literacy is to focus on cultural practices and meaning making. In my study, my use of the cultural-discursive dimension of literacy includes understanding that children use their language systems and digital technologies to make meaning or sense of the world around them.

The Critical-Reflexive Dimension

The critical-reflexive dimension of literacy is related to the social construction of knowledge and concerned with gaining understanding of how to transform text and operate within its power structures. Contemporary children must be able to assess multiple forms of literacy ranging from online resources to printed texts. They must not only be able to use digital resources and participate effectively and creatively in their own culture, but they also must be able to critique and use these various texts critically. In the digital environment, the critical-reflexive dimension means that young children need to be able to assess and critically evaluate software, websites, and other technology resources (Lankshear, Snyder, & Green, 2000). Beavis and Green (2012) explain that "it is the critical that transforms 'operational' activity into reflective practice, deepens insights, develops an orientation towards questioning and evaluation, and increases understanding and power, or capacity" (p. 192).

Multipurpose Model: The Three-Dimensions of Literacy

Beavis (2012) points out that Green's (1988, 2012) 3D model, "with its simultaneous attention to the intersecting cultural, critical, and operational dimensions, has provided a generative framework for researching young people's literacy practices" (p. 129). According to Beavis and Green (2012), the 3D model can be used pedagogically, conceptually, and

rhetorically (p. 2). This conceptual framework has immense potential value for educational research that focuses on learning literacy in different contexts, and has gained much attention in a variety of settings (Green, 2012). It has been used, for example, in process drama (O'Mara, 2012), curriculum and classroom work (Nixon & Kerin, 2012), media education (Durrant, 2012), and new literacies within digital games (Beavis, 2012), and is an underlying theoretical framework for a university preservice teacher education program (Faulkner, Ocean, & Jordan, 2012).

Complexity thinking orientation was used to guide this study and it provided a lens for me to explore and examine young children's literacy practices and learning. The metaphor of the rhizome was an effective image for understanding children's multidirectional literacy growth. Green's (1988, 2012) three dimensional model was used in many ways: to structure focus group meetings and informal interviews and conversations with participants; as a conceptual tool to understand the data analysis; and as a method to disseminate knowledge gained in this study. Next, I provide a brief description of an ecological approach to study with young children, connecting to my development of theoretical frames.

Ecological Approach

The adoption of approaches that are informed by complex perspectives is not new, with ecological approaches having been used for several decades in education research (see Bronfenbrenner, 1979). Ecological approaches have been used in various research contexts, such as studies of young children and technology at home (Stephen et al., 2013) and learning within early childhood education settings (Leu, 2008). According to Brown (1992), "the strength of studying the learning environment in this ecological way is that the various elements and systems must always be considered in relation to each other. No element or system is seen in isolation"

(p. 65). Ecologists argue that what we do as individuals affects all living and nonliving organisms on earth (Bateson, 1979). As Stephen et al. (2013) explain, an ecological approach to studying the contexts in which young children live and learn at home can be best achieved by examining their everyday activities at home.

The key focus of an ecological approach to study children is the interactions between children and their physical environment at different levels (Bronfenbrenner, 1979). In essence, ecology deals with the study of complex systems (Davis, 2004). Research using an ecological approach studies the ways that individuals or groups are characterized by their social structures at different levels of influence, and these structures include family, peers, school, work, community, and society (Purcell-Gates, 2011). The goal of the researcher within the ecological approach is to "observe behavior and elicit participant perspectives so that the analysis of systemic structures and meanings can proceed" (Purcell-Gates, 2011, p. 139).

At the early stage of my research, I adopted an ecological frame to research in young children's homes; it provided me with good background and knowledge to gather data. As I immersed myself in complexity thinking throughout my study, I learned that complexity thinking allows learning to be described in terms of living and social systems, resulting in a more dynamic interpretative process for understanding learning as emergent from experiences that transform learners (Richardson & Cillier, 2001). Consequently I took a more explicit complexity-thinking approach to my research.

Next, in Chapter 4, I outline my study's methodology.

Chapter 4: Methodology

> *A researcher's view of the world influences their choice of paradigm, and their paradigm effectively determines their methods and the type of knowledge they produce.*
>
> (Hughes, 2010, p. 35)

The philosophical differences among paradigms have direct implications for both the production and interpretation of research findings; therefore, it is important that researchers are clear about which paradigm guides their thinking (Guba & Lincoln, 1994). Furthermore, Merriam (2009) states that "qualitative researchers are interested in understanding the meaning people have constructed, that is how people make sense of their world and the experiences they have in the world" (p. 13). A qualitative study often involves an interpretive and naturalistic approach to the world (Denzin & Lincoln, 2005). I was interested in studying children's literacy practices and learning in their home environments, thus a qualitative research design is well suited for my study.

This qualitative study was informed by complexity thinking (Johnson, 2001; Waldrop, 1992), and as a complexity thinker, I believe that knowledge is constructed and shared by interacting with others. Knowledge is not something people acquire as an "object" or that can only exist in one individual; rather, it might better be thought of in terms of what Davis et al. (2008) call the "potentiality" and the "domain of possibilities" (p. 53). The work of complexity thinkers in educational research (Davis & Simmt, 2013; Davis & Sumara, 2008; Doll, 1993; Fenwick et al., 2011; Laidlaw, 2005) played a major role in the framework of this study. This work emphasizes that learning is a process through which a learner "becomes more capable of more sophisticated, more flexible, more creative action" (Davis et al., 2008, p. 73). In addition,

my study has been inspired by the work of contemporary literacy scholars. Specifically, my study has been informed by new literacy studies (Gee, 1999; Lankshear & Knobel, 2003; Street, 1984), multiliteracies (Kalantzis, Cope, & New London Group, 2000; New London Group, 1996), multimodality (Jewitt & Kress, 2003; Kress, 1997, 2003), popular culture and multimedia (Marsh, 2005), play-as-literacy (Wohlwend, 2011), artifactual literacies (Pahl & Rowsell, 2010), and children's home literacy experiences (Heath, 1983). The methodology used for this study reflects my complexity-thinking perspective, my understanding of literacy practices in terms of thinking and cognition (Green, 2012), and notions of literacy as social practices (Gee, 1996).

It was not my intention to use ethnography as my methodology, but as my research progressed I noticed that I began to adopt and use many ethnographical methods. For instance, within a few weeks of beginning my study, the children became more and more familiar with my presence. I became part of their playgroup and was invited to participate in their everyday literacy practices within their homes. I found myself being both a passive observer and an active participant at different times, and I was able to learn the cultural norms and values of these families. As Aubrey, David, Godfrey, and Thompson (2000) remind us, it is important to be "passive as a member of the group so as not to disturb the data but active as the observer, recording all the possible details of context, the participants and ongoing events" (p. 116). Siraj-Blatchford (2010) has found in her studies that most early childhood settings are "extremely friendly and easy going places" (p. 278) and participant observation is an appropriate method to use in these settings. I also found my young participants' families to be friendly and welcoming of my participation in their everyday literacy practices and home lives.

The qualitative methods I chose to collect data were participant observation; informal, semistructured interviews; focus groups; and field notes. I analyzed and juxtaposed the

transcripts of video and audio recordings of interviews, observations, and focus group discussions, the visual images of children's literacy artifacts, and my detailed field notes describing young children's multiliteracy practices and their parents' perspectives of these practices.

In this chapter, I briefly discuss the rights of children in research and consider how children's rights influenced this study's research methods. I present the rationale for choosing complexity thinking to inform my methods, and elaborate the data collection methods I used. Next is an outline of procedures I used in the study and a description of the participating families, data collection activities, and data analysis. In the final section, I discuss the ethical issues and limitations of my study.

Rights of the Child in Early Childhood Research

> *State Parties shall assure to the child who is capable of forming his or her own views the right to express those views freely in all matters affecting the child, the views of the child being given due weight in accordance with the age and maturity of the child.*
>
> (United Nations, 1989, Rights of the Child, Article 12)

In recent years, with the United Nations' (UN) declaration of the Rights of the Child (United Nations, 1989), early childhood researchers have increasingly recognized and acknowledged the importance of incorporating the voices of young children (Burnett & Myers, 2006; Carrington & Marsh, 2008; Folque, 2010; Jewitt, 2012; Kucirkova et al., 2013; Laidlaw, 2005; Marsh, 2011; McPake et al., 2013; Yamada-Rice, 2014; Yelland & Gilbert, 2014). Research has shown that young children are capable of communicating their own ideas, understandings, perceptions, and interests within a research context (Clark, 2011; Folque, 2010;

Graue & Walsh, 1998; MacNaughton et al., 2010; Soto & Swadener, 2005). The view of children as competent social actors and participants in research calls into question the common practice of having adults act as "representatives" for very young children in research. Having adults as children's representatives (e.g., parents filling out surveys to represent their children's experiences), can be problematic for researchers because the young children's views may be different from those of the adults who are asked to represent them (MacNaughton et al., 2010). For instance, in my research, several participating preschoolers had views of screen time at home that were very different from their parents' views, and both perspectives need to be documented. The perspectives of children and the need to value their views have been incorporated in many contemporary early childhood studies (Marsh, 2011; Soto & Swadener, 2005; Wohlwend, 2013; Yelland & Gilbert, 2014), as well as in my own study. Keeping in mind the importance of providing young children with opportunities to voice their experiences, share their knowledge, and offer their insights, this study intentionally sought the insights, views, and knowledge of young children in terms of their engagement with multiliteracy practices and their experiences at home.

To capture children's experiences, views, and knowledge of topics being studied, child-friendly and age-appropriate methodologies are essential in early childhood research (Clark, 2011; Coady, 2010; Ellis, 2006; Folque, 2010; MacNaughton et al., 2010). Many creative research methods have been developed by other researchers that attempt to capture young children's competencies, knowledge, thoughts, and interests, including informal interviews (MacNaughton et al., 2010), children's drawings (Clark, 2011; Coady, 2010; Folque, 2010; MacNaughton et al., 2010), ethnography (MacNaughton et al., 2010; Stephen et al., 2013), cyberethnography and multimethod approaches (Marsh, 2014), and photography (Folque, 2010).

Nevertheless, finding just one method that will be appropriate for all early childhood research studies is difficult (Holbrook, Albers, & Flint, 2014). The most appropriate method will depend on the research questions being asked, the study's theoretical framework, the social context, the children being studied, and the role of the researcher in the study (Ellis, 2006).

A variety of qualitative methodologies were considered in this study for the purpose of contextualizing, interpreting, and understanding young participants' experiences and meaning making of multiliteracy practices within their homes. The methods I selected included methodologies of an inductive nature that emphasize using "holistic" forms of data collection and analysis to describe, explain, and interpret a range of understandings. The data collecting tools I used included participant observation, interviews, focus group discussions, field notes, and the collection of children's literacy artifacts, including drawings, paintings, photographs, and videos created by children, as well as their favourite websites, online video games, and apps. The collected data were analyzed to uncover emerging themes, insights, patterns, and understandings (Patton, 2002).

Approach Informed by Complexity Thinking

In my study, frames informed by complexity thinking (Alhadeff-Jones, 2008; Davis & Sumara, 2006; Doll, 1993; Gleick, 2011; Johnson, 2001; Waldrop, 1992) were used to observe the interrelated systems and interconnectedness among agents (participants and their families) within the children's natural learning environment. We are not independent beings; we are part of, connected to, and "just one particular strand in the web of life" (Capra, 1996, p. 7). For example, the everyday multiliteracy practices and learning of the participating young children were interconnected with the children's home literacy resources, toys, digital devices, and

Internet connectivity. The children's parents' dispositions toward technologies were also intricately connected to children's literacy practices.

In taking an explicit complexity-thinking approach, it is important to keep in mind that "a complexity-informed methodology will . . . need to be coherent and theoretically well-grounded, with a clear link between the methods and data, the complexity theoretical perspective informing the work, and the epistemological positioning of the complexity frame" (Hetherington, 2013, p. 76). Therefore, my complexity-informed theoretical orientation served as my interpretive lens.

Seven homes were chosen in western Canada (4 urban, 3 rural) and four homes located in southeastern Australia (2 urban, 2 rural). The participants' homes contained a wide range of technology tools, including televisions, game consoles, desktop and laptop computers, DVD players, digital cameras, and mobile touchscreen devices such as tablets and smartphones. Every household in my study had Internet access. These homes also had "traditional" literacy tools, such as pencils and paper, crayons, chalks, paints, art and craft materials, and so on.

Many of the children I studied took part in a variety of activities outside of their homes, including visits to museums or libraries, lessons (e.g., swimming, gymnastics, and "circus" in Australia), and play dates with friends. To gain maximum access to the participants' homes, I communicated to parents that the research schedule was flexible and expressed my willingness to respond to last-minute invitations to conduct interviews or observations at different times and places. My observations and interviews occurred at various times throughout the day, on average once a week for one to four hours per observation. The observations that were conducted in the Canadian participants' homes took place between May 2012 and December 2012 and between April 2013 and December 2013; I collected data in Australia from January 2013 to March 2013. I chose Australia as a research site because my supervisor was conducting an international

research project with an Australian colleague and I was the project's research assistant. Their research project focused on digital literacy practices in both Australia and Canada, and I became interested to learn more about Australian children's home multiliteracy practices. This study did not set out to compare the two countries; however, it was unavoidable to note some obvious differences, including the influence of weather, culture, and the operation of school systems with a different focus on digital literacy. The two research sites allowed me to have the opportunity to observe children in diverse contexts and to recognize similarities and patterns across a wider range of families and situations, and expanded my view of children's multiliteracy practices.

Some of my observations took place outside of the families' homes in locations such as libraries, neighbourhood playgrounds, community centres, or museums because the parents and children occasionally made unexpected decisions and invited me to come along. In Australia, I visited participants' homes during January–March, which is the Australian summer season. The summer of 2013 was unusually hot in Australia and most of the observations were made indoors, where it was cooler and safer for the participants, although several brief observations and informal interviews were conducted outdoors. On the other hand, in the winter of 2013, some of the Canadian observations were also made indoors, where it was warmer and safer for the participants because we had several very cold days that winter.

Participant Recruitment

Following approval by the University of Alberta Human Ethics Review Board (see Appendix A), I posted recruitment posters (see Appendix B) on the university campus, in local libraries, community centres, preschool indoor playgrounds, and local playschool bulletin boards in two communities in western Canada. Through the "snowball effect" (Merriam, 2009) in the rural community, two families responded to the recruitment poster and these families referred

other families in the neighbourhood to participate. In the urban centre, one family responded to the recruitment poster on the university campus bulletin board and through this family, I recruited two more families who were willing to participate. The Australian families were recruited by referrals from a visiting Australian scholar whom I met on a university campus in Canada. I contacted potential participants' parents by phone and/or email to arrange for initial visits to explain the intentions of my study and to answer the parents' and children's questions related to the research goals. The consent and assent forms for this study were given to the parents and children during the initial visits (see Appendix C). I carefully explained to the potential participants, particularly the young children that they could withdraw from the study at any time. For the potential participants who were preschool children, I used a variety of methods to explain how they could withdraw from my study. For example, I created a puppet show to demonstrate how they could let me know when they wanted to withdraw. In this puppet show, I emphasized that the children could tell their parents if they wanted to withdraw and they did not have to tell me directly. This latter option was important because some children are more comfortable talking and sharing their feelings with their parents, and this method could also reduce pressure or stress for the young children.

During the initial visits to the potential participants' homes, I informally interviewed the families to determine if they could meet the criteria and time demands for the study. I selected families based on the following criteria: (a) must have preschool-aged children (i.e., 3–5), (b) could be from culturally and linguistically diverse family backgrounds, (c) English must be one of the spoken languages in the home, (d) the children had adequate oral language development and skills to communicate with me, and (e) the parents understood the importance of their presence during the home observations (i.e., they could not leave the house and use my presence

as a child care opportunity). All of the selected families indicated that their children and family members were willing to participate in the study and that they met all of the criteria. Several families of potential participants were not chosen for various reasons. For example, a single-father family that lived in temporary housing was not selected due to the difficulty of setting up regular observation times. To indicate informed consent and assent, the parents signed both forms and returned them to me via email or I picked up the forms. I asked all of the participating children to draw happy faces on the assent forms to indicate their willingness to participate in the study.

Participants

All 11 participating children (6 girls and 5 boys) were between 3 and 5 years old and had not yet started their formal schooling (i.e., kindergarten in Canada and the preparatory year in Australia known as "prep") at the time the research began. In Canada, 7 children participated, and in Australia, 4 children participated. All children spoke English at home, and two Canadian children were bilingual French and English speakers. Three children attended childcare centres regularly and two joined playgroups occasionally. The participating parents were the children's primary caregivers. While I did not use socioeconomic diversity and ethnicity as factors for selection, it became apparent during my research that the families represented diverse socioeconomic backgrounds and heritages. Participants included several university-educated parents, a single-parent family, first-generation immigrant parents working at multiple jobs, parents who were looking for employment, and several families of francophone and/or Canadian Aboriginal heritage. Sixteen of the parents worked outside of their homes and two mothers were full-time stay-at-home parents, including one single mother who worked as a childcare provider in her home. One distinctive feature of the participating families was that 5 parents out of 19

participating in this study were actively involved in the education profession as public school teachers or university educators.

Methods

Data were collected through the following methods: participant observation, informal interviews and conversations with preschoolers, collection of children's literacy artifacts, semistructured face-to-face interviews of parents, focus group discussions with parents, and field notes. The qualitative data analysis followed a general inductive and cyclic approach (Creswell, 2007; Merriam, 2009; Thomas, 2006). Throughout the study, the data were analyzed recursively at both a macro level and a micro level to seek emerging themes. For example, as I closely examined individual participants' literacy artifacts at micro and macro levels, I looked across all participants at particular patterns that emerged. I created a number of research vignettes to illuminate these themes to provide readers with thick narrative descriptions of observed phenomena.

Participant Observation

To understand young children's multiliteracy practices and why children engaged in particular literacy practices at home, I needed to engage in detailed recorded observations of the children and the contexts in which they interacted (Aubrey et al., 2000). Detailed descriptions of children's engagement with multiliteracy practices at home were recorded in my study. These collected contextual data are what Geetz (1973) calls *thick descriptions*, or thick data (p. 10). They are the additional detailed information that I have gathered to help me understand what I have observed. I used detailed field notes at the early phase of observation to refine my methods

of gathering data and later for my data analysis and interpretation. One method for obtaining thick contextual data is through participant observation (DeWalt & DeWalt, 2002).

Participant observation is an approach to research that has been established within the ethnographic tradition. It is a particularly appropriate research method for studying children's language and learning (Purcell-Gates, 2011, p. 143). In ethnography using participant observation, the researcher typically participates in the activities of the group to be studied and simultaneously records what is taking place (Siraj-Blatchford, 2010). Field notes are often written during the observations while the events remain fresh in the observer's memory. Still photographs and audio and video recordings are used to supplement the observations and field notes in order to provide more permanent documentation. The very flexible nature of participant observation means that the researcher has considerable leeway in how to design and conduct the data collection (DeWalt & DeWalt, 2002). As well, participant observation provides a systematic, organized, and fluid process to study complex phenomena. Moreover, participant observation enables researchers to learn about the activities of people being studied in a natural setting by participating in and observing those activities (Merriam, 2009). However, I acknowledge that my presence might have influenced some of the behaviours of the children and their family members. As Flewitt (2006) argues, "observers always have some kind of impact on those they are observing" (p. 133).

In this study, I took on the role of a "moderate participant observer" (Merriam, 2009), which meant that I only joined in the children's literacy practices and events when invited. Throughout my study, I understood that, as an adult, my participation alongside the young participating children could never be truly participation observation. The other dilemma I faced was the difficulty in finding something to return to the children that was useful to them; I did not

want to be a researcher who would "take the data and run." However, as my study progressed, I was able to share my knowledge of using mobile touchscreen devices with my young participants and their parents. The aspect of sharing knowledge is important to me because the participating families shared a tremendous amount of insight with me throughout the research. Another dilemma that emerged was my feeling of an internal tug-of-war: how much spontaneous participation was possible without missing something important as the researcher? DeWalt and DeWalt (2002) describe participant observation as a challenging activity for researchers because the researcher typically participates, but not to the extent of becoming totally immersed in the activity. It was important for me to remember to maintain a balanced role in my participant-observation approach in my study. Jones and Somekh (2011) suggest that a balanced role is crucial in participant observation: "the challenge is to combine participation and observation so as to become capable of understanding the setting as an insider while describing it . . . for outsiders" (p. 268). Despite the challenges of being a participant observer working with young children, I learned to maintain a balanced role and had opportunities to gain unique insights into the children's literacy practices at home. DeWalt and DeWalt (2002) argue further that, "although the ideal in qualitative research is to get inside the perspective of the participants, full participation is not always possible" (p. 125). As an adult, I could never fully understand the perspective of a child; however, I can certainly challenge some taken-for-granted adult assumptions about young children and their practices.

The data collected were recorded as "candidly and as unobtrusively as possible" (Aubrey et al., 2000, p. 125) given the ethical constraints of my study. Sometimes, video recording an observation at precisely the moment the literacy event occurred was difficult due to the physical environment. It was extremely challenging to take field notes or operate a video recorder while

engaging in some of the activities I was invited to join, such as playground visits or visits to a beach in Australia. On other occasions, my participation with the children in their literacy practices involved joining them in art activities or spontaneous play activities, which made note taking or video recording difficult. A stationary video recorder only worked well when a literacy event was relatively inactive. At the data collection phase, my primary role as a researcher was to gather information—that is, to capture the data from different views. Therefore, I used a waterproof audio/video recorder to record the "close-up" observations of children engaging in literacy practices and to audio-record the children's informal interviews. I set up a stationary video recorder on a tripod in a corner of the room to capture the literacy practices from a "panoramic" view. My smartphone was often used as an audio recorder near the children's literacy events, and occasionally my participants (i.e., the parents or children) even used their mobile touchscreen devices to record my participation with their literacy practices.

Participant observation methods focus on the ways people live in different cultures. In my study, the young participants were observed as they went about their everyday lives, doing the things they ordinarily do at home. During the process of participant observation, I tried to be as unobtrusive as possible. For example, in the Canadian research sites, I spent time getting to know the families before the study commenced so that I became less "strange" to the young participants and their siblings. My aim in using participant observation in this study was to provide a contextual interpretation and holistic account that included the children's learning processes of home multiliteracy practices. Even though participant observation was time and labour intensive, the richness of the data outweighed the time and energy expenditure (DeWalt & DeWalt, 2002; Merriam, 2009).

Interviewing Young Children

Interviewing young children can present unique challenges and rewards (Folque, 2010; MacNaughton et al., 2010). The contribution of the children's views and perspectives is critical to fully understanding their multiliteracy practices and experiences at home. The challenges I encountered included designing creative and innovative ways of interviewing preschoolers so they would feel comfortable expressing their views and ideas without feeling pressured. I was informed by other researchers in the field who had used innovative ways of interviewing young children in their research. For example, Gutierrez-Gomez (2005) used an interpretive approach using children's literature, and Soto and Lasta (2005) used children's drawings to initiate conversations with bilingual children as part of their interviews. As Folque (2010) suggests, designing interviews with "activities and contexts where children were most able to display their competence in thinking and expression while minimizing the constraints of adult-child power relations" (p. 244) was very important. Another challenge with some of the participating children was finding a quiet place to record interviews in their homes. Interruptions in busy households were not unusual, and noises such as a barking dog, a crying baby sister, and even an older sibling's drumming (imagine a 13-year-old practicing his first drum solo—not something I had read about in methodology texts) appeared in the background of some recordings, drowning out the children's responses. Occasionally parents would answer for their children or correct their children's answers. I was not surprised at this type of occurrences because parents act as gatekeepers; they have control of researchers' access and children's opportunities to express their views during interviews (Masson, 2004). For some of the children, it was difficult to access privacy in their home and I found it difficult to interview the children and parents separately. To overcome these challenges, I interviewed the parents outside of their homes and provided child

care; some children's interviews took place in their backyards or at the community library. For other children, interviews at home worked well; they had a playroom in the basement or a bedroom reserved for quiet activities. I tried to imagine how the children might feel when I turned on the voice recorder on my iPad or cell phone and placed it in front of them and asked questions related to literacy practices. What might they think I wanted and expected of them? Fortunately, many of my young participants were comfortable playing with the iPad or cell phone, and these digital devices did not interfere with our conversations and interviews.

Listening to and interviewing children has long been part of my professional teaching experience and repertoire. I am relaxed in the company of young children and they often seem to be comfortable chatting with me. According to Barbour and Schostak (2011), the researcher is the principal data-generating tool; I have the ability to think on my feet when interacting with children and can encourage children to speak their minds freely with me. As Folque (2010) asserts, "listening to children is not about having access to their untouched views, but rather is about engaging in dialogues in particular contexts" (p. 242).

My regular presence in the children's homes helped to increase their familiarity with me and allowed us to develop more trusting relationships, and the young participants accepted my role as a regular, friendly visitor-researcher in their homes. In this study, the interviews with children consisted of informal interviews, conversations, and child-guided tours of their homes. Informal interviews and conversations occurred throughout my visits as I prompted the children to speak about their experiences and activities (e.g., "What are you doing?" "Can you tell me how you use this app?" "What are you drawing?"). Most of the time, the children were happy to engage in informal interviews and conversations with me, though some occasionally seemed unmotivated during particular interviews. In such cases, I ended the informal interview

immediately, and if the children agreed for me to stay, I would shift to making observations and taking field notes discreetly. I learned to take advantage of informal opportunities and sought responses from the children in unplanned conversations as well as scheduled informal interviews. Without any planned interview agenda, spontaneous conversations with the participating children often emerged, and somehow these conversations evolved into "interviews." These interviews with my young participants became highly emergent and recursive patterns throughout my study. Often children would volunteer comments or continue to address topics related to my questions from previous interviews and conversations. Occasionally, these recursive interviews would branch out into fractal-like patterns where the answers were often related to my original question. In addition, I had learned from my research assistantship work and years of teaching experience that it is critical to establish a good rapport with the participants in interviews, and that doing so creates a relationship of trust, respect, and credibility. Interviewing children within their home contexts provided me, the researcher, with invaluable insight into the children's literacy learning process.

Data Analysis

After each observation and interview, I transcribed all video and/or audio recordings and read the transcripts several times to highlight participants' responses that were significant to my research questions. I also juxtaposed my field notes with these transcripts. As much as possible, individual transcripts were shared with the parents and children in person to provide member checking (Merriam, 2009). For instance, in several families, I would read the vignettes to the parents first and then to the children, and the video clips used in composing the vignettes often accompanied these readings. The highlighted phrases and/or words were transferred to file cards, which I used to identify important recurring patterns. On the back of the file cards I added

relevant information, including the identities of the observed children and the home context, which was essential to the interpretation and analysis of the data at a later date.

Through a complexity-thinking lens, I analyzed and interpreted the collected data from a macro level, that is, to get a fractal view of what the children are engaging with at home in relation to multiliteracy practices. Using Green's (1988) three-dimensional model of literacy, I further analyzed my data at a micro level to get a close-up view of the children's home literacy practices. Throughout my research, I analyzed the data at both macro level, to identify general patterns, and micro level, to capture details of young children's engagement with multiliteracy practices.

The data collected from each child were analyzed and interpreted recursively to find links or relationships with other children's data. In other words, my data analysis began in the field and continued even after I had left the children's homes within each observation. I always found it helpful to revisit my original research questions to focus my interpretations and analyses. Analyzing data at both the micro and macro levels was done to consider possible meanings and how they might fit within the emerging themes. These processes were messy and the data gathered were a bit unwieldy at times. However, such rhizomatic processes did not hinder my analysis of the data; rather, they provided opportunities for me as a researcher to see the intertwined and interconnected parts of a child's holistic literacy experiences at home. To present the analysis and interpretations of my data, I developed vignettes as a way of providing readers with concise representations of children's home literacy practices.[5] According to Graue and Walsh (1998), vignettes are

[5] Two published articles in Appendix G address some emergent themes not discussed in the dissertation.

> communication tools that help leverage understanding for both the reader and the writer. For the reader they do what stories have always done for teaching—vignettes put ideas in concrete context, allowing us to see how abstract notions play out in lived experiences. . . . The vignette is illuminative for the writer as well. Writing vignettes helps to prompt certain kinds of understanding. (p. 221)

The research vignettes presented in the following chapters illuminate my understanding of the phenomena being studied and also provide images or "snapshots" of the research settings, the participants, and particular literacy practices at a micro level, allowing the reader to share the "feeling" or vicarious experience of the time and place of my study.

Ethical Issues and Special Considerations

Studies that involve human subjects, in particular, young children require special attention and consideration in regard to ethical issues. In my study I paid careful attention to possible ethical issues that might emerge. According to the legal definition of informed consent, children cannot give consent; however, a child's legal guardian can give consent on behalf of the child (Coady, 2010, p. 75). In my study, the parents of the preschoolers provided consent for their children to participate. Nevertheless, the unequal social status of adults and children is an important issue to me and to other early childhood researchers. It is important to include a variety of age-appropriate and personally relevant activities in the research to counteract the children's possible feelings of being obliged to participate in the study based on their parents' wishes. In addition, some parents may not be fully aware of some of the research activities for various reasons (e.g., language barrier or cultural differences) and potentially may not be able to exercise their right to withdraw their child from the research. In keeping with the UN Convention on the Rights of the Child (United Nations, 1989), and with the practices of other researchers

(Clark, 2011; Coady, 2010, Ellis, 2006) working with young children, I strongly believe that it is good practice to also ask children to consent, or "assent," as it is known in the early childhood research field and many other fields of research (e.g., participants with disabilities).

As an early childhood educator who is experienced in working with young children, I used my experience, knowledge, and skills to gain assent from the children to participate in my study. I drew pictures, used puppets and toys, and told stories to convey to the children the nature of my study and to allow the children to indicate their feelings about participation and involvement. For example, I explained the goals of my study to the young children by drawing pictures of myself observing and taking notes of their daily home literacy practices. I created stories using toys and puppets as props to show my young participants what would be expected of them in my study and to ensure them that they could stop participating in my study at any time. The children also had the opportunity to use the puppets or toys to ask me questions about the research. Many of them did ask questions about what I would be doing in their homes.

Confidentiality and privacy are also ethical issues in early childhood research. I made sure that I followed all the specific procedures and protocols outlined by the University of Alberta Human Ethics Review Board. I paid close attention in choosing photos, video recordings, and audio recordings to be used in publications or conference presentations, and I avoided using images of children's faces, masking their faces when needed when sharing photos in public presentations. I also avoided using children's literacy artifacts in public presentations without their permission. For example, one young participating child created a picture book for her mother as a gift, and she refused to grant me permission to show it in one of my public presentations, even though her mother wished to share it with the larger audience.

Limitations

There are many possible limitations in my study. One is that the literacy practices I captured may have been biased by what the parents chose to represent as their children's everyday literacy practices at home. For instance, two of the families often prepared particular examples of their home literacy resources and their technology tools that they wished me to see, ahead of my observations. Examples of this were puzzles, paint sets, picture books, and iPad apps that they set up for their children to use. To capture the children's authentic multiliteracy practices, I needed to spend more time observing, to be patient, and to problem solve.

In addition, in working with young children, literacy practices and development may change over time and in different contexts. Even though a video camera can add multiple layers of visual and auditory detail to a data collection, video recordings cannot capture or convey the whole story observed by the researcher (MacNaughton et al., 2010).

In the next chapter, I introduce the participating families and present the data analysis and interpretations through a series of vignettes and discuss the emergent themes across different domains.

Chapter 5: Children's Home Literacy Practices: Small-Scale Perspectives

> *Qualitative research is a deeply interpretative endeavor . . . analytical processes are at work in every step of the crafting of the document.*
>
> (Ely, Vinz, Downing, & Anzul, 1997, p. 160)

Using a recursive analytical process throughout my study, I examined my data first from a "fractal view" to look for patterns across the families and then zoomed in for close-up analyses of each child's home literacy practices. The themes that emerged from my data analysis are understood in relation to one another and in their interconnected fractal-like patterns.

In Chapters 5 through 7, I discuss the themes that emerged from my data analysis while keeping my research questions in focus: What literacy practices are preschool children engaging with in their home environment? How are multiliteracy practices influencing the home lives of these children? What are parents' attitudes toward their children's engagement of multiliteracy practices in the home, including both traditional and new literacy practices? How are parents within the study interpreting their children's home literacy practices?

In this chapter, I begin by describing how the advancement of technologies has influenced the participating children's home literacy practices. Next, I present eight vignettes as examples of participating children's engagement with multiliteracy practices at home, and to illustrate shifts in their home literacy practices as compared to the practices of young children of previous generations. I present two more research vignettes in Chapter 6, which discusses how young children used digital devices within their literacy practices to pursue areas of interest and develop "islands of expertise" (Crowley & Jacobs, 2002) in their lives. I present the interconnectedness of children's literacy learning with their islands of expertise. In Chapter 7, I

present several parents' perspectives on their children's multiliteracy practices within their home contexts.

Children's Literacy Practices: Influenced by Technologies

In documenting young children's multiliteracy practices I have gained insights into their dynamic, interconnected, and multilayered literacy learning processes, and also into how their learning could emerge from several conditions of complexity at home. In their use of different media, I noticed that the participating children were able to move from one mode of literacy media to another seamlessly; this observation is similar to other research findings (Davidson, 2009; Marsh 2010b). Through taking what they learned in one form of literacy practice and applying it to another, the participating children developed a new repertoire of literacy practices that involved multimodality, multimedia, and traditional and semiotic texts. My own inquiry and other recent research (Dooley & Gattenhof, 2015; Lynch & Redpath, 2014; Marsh, 2014) has documented how children's literacy practices and events have extended beyond the written language of print texts to visual and multimodal realms. I observed consistently throughout my inquiry that children's literacy practices were often dynamic and nonlinear, and they were often creative and productive at the same time. Similar to Wood's (2015) study, the children in my study engaged with literacy practices in significant ways, that is, "literacies were used as meaningful and powerful shapers of the children's lives" (p. 75). Children engaged in literacy practices to make sense of the world around them, as a way to create identity, and to communicate with others in their lives. My observations of the young participants also helped me see literacies as fluid phenomena that can change over time and as co-evolving within the context of their homes. The children taught me that I needed to see them as competent literate

individuals and to value their literacy learning in ways that might be different from adults. To highlight what I have documented and to discuss my new understanding of children's home multiliteracy practices, examining on a micro scale, I present the example of a set of twin sisters in a family where the parents exhibited "new dispositions" (Kress, 2005) toward texts and who also strongly valued traditional literacy. The first example illustrates the children's access to and freedom in regard to technology tools within their literacy practices at home, as well as their parents' attitudes toward new digital devices in their home. The second example demonstrates the convergence of traditional print-based and digital literacy practices for these two young children. In these two examples, I will also reflect on how the parents' dispositions toward literacies and technologies influenced and impacted their children's literacy learning at home.

A Close Examination of a Child's Literacy Practices

A Portrait of the Brown Family

Vignette 1: A fractal view of the Brown family's literacy practices.

5-year-old twin sisters Susan and Christy are painting pictures with their watercolour paint set on the kitchen table while their older brother is playing an online video game with his virtual friends. Their mother is checking her email on her smartphone and sends a text message to her husband, who is at work. The children's grandfather is ordering a part for their stove on a website, using the family laptop computer. The girls ask me to take photographs of their paintings with my iPad and send them the photographs via their mother's email. (Field notes, December 2012)

Vignette 1 presents a family where I would suggest that the parents present an approach consistent with Kress's (2005) "new disposition" toward the use of multimodality and semiotic

texts. The parents in this family were "early adopters" of new technologies and their everyday literacy practices encompassed digital literacies, texts, and technologies. Susan and Christy's parents understood the need for their children to be "actively and practically engaged as makers and doers as well as users or readers of a range of technological forms" (Beavis, 2012, p. 128). They recognized the role of digital culture in their children's lives and the contemporary world; thus they encouraged their children to engage in multiple forms of literacy practices.

The Browns' home context.

There were two parents and three children in the Brown family. They lived near a university campus in western Canada. The father worked full time outside of their home, whereas the mother stayed at home to be the children's primary caregiver. The front window of the Browns' house was often decorated with the children's arts and crafts work. In the summertime, the sidewalk in front of their house was full of children's chalk drawings, and in the winter, their front yard was decorated with snow and ice sculptures made by the children.

Susan and Christy were the focus participants in the Brown family, and they were often observed playing together in their home. They liked to watch their older brother play online video games, such as Poptropica, Club Penguin, and Minecraft. They too enjoyed playing online video games, but they mostly played on websites deemed as "educational" and bookmarked by their mother, such as PBS Kids or Starfall. These bookmarked educational websites have many early literacy activities for preschool children, including phonemic awareness activities, games for matching letters with sounds, and rhyming words games.

In unpacking the preceding vignette of Susan and Christy's home multiliteracy practices, I turned to Green's (1988, 2012) three dimensions of literacy because it provides a language that was useful to analyze my data of Susan and Christy working simultaneously across multiple

dimensions of literacy practices. In the next three sections, I describe some of the ways in which I worked with Green's 3D model of literacy in understanding young children's home literacy practices.

Operational-technical dimension.

Green (2012) explains that "the operational dimension of literacy is to point to the manner in which individuals use language in literacy tasks, in order to operate effectively in specific contexts" (p. 5). In Green's revised description of the operational dimension of literacy, he argued that literacy and technology must be "thought together" (p. 37) and "in relation to each other" (p. 37). The term *l(IT)eracy* coined by Durrant and Green (2000) was helpful in understanding Susan and Christy's engagement with multiliteracy practices. I observed that Susan and Christy's language, literacy, and technology learning were interwoven with each other within their everyday multiliteracy practices. Nixon and Kerin (2012) explain that l(IT)eracy is when children learn "how to operate the language and technology systems; how to make them work together for one's own meaning and purposes" (p. 64). In Susan and Christy's home learning environment, they had many opportunities to explore the operational-technical dimension of literacy. Their parents encouraged them to play online educational games on their family laptop computer and to work on their early literacy skills with traditional print-based colouring and early literacy activity books (e.g., matching beginning sounds to pictures, circling rhyming words, etc.). In the preceding vignette, I observed Susan and Christy being proficient users and producers of both print and digital technologies and texts. They clearly demonstrated that they understood how the language system of print-based and digital texts worked. Their competencies within the operational-technical dimension of literacy included the mechanics of how to make their family's laptop computer work, from the basics of turning on the laptop to

opening and closing bookmarked websites, and they often searched for information and navigated the World Wide Web with their older brother's and parents' assistance.

Cultural-discursive dimension.

Green's (2012) cultural-discursive dimension of literacy includes understanding that people use language and digital technologies in particular contexts for particular purposes, including for pleasure, making meaning, and "to get things done in the world" (p. 37). During the times I observed them, Susan and Christy demonstrated how some young children learn the culturally acceptable protocols of online video games (e.g., "no bullying other avatars") in their discussions with older family members at home. I also recorded Susan and Christy learning and practicing the cultural-discursive dimension of literacy with their parents while they watched their parents having conversations with each other over the Internet using audio or video application software (e.g., Skype or FaceTime). With their mother's help, Susan and Christy often took photos with their mother's smartphone and posted them on their family's Facebook sites. The children's development of the cultural-discursive dimension of literacy was illuminated by how they made meaning of the culture of online games and their authentic l(IT)eracy learning at home alongside their parents and older brother.

Critical-reflexive dimension.

According to Nixon and Kerin (2012), "the critical dimension of l(IT)eracy includes being able to assess and critique digital texts, software and other resources, and to appropriate or even redesign them for one's own purposes" (p. 65). In observing Susan and Christy's literacy practices, I noticed that they critically evaluated and assessed some of their mother's bookmarked educational websites. During several participant observation sessions, they asked me to help them delete several bookmarked educational websites that they considered as

"boring" or "not fun games to play." In one of the informal interviews with Susan, she informed me that "bad websites have naughty pictures, you must tell a grown-up when you see them" (Field notes, November 2012). These two young children responded critically and responsibly to media texts, and their actions suggested that they had learned the critical-reflexive dimension of literacy within their everyday literacy practices, assisted by their parents' support and scaffolding. Observations and informal interviews with Susan and Christy throughout my study provided some insights into their abilities to deal with literacy practices effectively in a technological environment, as well as their capabilities associated with different aspects of technology.

Access, freedom, and rules for use of technology tools.

At the beginning of the study, along with many traditional communication tools, such as crayons, paint sets, drawing paper, and pencils, the Browns owned two smartphones, a DVD player, a game console, a desktop computer, two laptop computers, an iPod Classic, two MP3 players, a digital camera, a digital video recorder, a television set, and a music system. The children often used these materials as play objects and/or tools to support their literacy practices. Toward the end of my observations, nine months later, the Brown family's technology ownership had increased to include three mini iPads (one for each child), a laptop computer, wireless speakers added to their music system, and access to high-speed Internet. The reason behind this rapid increase in technology tools in this family was the parents' views and attitudes toward the use of digital devices. The parents explained it to me this way: "Our kids are learning good readiness skills for school, they are learning how to read and write with these educational apps on their iPads" (Field notes, November 2013). Each child had his or her own iPad password and they were given permission to purchase apps that cost less than two Canadian dollars. Their

parents encouraged and provided the scaffolding for their children to make decisions in purchasing apps. Scaffolding (Bruner, 1996) in this situation meant that the parents provided sufficient help and support for the children to make critical decisions in regard to buying apps. According to Susan and Christy, many of their apps were free, and they both could read the word *free* to make this distinction. I witnessed the girls download free apps onto their iPads independently (Field notes, November 2013). I also noticed that the children in this family had much freedom and choice in using and accessing technology tools at home. There was no restriction on screen time, and screen time was not placed in a privileged position in this household or treated as a reward. However, there were two basic family rules regarding screen time in this household: the iPads were not allowed to go outdoors, and playing on the iPads was not acceptable when they had visitors. The parents explained the rules this way:

> *We don't let them play with their iPads outside or when we have company because we want them to play outdoor games when they are outside and visit with our friends and relatives when we invite them over to our home. It is very important to learn to socialize with others and not play on their iPads all the time. The kids have no problem with these two rules.* (Interview transcript, November 2013)

Despite the parents' openness and new disposition toward the usage of digital devices in their home, they considered playing with the tablets in the presence of adults as antisocial behaviour. However, the children were allowed to play with other toys, such as dolls and toy trains, when visitors were present. Interestingly, emerging research suggests that young children often play together socially with digital devices such as tablets and computers (Plowman et al., 2012; Stephen et al., 2013; Wohlwend & Kargin, 2013; Yelland & Gilbert, 2014). As I video-recorded them, the children in the Brown family often worked collaboratively to create products such as

videos and cartoons, musical compositions, "doodle" drawings, special effects photographs, and "selfies" using their digital devices.

Parent-supported and Parent-scaffolded multiliteracy practices.

Parents play a crucial role in helping young children become successful literate individuals (Clay, 1993; Heath, 1983; Marsh et al., 2005). They support their children's literacy learning by actively participating in and scaffolding literacy practices and events at home through such practices as reading aloud, modelling literate behaviours, and demonstrating responsible behaviours in virtual worlds. In my observations, I watched Susan and Christy's parents sharing their online shopping experiences with their children. For instance, when the parents were shopping for new tablets and laptop computers, they showed their children how to search for items and compare prices. The children also watched their mother using her laptop computer on the kitchen counter to search for recipes, communicate with her friends and relatives over the Internet or email, read posts on blogs, or post photos on her website. I regularly observed Susan and Christy and their mother searching for arts and crafts ideas or educational games on the family's laptop computer. As demonstrated by these practices, the children in the Brown family experienced "old" and "new" literacies alongside their parents from a very young age. In this family, the parents appeared to encourage their children to engage in techno-literacy practices (Marsh, 2004) more frequently than they engaged in traditional print-based literacy practices; however, the father still maintained that print-based literacy practices are "critical foundations for learning to read and write in school" (Interview transcript, July 2012).

In the following section, I provide a close-up view of an example which I examined closely at a micro level of one child's literacy practices within the larger (macro) context of the Brown family.

Merging "old" and "new" literacies.

As a way of gaining a close-up perspective of one child's home literacy practices at a micro level, I focus here on Christy Brown. During my study, I seldom spotted Christy playing alone without her twin sister or older brother. In vignette 2, which follows, Christy was engaging with her literacy practices by herself, a more rare occasion. She was very interested in techno-literacy practices (Marsh, 2004) and was often encouraged by her parents to explore a variety of modes and media within her home multiliteracy practices. However, she also enjoyed more traditional activities, such as drawing pictures with her crayons and watercolour paint set.

Like many of the other children in this study, Christy treated the iPad both as an everyday technology tool for meaning making and communicating, and as a play object. The affordances of this tool meant that it could be used to design and redesign products, such as shifting a print-based book into an interactive e-book. As Merchant (2005) suggests, "viewing screen-based technology as a tool for meaning-making and communication changes the way in which it is perceived by adults and used by young children" (p. 198). I learned that the importance of any technology tool is in the communication, not in the technology itself, a perspective supported by other researchers and literacy scholars (Marsh, 2011; O'Mara & Laidlaw, 2011; Plowman et al., 2012). Research vignette 2 below illustrates how Christy explored the properties of an iPad and how she attempted to converge old and new literacies with a technology tool, the iPad, to design and redesign a book.

Vignette 2: Print-based book and e-book.

Christy was making a traditional print-based book as a gift for her mother. She spent most of the afternoon drawing, colouring, and designing the book with crayons, but she was tired of drawing and colouring after the third page of the book. Christy remembered a faster way of

colouring pictures using a colouring app on the iPad, and she found the app quickly. She began to colour a picture of a horse by tapping and dragging the colours from the "paint bucket" over to the horse (see Figure 1). It was faster and easier than using her wax crayons on paper; however, she discovered some limitations of this app, which did not allow her to create her own drawings. After a few minutes of pondering, Christy wanted me to help her change her print-based book into an interactive e-book, but I did not know how to do this. Next, Christy decided to take images of her drawings in her print-based book with the iPad camera so she could ask her father to help her with the interactive e-book production later on. (Field notes, September 2012)

Figure 1: The colouring app (PBS for Kids, 2012) used by Christy.

Three dimensions of literacy as a framework for analysis.

To undertake a micro-level analysis of research vignette 2 and examine Christy's use of multimodal literacies, engagement with multiliteracy practices, and her choices and interactions with technology tools, I used Green's (1988, 2012) 3D model, which emphasizes that literacy learning happens as people participate in the social and cultural practices of making meaning for

real purposes. In the preceding vignette, Christy engaged in a variety of purposeful literacy practices.

As addressed earlier in the dissertation, according to Green's (1988, 2012) 3D model of literacy, the operational-technical dimension of literacy learning includes learning how to operate the language and technology systems: how to make them work for one's own meaning and purposes (Green, 2012, p. 64). With specific focus on digital media and technologies, the operational-technical dimension includes the "how to" aspects of using and navigating digital devices. What was Christy's operational-technical competence? Close examination revealed that Christy knew how to navigate and operate the iPad with some assistance from me or her older brother, including how to locate and use the textual elements of the colouring app (e.g., colour, icon, movement, images, and sound) and how to use the iPad camera to capture images of her print-based book. In her print-based book, she also demonstrated emerging competency with the writing system by printing the words "mom" and "love" on the first page. Christy also showed awareness of the operational dimension of "traditional" literacy through her knowledge of print-based book structures (e.g., left to right directionality, letter and sound correspondence).

In the everyday life of a contemporary child like Christy, the cultural dimension of literacy includes, for example, understanding digital literacy practices, structures, and rules for playing online video games, for communicating with distant relatives over the Internet or sending emails to friends, and for sharing literacy artifacts (e.g., photos or video recordings) with others on social media. In research vignette 2, Christy showed competency within the cultural-discursive dimension of literacy by drawing pictures of her mother helping her in different activities at home as a gift to express and communicate her appreciation of and love for her mother, sharing an understanding of cultural practices related to birthday celebrations. She

refused to let me make a copy of her print-based book as a data source, explaining, "If you want a present, you've [got] to ask your kids to make you one. This is for my mom" (Interview transcript, September 2012). Christy understood that it was culturally inappropriate to share her mother's gift with me. Drawing on her cultural knowledge and understanding, Christy was aware of the importance of making textual and structural choices for her mother's present. She was aware that her choice of colours, details of her drawings, and text she used were highly valued by her mother. This understanding was confirmed when she related that her mother likes "presents with nice drawings and not messy colouring" (Interview transcript, 2013).

In analyzing research vignette 2, it became clear that Christy had critically assessed and critiqued her own drawings and colouring and wished to redesign them as a digital interactive storybook, just like the interactive e-books she had been reading on the iPad. She preferred the interactive nature and designs of e-books to print-based books because "you can do things . . . like move the pictures around, and it has songs" (Interview transcript, August 2012). Christy also critically considered and evaluated the limitations of the colouring app on the iPad and decided not to use the picture of a horse in her mother's gift.

It is important to note that even though Christy's digital literacy practices may be discussed alongside her print-based literacy practices, her experience with using the bookmarked websites, online computer games, and apps on her iPad was often different from her engagement with print-based literacy practices. Green's (1988, 2012) 3D model of literacy has assisted me to analyze the literacy practices that have extended children's literacy repertoires to include rich and complex forms of l(IT)eracy practices. Literacy learning, like any other type of learning, is not a linear process, and therefore cannot be as predictable as many models of literacy learning (Goodman & Goodman, 2004).

Framing through complexity thinking: Neighbour interactions.

Davis and Sumara (2006) suggest the notion of *neighbour interactions* as ways that agents within a complex system can affect one another's activities; they refer to it as "a key structure of the system" (p. 142) and suggest that the manner in which neighbours interact should be an important consideration in complexity thinking. What might constitute a neighbour in the context of a knowledge-producing community such as a classroom grouping, or even, as Davis and Sumara suggest, "an individual's psyche" (p. 142)? Davis and Sumara propose that the neighbours in knowledge-oriented communities are not physical bodies or social groupings; rather, "*the neighbors that must interact* with one another are ideas, hunches, queries, and other manners of representation" (p. 142, emphasis in original). Furthermore, in order for ideas to "bump" against one another, they must be represented in some way, for example, as a conversation with others or a blog post on a website. According to Davis and Simmt (2003), in their research "what was important was not the opportunity for direct interaction [with others], but the possibility of making ideas collide with one another" (p. 156). Not only must there be neighbour interactions, there must be sufficient density of neighbours to interact (Davis & Simmt, 2003; Davis & Sumara, 2006). Neighbour interactions are critical components of children's literacy learning environments. As Davis and Simmt (2003) suggest, neighbour interactions encourage the possibility of "conceptual blends"—that is, of collaborating with others to meld ideas and images (p. 163). Neighbour interactions are important, they write, not only because they offer possibilities to make "surprising combinations," but because they "foreground the place of interpretation" (p. 163).

During my observations of Christy, it was not unusual to observe her communicating with her family members, in particular with her twin sister and older brother, or talking aloud to

herself about different ideas. Within the context of home literacy practices, Christy not only had opportunities for direct interaction with her family members, but also the possibility of making her own ideas collide with one another. For example, in the preceding research vignette, as her ideas of redesigning her print-based book as an e-book interacted, her understanding and interpretation of the concept of meaningful communication with others was enhanced through her ideas bumping into or colliding with each other. Christy's literacy learning at home emerged and sustained itself through neighbour interactions, rather than through planning or other deliberate strategies organized by her parents. Davis and Sumara (2008) offer this explanation of neighbour interactions:

> Our experience is that one of the first lessons of enabling neighboring interactions is that one must relinquish any desire to control the structure and outcomes of the collective, following an important conclusion of complexity research (Kelly, 1994). Consistent with such unities as brains, anthills, cities, and ecosystems, control in a knowledge-producing collective must be understood as decentralized, arising in localized activities. (p. 41)

My observations suggest that the family learning environment, along with opportunities for neighbour interactions, can affect the exchange of ideas and, in turn, support the emergence of young children's early multiliteracy learning at home.

In the next section, I present another close examination of another family and the focal child's literacy practices.

A Micro-level Examination of a Child's Literacy Practices

A Portrait of the Fortune Family

Vignette 3: A fractal view of the Fortune family's literacy practices.

Léla is a 4-year-old girl who can speak English and French fluently. Her father is reading a picture book with her 2-year-old brother in the living room, her mother is checking her email on her laptop, and Léla is inserting a disk into her own DVD player so that she can watch the movie Lilo and Stitch *in her bedroom. She clicks on the word "French" on her DVD player's screen and then clicks "Play." She stops the DVD player and then clicks the word "English." She turns to me and apologizes: "Sorry, forgot you don't understand French."* (Field notes, August 2012)

Research vignette 3 shows a family similar to the Brown family, in that I would suggest that Léla's parents present an approach consistent with Kress's (2005) new disposition toward the use of new technologies and also toward semiotic texts. However, Léla's parents had mixed feelings and appeared to have ambiguous values regarding traditional literacy and new digital literacy practices. Léla was the focus participant in this family.

The Fortune family context.

The Fortune family lives in a small town in western Canada. In this family, which has two children, the mother works day shifts while the father works in the evenings. When I conducted my research with them, this bilingual household owned many books, videos, magazines, music CDs, and board games in both French and English. Léla had a wide selection of English and French children's picture books and music CDs on the bookshelves in her

bedroom. The children's artwork and drawings were posted on the refrigerator door and a bulletin board in the kitchen. In one corner of the living room was a little table and chairs for Léla and her brother to do "school-like" literacy activities (e.g., colouring, alphabet puzzles, beading, reading, and drawing). Léla used a variety of old and new technologies within her home literacy practices, and she had access to pencils, crayons, pens, paper, painting sets, arts and crafts materials (e.g., scrapbooking items), a DVD player, a television set, a laptop computer, and her parents' smartphones.

Framing through the three dimensions of literacy.

As noted in vignette 3, Léla could independently operate her own DVD player in her bedroom to watch her favourite movies. Often she would show her younger brother how to adjust the volume or pause the movies, and she showed me how to change the language setting from French to English, revealing her competency with the operational-technical dimension of literacy. In addition, she could operate her family's cable television and laptop computer and her mother's smartphone independently. Léla also illustrated competencies in using traditional technology tools and practices across the operational-technical and cultural-discursive dimensions (Green 1988, 2012) in her use of pencils, wax crayons, watercolour paints, and markers to draw pictures to create cards for relatives living in another city.

Access, freedom, and rules for use of technology tools.

Similar to the Brown family, the parents in the Fortune family did not place limits on the children's screen time or use of technology tools. However, Léla's parents paid close attention to the digital content their children consumed and were always involved in their children's literacy practices and events during my home observations. Both parents expressed their concerns about the possible dangers their children might encounter on the Internet, but they refused to place

digital surveillance on their children's digital devices. For example, Léla's parents could have used the "restrictions" setting, also known as "parental controls", to prevent Léla from accessing specific apps on their iPhones, but they did not turn them on. However, Léla's mother did preset playlists of movies, music, and e-books for Léla to play on her smartphone and laptop computer. Léla's mother explained that the presets were not to restrict specific apps or features but to make it easier for her children to find their playlists and be more independent. Léla's mother told me her views in one of the semistructured interviews: "I want my children to work things out by themselves first and not jump in to solve their problems immediately" (Interview transcript, July 2012).

In my time in the Fortunes' home, I observed Léla's parents routinely reading picture books, cooking in the kitchen, watching movies in the living room, and playing games with their children; they were always involved with their children's home literacy practices. They considered these activities as "good foundations and healthy routines" for their children's future success in formal schooling.

The following vignette illustrates how Léla was encouraged to use both old and new literacies and technologies within her everyday literacy practices. This example also shows how websites provide children with opportunities for reading or viewing texts in multiple modes, such as visual, written, oral, auditory, and multimodal. I noticed that Léla, Christy, and other children who participated in my study often favoured websites for their informational reading because information searches are often more convenient and successful on digital devices, as compared to similar searches in print books.

Vignette 4: Recipes on cards and online.

Léla was searching for a recipe for "chickpea chocolate chip cookies" with her mother in their living room. They verbally played around with the "ch" sound by repeating the names of the ingredients while they were browsing through the family's cookbooks, recipe binder, and recipe cards. When they could not find a recipe for chickpea chocolate chip cookies in a print-based format, Léla went to the kitchen, turned on the laptop computer on the kitchen counter, and asked her father to Google a chickpea chocolate chip cookie recipe. They found several websites that had recipes for chickpea chocolate chip cookies. Léla's father read out loud several recipes, and eventually Léla decided to use the recipe with the most "delicious pictures." She wanted to use a recipe with rotating photo images of the cookies because it suggested a "delicious recipe" to her; she was making meaning based on the visual images on the website. Despite Léla's inability to decode the alphabetic text on the screen, she was fully engaged in critically examining (Green, 1988; Luke & Freebody, 1999) the images of cookies on the screen and following the recipe's instructions. When the cookies were baking in the oven, Léla wanted her mother to help her make a hard copy of the recipe for their family's recipe binder. Her mother gave Léla a piece of paper and pencil and Léla drew a picture that was similar to the chickpea chocolate chip cookies on the website. Then she asked her mother to "write the words in" for her recipe. (Field notes, July 2012)

Within the preceding research vignette, I noticed that the Fortunes' home, like many homes in this study, provided the participating child with an environment that included both traditional and new media and technology tools. In such home environments, children had opportunities to explore and examine multiple possibilities, and their multiliteracy practices tended to emerge

from the combination, blending, and remixing of the traditional and the new. However, Léla's parents, similar to many parents in this study, had strong beliefs that traditional print-based literacy practices were more beneficial to their children's future school achievement than new literacy practices were.

Because the Fortune parents used their laptop computer for gathering information and communicating with others, their children had much experience with using the laptop and learning the operational-technical dimensions by closely observing their parents' digital literacy practices. As noted in research vignette 4 of Léla, direct interactions around this technology tool were often focused on responding to Léla's engagement in literacy practices (e.g., helping her to Google a recipe and reading the ingredients for her). In particular, Léla's parents focused her attention on the critical dimension of literacy through supporting her to evaluate several recipes before choosing a "delicious recipe" and accepting her choice of a "good recipe" for chickpea chocolate chip cookies. Léla's parents encouraged her to engage in the cultural-discursive dimension of literacy by agreeing to "add this delicious recipe" to their family's recipe collection. In addition, her parents appeared to be comfortable with using both the digital and print-based recipes and, in this example, demonstrated both traditional and new dispositions toward technology tools.

Framing through complexity thinking: Decentralized control.

Vignette 4 reveals the importance that decentralized control played in Léla's literacy learning at home. Her parents did not order Léla to choose a specific recipe for the chickpea chocolate chip cookies; rather, Léla and her parents shared control of this project by searching for the recipe together in print-based and digital texts. In the context of the Fortune family, the complexity condition of decentralized control was not giving up parental control; rather, it was

through sharing the cookie-baking project that all agents, child and parents together, became learners in the kitchen. The direction of the Fortune family cookie-baking project was not predetermined by either the parents or Léla; instead it arose at the local level. Phrased differently, neither the parents nor Léla tried to predetermine the outcomes or control the learning environment. Through the lens of complexity thinking, the local interactions among the agents (parents and daughter) could have been due to close physical proximity or because they shared some common information at the local level. It was important for the whole family to learn together, and the learning was shared, advanced, and transformed collectively as a group of individuals interacting with each other to find a recipe. These individuals are linked together through their interactions. They could also be thought of as forming part of a decentralized network. Within the complex condition of decentralized control, Léla's ability to interact with others in her family changed her literacy practices and her "literacy learning system" (Davis & Sumara, 2008). The Fortune family members interacted in a way which suggested that decentralized control allowed all members within this collective to share their knowing and knowledge, and this sharing enhanced the group's collective learning.

A Child's Literacy Practices Through a Micro-level Examination

A Portrait of the Nelson Family

Vignette 5: A fractal view of the Nelson family's literacy practices.

Tyson lived with his mother and his 2-year-old sister in a mobile home in western Canada. This was a single-parent household. His mother had previously worked as an educational assistant in a primary school but now was operating a home-based childcare centre. Along with many traditional literacy tools, such as

> *crayons, pencils, chalk, and paints, this family also had an iPad, a digital camera, a DVD player, a television, and a flip mobile phone. Tyson had access to and free use of all the technology tools available in his home, although sometimes he had to share various devices. In one corner of the living room, there was a television set with a DVD player. The rest of the living room was occupied with what Tyson's mother called "reading and writing centre" materials for her children (see Figure 2). The children's paintings, drawings, crafts, and LEGO structures were displayed throughout the house. In another corner of the living room were baskets of children's picture books, junior novels, and information books. This family's living room reminded me of a preschool or a nursery school educational setting because the furniture and materials were arranged and organized at young children's height and thus were easily accessible for the children.* (Field notes, March 2012)

The preceding vignette suggests that Tyson's mother intentionally and carefully organized his exposure to educational resources and technology tools. His mother communicated a positive attitude about the educational potential of the iPad, more so than most other participating parents in this study. She mentioned several times during the semistructured interviews that the iPad was best used as a tool for reinforcement of the educational activities she had introduced to her children, including identifying letters of the alphabet, matching letters and sounds, and counting number skills. She explained her view of the iPad this way:

> *The children can learn to read and write, and count the numbers while playing games on the iPad because if they get the answers right, they get happy faces or claps right away. . . . It is better than stickers for some kids.* (Interview transcript, March 2012)

Tyson's mother also talked about the importance of "age appropriate" and "educational" apps on her iPad and sharing her "love of reading" to all the children in her care. The following research vignette provides an example of how Tyson explored multiliteracy practices with the limited digital devices available to him at home.

Vignette 6: Multiliteracy practices in action.

Tyson was making invitations for his fifth birthday party. He had coloured pencil crayons, scissors, glue, and paper spread out on the kitchen table for this task. An image of his favourite cartoon character was displayed on the iPad screen in front of him, and he was busy drawing the same cartoon character image on his invitation cards. With his mother's help, he carefully printed each guest's name on an envelope and was careful not to make any errors in the spelling. When he was finished making his invitations, he decided to search on the Internet with his mother for a cartoon character image transfer[6] *for his birthday cake. Eventually, they found a website with transferable images for cakes and a YouTube video on how to decorate cakes with transferable images. When the cake was decorated, Tyson took photographs of the cake with the iPad and then with his mother's assistance shared these photographs with his grandparents via email.* (Field notes, June 2012)

In analyzing the preceding vignette, it is important to note that Tyson's access and use of the iPad was limited; however, the ways he used the iPad alongside the other technology tools had been meaningful and for specific purposes. Vignette 6 suggests that

[6] There are tools available that can transfer edible image sheets onto cakes.

Figure 2: The reading and writing centre in Tyson's living room.

Tyson's mother had created several "enabling constraints"[7] which allowed her children to learn and explore the benefits of the iPad in a structured learning environment. For example, she encouraged Tyson to search for the transferable birthday cake images online after all his birthday invitation cards were finished, and Tyson could search on websites with her support and supervision. He understood what was allowed while they were searching online, that is, to look for a suitable transferable image for his birthday cake and not to search for online video games. He accepted the limitations set out by his mother, but at the same time, the enabling constraints created possibilities and opportunities for Tyson to find a cartoon image for his birthday cake and engage in digital literacy practices and learning.

[7] Enabling constraints is a complexity notion that refers to the structural conditions that help to determine a task through limitations and guidelines without prescribing the child's actions.

Framing through three dimensions of literacy.

In vignette 6, Tyson demonstrated the operational-technical dimension of literacy by showing his ability to hold a pencil to print his guests' names on the invitation cards, to navigate the iPad interface, and to search for videos on YouTube with his mother's assistance. He also demonstrated understanding of the language system by printing and spelling his guests' names, and he showed some evidence of early literacy skills, such as left to right directionality, forming the letters of the alphabet, and understanding the purpose of a birthday party invitation card.

Tyson also illustrated his competency with the cultural-discursive dimension of literacy by taking his time to create personalized and attractive birthday party invitation cards for his friends because he wanted all his friends to accept his invitation. He also showed an awareness of what is culturally acceptable to include in the party invitation genre. Using the appropriate words on the invitation was important to the success of his party, which was a theme party with his favourite cartoon character on the invitation cards and the birthday cake.

Tyson's competency with the critical-reflective dimension of literacy was visible when he was able to assess and critique digital texts and visual images and redesign them for his own purposes (e.g., drawing cartoon characters on the invitation cards). Not only was he a critical reader and consumer of the digital texts and visual images, he was also a critical producer and communicator. In vignette 6, Tyson illustrated his proficiency with the critical-reflective dimension of literacy practices by selecting what he considered to be the best cartoon image for his birthday cake after critically assessing which YouTube video would be most helpful for decorating his cake.

The tablet, in this case, may have played an important role in Tyson's emergent literacy skills and development because there were many educational apps on his iPad that focused on

letter name and sound knowledge, early writing, print concepts, and phonological awareness. These skills are important precursors of future reading and writing ability (Clay, 1993; Fountas & Pinnell, 1996). Similar to previous studies of young children's media and technology use (Burnett, 2010; Marsh, 2010a), my observations of children like Tyson point to how children's home literacy experiences often involve current technologies and how they use technologies independently or with some assistance from their parents. I noticed that young children in this study, like Tyson, could and did engage actively with the operational-technical aspect of technology on their own, and they were able to gain a great deal of information from independent engagement. As Holloway et al. (2013) note, "apart from the obvious enjoyment many young children experience playing games, watching video clips and socializing online, their engagement with the Internet helps to develop emergent digital literacies" (p. 14).

Changes in Technologies, Changes in Literacy Practices

The affordances of new digital devices have changed the ways some young children engage in literacy and multiliteracy practices, and some of the children in this study provide evidence of a shift from print-based literacy practices toward techno-literacy practices (Marsh, 2004). For young children like Léla, Tyson, Susan, and Christy, the ease of digital photography has provided new ways of meaning making, communicating, and contributing to literacy learning; these children are able to take photographs with iPad cameras, "read" images using semiotic cues, and use "text to speech" features on laptop computers or tablets. Kress (1997) reminds us that children quite naturally use a variety of modes to make meaning from many semiotic resources. As others have suggested, children are also strategic literacy learners who pay attention to their environment and learn to read environmental print at a very young age

(Clay, 1993; Goodman, 1986; Teale & Sulzby, 1986). Other literacy researchers note the value of educational opportunities for young children who are using current digital devices. Neumann and Neumann (2014) make the point that "tablets with their print-based interfaces possess several features that may facilitate the development of emergent literacy skills" (p. 231). These include emergent literacy skills, such as letter name and sound knowledge, early writing, print concepts, and phonological awareness (Whitehurst & Lonigan, 2003). As I have observed, and as suggested by other researchers (Neumann & Neumann, 2014; Rowsell et al., 2013; Verenikina & Kervin, 2011; Yelland & Gilbert, 2014), in contrast to laptop or desktop computers, mobile touchscreen devices provide an easier-to-use and more intuitive interface because these devices do not have a mouse or a keyboard: they are light, mobile, handheld devices with a user interface based on a touchscreen. In my study, I noticed that children could place a tablet on their lap, lie down on the floor to use it, or use it in varied locations, such as their bedroom or in the car, or alongside favourite toys. The portability of this digital device allows collaboration between children during play (O'Mara & Laidlaw, 2011) and the interactive multimedia display can offer children instant feedback and may stimulate visual, auditory, tactile, and kinesthetic sensory systems (Flewitt et al., 2014; Kucirkova et al., 2013). Other literacy researchers (Neumann & Neumann, 2014; Yelland & Gilbert, 2014) describe tablets as potential literacy learning tools because of their versatility for writing and drawing and because of the easily downloadable apps. As I have observed in this study, many of the participating children were able to interact with the digital world because of the design and availability of a tactile-based digital interface on a tablet. The participating children in my study are learning to become literate in different ways and they demonstrated the shift of literacy practices in their merge of old and new literacies. Laidlaw et al. (2015) summarize the shift this way:

> Screen-based communication and new digital tools are more accessible to very young children than previous technologies and these children have integrated the technologies into their everyday lives. . . . By the time they are preschoolers many children are independently using tablet devices to engage with a variety of applications (apps), play games, take photos, or make recordings. (p. 65)

As these new digital devices become increasingly integrated into everyday life, young children are using digital devices and practices in their everyday play and their home literacy practices.

Next, in Chapter 6, I discuss the relationship between children's interests and multiliteracy practices and the emergence of "islands of expertise."

Chapter 6: Multiliteracy Practices and Developing Expertise

In this chapter, I "zoom in" to analyze children's development of "islands of expertise" (Crowley & Jacobs, 2002), which often emerged from their interactions and connections with members of their family and community alongside their literacy practices and play. I present two research vignettes to highlight how these children's islands of expertise can emerge from both traditional and new literacy practices and technology tools.

"Islands of Expertise" and Affinity Spaces

Throughout my research, I became aware of several participating children who had developed expertise in areas of their interest (e.g., dinosaurs, rocks, cars, or trains) while they engaged within their everyday literacy practices and play. To understand this unexpected emergent phenomenon in my study, I turned to Crowley and Jacobs' (2002) idea of islands of expertise to further inform my analyses. The two vignettes I present in this chapter illustrate how children's emergent islands of expertise were closely interconnected to and interdependent on their literacy practices.

What is an Island of Expertise?

Crowley and Jacobs (2002) first coined the term *islands of expertise* in their study of the ways young children and their parents learn together in museums. Their notion of islands of expertise refers to a topic of passionate interest to young children (e.g., dinosaurs, trains, rocks, toys, or other things) about which the children develop relatively deep and rich knowledge. These "islands" typically emerge over weeks, months, or years as young children talk with their parents or older siblings, read books, watch videos, and learn about the objects of their passion

(Crowley & Jacobs, 2002, p. 333). The development of any island of expertise is typically woven throughout interconnected family activities involving toys, books, online games, and a variety of literacy events in the children's daily life. "Island building" is a complex social learning process that is recursive, multidirectional, and unpredictable, and it is difficult to predetermine what the roots will create for young children's interests or passions. Young children's processes for building their islands of expertise tend to follow a fractal-like pattern, that is, their learning branches out in many directions but maintains their original spark of interest on a topic (e.g., an initial interest in a dinosaur toy may branch out to an investigation of carnivorous dinosaurs in Alberta).

Parents and other family members play important roles in the formation of these islands of expertise (Crowley & Jacobs, 2002). Preschool children need their parents' help to build such islands of expertise because if no one reads them books, or explains what they view on websites, videos, and in museums, or answers their questions about their topic of interest, then the young children may not have adequate information to generate further understanding. Furthermore, the children are not alone on their islands because islands of expertise often emerge from the "ongoing negotiation of children and parents' interests, children and parents' choices about family activities, and children and parents' cognitive processes, including memory, inferencing, problem solving and explanation" (Crowley & Jacobs, 2002, p. 333). Children build and inhabit these areas of deep interest with their parents and older siblings through family activities that they do together everyday. Crowley and Jacobs (2002) explain how most of the shared learning occurs in everyday family activities, such as during dinner, playing in the backyard, walking to the neighbourhood park, or at bedtime. Phrased differently, islands of expertise become platforms for young children to practice deep and critical thinking like experts do and to have

conversations about abstract and general ideas that might not happen about topics that are less interesting to them. Some of these learning moments might be small, and they are typically "unremarkable moments of thinking, practicing, and exploring for the child" (Crowley & Jacobs, 2002, p. 338).

Through my complexity-thinking lens, I was able to connect Crowley and Jacobs' (2002) notion of islands of expertise with the complexity-thinking notion of emergence (Johnson, 2001). I understood that children's learning could emerge from the collaborative and collective behaviours of children and their parents during the process of building islands of expertise. In early childhood education, particularly in programs that are informed by the Reggio Emilia approach, the notion of *emergent curriculum* (Wien, 2008) is understood as an approach that teachers collaboratively use to focus on children's interests and understandings and use these as the beginning points for curriculum (Wien, 2008, 2011). The primary goal of emergent curriculum is to create positive relationships among children, teachers, families, and their environment (Wien, 2008). The notions of emergent curriculum, islands of expertise, and emergence have informed my analyses and deepened my understanding of the complex phenomena of children's literacy practices and learning.

In developing islands of expertise, the learning is typically not planned by the parents or children (Crowley & Jacobs, 2002). Usually, a child notices something of interest and asks a question; parents often give spur-of-the-moment explanations to these questions. The children's learning may appear to be incidental or spontaneous at first glance; however, through my complexity lens, as I examined such phenomena carefully at a micro level, I learned that the participating children tended to self-organize these relatively small "unremarkable moments of questioning and inquiring" (Crowley & Jacobs, 2002) in their everyday lives to build their

islands of expertise and learning, which emerged in a recursive process. As Thelen and Smith (1998) remind us, "self-organization—processes that by their own activities change themselves—is a fundamental property of living things" (p. 564).

As Crowley and Jacobs (2002) note, most of what young children know about a topic of interest may have been learned in smaller moments of practicing, remembering, and exploring in recursive patterns in their everyday lives. Children learn to sustain their islands of expertise through "repeated exposure to domain-specific declarative knowledge, repeated practice in interpreting new content, making inferences to connect new knowledge to existing knowledge, repeated conversations with others who share or want to support the same interest" (Crowley & Jacobs, 2002, p. 338). In my study, I documented how children's repeated exposure, practice, and conversations were different from repetition (i.e., the same activity occurring in virtually the same way over and over again). For example, even though many of the participating children asked their parents to read the same book over and over again for a bedtime story, each rereading of same storybook was received differently. Reading the same storybook was always reconnected to their prior experience in a new way; it was a "nonlinear cycle of response" (Laidlaw, 2003, p. 205) or, in complexity thinking, a recursive-learning process with feedback loops (Doll, 1993).

Crowley and Jacobs (2002) studied children and families learning factual knowledge in museums, and their concept focused on the role that islands of expertise played in young children's intellectual development and accumulation of knowledge. In my study, I observed how young children's imaginations, fantasy worlds, and play (in both online and offline games) also helped to further develop their islands of expertise because these spaces allow ideas to bump into each other, as neighbour interactions.

How long do children's islands of expertise last? What happens when a child loses interest and the island of expertise begins to diminish? According to Crowley and Jacobs (2002), "even when a child loses interest and an island of expertise begins to fade, the abstract and general themes that used the island's rich knowledge as a launching pad will remain connected to children's other knowledge" (p. 333). My data analysis suggests that being an expert in one interest area gives children confidence in their own learning and critical thinking, and that learning expert ways of thinking shapes the ways they live, communicate, and take on new challenges.

In the following vignettes, I address how some of the participating children built their islands of expertise at home through their multiliteracy practices and living in the "iWorld" (O'Mara & Laidlaw, 2011).

Vignette 7: A train expert emerges.

Ricky's parents shared with me that the first indication they noticed in connection to Ricky's interest and fascination with trains occurred when they took him to a historical railway museum. He was nearly 3 years old at the time of this museum visit. The family visited the steam train exhibition during this outing and rode on a train caboose that was built in 1919. Ricky's mother reported that initially Ricky was a bit frightened by his first ride in an "old" train caboose, but later was also amazed by this experience. In the steam train museum, his father told me that Ricky was fascinated by the old steam engines and asked his parents to read all the displayed information about each steam engine. At the souvenir store, his parents purchased a wooden train set, an old-fashioned train conductor whistle, and a replica of an old train catalogue from the 1900s. Ricky's mother shared with me in one of our informal interviews that when Ricky got home from

his first visit to the historical train museum, he gathered his Thomas the Tank Engine books and toy train sets. He put his newly purchased wooden train set and the conductor whistle next to his Thomas the Tank Engine books. His mother also noted that after Ricky's visit to the historical train museum, during his family's weekly visit to the public library, Ricky found several books about "old-fashioned" trains and insisted on taking them home to read. He also wanted to borrow Thomas the Tank Engine videos. In the following few weeks, he borrowed more train books, and within a few months, books about trains were the only books Ricky wanted to borrow from the library and the only ones he wanted his parents to read for his bedtime stories. He had several favourite train books and he asked his parents to read them to him over and over for many weeks. According to Ricky's parents, he "read" the old train catalogue many times and could name many types of trains in the catalogue (see Figure 3). He revisited his books, train sets, toys, videos, and games over and over for many weeks. A train expert emerged. (Interview transcripts and field notes, November 2012)

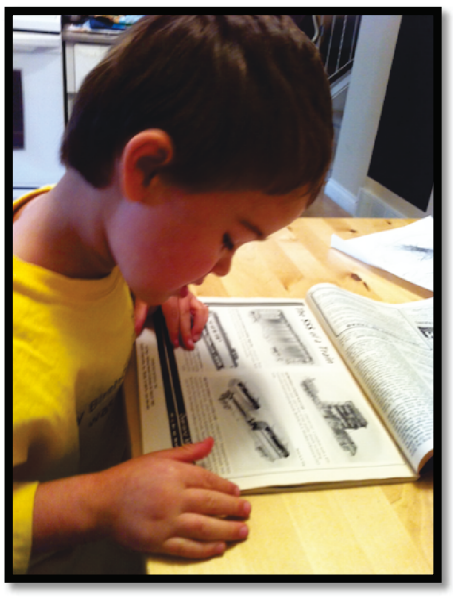

Figure 3: Ricky "reading" an old train catalogue.

Emergence of islands of expertise.

Across all my participants, children frequently were engaged in topics connected to their deep interests, which often intersected with their daily literacy practices. The example of Ricky, as elaborated in the preceding vignette, provides a snapshot of such deep engagements. Ricky was a 3-year-old with a passion for trains. His daily conversations with his parents often focused on this topic: he asked questions about trains during dinnertime and on his daily walk with his family, and at bedtime he always requested train stories. Frequently, he inquired into how trains work during conversations with his mother, who answered his inquisitive questions with "adult-like" explanations and descriptions.

Ricky's islands of expertise grew bigger and more in-depth as his ongoing conversations about trains with his parents increased and became more sophisticated. On many occasions, I watched Ricky revisit his train books repeatedly in order to reexamine the illustrations and think about different ways to play with his train toys and to create different literacy artifacts, such drawings of trains. Sometimes he intermingled the different story characters together and created a hybrid character from his storybooks, videos, and games to use within his imaginary role-play. For example, in one video-recorded observation, Ricky dressed up in a fairy costume with a train conductor's hat on while he used his wooden whistle to direct Thomas the Tank Engine and other train characters in the living room. Throughout the time I spent with him, he would invite his mother and me to join in with his imaginary play: he was always the conductor and his mother and I were the passengers. Ricky was engaged in complex learning processes in building his islands of expertise about trains, and his literacy learning had many layers of dynamic nested activity that were constantly at play in his home environment (Davis & Sumara, 2006).

Within Ricky's experiences of learning about trains, he looped back on ideas about and experiences with trains continuously while he built his islands of expertise (Crowley & Jacobs, 2002). Ricky's desire to listen to and read train books and watch train videos over and over again may be interpreted as a recursive-learning pattern of a complex adaptive system (Davis & Sumara, 2008). His recursive-learning pattern includes a process of continued reflecting and thinking, critical questioning, and personal experiences. Doll (1993) explains recursion as a kind of looping back of "thoughts on thoughts [that] distinguishes human consciousness; it is the way we make meaning" (p. 177). In this sense, Ricky responded to familiar ideas, books, toys, and games on his favourite topic in a nonlinear way, because recursion leads to the conceptualization of something different while using former things and ideas (Low, 2008). In the context of his learning at home, Ricky had the time, space, and provocations in his learning environment that supported him in pursuing his interests and passions. He revisited his explorations, questions, and conversations about trains with his parents regularly, while simultaneously engaging in connected home literacy practices. Ricky's daily recursive literacy practices and learning were not typically planned or scheduled by an adult, and gave the impression of being spontaneous or accidental. However, viewing Ricky's literacy experiences closely at a micro level through a complexity lens, I saw that his everyday learning "emerged" (Johnson, 2001) through the feedback he received from his daily conversations with his parents, explorations in his community, imaginary play with his toys, and early literacy practices related to trains. Thus, his literacy experiences appeared to have expanded his understanding and knowledge about trains.

According to Crowley and Jacobs's (2002) notion of islands of expertise, it is important for parents to add new information or explanations to what a child already knows because children often connect new information to their background experiences and prior learning. I

noticed that in Ricky's family, his parents provided support for his learning by helping him to remember what he had learned from books, games, museum visits, and everyday literacy events. The following conversation between Ricky and his mother illustrates this point:

Ricky: *Is this a steam engine train?* (pointing to a picture in his book)

Mother: *Yes, this is a steam train like the one we saw in the museum. Remember, coal makes heat and steam?*

Ricky's parents supported his areas of interest by "scaffolding" his learning (Wood, Bruner, & Ross, 1976). As Wood, Bruner, and Ross (1976) suggest, scaffolding should stem from the children's interests and desires, and it works when the adults around the children are alert and responsive to the children's learning needs. Over the course of my observations, I noticed that Ricky's parents scaffolded his learning by engaging in thought-provoking conversations about trains; his mother's conversations became increasingly sophisticated and she elaborated information at deeper levels. Their conversations were often about how trains work. Ricky's mother trusted that Ricky would understand her complex explanations, and she nourished her child's islands of expertise by listening, talking, answering questions, reading books, and researching Ricky's interests. Crowley and Jacobs (2002) suggest that, for many children like Ricky, their "vocabulary, declarative knowledge, conceptual knowledge, schemas and personal memories related to trains are numerous, well organized, and flexible" (p. 336).

In spite of Ricky's singular focus, his parents seldom ignored his questions or showed signs of being tired of the topic of trains. Ricky's recursive-learning processes had no fixed beginning or ending, and the looping back feedback simply provided opportunities for Ricky to explore further and deepen his understanding of his topic of interest. As Doll (1993) explains, "recursion aims at developing competence—the ability to organize, combine, inquire, use

something heuristically. Its frame is open" (p. 178). Furthermore, Ricky seldom abandoned his initial literacy practices, such as drawing or colouring train pictures, and he often extended these, elaborating on his previous drawings to recreate new ones. Crowley and Jacobs (2002) have pointed out that every ending is a new beginning and every beginning emerges from a prior ending. From a complexity-thinking perspective, children's learning occurs recursively and often expands in fractal-like patterns. Near the end of the time I spent observing Ricky, he began to explore and inquire into other interests, which included trucks and cars. His interest in trains was a launch pad for building other islands of expertise and would remain connected to his subsequent knowledge and literacy learning.

In the next section, I present a research vignette as an example to illustrate how Gee's (2004) notion of affinity spaces can be connected to children's building multiple islands of expertise with their multiliteracy practices at home.

Building Multiple Islands of Expertise in Affinity Spaces

James Paul Gee, a digital and sociocultural literacy scholar, was the first to introduce the idea of *affinity spaces* to the literacy research community. According to Gee (2004), "an affinity space is a place or set of places where people affiliate with others based primarily on shared activities, interests, and goals, not shared race, class culture, ethnicity, or gender" (p. 67). He proposes that, instead of thinking about a group of people being either "in" or "out" of a community, we think of *spaces* where people interact. Affinity spaces can be a virtual or physical place, and he calls these kinds of spaces *semiotic social spaces* (Gee, 2004). Semiotic means the study of signs and symbols. These semiotic social spaces share certain characteristics: *content* (what the space is about), *generators* (what creates content for the space), and *interaction*

(what users do with the content and how they connect with each other around the content). Gee (2004) uses the example of a painting, where the image is the *content*, the artist is the *generator*, and the *interaction* is how the painting makes people feel when they look at it. Another important feature of affinity spaces is the *portals* through which people get access to interact with the signs that generators have generated; some portals may require keys, passwords, or other, more complex, means. The Internet has dramatically increased the number of affinity spaces for people to connect with others virtually, and in today's Web 2.0 (O'Reilly, 2007) environment, many children collaborate and learn with others virtually within affinity spaces (Marsh, 2010b, 2011; Merchant, 2009; Wohlwend, 2010). In addition, the arrival of mobile touchscreen devices, such as the iPad and smartphones, in many young children's homes has increased the opportunities for many young children to gain easy access to affinity spaces for their everyday learning and play (Dezuanni, Dooley, Gattenhof, & Knight, 2015; Rowsell et al., 2013). This is because the iPad allows young children to interact with its interface by a range of actions, including one tap, double tap, long press, scroll, flick, two-finger tap, pinch, and stretch (Dooley & Gattenhof, 2015). The digital interface also enables children to begin their interactions with the digital world and in affinity spaces at a very young age (Marsh, 2014; McPake et al., 2013; Neumann & Neumann, 2014). The affordances of the iPad have also extended young children's media experiences beyond watching videos to include many aspects of their play and everyday lives. Contemporary literacy researchers (Marsh & Bishop, 2013; O'Mara & Laidlaw, 2011; Yelland & Gilbert, 2014) have found that children's play often includes references to popular culture, media, and online communities. Marsh and Richards (2013) explain that "many children are located within a digital nexus in which play and creativity are central to multimodal, multimedia meaning-making practices . . . and in which particular

media characters, texts and artefacts, seep into all aspects of their lives from a young age" (p. 12). Within Gee's (2004) affinity spaces, young children have opportunities to create, consume, connect, collaborate, and communicate with others, such as while using the iPad as a play object. This form of interaction has shifted children's literacy practices beyond the physical boundaries of their home and community. Affinity spaces also provide opportunities for two essential elements of complexity thinking: neighbour interactions and decentralized control that allow children to have a platform to distribute knowledge as well.

Contemporary researchers (Marsh & Richards, 2013; Wohlwend, 2011, 2013; Yelland, 2011) address how young children's play currently includes the use of a wide range of digital technologies, such as mobile touchscreen devices, DVDs, game consoles, and laptop computers (Plowman et al., 2012; Rideout, 2013). As I and other early childhood researchers (Black, 2010; Marsh, 2011) have found, children are actively participating in affinity spaces (e.g., Poptropica, Club Penguin, BarbieGirls, Webkinz World) and they are active consumers and producers of digital media and popular culture (e.g., viewing and creating videos to post on YouTube channels). The convergence of "traditional" play and digital play is what many young children are currently experiencing at home (Marsh, 2011; McPake et al., 2013). In my study I observed children ages 3 to 5 going online to chat with relatives and friends, playing online games, and seeking entertainment via the Internet. Younger children are becoming more visible in many semiotic social spaces (Gee, 2004).

While my study did not set out to examine the use of mobile touchscreen devices such as iPads or smartphones within children's home literacy practices, it took an unexpected detour when I realized that many of my participating children used and accessed iPads at home. My study took place in the years when iPads and smartphones exploded into consciousness and

increased in use in many parts of the world. The young children in my study, like many adults, also participated in what Gee (2004) calls semiotic social spaces. The following example illustrates how a 5-year-old boy's engagement with multimedia and multimodal devices contributes to his motivation and independent learning in playful ways at home. A central consideration for me in the following vignette is the relationship between the child's critical responses to media and his creative production of a LEGO review video, as well as how toys, books, musical instruments, and digital objects such as his iPad help him make sense of the world around him.

Portrait of Andrew

Andrew is a 5-year-old who lives with his parents and a 7-year-old sister in an urban centre of southeastern Australia. Andrew's parents are competent users of current digital devices; his father works in the ICT sector and his mother relies on technologies at work and at home. Each member of Andrew's household has an iPad with a secured password. Andrew is not yet literate in the traditional school sense (i.e., he cannot read text or print his name with a pencil), but he can key in the letters of his name on the iPad. He uses his name as an iPad password, and he can spell and recognize the word LEGO in a search engine.

In Andrew's bedroom, there are books of many different genres (e.g., picture books, information books on LEGO, comics, magazines, and junior novels), toys ranging from a light sabre[8] to LEGO sets, dress-up clothes, musical instruments (e.g., a drum set, a guitar) and an iPad, which usually travels with Andrew throughout the house. In the family's living room, there is a large bag full of LEGO bricks and several elaborate LEGO structures strewn on the floor. Andrew often takes photos of LEGO structures with his iPad before he disassembles them.

[8]A light sabre is a fictional energy weapon featured in the Star Wars universe.

LEGO structures built by Andrew, his sister, and their father are used to decorate the home (e.g., a Christmas manger created out of LEGO bricks is sitting under the Christmas tree). Andrew took his iPad to his childcare centre to video-record his play activities with his playmates, but the childcare worker disallowed further use of the iPad in the childcare centre. (Field notes, January 2013)

Vignette 8: Multimedia, multimodal devices, and motivation to learn.

Andrew is sitting in the living room surrounded by a brand new LEGO building set[9]*. He opens the LEGO set and begins to construct a Star Wars spaceship.*

Andrew: *This is what it looks like. (He points to the picture on the box. After a few minutes, his facial expression shows frustration.)*
What…? Where do these go? (He points to some LEGO bricks and compares his spaceship to the picture on the box. He reaches for the instruction pamphlet that comes with the LEGO set and begins to examine the diagrams. With the instruction diagram open, he tries to connect the LEGO bricks according to the diagram [see Figure 4]). No! This is not right! (He puts the "under construction" spaceship on the floor and runs to his bedroom to retrieve a book about LEGO.)

Suzanna: *Why are you using that book?*

Andrew: *There's a Starfighter in here. I remember it. (He flips through the pages of the book.)*

Suzanna: *What is a Starfighter?*

[9] The LEGO subculture encompasses books, movies, and online games.

Figure 4: Andrew following the diagram to construct his spaceship.

Andrew: *A spaceship with retractable landing gear. (He leaves the printed book page open, reaches for his iPad, scrolls through his YouTube video playlist, taps on the video review of Starfighter, and begins to watch a video[10] reviewing this new LEGO set. See Figures 5 and 6.)*

Suzanna: *Is that a movie on LEGO?*

Andrew: *It's a LEGO review. . . . It tells me about the Starfighter. (He pays close attention to the video presenter, who appears to be a teenager.)*

Suzanna: *Why are you watching it?*

Andrew: *I want to make my own review. He is not very good. He said it [the LEGO set] had 320 pieces but it has 325 pieces! My dad can video me with his iPhone tonight.* (Transcript from video recording, January 2013)

[10]The LEGO reviews Andrew watches are YouTube videos posted by LEGO enthusiasts who share their ideas and opinions about certain LEGO products. Users gather information on specific LEGO sets by watching these videos.

Andrew continues to construct his spaceship using the pictorial diagram instructions that came with the LEGO set. Andrew also "reads" the visual images from his LEGO book. Although he is not reading fluently in a traditional sense, he is able to navigate his online activities using search engines to locate video reviews in his interest areas, in particular LEGO construction. He critically examines these videos on YouTube and tries to create his own video reviews to be posted on YouTube with his father's assistance and support. (Field notes, January 2013)

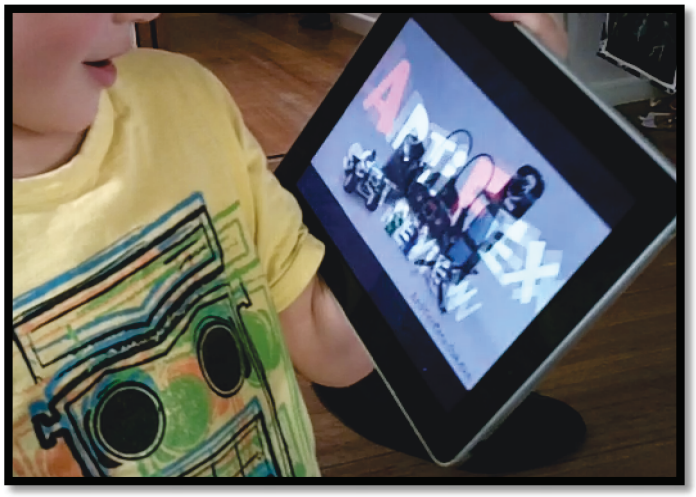

Figure 5: Andrew views and evaluates the LEGO reviews on YouTube.

Figure 6: Andrew searches for LEGO instructions online.

Framing through three dimensions of literacy.

In more closely examining Andrew's example in research vignette 8, I turn to Green's (2012) 3D model of literacy. Andrew has demonstrated his competency in Green's operational-technical dimension; he has a good understanding of the purposes of various kinds of language and texts (e.g., he uses conventional books, construction diagrams from his LEGO set, and digital texts in overlapping ways), an emerging understanding of conventional orthography (e.g., he can key in the letters of his name as a password and type "LEGO" into the search engine). Andrew is also competent in the critical-reflective dimension of literacy practices because he could tell me that a LEGO reviewer was "not very good" because the reviewer did not know the correct number of LEGO pieces in a specific set (Video recording transcript, January 2013). As well, Andrew understands that a LEGO reviewer must have some knowledge and expertise of the LEGO set being reviewed, particularly creative ways to construct the structure. This understanding indicates that Andrew is aware of the cultural-discursive dimension of literacy practices in the online LEGO review community. Andrew also told me that he does not watch too many LEGO reviews produced in "America" (Canada and USA) because some LEGO sets are available exclusively in "America" and not in Australia, and he often asks his parents to buy LEGO sets online. During this interaction with multimedia and multimodal tools, Andrew has engaged and made meaning within all three dimensions of literacy practices simultaneously to develop his expertise in his area of interest.

Playful building of "islands of expertise" in affinity spaces.

Today, children's play can involve new digital devices, popular culture, multimedia, and multimodality, with apps and toys that are increasingly interconnected and where offline toys

interact with a particular app or online game (Marsh & Bishop, 2013). For example, throughout my observations of Andrew, he explored the online community of LEGO experts and he paid close attention to his area of interest within popular culture and media: scanning advertisements, downloading the latest LEGO apps onto his iPad, watching "LEGO Star Wars" videos on his YouTube playlist, building LEGO spaceships virtually or physically with his LEGO sets at home, requesting informational books about LEGO for his birthday, and occasionally buying printed books in a bookstore. During my last observation of Andrew (March 2013), he asked me to write down a list of American LEGO sets in my field notes book so I could send him LEGO sets from Canada that were not available in Australia. I asked him how he knew the LEGO sets were available in America; and he replied, "I Googled it" (Interview transcript, March 2013). Andrew might not be 'school literate' yet, but he was functionally literate in certain contexts.

The convergence of multiliteracies and digital devices has created significant impacts on young children's early literacy practices and learning (Flewitt et al., 2014; Kucirkova et al., 2013; Merchant, 2015). Children like Andrew are developing their islands of expertise by searching for information online with the help of their parents, entering affinity spaces such as Club Penguin and other online LEGO community, but maintaining printed books as resources.

In the example of Andrew, I saw a child who was highly capable of engaging with multiliteracy practices using multimedia and multimodal devices. He was not a passive consumer of multimedia; rather, he was an active producer and designer at a very young age, with support and scaffolding from his parents. Andrew could share his expertise of LEGO constructions with other LEGO "experts" by posting his video-recorded reviews online. During his interactions within the LEGO online community, he also learned new ways to construct his LEGO structures

by viewing videos posted by other members, and he interacted with the group by choosing the "good" reviews to watch.

Andrew's father was also interested in the LEGO review group. He and Andrew often conversed about different LEGO websites, reviews, and virtual games while they constructed LEGO structures together. His father encouraged Andrew to video-record his LEGO review to be posted. During the time I spent with Andrew, I noted that he was aware that certain people within his LEGO online community had more expertise than others, and that these people took on a certain identity: they used a "LEGO experts" Discourse (Gee, 1989) with a specific terminology (e.g., "studs" are the little protrusions on top of LEGO pieces and "bricks" is the term used for the pieces [see Figure 7]). In one of my informal interviews with Andrew, he explained it to me this way: "Some people have good ideas and can build super spaceships with LEGO. Then, they post them [videos] of what they built on YouTube so others can learn from them. It's like—who makes the best LEGO spaceships" (Interview Transcript, 2013)? In this example, the LEGO review portal into the affinity space also encouraged and enabled young children who used it to gain and spread knowledge about building with LEGO sets. In Andrew's case, he watches a few minutes of the review, pauses the video, tries out the new techniques presented by the reviewer, and often integrates his own ideas with the reviewer's suggestions and ideas. These types of neighbour interactions could expand Andrew's islands of expertise on LEGO.

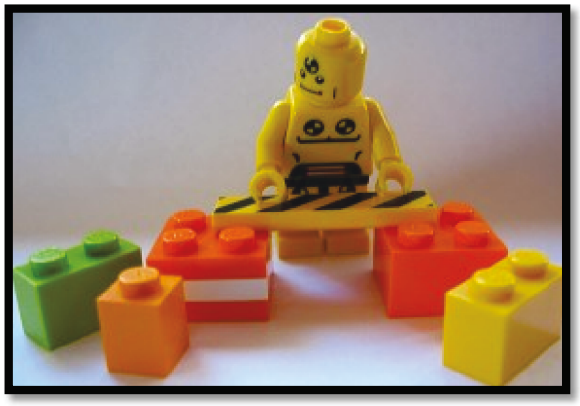

Figure 7: "Studs" are the protrusions on top of LEGO "bricks."

Affinity spaces are common in our globalized high-tech world (Gee & Hayes, 2011), and young children are more easily participating in these semiotic social spaces because of the affordances of the iPad. The mobile touchscreen devices make it easier to produce, create, and consume the content generated in these spaces. I expect that young children like Andrew, who have experienced distributed knowledge within affinity spaces, will encounter knowledge sharing differently when they enter formal school settings where classrooms tend to encourage and reward individual knowledge. Many formal early childhood educational environments do not often allow students to network with each other or with various technology tools (Honan, 2012). Individual achievements tend to be rewarded in many of the current early childhood classrooms, and these educational settings tend to closely constrain where students can gain knowledge, rather than encouraging them to utilize widely dispersed knowledge (Gee & Hayes, 2011). In my follow-up conversations with parents in my study, several parents reported that their children noticed the lack of multiliteracy practices in school. In Andrew's case, his mother reported that when Andrew went to school, he frequently tried to question the purpose of activities he did not see as purposeful. Susan and Christy's parents reported that they decided to teach their children

at home because their children found it challenging to have "rigid routines" and a lack of iPads available for the children to use in their kindergarten classroom.

I presented two vignettes in this chapter to illustrate how traditional print-based literacy practices and multiliteracy practices could converge with multimedia and multimodal tools to provide platforms for young children to build their islands of expertise. This convergence of literacy practices played an important role in my young participants' early literacy learning. Within Ricky's home context, his parents helped him build his "islands of expertise" and expanded his interest in how trains work by providing a variety of resources in both printed and digital texts for his literacy practices. Ricky's parents also encouraged him to engage in neighbour interactions and allowed his ideas to bump into each other. His islands of expertise emerged from these neighbour interactions. Andrew's literacy practices branched out in a fractal-like pattern. For example, he began with a simple visual diagram from the LEGO box, reached out for a more elaborate informational book that included visual graphics, written explanations, diagrams, charts, and photos of LEGO structures, and expanded his learning to create a video with the assistance of his father. His interest in playing with LEGO grew into a video-recorded production of his opinions and expertise on the topic.

In this chapter I presented my observations and interpretations of two young participants engaging in multiliteracy practices and literacy learning in home environments that were different than my own childhood experiences and many educators' early childhood literacy experiences. In contemporary childhood experiences, mobile touchscreen devices and digital technologies are increasingly present, yet within many formal early childhood education contexts, children's usage of mobile touchscreen devices can present challenges. For example, several of the participating children in my study who had entered kindergarten in 2013 were not

allowed to bring their own iPads to school. If formal school learning is to build on the experiences and strengths that children bring to early childhood education settings, then how can educators help children like Andrew and Ricky to expand their islands of expertise and acknowledge the "funds of knowledge" (Moll et al., 1992) they bring with them when they enter formal schooling?

Next, in Chapter 7, I discuss parental perspectives on their children's multiliteracy practices.

Chapter 7: Parental Perspectives

> *Given the dramatic increase in media now being produced for infants and toddlers, it has become particularly important to understand how parents incorporate these materials into the early learning home environment.*
>
> (Mol et al., 2014, p. 1251)

Traditional and New Dispositions to Text

In this chapter, I expand my discussion from the previous chapters of the parents' dispositions toward technologies and their perspectives on their children's multiliteracy practices. I present my interpretation of the data analyses across different domains to seek general patterns across the participating families, regionally and internationally.

Similar to the findings of Stephen, McPake, Plowman, and Berch-Heyman (2008), I found that access to and use of technology tools at home was not dependent on socioeconomic status, family circumstances, or family composition. The technology tools that were available for the participating children to use at home depended primarily on their parents' attitudes and dispositions toward, and interactions with, new technology tools and digital devices. All of the participating parents were aware of the different technologies their children were using for text making and meaning making. As O'Mara and Laidlaw (2011) observe, today's children have been "born into new dispositions toward and relationships with texts" (p. 156), something I observed too for most of the participating children. To understand the notion of old and new dispositions toward text, I turn to Kress (2005), who describes traditional dispositions to text as monomodal and linguistic. The traditional disposition toward texts tends to be stable, sequential, and linear, composed by the producer and interpreted by the reader. The traditional disposition

toward texts reinforces the author's authority; the "text is [the] site of knowledge" (Kress, 2005, p. 2). In comparison, new dispositions toward text are multimodal and use a semiotic approach. According to Kress (2005), "text-making and text-reading has (sic) become different and more demanding . . . text is now radically unstable" (p. 2). Reading and writing multimodal texts requires a different disposition toward texts and a different authorship than for monomodal texts (Kress, 2005). Kress suggests that many contemporary young children and adults have new dispositions toward text because they "have grown up in a world where the screen and its potentials have already become naturalized, [and] are taking as natural all the potentials of the screen" (p. 2). My observations suggest that for some participating parents, their disposition appears to be changing from a linguistic to a semiotic one. These parents were "early adopters" of new technology tools. They understood that text making and text reading have become different and more demanding in a multimodal environment. As well, participating parents' new dispositions toward text seemed to impact the ways their children engaged with multiliteracy practices. One of the participating parents explained his new disposition toward digital text as follows:

> *We bought her an iPad for her third birthday because my wife has one, I have one, so we thought Amber would enjoy having her own iPad. Besides, I like reading on the iPad with her. . . . I mean that we like listening to the story read to us together because we don't just listen to the story. Amber likes to sing along with the songs that are already linked to the story and she likes to touch the screen to move the pictures around. There are more things to do when you read a kid's e-book than the paper books. I guess my wife and I like gadgets and I find reading on the screen is a lot of fun for us.* (Interview transcript, April 2013)

Parents' Traditional and New Dispositions Toward Literacies

The families who participated in my research owned a wide range of, and often multiple, technology devices. As well, many of the literacy practices I observed in the children's homes involved some type of technology tool, such as laptop computers or mobile touchscreen devices. During my initial analysis, three distinct family groupings emerged from the data. Each category shared common parental perspectives. I categorized the three groups as follows:

- *New digital disposition.* These families were early adopters of new technologies. They had a wide range of technology tools and devices for their children to use at home, with children and adults each having their own digital devices. Typically, the parents in this group were enthusiastic and competent users of technology; they were relaxed and comfortable about their children's independent use of technology at home and seldom monitored their children's screen time. The parents in this group were also new technology users themselves, and they used digital tools for reading and writing in addition to using paper-based media, such as books and magazines. These parents were frequent users of social media for communication and some had encouraged their children to begin to explore social media. Parents in this group also tended to be open to a household that did not need to be strictly organized, that is, their children were not required to tidy up their games, toys, or dress-up clothes daily if the continuing play was deemed valuable. For instance, a child could leave his LEGO construction intact or puzzles incomplete and return to them later. Figure 8 shows a graphic illustration of a new digital disposition family's literacy materials.

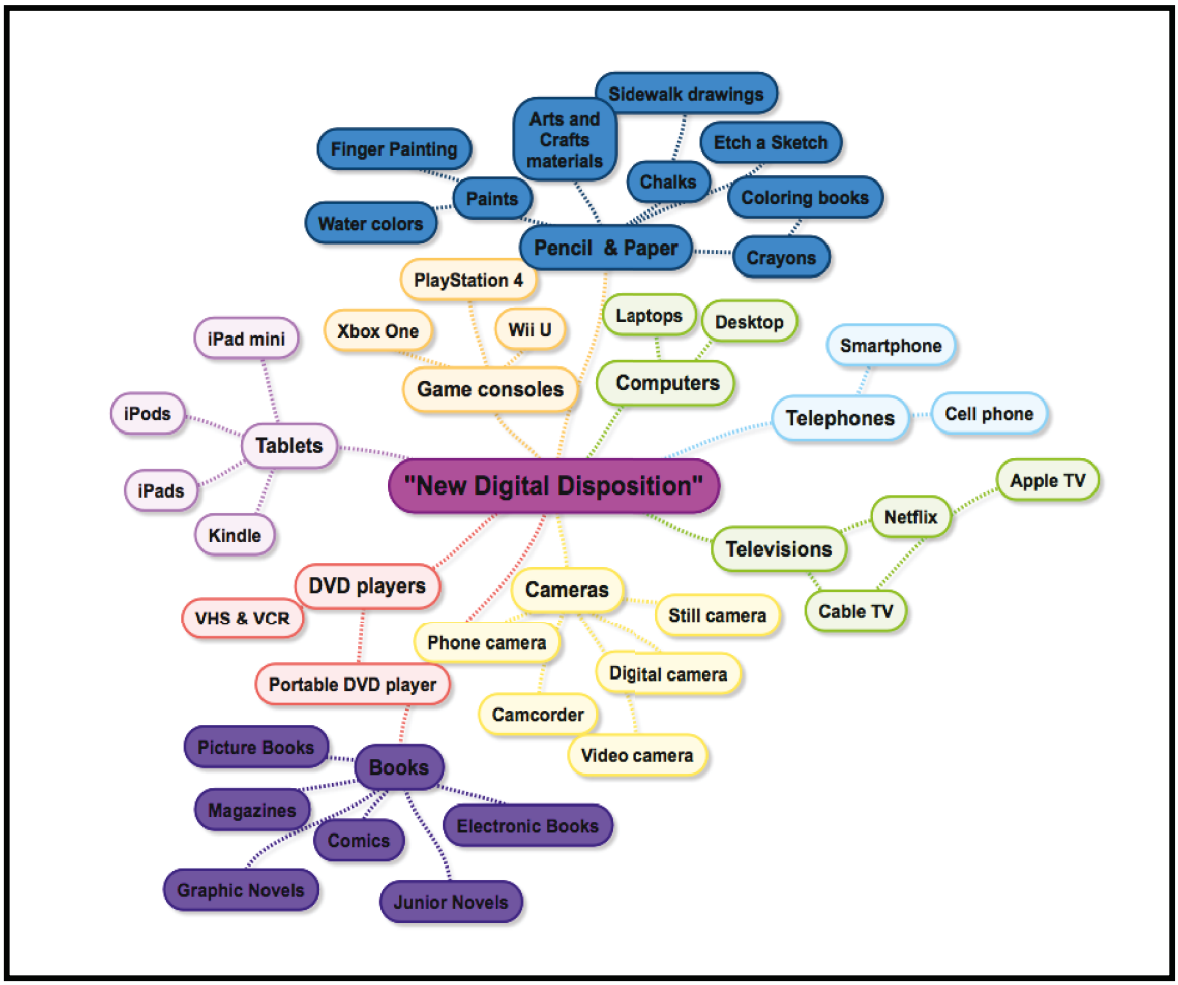

Figure 8: Technology tools observed in a new digital disposition family.

- *New and old dispositions.* These were families who tended to have mixed values of traditional literacy and new dispositions toward digital text. The families in this group often owned a desktop and/or laptop computer, a television, a tablet, and/or a smartphone for the whole family to use and share. The parents in this group tended to supervise their children's use of technology tools closely and monitored their children's screen time. They encouraged their children to explore both traditional forms of text and digital devices. The parents in this group explored their own writing and reading on screens and communicated with others over the Internet using various software applications (e.g., Skype). However, digital screens were not replacing paper pages and books for these

families, who also owned many traditional print-based books along with their digital reading and viewing materials. Figure 9 shows an example of a new and old disposition family's literacy materials.

Figure 9: Technology tools available in a new and old digital disposition family.

- *Traditional literacy disposition*. These families tended to value traditional literacy practices, and the printed book was the dominant text medium. These families typically had one computer, a television, and a smartphone in the home, but children were not permitted to use them freely without parental supervision. The parents had guarded

attitudes toward technology and were often worried about the safety of their children using the Internet. While I have categorized this group of parents as reflecting traditional dispositions, there was some evidence of openness to shifting this position. For example, I observed that some parents in this group were willing to explore the affordances of new mobile touchscreen devices with their children. Another example was one parent from this group who was very interested in learning how to use my iPad that I was using to record her children's literacy practices. In several observation video recordings, this mother was learning how to a play game on an app with her daughter. I also observed several children in this group whose playmates had shared their mobile touchscreen devices with them during their play dates. Figure 10 shows an example of a traditional literacy disposition family's literacy materials.

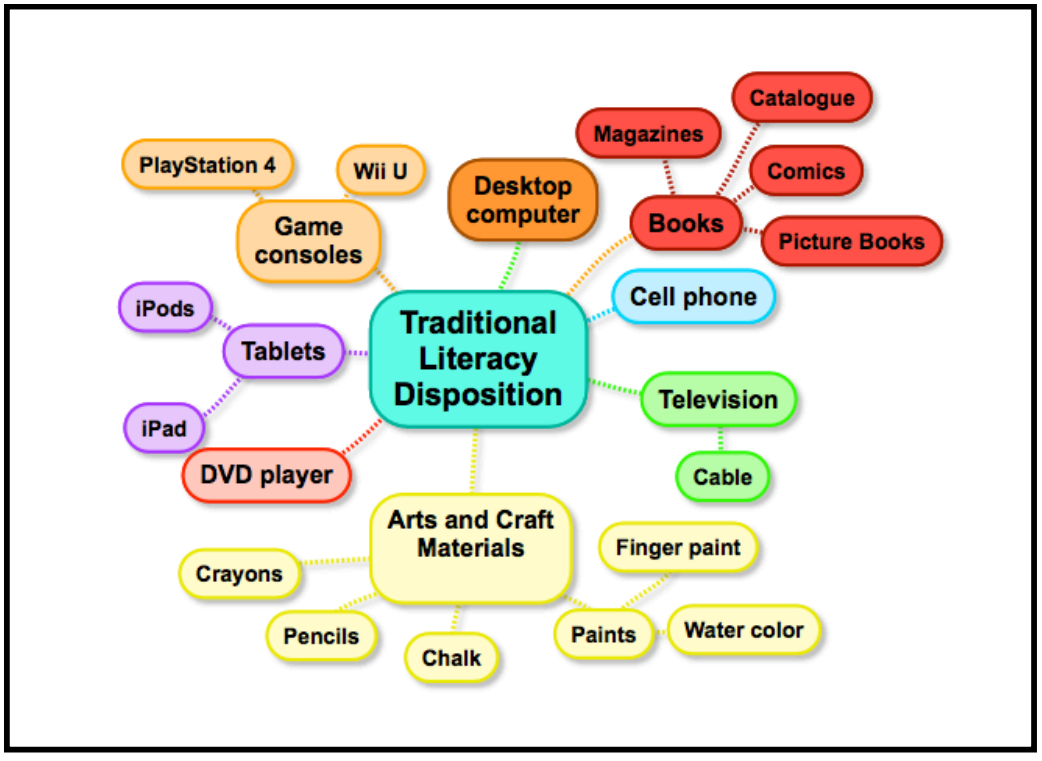

Figure 10: Technology tools available in a traditional literacy disposition family.

I suggest that the most important implication for analyzing the data from parents is that there are distinct parental dispositions toward texts and these dispositions may have a significant influence on the way children engage with multiliteracy practices. The participating parents' dispositions toward texts suggest that a rich digital literacy learning environment is not simply a matter of acquiring a vast number of technology tools in the home, but rather depends deeply on the parents' attitudes toward and perspectives on multiple forms of literacy practices within their homes.

Using the Three Dimensions of Literacy to Understand Literacy Practices

As noted earlier, Green's (1988, 2012) 3D model of literacy was used to examine the home literacy practices of each child from each of the three family groups at a micro level. The children I studied typically had acquired operational-technical competencies in several areas: they had learned to switch digital devices on and off, download, open and close apps, choose from options on a main menu, and navigate websites. Many of the participating children learned these skills by observing their parents and/or older siblings at home. Other studies (Marsh, 2014; McPake et al., 2013; Mol et al., 2014; Neumann & Neumann, 2014) have also observed such phenomena, that is, children are developing their operational-technical competencies at their parents' elbows or on their parents' laps in front of a digital device, starting at a very young age. Many of the children in this study have also developed competence in the cultural-discursive dimension of literacy alongside their parents and have learned how to make meaning within their home context. For example, children in the new digital disposition families have learned that many popular media sites, such as Facebook or blogs, require that they participate with specific cultural practices. The cultural practices include updating family photos and posting current

"happenings" of the family on Facebook, and posting appropriate birthday wishes on the Facebook timelines of relatives and friends who are having birthdays. Many parents in this group have also encouraged their children to explore the cultural dimension of literacy practices through language and technology, such as video recordings, to convey messages and ideas to relatives living in another city. In the traditional disposition family group, children often learned that homemade birthday cards were culturally acceptable to express birthday wishes to others. In this study, many children learned the critical-reflective dimension of literacy practices from their parents and with peers in the community. For example, throughout my observations, children critically evaluated different apps that their parents had purchased or websites that their parents had bookmarked for them to use. In several informal interviews with my young participants, they recommended several "fun apps for kids" to me because they had "checked them out" and critically assessed the values of these "fun" apps (Interview transcripts, 2013).

I have highlighted several examples from this study to show that many of the participating children, including the children from the traditional literacy disposition family group, had experience with using the Internet to search for information, seek entertainment, or communicate with relatives living in another city with video chat platforms such as Skype or FaceTime, operational-technical skills they had learned from watching their parents and through parental instruction. Today's young children have had very different home literacy experiences than a decade ago, when many children communicated with relatives over landline telephones or by sending letters using the postal service. Many contemporary young children have experiences with digital screens and texts (Holloway et al., 2013; Rideout, 2013). The young participants also had experience with cultural-discursive literacy practices, both online and offline, in all three family groups. In this study, I noted that the critical dimension of literacy had transformed some

participating children's operational literacy practices into reflective practices, had deepened their insights, had developed their ability to question and evaluate, and had increased their understanding. For example, some older children in my study had learned how to delete apps that they deemed to be "boring games."

Other literacy researchers (Marsh, 2004; Plowman et al., 2011) have also found that parents' dispositions toward and support for the use of technologies have significant impacts on the ways children engage with literacy practices. As Plowman et al. (2011) noted,

> parents orchestrated learning through the provision of resources, by setting up activities, overseeing safety and ensuring that children were not getting stuck. . . . The ways in which children's learning with technology was supported at home were not necessarily visible and . . . parents frequently underestimate their role. (p. 367)

My data analyses suggest that children have developed learning with digital devices in the areas of acquiring operational-technical competences, including how to use computers, tablets, DVD players, and smartphones. Digital literacy practices have extended their awareness in the cultural-discursive dimension of literacy, such as learning about the roles of technologies in everyday life and how they can be used to maintain family relationships and communication (e.g., choosing the appropriate photos to upload onto their family Facebook page with their parents' help). Many of the participating children have also developed the critical-reflexive dimension of literacy competence by critically evaluating the "educational" or "fun game" apps within the technology medium. I also observed many participating parents in the new digital disposition family group encouraging their children to make critical decisions in purchasing apps

independently; in one family, the children were allowed to spend two dollars per month in purchasing apps of their choice.

Parents' Dispositions Regarding Access to New Technologies

Another thread that emerged from my study was that the participating parents' disposition toward new technology tools appeared to be a highly influential factor in a child's home literacy environment. Young children's access to technology tools at home was primarily determined by their parents' beliefs about and attitudes toward new technologies and digital media. As I have discussed earlier in this chapter, parents have different dispositions (Kress, 2005) toward texts, and their perspectives in regard to multiliteracy practices and digital tools impact their children's early literacy experiences at home. Every parent interviewed in this study noted directly or shared implicitly that current digital devices play an important role in their children's literacy experiences at home. The following statements from parents' interview transcripts illuminate their attitudes about and perspectives on their children's digital literacy practices:

> *It is important for my kids to have experiences with these new tech stuff.*
>
> *You can't stop them from using the computer or going onto the Internet at friends' houses. I might as well have one at home . . . so I can watch what they are doing.*
>
> *I know my son is learning a lot of school stuff with the educational apps on his iPad.*
>
> *I am comfortable with my child using the iPhone and iPad because it will help them in the future.* (Interview transcripts, 2013)

These statements demonstrate that some parents of my participants were willing and ready to have their children engage in digital literacy practices at home, despite some parents expressing concerns about the possible dangers their children may encounter on the Internet. Based on the informal interviews with parents and discussions of the focus groups, I realized that

many of the participating parents were aware of how digital devices had influenced their family's home life. Many of the parents acknowledged that their families consistently used digital devices within their everyday literacy practices. One parent articulated this view clearly in his interview, saying, "There is no turning around now—we need our gadgets to survive in our family . . . not sure how we can organize our kids' after-school activities without our iPhones" (Interview transcript, April 2013). In this study, I observed many children whose learning was scaffolded by their parents or who were encouraged by their parents to engage with multiliteracies involving multimodal approaches. These multiliteracy practices highlighted many contemporary young children as capable, creative, and competent communicators.

iPads for Children: A Surprise Detour

It was not my intention to focus in this study on specific technology tools used for children's literacy practices. However, my study took a slight detour because much attention was given to the iPad in many of the interviews I conducted over the course of my study. The iPad constantly emerged as a phenomenon from the interviews and informal conversations with both participating children and their parents. Several parents explained why they purchased iPads for their children to use at home and how their children "fell in love with their iPads." Many of the participating parents told me that they decided to purchase iPads for their children for various reasons, such as the educational and entertainment values the iPad can provide to their children. One participating parent explained to me why he had purchased an iPad–mini for each of his three children:

> *My kids love playing with their iPads by themselves or sometimes they like to work together on a game using one iPad. You see . . . Susan likes her colouring apps and listens to stories and watches videos about animals, Christy likes to take*

funny pictures using special effect stuff on her iPad, and their brother likes to create his own music using GarageBand[11] *. . . so it is best that they each have their own iPad. This way they can't mess up my iPad.* (Interview transcript, March 2013)

Many of these parents agree that the iPad is lightweight and mobile; it can be used anywhere in the home, in the car, or in any other place the parents decide to make it accessible to their children; most important of all, young children find it easy to navigate (Field notes, 2013).

According to other literacy researchers (Kucirkova et al., 2013; Yelland & Gilbert, 2014), unlike most technology tools, tablets are a highly sophisticated "convergence" (Jenkins, 2006) of multimedia tools, including a built-in camera, an audio recorder/player, a video recorder/player, a telephone, and a computer. It combines multiple functions that enable children to play and interact with it, to communicate with others, to access information, and to seek entertainment in multiple ways. Young children in my study demonstrated how they utilized the affordances of the iPad within their literacy practices and learning at home. Moreover, many of the participating parents believed that the iPad had met their family's needs as a tool for entertainment, communication, and, particularly, education.

Like Neumann and Neumann (2014), I documented parents scaffolding their young children's early literacy skills and development, such as print knowledge, by pointing out individual words, reading and clarifying how digital print works to their children. I suggest that the scaffolded literacy interactions with digital print while using digital devices, particularly the iPad, may help in fostering young children's early literacy development (e.g., print concepts and phonemic awareness). In one observation, I noted that a father reading an e-book with his

[11] GarageBand is a software application that allows users to create music or podcasts.

daughter pointed out that the "jumping green dot" that was tracking the words on the screen always lands on top of each word, and he paused the story to illustrate this concept to his daughter. This father also asked his daughter to tap on the screen to turn the pages throughout the story. The child appeared to understand the concept of directional movement in reading text on the screen. As Neumann and Neumann (2014) did in their study, I also observed children interacting with a touchscreen tablet by finger-tracking print, pointing to words, turning pages, and sometimes repeating words from an e-book. Little research has examined the educational effects of using e-books via iPads in children's homes or in early childhood settings, but according to Jabr (2013), researchers have suggested that the technology we use to read, such as the iPad, does change the way we read (p. 2). Because iPads are relatively new devices, further research is needed to investigate how parents can use the iPad at home to scaffold early literacy learning and development for their young children. Research is also needed to determine the educational benefits of iPads for young learners at home and in schools.

From my study and other studies conducted to date (Dooley & Gattenhof, 2015; Lynch & Redpath, 2014; Neumann & Neumann, 2014), it may be concluded that young children are quickly becoming competent users of mobile touchscreen tablets (iPads). Participating children like Andrew, Susan, Christy, Ricky, and Léla were able to successfully navigate through the iPad interface by touching, swiping, and pinching and by interpreting icons, symbols, and traditional printed words (e.g., free, download, play). The current touchscreen devices afford young children who are emergent literacy learners more accessible communication options than are present with more traditional literacy tools, such as pencils and paper. My observations, supported by other studies (Neumann & Neumann, 2014; Stephen et al., 2013), suggest that the convergence of digital and printed literacy practices through children's early home literacy experiences with

these new mobile touchscreen devices may have the potential to enhance early literacy skills, such as their knowledge of the alphabet letters, words, print concepts, and early writing skills. However, more research is needed in this area.

As I have observed in my study, digital devices, in particular the iPad, have had an impact on children's literacy practices at home. Therefore, I propose that the traditional concept of environmental print and print concepts can be extended to include environmental screen text concepts, where reading and writing can move in multiple directions rather than always moving in a linear pattern from left to right. The screen texts are interactive and hyperlinked, and these qualities may influence how children learn environmental print from early literacy experiences with screens (Wong, 2013). However, further studies are needed in this area.

Impact of Schooling and Culture

New mobile touchscreen devices and new forms of literacy practices are common in many children's homes, such as Andrew's home. In my study, these new devices appeared to have a great influence on the ways that participating children learned their "three dimensions of literacy" practices (Green, 2012). The participating children's literacy practices and experiences at home were closely connected with their parents' dispositions toward digital technologies and with the resources available in their home environment. Many children in my study have had freedom to explore with multimedia and multimodal approaches to learning and opportunities to make decisions related to their choice of digital devices within their literacy practices. Many children I studied had relative openness and freedom with their home digital device usage, and these home literacy practices might be different from later school literacy practices. Today's children have had a different upbringing to those of previous generations in terms of their

relationships with digital screens and digital texts, and these different early literacy experiences may have a great impact on schooling for these young children.

Next, in my closing chapter, I discuss some surprises I encountered in my study and share what I have learned about myself in my research journey. Finally, I suggest some recommendations for future research in the area of early literacy learning and new technology tools.

Chapter 8: Discussions, Recommendations, and Possibilities

We look at the present through a rear view mirror. We march backwards into the future.

(McLuhan, 1967, p. 74)

Through the work of my dissertation research, I have been able to take a snapshot of several young children's engagement with multiliteracy practices in their homes. I also had opportunities to gain many new insights into the participating parents' perspectives and their attitudes toward their children's multiliteracy practices and learning. In this dissertation, I have analyzed and interpreted my data and observations and presented some emergent patterns. While my work in Chapters 5–7 has addressed my key research questions, my discussions also brings forth more questions and issues for future research in this area. In this final chapter, as I "march backwards into the future," I take a closer look through my "rear view mirror" at the data presented in the preceding chapters and discuss how my deeper understanding and the insights I gained from my study may inform early childhood educators, policy makers, and other educational stakeholders in relation to children's literacy practices at home. Finally, I share my future journey.

Responding to the Key Research Questions

In analyzing the data and in response to my two key research questions (i.e., What literacy practices are preschool children engaging with in their home environments? How are multiliteracy practices influencing the home lives of these children?), I learned that many of the participating children in my study are engaging in a wide range of literacy practices that are integrated with a plethora of technology tools available to them at home. Many of the children I

studied experienced powerful learning affiliated with multiple forms of media, affinity spaces (Gee, 2004), and popular culture, as I have illuminated in my research vignettes. These children are in a position to compare and contrast how learning might occur in different learning environments and spaces when they arrive at school. Through my deeper understanding and the new insights I have gained in my study, I suggest that early childhood educators, now more than ever, will need to consider and acknowledge children's home literacy experiences and the "funds of knowledge" (Moll et al., 1992) that they bring with them when they arrive in formal schooling. I foresee some new challenges for teachers in formal schooling, particularly in connecting home and school digital literacy practices. Young children like Andrew, Susan, and Christy in my study have shown their new dispositions toward digital texts (Kress, 2005); they understand that digital texts on their mobile touchscreen devices are not always in a sequential, linear order, that such texts are multimodal, and that the mode of approach to digital literacy learning is semiotic. If formal schooling is to build on the experiences and strengths that children bring to school, then how can what is happening at home be connected to school literacy practices using current digital devices?

Many factors contribute to the absence of multiliteracy practices in early childhood classrooms. One factor may be public debate about the dangers and risks young children may encounter in multiliteracy practices and events, particularly on the Internet and in virtual worlds (Holloway et al., 2013; Honan, 2012; Laidlaw & Wong, 2013; Levy & Marsh, 2011; Linn et al., 2012). As Harrison et al. (2009) explain,

> some early childhood teachers reject the use of ICT in early childhood playrooms arguing that the use of computers and other forms of ICT promotes solitary play,

impedes children's play and social interactions and does not enable children to develop across the various developmental domains. (p. 467)

A second factor that might contribute to the absence of multimodal literacies in early childhood classrooms is that the different approaches to integrating ICTs and multiliteracies are not always consistent with developmentally appropriate and experiential hands-on activities and early childhood philosophies (Burnett, 2010; Dooley & Gattenhof, 2015; Neumann & Neumann, 2014).

A third factor may be the perceived difficulties of assessing multiliteracies in primary classrooms because they are relatively new elements in education (Laidlaw et al., 2015; Lynch & Redpath, 2014). Finally, the lack of confidence and expertise with new technologies of early childhood educators may be a constraint for full integration of multiliteracy practices (Arrow & Finch, 2013; Honan, 2012).

My View as a Former Kindergarten Teacher

From my research observations, coming from the point of view of a former kindergarten teacher, I was intrigued by the complex ways some participating children made decisions in relation to their engagement with literacy practices. Their decisions were often made without a child or an adult leader; however, the children often understood and recognized the "enabling constraints" set up by their parents during their process of decision making. For example, some parents in this study insisted that their young children must clean up their play area daily (e.g., taking the train set apart), whereas other parents allowed their children to leave their play materials intact or their painting incomplete so that they could continue to work on them the next day. For the focal children in my study, decisions about literacy practices were not made in

isolation but often involved multiple factors, such as how much time the child could spend on a literacy event, where they would like to practice literacy, and the technology tools or resources they were allowed to use. Andrew, for example, decided to wait for his father's technical advice and support before he began to video his LEGO review, and he spent much time rehearsing what he wanted to convey to his audience. In another family, Ricky drew on the technology tools that were available to him at home: he made use of his wooden train set and the plastic toy trains his grandparents had sent to him for his birthday. Even though the plastic toy trains did not run smoothly on his Thomas the Tank Engine train tracks, he merged the toys that were available. As I reflect back on my pedagogical approach as a kindergarten teacher, I seldom encouraged or allowed my former students to make their own decisions entirely independently. My lesson plans included a time allotment for every literacy event in my literacy centres. I was unaware of the powerful learning that can occur when children are allowed to make their own decisions in relation to their literacy practices, as I have observed in my study.

I learned from my study that time is an important resource for children to explore literacy practices, but time for exploration was often limited in my kindergarten classroom. In one of my follow-up interviews with a young participant who started kindergarten in September 2013, she told me that in her kindergarten classroom, there was never enough time to finish her "job" because her kindergarten teacher insisted that she switch literacy centres every fifteen minutes. In my study, I observed this child at home taking plenty of time to explore, observe, and interact with her literacy artifacts, digital devices, and toys. Throughout my time with this child, I recognized that being provided with ample time was an important component of her home literacy practices and learning. However, as Du (2014) noted in her study, "time sometimes worked against the children in the classroom . . . [children] needed more time to complete the

assigned literacy task in the [classroom] literacy centres" (p. 181). I suggest that early childhood educators in formal schooling need to consider how they structure their pedagogical approach and provide more time, space, and opportunities for young children to explore and learn literacies within their classrooms.

Transitions and Possibilities

Literacy researchers (Heath, 1983; Holdaway, 1979) have long recognized the need to connect home and school literacy practices; however, recently this principle has been extended to include digital literacy, techno-literacy, and new literacies practices (Honan, 2012; Lankshear & Knobel, 2011; Larson & Marsh, 2005; Pahl & Rowsell, 2010). Other studies of literacy practices (Gee, 2009; Honan, 2012) also point to a mismatch between the children's home and school literacy practices. More recent literacy studies, taken alongside my study, reveal a wide range of literacy spaces for children to engage in at home every day that are rich in multimedia, multimodal, multilingual, and multicultural practices. For example, children such as those in my study—specifically Léla, Susan, Christy, and Andrew—will enter formal schooling with well-developed competence in multiliteracy practices and Green's (2012) three dimensions of literacy practices. It is critical for all children to experience a successful and smooth transition from home to school in relation to literacy practices. Contemporary children are growing up with new dispositions toward digital-based texts, which are multimodal and spatially organized so that they can be redesigned by the user and reader (Kress, 2005). However, when contemporary children such as the focal children in my study enter formal schooling, they may encounter traditional dispositions toward text where digital and multimodal competencies are not acknowledged (O'Mara & Laidlaw, 2011). Some children who may, in fact, have highly

developed literacy skills are at risk of being deemed not ready for formal schooling (Laidlaw et al., 2015).

Some children in my study may have less experience with traditional print tools, but will arrive at school with a wealth of digital literacy knowledge, competencies in Green's (1988, 2012) three dimensions of literacy, and, for some, well-established islands of expertise. Understanding and recognizing such "funds of knowledge" (González, Moll, & Amanti, 2005) children possess is important because teachers can scaffold from and expand on what the children have already learned and experienced at home. Early childhood educators can also gain valuable insights into children's operational-technical, cultural-discursive, and critical-reflective literacy practices through understanding the multiliteracy practices students have been engaging in and the digital devices they have been using before they entered school. Understandings of children's home literacy experiences may provide a connection between home and school. Dooley and Gattenhof (2015) suggest that we rethink the use of the engineering metaphor of "bridges" or the notion of "pathways" to make connections between home and school literacy practices, in contrast to a long-established one-directional movement from school to home. I suggest that children's literacy learning is like a fractal pattern, and that this pattern may be a more appropriate metaphor to describe how teachers can connect children's home literacy learning with school literacy practices. I recognize that children's literacy learning is a complex endeavour that may be initially generated by simple literacy activities at home, such as drawing pictures or playing a game on an iPad. If teachers in early childhood settings can provide opportunities and time for children to work recursively from initial home literacy learning, children's literacy development and learning may be able to extend exponentially in a fractal pattern. I propose that parents and educators continue to support and encourage young learners to

travel in and out of their many "literate worlds" (Dooley & Gattenhof, 2015) as border crossers who traverse and navigate multiple literate worlds.

One possible way for young children, such as those in my study, to become literate in their many literate worlds might be to share the digital products they have created at school and home virtually with parents, students, teachers, and larger audiences in different kinds of social semiotic spaces (Gee, 2009). For example, artifacts from children's home literacy or school literacy activities might be shared with classmates and teachers on secure school websites. I imagine multipurpose pathways that children can use to travel between their literate worlds at home and school, envisioning these pathways as looped and recursive, where feedback can continuously advance young children's literacy learning in a fractal-like pattern. In the present literate worlds of young children, where their YouTube videos may go viral, where virtual friends can be made through social networking, and where bedtime stories can be printed picture books or digitized e-books, it is critical for teachers and educational stakeholders to include digital and techno-literacy practices in early childhood curricula. Instead of worrying about dividing our attention between the text on a screen and on a page, navigating between the fear of and hope for digital devices in young children's lives, I suggest that perhaps parents and early childhood educators should direct more attention to a learning environment that is rich, dynamic, and open to mixing and remixing modes and the realms of both digital and print-based practices and tools.

Affordances of Digital Devices and Opportunities for Learning

As I have observed in my study, the affordances of current digital devices can provide young learners opportunities for more complex and accessible engagements within their literacy

practices at home. My observations of young literacy learners suggest that significant literacy learning may also be occurring in interesting and sustained ways long before children begin formal schooling (see also Wong, 2013). Much future potential seems to exist for extending the affordances of the mobile touchscreen devices to young learners' literacy practices in their literate worlds. For example, young children in my study had learned to search using different search engines and built-in speech recognition software (e.g., Siri), and several of the young participants in my study produced videos using different recording apps on their tablets to convey personalized messages to relatives and friends.

My study contributes to the body of research that confirms an uptake of digital and techno-literacy practices that can assist young children to become more powerful and sophisticated users of technologies (Holloway et al., 2013; Marsh, 2014; Marsh & Bishop, 2013; Neumann & Neumann, 2014; Rideout, 2013). More than ever, the challenges for early literacy educators, if not all educators in formal schooling, is to provide educational experiences that challenge and take up the opportunities provided by multiliteracy practices, social media, and popular culture that are being created through the use of various technologies in our world. However, I also recognize that some children in my study were living with parents who have more traditional dispositions toward texts. These children will enter formal education settings with little digital access and experiences. Thus, early childhood educators must navigate a wide range of diversity and address "digital inclusion" concerns. According to Dezuanni, Dooley, Gattenhof, and Knight (2015), digital inclusion can be accomplished when teachers create opportunities for children to engage in digital literacy practices in school; these authors state that "digital inclusion has been identified as one of the keys to overall social inclusion" (p. 4).

My study has confirmed my knowledge and understanding that new mobile touchscreen devices cannot replace active parental involvement and supportive guidance for children at home. I observed throughout my study that the most important factor that influenced children's literacy practices at home was not how many new digital devices each family owned or whether or not these were the latest version; rather, it was how children, along with their parents, used these technologies for specific purposes within their everyday lives and literacy practices, and how the devices became part of children's sociocultural and critical literacy worlds, in addition to offering operational-technical learning opportunities. This study has also contributed to the current knowledge of children's early literacy experiences and learning at home; it will inform early literacy educators, policy makers, and other stakeholders who make decisions and plans for young children's literacy learning in formal schooling.

I entered into my study expecting that I would see how children were working with digital tools and practices as a part of many home literacy activities. However, I did not anticipate how the affordances and accessible nature of particular digital tools would be shifting the balance of knowledge and skill. For example, in working with pencils, crayons, and books, most often the child is positioned as a learner and the parent as having a higher level of skill and knowledge. The affordances of mobile touchscreen devices enabled my young participants to exercise more power and control in their learning than working with traditional technology tools. Several children were observed using the software Siri to search for information and the voice recognition software allows non-writers to use a search engine. And, towards the end of my study, after the data were analyzed and patterns emerged, I was surprised to notice how many of the participating parents were learning about techno-literacy practices alongside their children, and that the role of expert switched back and forth between parents and children frequently

throughout the study. As well, I encountered evidence that, often, the young participants initiated intergenerational communication exchanges; for example, many of the preschool children in this study could make calls to their grandparents independently using Skype or FaceTime. The children in my study were often taking charge of digital technologies in ways I had not anticipated, with the adults sometimes following along. Even in my role as a researcher, I discovered, after my data collection was finished, that several of my young participants had taken control of my iPad and recorded me, researching them.

Directions for Future Research

As I look through my "rear view mirror" (McLuhan, 1967) at my dissertation research to see areas for future research, I suggest that further exploration and examinations of young children's multiliteracy practices across different domains are needed, with a focus on the transitional space between home and the start of formal schooling. Many studies have examined young children's literacy learning at home or in school from different perspectives, but less is known about the ways young children's multiliteracy experiences shift in the transition from home to formal schooling. Throughout my study, I became increasingly aware of the differences between the learning environments of my participating children and those of my former kindergarten classrooms. Based on several informal follow-up interviews with participating children who began formal schooling in 2013, I learned of challenges and struggles some of these children encountered in the transition from home to school. It is my intention to conduct future follow-up research with the participants in my study to examine their experiences of transitioning from home to formal schooling in relation to their multiliteracy practices.

Mobile touchscreen devices were recent arrivals in many children's homes during the November 2012 to March 2013 time period of my study. Research into the impact of these mobile touchscreen devices on early literacy learning is gaining considerable momentum. For example, I have noticed an increasing number of presentations at international and national educational conferences (e.g., The Canadian Society for the Study of Education, The American Educational Research Association, and the annual meeting of the Language and Literacy Researchers of Canada) in the past two years. More research undertaken by literacy researchers is certainly needed to examine this emergent phenomenon to further inform parents, educators, and policy makers on the influences of digital technologies on children's literacy learning at school and in their home lives.

Regional and International Contexts

The opportunity to conduct part of my study in southeastern Australia arose when I was working with my supervisor as a graduate research assistant in an international collaborative research project with an Australian researcher. Since I was going to be in Australia for several months, I thought it would be interesting to include a number of Australian participants, particularly since mobile touchscreen devices such as the iPads, were being increasingly used at the entry level of schooling (the preparatory year) in the city where the collaborative project was located. I was initially expecting more differences than similarities between the participating families in the two countries due to their geographical, cultural, and local climatic differences. However, throughout my study, I noted many similarities in the participating children's engagements with multiliteracy practices. One striking similarity was the children's access to and use of the iPad at home, the apps they used, the videos they watched, the online games they played, and the ways they integrated the iPad as one of their everyday play objects. For example,

many of the young participants in both countries had watched The Wiggles (an Australian children's music group) on television or on a YouTube channel and many often sang and danced along while they watched these music videos. Many participating children in both Canada and Australia had experience with the iPad camera for taking photographs or recording videos. Another similarity among many of the participating parents was that they liked to read their own favourite childhood books to their children (e.g., Dr. Seuss in the traditional print-based format and not in e-book format). In relation to the kinds of literacy engagements and practices, use of digital tools, and even content, I expected the Canadian and Australian children's picture books, shows, and songs to be different due to our cultural differences; however, there were fewer differences between the Canadian and Australian participants and their families than I had anticipated.

Rural and Urban Distinctions

In my study, three families lived in an urban centre and three families lived in a rural community in western Canada; two families lived in an urban centre and two families lived in a rural community in southeastern Australia. The urban participants had more experiences visiting public libraries, museums, bookstores, and entertainment facilities than the participating children who lived in rural communities. The participating families in both Canadian and Australian urban centres also had fast Internet connections, and many of the participating children searched online frequently. However, it was not surprising for me to notice in my study that the participating children who lived in a very small Canadian rural community had less connectivity than their counterparts in the urban centres. Due to the slow network bandwidth in this Canadian rural community, many of the participating children watched videos on their own DVD players rather than downloading movies via the Internet. In two participating families, the children

rented movies from a store or borrowed movies from the local library, and they seldom downloaded movies off the Internet. I observed that many of the participating children living in this Canadian rural community abandoned or avoided downloading videos from the Internet due to the slowness of the bandwidth. I suggest that there may be some relationship between the speed of the Internet connections and the ways children engage with literacy practices at home in this rural Canadian community. More research is needed in this area that focuses on the relationship between connectivity and children's home digital or online literacy practices.

Despite the urban and rural Internet connectivity differences in my study, I noticed that many of the participating children had had similar popular cultural influences and multimedia exposure. For example, many of the participating children, including the boys, had watched at least one of the Disney princess movies, many had heard of or had experiences with online affinity spaces, such as the Club Penguin website, and many had watched someone in their family play Minecraft[12].

Looping Back at My Research Journey

In my study I have illustrated some characteristics of contemporary children's home literacy experiences with technology tools. I observed children using these tools for entertainment and play, communication and meaning making, and information seeking. The families in my study acquired digital devices and technology tools for different purposes, and the children in those families were therefore being introduced and immersed into different sets of cultural practices. As an important site of early literacy learning, these homes provided space,

[12] Minecraft is an online 'sandbox' video game where you dig (mine) and build (craft) different kinds of three-dimensional blocks within a larger world with a variety of terrains and habitats to explore.

time, and opportunities for children to observe and participate in authentic literacy practices, and to develop a sense of social value and gain understanding of the role technologies play in everyday life. The current textual and technological landscape of these homes meant that these children were continually aware of environmental print (both traditional and screen based) and they gained awareness of the many uses of texts. Combined with parental influence and interactions within nested complex systems, I observed rich potential for my young participants' literacy learning at home. For example, as mentioned in Chapter 5, many participating children had different areas of interest which their parents supported thorough providing resources connected to their child's interests and emergent literacy learning.

It is difficult for me to predict what children's future literacy learning will look like in classrooms. However, I anticipate, given the huge gain in usage, as I have documented in this dissertation, that contemporary young children will continue to have increased access to the Internet as more families purchase tablets and smartphones, enabling even the youngest of children to access online sites and resources easily. The impact of mobile touchscreen devices on young children's use of and access to the Internet deserves more attention by early literacy researchers.

As the current trend of mobile digital devices continues to develop exponentially, including an emerging trend toward wearable devices such as iWatch and activity trackers, literacy researchers may be interested in following the kinds of online literacy practices young children may engage in if they are connecting to the Internet through the use of a watch or a bracelet. Will young children be playing games online or communicating with others using wearable technologies?

Smart technologies that can gather data and translate it into intelligence that can inform our daily lives (e.g., our refrigerator informing us that we need more milk, smart digital calendars that remind us of appointments) have been developed and are increasingly available. Will these "smart" technologies enable parents to monitor how their children are using their "smart toys" within their home literacy practices or play? Future research questions I would like to pursue include these:

- How can mobile touchscreen devices be used most effectively to support early literacy learners in classrooms? What specific literacy practices do these digital devices support?
- How can parents and teachers in early childhood education settings work together to best scaffold these digital literacy practices in their literate worlds?
- How can application designers work with educators to create open and fluid creative apps rather than focusing on apps that are "closed" and that present more traditional "drill and skill" learning approaches?
- What pedagogical practices will optimally support children's early multiliteracy practices and learning?

These questions for future research can guide me and other literacy researchers as we continue to observe children's literacy practices at home and in classrooms in a time of exponential shifts in digital literacy.

While these predictions of future directions of early literacy research are interesting to me, beyond questions connected to new tools, I also believe it is important to advocate for early literacy researchers to ensure that young children's voices are central and respected in any future early literacy research. In my study, the participating children generously shared their opinions, ideas, insights, and understandings of home literacy practices with me. These young children

taught me that it is vital for adults to recognize children as capable knowledge seekers and meaning makers, and as individuals who, in many ways, are leading the adults around them in their use of new digital literacy tools.

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Appendix A: Ethics Approval

Notification of Approval

Date:	May 18, 2012
Study ID:	Pro00023337
Principal Investigator:	Suzanna Wong
Study Supervisor:	Linda Laidlaw
Study Title:	Normal.dotm 0 0 1 10 58 University of Alberta 1 1 71 12 .0 0 false 18 pt 18 pt 0 0 false false false An Ecological Inquiry into Young Children's Multiliteracy Practices and their Parents' Perspectives
Approval Expiry Date:	May 17, 2013

	Approval Date	Approved Document
Approved Consent Form:	5/18/2012	Information sheet for participants in research into: An ecological inquiry into young children's multiliteracy practices and their parents' perspective
	5/18/2012	Informed consent for participation in research

Thank you for submitting the above study to the Research Ethics Board 1. Your application has been reviewed and approved on behalf of the committee.

A renewal report must be submitted next year prior to the expiry of this approval if your study still requires ethics approval. If you do not renew on or before the renewal expiry date, you will have to re_submit an ethics application.

Approval by the Research Ethics Board does not encompass authorization to access the staff, students, facilities or resources of local institutions for the purpose of the research.

Sincerely,

Dr. William Dunn
Chair, Research Ethics Board 1

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Appendix B: Recruitment Letter

INFORMATION SHEET FOR PARTICIPANTS

An Ecological Inquiry into Young Children's Multiliteracy Practices and their Parents' Perspectives

You are invited to participate in the above named research study conducted by Suzanna Wong for her PhD program in the Department of Elementary Education at the University of Alberta. This information sheet describes the methods that will be used to gather data for this research project, including benefits and risks to participants of the research.

Purpose of the research

This research aims to document, describe and analyze the ways in which preschool-aged children ages 3 to 5, engage in multiliteracy practices at home, and to examine the attitudes and perspectives of parents toward these multiliteracy practices. I will be collecting data from 5 families beginning May 31, 2012 and continuing until November 30, 2012. This study aims to shed light on preschoolers' literacy practices within their homes, before they are exposed to formal school literacy practices. There is a pressing need for more research on young children's engagement with multiliteracy practices at home, because much of current research focuses on adults' or adolescents' multiliteracy engagement.

Study Procedures

Observations

With your permission, my observations of literacy activities in your home will occur in the morning, afternoon, or evening throughout the research period at your convenience (i.e. flexible scheduling). I will visit one day every other week for one to two hours of observation for a total of 12 visits. I will make field notes; take photographs, and/or videotape during these sessions.

Interviews

During time when I am in your home for observations, I would like to ask your child a series of "play-based" interview activities in an informal conversation format related to his/her experiences of multiliteracy practices at home. Each informal conversation will be approximately 20 minutes in duration, unless your child shows interest in a longer conversation to a maximum of 1 hour. There will be a total of 3 "play-based" interviews in the research period. With your permission I would like to audio-, or video-record these play-based interviews, and I will transcribe these recordings. You will have opportunities to review, modify or withdraw transcripts of your child's interviews. If you are not comfortable with me audio/video recording of your child, I will ask other families for their participation. Your child will be presented with opportunities to use a computer or an iPad and asked to "show and share" with me how she/he would use these technology tools.

I would also like to conduct two individual semi-structured and open-ended interviews with you as parent(s) or primary caregivers at places of your choosing (e.g., home, café, or library). These interviews will be approximately thirty minutes long and I would also like to audio tape them. I will transcribe the recordings and you will have opportunities to review, modify or withdraw transcripts of your interviews. If the interviews are outside of your home, I will provide child-care services (i.e. pay for a babysitter).

Artifacts

With your permission, materials and artifacts of your child's various home literacy practices will be collected (e.g., images of favourite texts, writing and drawing samples, stories, songs and digital forms of these as well).

Focus Group Sessions

You will be invited to attend three focus group sessions involving one or both parents from each of the five families. They will occur once every other month for about two hours at a location mutually agreed upon by everyone. The main purpose of these sessions is for you to share and discuss your observations of your preschoolers' literacy practices at home, and to respond to readings, video clips, newspaper articles or documentaries related to young children's literacy practices. If the focus group sessions are outside of your home, I will provide childcare services (i.e. pay for a babysitter).

Benefits of the Research

I believe that all participants of the research will benefit from participating, in particular, interviews and discussions with parents will focus on understanding the concepts of multiliteracy practices and learning what may support and enhance parenting practices. Children may enjoy working with some "new" literacy tools and practices.

Possible Discomfort or Risks to Participants

It is possible that the focus group sessions may address some topics that may be difficult for some participants. As in all research, participants may choose not to respond to questions or discussion topics they experience as uncomfortable. As an experienced educator and group leader, I will be alert to such situations, and if necessary, end discussions on certain topics if individuals are clearly experiencing difficulty. It is possible that some preschoolers may feel shy

or uncomfortable with the researcher initially due to having a stranger in their homes. As an experienced teacher, I will use age appropriate play activities to observe and interview young children. I will suspend research activities at the signs of young participants' distress (e.g., push away, no eye contact or hiding behind parent).

As adult participants, you have the option to review the transcripts and reasonably request that certain statements or photos not be included in the research analysis. The final date for such request is November 30, 2012.

Confidentiality & Anonymity

Only my supervisor and I will have access to the research data. All hard copies (e.g., field notes, photos) of research data will be stored in a locked filing cabinet and locked storage room or office in the University of Alberta. All digital files of research data will be stored in an encrypted computer with secured password. Original computer files will eventually deleted once copies have been made and stored securely. Data will be stored for 5 years, as required, in a locked file cabinet and password protected computer, after which time it will be destroyed in such a way so as to ensure your privacy.

I will use sound, video and still images in my data dissemination. With your permission I will render individuals unidentifiable by masking or blurring faces and altering voices.

The information you share will be used in my doctoral dissertation and possibly for publications and presentation. Quotations from the transcribed interviews may be used in these documents. You will not be identified in the research dissemination and pseudonyms will be used for all participants.

The research data will be kept confidential and anonymous by the research. It is possible that personal issues could surface during focus group conversations. Focus group participants

will be asked to keep information shared in the focus groups confidential, but as the researcher I cannot guarantee confidentiality, as I don't have control over what others say.

Voluntary Participation & Freedom to Withdraw

Your participation in this study is entirely voluntary. You are free to withdraw from the study at any time by contacting me, and/or may take part in only those aspects of the study that you wish. You will have opportunities to review information that you have shared and modify or withdraw aspects as you wish. The final date for withdrawal of any information you have shared is November 30, 2012, after which time data analysis will begin. The total time commitment for this research study is approximately 20 hours.

CONTACT INFORMATION

Research Investigator:
Suzanna So-Har Wong
Department of Elementary Education
636 Education South
University of Alberta
Edmonton, AB T6G 2G5
suzannaw@ualberta.ca
Phone: 780-492-2107

Supervisor:
Dr. Linda Laidlaw
Department of Elementary Education
535 Education South
University of Alberta
Edmonton, AB T6G 2G5
llaidlaw@ualberta.ca
Phone: 780-492-088

The plan for this study has been reviewed for its adherence to ethical guidelines and approved by Research Ethics Board 1 at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Research Ethics Office at (780) 492-2615.

Appendix C: Consent and Assent Forms for Participants

INFORMED CONSENT FOR PARTICIPATION IN RESEARCH

Research title: An ecological inquiry into young children's multiliteracy practices and their parents' perspectives

Researcher: Suzanna So-Har Wong

This study will focus on young children's multiliteracy practices at home. Home literacy is increasingly diverse and children's early literacy experiences are significantly different from the experiences prior to the digital era. Meaning is made in ways that are more and more multimodal (e.g., oral, visual, audio, gestural, tactile and spatial). Children's multiliteracy practices at home involve multiple forms of literacy (i.e., reading and writing print-based texts, drawing pictures with crayons or digitally, singing songs, dramatic role playing, video gaming, digital storytelling and so on). Within this context, I am interested in documenting, describing and analyzing the ways in which preschoolers engage in multiliteracy practices at home and examining the perspectives of parents toward these multiliteracy practices.

The university and the researcher conducting this inquiry subscribe to the ethical conduct of research and to the protection at all times of the interests, comfort, and safety of subjects. This form and information are given to you for your own protection and full understanding of the procedures, risks and benefits of participation in this study (see attached "Information Sheet for Participants"). Your signature on this form will signify

that you have received and read the information sheet, that you have received adequate opportunity to consider the information in the document, and that you voluntarily agree to participate in the project.

_____Having been asked by Suzanna So-Har Wong, Doctor of Philosophy candidate, Department of Elementary Education, University of Alberta, to participate in a research project, I have read the procedures specified in the document "Information Sheet for Participants" for the above named study.

_____ I understand the procedures to be used in this research project and the personal discomforts and benefits to me in taking part. I also understand that I may withdraw my participation in the research at any time, final date for withdrawal is November 30, 2012, without prejudice. I understand that if I opt out my collected data will be withdrawn and not included in the study. Electronic or other copies of work collected to that point will be withdrawn.

_____I understand that I have the right to privacy, anonymity and confidentiality, though confidentiality of information shared in the focus group cannot be guaranteed. I understand that pseudonyms will be used in any products that may emerge from this research. I understand that all research data will kept secure by the researcher and that I have a right to disclosure of the presence of any apparent or actual conflict of interest on the part of the researcher.

_____I understand that the information I provide may be used in Suzanna So-Har Wong's dissertation thesis. This data may also be used for presentations, academic or professional publications. I will have the opportunities to review the sound/images

Suzanna So-Har Wong wishes to use in her dissertation thesis, presentations, academic or professional publications.

_____I may obtain a copy of the results of this study, upon its completion, by contacting: Suzanna So-Har Wong, University of Alberta (780) 492-2107, email: suzannaw@ualberta.ca

or Dr. Linda Laidlaw (research supervisor), University of Alberta (780-492-0884), email: llaidlaw@ualberta.ca

Additionally, regular opportunities to review and respond to aspects of the study, throughout the project, will be made available to participants.

The plan for this study has been reviewed for its adherence to ethical guidelines and approved by the Research Ethics Board 1 (REB 1) at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact REO at 780-492-2615.

I am fully aware of the nature and extent of my participation in this project as stated above and any possible discomfort. I hereby agree to participate in this project. I acknowledge that I have received a copy of this consent statement.

Name: _____ Address: _____

(Please print)

Signature: _____ Date _____

Phone: _____ Email:

_____

Signature of researcher: (Suzanna So-Har Wong)

_____

CONTACT INFORMATION

Research Investigator:

Suzanna So-Har Wong

Department of Elementary Education

Education

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University of Alberta

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Supervisor:

Dr. Linda Laidlaw

Department of Elementary

535 Education South

University of Alberta

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llaidlaw@ualberta.ca

Phone: 780-492-0884

PARENT PERMISSION FORM FOR A MINOR & CHILD ASSENT FORM

Research Title: *An ecological inquiry into young children's multiliteracy practices and their parents' perspectives.*

CONTACT INFORMATION

Research Investigator:

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Education

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Phone: 780-492-0884

_____I have read the "Information Sheet for Participant" about a study being conducted by ***Suzanna So-Har Wong*** of the Department of Elementary Education at the University of Alberta, under the supervisor of Professor ***Dr. Linda Laidlaw***. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted.

_____I am aware that my child will participate in the study if he/she agrees to participate and I agree to his/her participation.

_____The data collected from my child may include observation field notes, artifacts and materials created by my child (e.g., drawings) during observations, audio- or videotaped and transcribed "play-based" interviews and informal conversations with my child. Information obtained including, with your permission, audio/video materials and photographs with voices altered and faces rendered unidentifiable, may be included in Ms. Wong's thesis dissertation, presentations, and/or publications to come from this study, with the understanding that quotations will be anonymous.

_____I understand that all information gathered on this project will be used for research purposes only and will be considered confidential. I am aware that my permission may be withdrawn at any time prior to November 30, 2012 (by either the parent and/or the child) without penalty by advising the researcher.

_____I am aware that a Research Ethics Board at the University of Alberta has reviewed the plan for this study for its adherence to ethical guidelines. For questions regarding participant rights and ethical conduct of research, contact the Research Ethics Office at (780) 492-2615.

Child's Name: _____

Child's Birth Date: (yyyy/mm/dd) _____ _____ _____

_____I agree to have my child's interviews audio- and video- recorded to ensure accurate recordings of his/her responses.

_____I agree to the use of sound/images in any thesis or publication that comes of this study, with the understanding that the researcher will render individuals unidentifiable by masking or blurring faces and altering voices.

_____I agree to the use of anonymous quotations in any thesis or publication that comes of this study, with the understanding that all quotations will be anonymous.

_____With full knowledge of all the above, I agree of my own free will, to have my child participate in this study.

Name of Parent or Legal Guardian: _____
(Please print)

Signature of Parent or Legal Guardian: _____

CHILD ACKNOWLEDGEMENT (recorded by researcher if verbal assent given)

It is okay with me for my work to be used to help Suzanna Wong and my parents learn more about what I like to do at home (e.g., read, write, sing, play, draw, and video games).

My name:

Draw a happy face if you do not want to print your name:

Appendix D: Interview Questions—Children

Children Interview Questions:

1. What is your favourite thing to do at home? Explain, please.
2. What are your favourite toys?
    - Why do you like them?
    - What types of games do you play with them?
3. Which are your favourite books to read at home?
    - Why do you like them?
    - Who do you share your books with?
    - What stories do you like to read with your mom or dad?
    - What stories do you like to listen to?
    - What stories do you like to tell?
4. What are your favourite movies?
    - Do you watch movies on the television, DVD player, iPad, iPhone, and YouTube?
    - Where do you like to watch your movies?
    - Who do you watch your movies with most of the time?
5. What songs do you like to listen to?
    - Do you listen to your songs on DVD player, iPad, MP3 player, iPod, iPhone or television?
    - Do you have a playlist on your iPad?
6. Do you watch programs on the TV? If yes, what are your favourite programs?

7. What do you like to draw with?
8. What kinds of things do you like to do on a computer or iPad?
9. What are your favourite game apps?
10. What websites do you like?
    - What kinds of thing do you like to do on these websites?
11. Do you use your mom or dad's iPhone? What do you like to do on the smartphone?
12. Do you think you need to know the ABC or know how to read and write to play online games?

Appendix E: Interview Questions—Parents

Parents Interview Questions:

1. What stories do you like to read to your child?
2. What stories does your child share with you?
3. What songs do you sing with your child?
4. How would you describe your child's language development? Please give me some examples.
5. How would you describe your child's literacy development? Please give me some examples.
6. What kinds of activities do you associate with the term "literacy"?
7. What language and literacy activities are most important for your child?
8. What sorts of literacy activities does your child like to do at home?
9. What are some of the technology tools you like to use with your child at home? For example, TV, DVD, tablets, crayons, pencils etc.
10. What are your views and feelings on the role of new technology in your home and your child's lives?
11. What do you think 'literacy' means these days for young children?
12. What do you see as the advantages/disadvantages of providing your child with a computer or other digital technologies?
13. Would you describe yourself as a confident technology user? How often do you use a computer?
14. Would you describe your child as a confident technology user? How often does your child use digital technology?

15. How confident do you feel using new technologies like the iPad and other touchscreen devices?
16. How do you view your role in facilitating the use of new technologies in your home?
17. Do you think new technologies such as iPad activities help your child's literacy development?
18. What are, in your view, the challenges and opportunities of new technologies in your home?

Appendix F: Press Release and Interviews Associated With This Research Study

Pre-schoolers developing 'multiliteracy' skills on touchscreen devices: Researcher suggests we may need to rethink school curriculum

Federation for the Humanities and Social Science Media Release

By Nicola Katz, Communications Manager

Ottawa, May 30, 2015

OTTAWA, May 30, 2015 — A study of preschoolers in Canada and Australia shows that they are exceptionally adept at touchscreen devices—to the point where they have developed a range of 'multiliteracy' skills that include voice, the written word and computer ability.

The researcher who did the study—a former kindergarten and Grade 1 teacher—says the children's new abilities mean we may have to rethink the way we teach the generation that is growing up with portable touchscreen devices.

Suzanna Wong, now a PhD candidate at the University of Alberta, studied the ability of children between the ages of 3 and 5 to use touchscreen computers. She is presenting the result of the study at the 2015 Congress of the Humanities and Social Sciences in Ottawa.

Wong wanted to know what the children were learning before coming to school—and in particular what amount of their learning was coming from 'traditional' methods such as colouring books and crafts, and what amount was digital.

She found children and their parents were mixing old and new methods with ease.

She described the case of a five-year-old boy who had been given a box of Lego with a Star Wars spaceship he could build. His first reaction was to look at the instructions in the box. The instructions were graphic images that contained no words. When he found he didn't understand them, he ran into his bedroom to look in a Lego book he had. Then he grabbed his portable touchscreen computer and went to YouTube. Within minutes he had found a video that showed how to assemble the spaceship. "He put those three sources of information on the floor in front of him and put his spaceship together," says Wong.

"I just didn't think children would be doing that!" she adds. "Children are searching for information online like you and I!"

And she says that they are doing it without knowing how to read—or at least, how to read as it has traditionally been understood. Wong says children understand what icons and colour coding mean, and even if they can't read in a traditional sense, they recognize visually what words like "Download" or "Free" mean.

The devices themselves change the way they approach literacy. Wong describes how one boy took her iPad while she was talking with his mother, found the game Poptropica, and began playing it.

She asked him later how he'd found the game, since he did not know how to spell it. The boy explained that he knew how to search, and he knew the first three letters were P-O-P; when he typed those in, the computer suggested various things, and he recognized Poptropica among the suggestions.

"These children are so digitally literate!" says Wong. "Are schools ready for this? How are we going to plan a curriculum for these very sophisticated computer users?

"My overall impression from my observations of the children is that they are like adults in many ways, because the tools allow them to do things like adults. "They don't really need to know how to spell. With some devices they can even speak into the microphone."

And she adds that the devices are so portable, they are easy for children to use. That, she says, means children are not passive recipients of this technology; they use it to create.

And they did create. Even as she studied them, the children used her own iPad to snap pictures of her. "I'm starting to discover some interesting photos of me in Photo Booth," she says.

You Suzanna Wong will be presenting this research on June 1 at the 2015 Congress for the Humanities and Social Sciences in Ottawa. This presentation is called "Preschoolers' Home Multiliteracy Practices Using Touch Screen Digital Devices" and will take place at 8:30 am on the University of Ottawa campus in the LMX building, room 403.

— 30 —

Young Children and Digital Literacy Practices

91.9 The Bend in Moncton Weekend News
Interviewed by David Heintzman, Moncton, NB, June 6, 2015

Preschoolers' Multiliteracy Practices at Home

CBC Ottawa Morning with Robyn Bresnahan
Interviewed by Robyn Bresnahan, Ottawa, ON, June 1, 2015

Making Smart Choices About Digital Technology and Young Children

Interviewed by Reporting Staff
Early Child Development Mapping Project Newsletter, Summer 2013
Alberta Government, AB
Retrieved from:
http://www.ecmap.ca/images/ECMap_Newsletters/2013/ECMap_Newsletter_Summer2013.pdf

Appendix G: Published Articles

In Appendix G, I present two articles published from my research, in earlier stages of my dissertation work. The first article was published in *Early Childhood Education*, Volume 41, Number 1, 2013; the second article was published in *Language and Literacy*, Volume 17, Issue 2, 2015. Each paper provides additional information that aligns with and attends to aspects of my research questions. These two articles present themes that have emerged from my data analysis which were not discussed in details in my dissertation, thus, I have included them for additional reference.

Hop on Pop,[1] Click on *Poptropica*:[2] Preschoolers' Multiliteracy Practices at Home

Suzanna So-Har Wong

Suzanna So-Har Wong is currently completing her PhD in elementary education at the University of Alberta, with a focus on language and early literacy. Her research interests are early literacy development, new literacies, multiliteracy learning and using current technology tools. She is a passionate global, environmental, outdoors and literacy educator.

Abstract

This article draws on data analyses from an ecological inquiry informed by complexity thinking. It uses Green's (1988) conceptual framework of a three-dimensional (3-D) model. As a participant observer, I documented, described, and analyzed the ways preschool children engage in multiliteracy practices at home. In this article, I present one example from the study to illustrate a preschooler's multiliteracy practices at home. This example suggests that young children can be sophisticated users of current technologies (eg, iPads and laptops); can use a variety of technology tools as part of their everyday play objects; and can develop early literacy skills and knowledge while exploring such objects.

Introduction

This article presents interpretations from an ecological inquiry that describes, documents and analyzes preschoolers' engagement with multiliteracy practices at home. The study examined how such literacy practices might influence the children's home lives. A deeper understanding of young children's home literacy experiences can inform educators, policymakers and other stakeholders who make decisions and plan curricula for young children's literacy learning. The article illustrates some new ways that young children are using current technology tools (eg, laptop computers and mobile touch screen devices) as play objects at home. It highlights the example of one preschooler's home literacy experience with *Poptropica*, an online video game. This was one of many examples observed in this study that illustrated the complexity and interconnectedness of preschoolers' literacy learning.

This study took place in two urban and two rural centres in western Canada and southwestern Australia. The example presented here addresses the question, In what literacy practices are preschool children engaging in their home environment?

Theoretical Framework

Complexity theory provides the theoretical frame for this study; it recognizes literacy learning as a nonlinear, interconnected and recursive process. Complexity theory also recognizes systems such as social systems, including families, as adaptive complex learning systems (Davis and Sumara 2008; Doll 2012; Waldrop 1992). Davis (2004) notes that, unlike analytical science, which focuses on a simple cause-and-effect model and has expectations of linear predictability and certainty, complexity theory is more interested in nonlinear, uncertain, interconnected, emergent, self-organizing, adaptive

[1]Dr Seuss. 1963. *Hop on Pop* is a children's picture book. It was published as part of the Random House Beginner Books series.

[2]*Poptropica* is an online, role-playing game designed for children ages 5 to 15. Players can go to different islands, compete in multiplayer games and communicate with each other (www.poptropica.com).

complex systems. Organisms that dynamically connect to and influence their environments and are influenced, in turn, by their environments can be understood as "complex" (Morrison 2002). My study considers the preschooler as an organism that is inherently connected with and influenced by his or her home environment and is often influenced by family members and play objects (eg, toys, books, technology tools) at home. I use the term *complexity thinking* to represent the sensibilities of complexity theory because, as Richardson and Cilliers (2001) suggest, complexity thinking is "a way of thinking and acting to understand our complex universe" (p 160).

Complexity in Educational Research

Many scholars and researchers in the humanities (eg, anthropology, sociology) and, more recently, education have adopted complexity thinking. From an educational perspective, *complexity* refers to conditions or phenomena in our classrooms that are too complex and intertwined to comprehend in simple linear ways (Davis and Sumara 2006; Fenwick, Edwards and Sawchuk 2011; Jörg, Davis and Nickmans 2007; Laidlaw 2005; Morrison 2006). Complexity thinking can be used to inform educators about the possible formation and transformation of collective intelligence in a classroom (Davis, Sumara and Luce-Kapler 2008). For example, the combined problem-solving efforts of a group of students may provide insights beyond what an individual student could do on his or her own. With respect to a family, while the family members (eg, siblings, parents, grandparents) are important, it is how these family members are interconnected with and dependent on each other that constitutes the family system. Morrison (2002) notes that "a central pillar of complexity theory is self-organization; it contains several features: adaptability, open systems, learning, feedback, communication, and emergence" (p 15). Families are self-organized and emergent systems.

In educational research, complex adaptive systems can be considered learning systems (Davis 2004). A learning system may be made up of human beings—in particular, a class of students and teacher(s) may form such an entity (Davis and Sumara 2008). A complex adaptive system is a collection of interacting parts that act together to bring forward organized behaviours in the system as a whole. In my study, the "learning systems" consist of young children, parents, siblings, playmates, neighbours and extended family members. Play objects, technology tools and resources (eg, books, DVD players, toys) available to the children at home are included in this learning system.

Methodology

Design

This was a one-year ecological study to examine preschool children's literacy practices in their families. Observations, documentation and artifacts related to children's multiliteracy practices were collected in children's homes and in their typical community environments (eg, local beaches, museums, libraries, playgrounds). According to Pahl and Rowsell (2012), an ecological approach enables literacy researchers to consider the home and school as "interconnected systems" (p 21). Neuman and Celano (2001) argue that literacy learning and development cannot be separated from the "individual's social environment, the ecological niche" (p 8). As a participant observer gathering data in children's home environments, I could observe naturally occurring multiliteracy practices. Clark (2011) notes that

> Observation allows us to learn about children too young to express themselves verbally, including their interplay with parents or each other. Observation has led scholars to venture outside the laboratory into the naturalistic domain of children's daily lives where they meet children on their own turf. (p 42)

Data were analyzed with the understanding that all data collected were affected by my presence and my participation.

Participants

Participants in the study met the following criteria:

a) they were children from families with children ages three to five,
b) the children had not begun formal schooling; that is, Canadian kindergarten or the Australian preparatory year, and
c) English was the primary language spoken at home.

The participants included ten families from diverse backgrounds, including a total of 11 children.

Procedure

Data Collection

Data were collected through in-home observations as well as interviews and focus group discussions with parents of participant children. Observations were spread over several months (nine months for Canadian preschoolers and three months for Australian preschoolers). Observations were scheduled to fit the children's availability and the children's willingness to participate. The total amount of observation time per family ranged from

10 to 40 hours. Some interviews and focus-group discussions with parents were conducted separately from their children.

I assumed a role of participant observer in the children's homes, joined in games/play activities when invited, interfered as little as possible in the everyday activities of the families and assumed an unobtrusive position. I did not initiate any literacy events; however, my field notebook and pen in hand or my iPad recording occasionally initiated requests from the children for some type of literacy practice. During observations, I noted all events of children's literacy practices, including print-based literacy, digital literacy and multiliteracies.

According to Honan (2012), "interviews as a technique for data collection have become a commonplace (almost ubiquitous) component of educational research using qualitative methods" (p 87). She cautions education researchers to remember the danger of the imbalanced power between the researcher and participants. Keeping this warning in mind, all the children's interviews were conducted during informal playtime; some were audio- or video-recorded and transcribed and some were recorded in my field notes.

Hop on Pop, Click on *Poptropica*

The following two vignettes illustrate and exemplify the complex interconnectedness and emergent learning processes exhibited by the preschoolers in the study. Vignette 1 describes a five-year-old who is a sophisticated technology user as he engages in learning literacy by playing an online video game.

Vignette 1—New Textual Landscapes on Multiple Screens

Tim[3] *is playing an online video game on his father's laptop; his younger twin sisters are playing a tea party game using a mobile touch screen table app (Toca Boca Tea Party) and their mother is checking e-mail on her smart phone. The children's conversations are mostly about the games they are playing.* (Field notes July 2012)

This example demonstrates the extensive presence of new technology tools, media and modes in contemporary preschoolers' home lives. O'Mara and Laidlaw (2011) note that "Our children have had a very different upbringing in terms of their relationships with screen and text to those of previous generations" (p 156). Tim and his siblings had opportunity, time and space to explore new technology tools, multimedia and multimodality at home and often showed strong attachments to them. The use of digital technologies is rapidly becoming a reality in many children's homes, and mobile touch screen devices mark a turning point in leisure activities for many preschoolers (Hill 2010; Honan 2012; Marsh 2011; O'Mara and Laidlaw 2011). According to Carrington (2005),

> If we accept that changes in communications are embedded in larger shifts around technology, social structure, and culture then there can be little doubt that there are implications for young children and, consequently, for those who are charged with their education. (p 13)

Educational researchers (Hill 2010; Honan 2012; Marsh 2011) seem to confirm that young children are experiencing diverse literacy practices at home and that digital technologies play an important role in some children's lives.

Vignette 2—Reading *Hop on Pop* and Playing *Poptropica*

*Tim invites me to play an online game with him. Quickly, he tells me the name of the game, "*Poptropica*." I am puzzled; it is an unfamiliar word to me.*

"Could you please say it again?" I ask.

"P-O-P," he replies, enunciating each letter clearly. "P-O-P!" He repeats the letters slowly for me. "Like my favourite book. I told you! Like Dr Seuss's Hop on Pop*." He reaches for my laptop, keys in* P-O-P *and recognizes* Poptropica *within the list of websites that begin with* pop. Poptropica *appears first on the list. Tim clicks on* Poptropica *and says, "There, let's play!"*

"How do you know that is Poptropica*?" I inquire.*

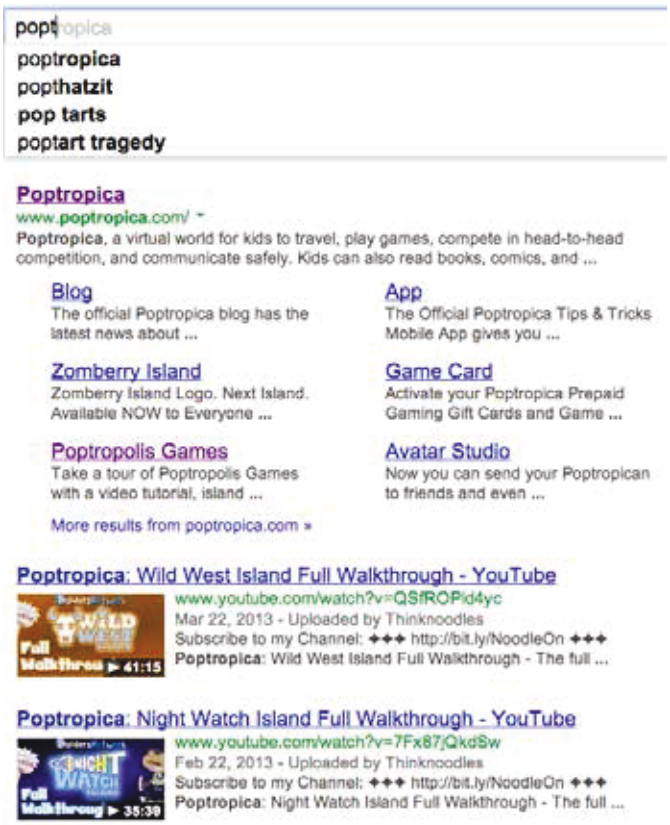
"I just know!" he sighs. "See, it's purple and I played it already today," said Tim.

As vignette 2 illustrates, Tim's literacy experience and knowledge of search practices on the Internet scaffold his early literacy skills. He connects his digital literacy learning with print-based literacy learning in complex ways and makes intertextual connections among different texts (eg, the picture book and the game vocabulary).

Tim used the technology tools available in his home for entertainment, communication and play. Through his interactions with such tools he was engaged in new literacy practices and learning new literacies. He watched his favourite movies on YouTube, sent e-mail to his relatives with his

[3]Pseudonym.

Figure 1. Search engine word prompt of *Poptropica*



mother's help, and played online games with his "Poptropica friends" and sometimes, remotely, with his father at work. Tim was not yet a conventionally fluent reader and writer—he could not spell or write sentences, but by connecting his online and offline literacy experiences, he appeared to understand print concepts. For example, he clearly understood the word *pop* from reading Dr Seuss's *Hop on Pop* (1963). Then he connected this printed text background experience and knowledge to *Poptropica* as part of his digital literacy practice. This data observation illustrates how Tim, as a typical contemporary child, experienced digital literacy practices as an embedded part of his daily life and used digital tools as play objects in sophisticated and complex ways. From a complexity-thinking perspective, Tim's literacy learning insight can be viewed as emergent and interconnected

During my observations of Tim in this study, I was also able to witness Tim's understanding of literacy practices in terms of Green's 3-D model of literacy, which incorporates three interlocking and interdependent dimensions: operational-technical, cultural-discursive and critical-reflective dimensions of literacy (Green 1988; 2012). These three dimensions of literacy have no hierarchy—they should be integrated simultaneously. In other words, the 3-D views of literacy function recursively and should be conceptualized as nonlinear and interconnected literacy learning processes with constant changes and complex interactions.

Different Dimensions of Literacy

The *operational-technical* dimension refers to the operating language and technology systems. For example, how adequately and appropriately are children able to read, write and operate technology tools? The *cultural-discursive* dimension focuses on making meaning in different contexts; that is, to know the purpose of a particular text requires understanding relevant elements of the culture. The *critical-reflective* dimension refers to how well children are evaluating and reconstructing meanings in texts.

Operational-Technical View of Literacy

Green (1988; 2012) emphasizes that literacy learning occurs as people participate in the social and cultural practices of making meaning for real purpose. In vignette 2, Tim demonstrated an understanding of the operational-technical aspect of literacy practices within online video games. Fundamentally, the operational-technical aspects address the how-to of literacy. Tim knew how to operate the laptop computer and a search engine, recognized the functions of the word prompt and recognition features of a search engine, identified several letters of the alphabet (ie, *p-o-p*) and appeared to read the environmental-screen text of *Poptropica*. In addition, he connected his previous literacy experience of reading *Hop on Pop* (Dr Seuss 1963) to his online reading of *Poptropica*. The interconnectedness of these online and offline literacy experiences contributes importantly to the development of early language and literacy skills (Pahl and Rowsell 2012).

Tim (vignette 2) purposely selected *Poptropica* as one of the "best games" for me to play with him as a new *Poptropica* player because it was easy to navigate and understand. Later, when Tim and I played *Poptropica* and talked about this game, it was clear that Tim understood the appropriate cultural practices of an online video-game community. He explained that bad behaviour on *Poptropica* was not acceptable. He also understood that my avatar's gender did not need to reflect my real-life gender, that helping the other *Poptropica* friends was good social practice and that declaring my actual age online was not necessary. Tim's

statements and behaviour demonstrated his cultural and critical understanding of playing an online game. Tim provided examples of Green's (1988; 2012) operational-technical, cultural, and critical dimensions while playing a *Poptropica* game with me.

Conclusion and Implications

Successful early literacy learning is not simply a matter of acquiring knowledge from experts (eg, teachers or parents) in linear steps. Literacy learning involves being able to learn from multiple interconnected aspects of literacy through multiple textual landscapes. Green (1988; 2012) provides a model to help educational researchers understand the multiple aspects of literacy practices and learning processes. As Tim's examples in this article illustrate, literacy learning processes are complex and interconnected and do not occur in linear or predictable ways.

New digital technologies have placed early childhood literacy at the crossroads of a "tectonic shift" (Honan 2009). The influence of new digital technologies on young children's lives makes it difficult to predict where technology will lead them as they continue in literate lives.

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Mobile Digital Devices and Preschoolers' Home Multiliteracy Practices

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Abstract

The increased use of digital devices such as touchscreen tablets in the home for work, communication, entertainment, and information searching makes them naturally attractive to toddlers and preschoolers who learn to communicate by observing and interacting with parents and older siblings. This paper presents one of the major findings from a study in Canada and Australia that examined preschoolers' (ages 3 to 5) home multiliteracy practices. By focusing on data from one of the participants in this study, this paper discusses how the use of iPad engages children in multimodal literacy practices, motivates literacy learning and provides opportunities for independent exploration and creation. This study is informed by complexity science and the data collected were analyzed using Green's (1988, 2012) three-dimensional model of literacy. The findings shed light on technology's evolving influence on society and contribute to insights in preschoolers' home literacy practices.

"*We shape our technologies and thereafter they shape us.*" (McLuhan, 1964)

This paper presents the findings of one part of a yearlong qualitative study in western Canada and southern Australia that examined preschoolers' (3–5 years old) multiliteracy practices at home. This research was motivated by a belief that current literacy and communication practices are increasingly multimodal, employing images, music, writing, gesture, and speech. Research on contemporary multimodality (Jewitt, 2006; Jewitt & Kress, 2003; Kress, 1997; Rowsell, 2013) suggests that the advancement of digital technologies "enable image, sound, and movement to enter the communicational landscape in new and significant ways" (Jewitt, 2009, p. 18). The new digital technologies with touch screen sensitivity and a variety of applications (apps) impact the ways children engage with multiliteracy practices at home. Young children use these new digital devices to communicate, learn, and to participate in and make sense of the world they live in (Marsh, 2011). In this study, the term "*multiliteracy*" refers to the New London Group's (1996) redefinition of texts and practices in their seminal document "A Pedagogy of Multiliteracies: Designing Social Future." Multiliteracies encompass multiple ways of meaning making and communicating, including visual, audio, spatial, behavioural, and gestural modes. Multimodal texts include the body-as-text (New London Group, 1996, p. 64); preschoolers' bodies, therefore, are recognized as sign generating systems that enhance communication (Leander & Boldt, 2012). The New London Group (1996) advocated a change of literacy perspective from the passive consumption of texts to the "understanding and enacting of literacy practices" (Leander & Boldt, 2012, p. 2). Recent multiliteracy pedagogies (Cope & Kalantzis, 2000, 2009; New London Group, 1996; Rowsell, 2013) can help us understand literacy as a dynamic

and complex repertoire of social practices that help young children to participate in their everyday lives. Multiliteracies recognize digital technologies and other modalities (e.g. music, dance, visual representations) as valuable tools to support children's knowledge construction and meaning making (Rowsell, 2013). Here the term "*multiliteracy practices*" refers to children's reading and writing using printed and/or digital texts, viewing images, presenting ideas visually and orally, and the cultural ways children interact with literacy. Multiliteracy practices enable children to read and interpret texts that are mediated by multimodal and multimedia communicational tools.

Digital Devices in Preschoolers' Lives

Mobile touchscreen devices (e.g., iPads) provide opportunities for young children to engage with digital technologies in ways that previously were not possible. These digital technology tools enable young children to search the Internet for images, songs, and videos, and create digital pictures, audio recordings, video recordings, and other multimedia that can be uploaded and published in online platforms (Kucirkova, Messer, & Sheehy, 2013; Plowman, Stevenson, Stephen, & McPake, 2012). However, as Kucirkova et al. (2013) note, "a range of 'older' technologies, including audio-recorder, picture-camera, drawing pad, and an on-screen keyboard" (p. 115) have merged into one multifunctional and portable tool that enables young children who cannot yet read conventional print-based text to independently produce sophisticated digital texts (Lynch & Redpath, 2014). Many contemporary preschoolers have access to these new digital devices. This has major implications for children's overall literacy development (Neumann & Neumann, 2014), as their resources for learning and meaning making now include traditional print-based texts and "techno-literacy" (Marsh, 2004).

Digital Devices and Early Literacy

Studies of young children's use of digital technologies in the home confirm that young children engage in a wide range of digital literacy practices (Burke & Marsh, 2013; Carrington & Marsh, 2008; Flewitt, Messer, & Kucirkova, 2014; Marsh, 2005; O'Mara & Laidlaw, 2011; Pahl & Rowsell, 2012). Digital technologies have become increasingly portable, affordable, and accessible to many young children at home in affluent societies such as Canada and Australia (Lynch & Redpath, 2014; Rowsell, Saudelli, Scott, & Bishop, 2013) and are increasingly available to children in developing countries (United Nations Educational Scientific and Cultural Organization, 2014). The portability of these new mobile touchscreen devices allows children to use them everywhere [1] in their homes and communities. It is hardly surprising that many preschoolers are eager to master the use of these new technologies (Rideout, 2011).

Today, children under the age of nine years enjoy online activities; like adults, they watch videos, play games, search for information, and socialize in virtual worlds (Holloway, Green, & Livingston, 2013). According to the Common Sense Media (2013) study of children in the United States, three-quarters (75%) of the children (ages 0 to 8) studied had access to mobile digital devices such as tablets and smartphones at home (p. 9). A similar study conducted by Holloway et al. (2013) found an emerging trend in

[1] There are many iPad holders in the market for toddlers (e.g., iPad holders for baby car seat, toddler's toilet seat, and high chair).

many European countries of toddlers and preschoolers using Internet connected devices such as tablets and smartphones for entertainment and communication (p. 4). As new digital devices continue to become an integral part of everyday life, young children increasingly incorporate them in their daily literacy practices by using them as play objects at home (Burke & Marsh, 2013; Verenikina & Kervin, 2011).

A growing body of research reveals that many children experience a digital technologies environment from a young age (Flewitt et al., 2014; Lynch & Redpath, 2012; Marsh, 2011; Plowman et al., 2012; Rowsell et al., 2013). Many preschoolers are surrounded in their home environment by multimodal communication tools and digital media, including laptop computers, handheld and console video game players, and mobile touch screen devices such as smartphones and tablets (Common Sense Media, 2013; Holloway et al., 2013). This study examines the impact on young children's multiliteracy practices with digital devices, in particular the iPad, used in the home.

Theoretical Orientation

This study was informed by complexity thinking perspective on learning (Davis & Sumara, 2008; Doll, 1993). Complexity thinking understands the world as an integrated whole, fundamentally interdependent, interconnected, and intertwined, rather than as an isolated and disconnected collection of small parts (Bateson, 1979; Capra, 1996; Maturana & Varela, 1992). Therefore, complex phenomena—including young children's multiliteracy practices, their learning at home, and their interactions and relationships—needed to be viewed holistically and cannot be broken down into small parts. As Fenwick, Edwards, and Sawchuk (2011) remind us, in educational application of complexity thinking, "attention is drawn to the relationships among learners and environment" (p. 28). The interconnectedness of children and their home learning environment is a critical component of their complex learning systems.

Complexity thinking focuses on the study of complex systems that are pervasive in the world. Examples of complex systems are large-scale economies, climates, ecosystems, brains and living organisms. Complex thinking suggests that living organisms—human and cultural systems such as neighbourhood, schools, classrooms, families, and individual learners—might be better understood as adaptive, emergent, dynamic, and self-organizing (Doll, 1993; Waldrop, 1992). A learner in this case is a child; he or she is recognized as a complex learning system. A child as a complex learning system has the ability to self-organize and adapt within his or her learning environment. Self-organization within a complex system is sustained through a variety of feedback loops (Capra, 1996). "A "feedback loop" is a continuous and recursive process that takes part of a system's output and feeds it back as input" (Davis, Sumara, & Luce-Kapler, 2008, p. 204). An example of a feedback is when parents communicate greater confidence in their child's abilities and selects literacy events and practices that are challenging but do-able. The parents' expectations support the child's willingness to accept the challenge independently. In turn, this feedback loop prompts the child to gain and internalize confidence that is first expressed by his or her parents. With the parents' feedback, young children's literacy development emerges from such recursive learning process. According to Thelen and Smith (1998), children's learning and development can be understood as "the multiple, mutual, and continuous interaction of all the levels of the developing system, from the molecular to the cultural" (p. 258).

Complexity thinking provides theoretical principles for understanding the complex interrelations of children's early literacy learning at home. Recently, digital networks and technologies are frequently cited as examples of complexity thinking (Fenwick, Edwards, & Sawchuk, 2011; Johnson, 1997, 2001, 2010); it also has been used to develop new practices and to support innovation in technology development (Johnson, 2010). Therefore, complexity thinking offers "new language" (Rorty, 1999) for thinking about the early literacy learning and multiliteracy practices of young children living in the "iWorld" (O'Mara & Laidlaw, 2011).

Conceptual Framework

For this study, Green's (1988, 2012) three-dimensional (3D) model of literacy was used as an analytical tool to interpret the data at a microlevel and macrolevel. The model is rooted in many of the principles of complexity thinking: the learning processes of literacy are interconnected, nonlinear, dynamic, and recursive. Green (1988, 2012) suggested that literacy educators should view literacy holistically in terms of three interlocked dimensions: the *operational,* the *cultural,* and the *critical.* The three dimensions are not ordered or hierarchal, but work interdependently and should be integrated simultaneously to engage learners in purposeful literacy practices. They function recursively and can be conceptualized as nonlinear learning systems where constant changes and complex interactions are occurring (Green, 2012). With the changing demands for new literacies and technology learning, young children need to become proficient in nonlinear learning, constant change, and complex interactions of literacy and technology; for example, the reading path on a mobile touchscreen device is typically multidimensional and multimodal (Simpson, Walsh, & Rowsell, 2013). Durrant and Green (2000) coined the term "l(IT)teracy" to highlight the importance of information technology (IT) in everyday literacy practices and to emphasize the merging of literacy and IT. Seeing literacy as multidimensional, with complex relationships, I could make new kinds of connections while examining the children's multiliteracy practices at home.

In the *operational* dimension, a child's "competency with regard to the language system" (Green, 2012, p. 5) is important. For instance, a participating preschooler's video production is an example of a child's competency with written language and visual meaning making in this dimension. The *cultural* dimension requires competency in the "meaning aspect of literacy" and requires competency with the meaning system in the culture (Green, 2012, p. 5). For example, children in my study playing online video games with virtual friends, communicating with grandparents in another city with Skype,[2] or drawing pictures for family celebrations are engaging in the cultural dimension of literacy. In Green's *critical* dimension of literacy, the social construction of knowledge is achieved. To participate productively and effectively in social practices, young children must be socialized into the culture. In a digital learning environment, a child must be able to assess and critically evaluate software, websites, and other technology resources (Green & Beavis, 2012). Green's 3D model of literacy pays attention to literacy and technology together, thus it provides a generative conceptual

[2] Skype is a software application that allows voice communication and video chat over the Internet.

framework for researching young children's multiliteracy practices and recognizing the important role of digital cultural in young children's daily lives at home. In addition to its value as a framework for conceptualising children's home literacy practices, the model also "provides a lens for understanding digital texts and socially situated digital cultural practices in terms of literacy and technology" (Beavis, 2012, p. 128).

Methodology

This study was designed as a basic qualitative study (Merriam, 2009) using an ecological approach. This form of research is especially effective in studying the contexts in which young children live, learn, and grow at home (Naughton, Rolfe, & Siraj-Blatchford, 2010). It is also one of the best ways in obtaining data about children's everyday activities and interactions within their natural environment (Hogan & Greene, 2005; Naughton, Rolfe, & Siraj-Blatchford, 2010). This study is grounded in the assumptions that reality is multilayered and complex. Many literacy events are not reducible to simple interpretation; therefore "thick descriptions" (Denzin & Lincoln, 2005) are critical to represent children's complex multiliteracy practices at home. The methodology used in this study reflects my acknowledgement of the importance of incorporating the voices of young children, my complexity thinking perspective, my understanding of literacy practices in terms of thinking and cognition (Green, 2012), and literacy as social practices (Gee, 1996).

This study was conducted in seven homes in western Canada and four homes in southern Australia. The participants' homes contained a wide range of technology tools, including televisions, games consoles, desktop and laptop computers, DVD players, digital camera, and mobile touchscreen devices (such as tablets and smartphones), and every household had access to the Internet. The homes also had "traditional" literacy tools, like pencils and paper, crayons, chalks, paints, arts and craft materials and so on.

Participants

This study involved six Canadian and four Australian families whose 3–5 year-old children had not yet started formal schooling (i.e., Canadian kindergarten or Australian preparatory school) at the time of the study. The families were from diverse family backgrounds; five families were located in rural communities and five in urban centres. The families answered the recruitment posters in their communities or were recommended by families already recruited for the study. English was the primary language spoken at home, although in two Canadian families, several of the children were bilingual (i.e., they spoke French and English). Participant families included multigenerational, single-parent, and divorced-parent family compositions.

Data Collection and Analysis

During the initial visits to the potential participants' homes, I informally interviewed the families to determine if they met the criteria and the time demands for this study; that the young children had the oral language development and skills to communicate with me; and that the parents understood the importance of their presence during the home observations (i.e., that they could not leave the house and use my presence as a childcare opportunity). To indicate informed consent and assent, the parents signed both forms and returned them to me via email or I picked them up in-person. I

asked many of the participating children to draw happy faces on the assent forms to indicate their willingness to participate in the study. My rapport with the children was strengthened by several informal visits and play-dates prior to my data collection. I gradually gained the trust of the children and families.

Many of the participating children took part in activities outside of their homes, including visits to museums or libraries, lessons (i.e., swimming, gymnastics, and circus acts), and invitations to play-dates with friends. To gain maximum access to the participants' homes, I implemented a flexible research schedule expressing a willingness to respond to last minute invitations to conduct interviews or observations in different times and places. My observations and interviews occurred at various times throughout the day, on average, once a week for one to four hours per observation; sometimes, the parents, children, and I prearranged the times. Some of the observations took place outside of the families' homes (e.g., at libraries, in neighbourhood playgrounds, community centres, museums), because the parents and children occasionally made unexpected decisions, or their decisions were made during the children's playtime.

The data collection tools used in this study were participant observations, informal interviews, field notes, and conversations with the children, as these tools were best suited to study young children's literacy practices in their natural home environment (Naughton et al., 2010). I acknowledge that my presence *might* have influenced some of the behaviours of the children and their family members because "observers always have some kind of impact on those they are observing" (Flewitt, 2006, p. 133). Several unexpected challenges emerged throughout the study. For example, during the informal children interviews, some participating parents had a tendency to answer their children's questions for them and occasionally they would interpret or contradict their children's answers. In several families, parent participants often inquired about their children's answers to my interview questions (e.g., "What did my son or daughter say about bedtime stories?"). These incidents became an ethical issue for me as a researcher. To respect my young participants' privacy, I could not reveal their answers to their parents. To avoid tensions with these parents, I learned to conduct informal interviews with the young participants when their parents were in another room and reassured the young participants that they did not have to answer all my interview questions. Another challenge was how to simultaneously video record, make field notes, participate in and observe the children's literacy practices, and listen to parents. To capture preschoolers' multiliteracy practices across a wide range of media—computers, television, DVDs, eBooks, picture books, comics, catalogues, magazines, and environmental prints—and document their everyday literacy practices in their natural home environment- I had one stationary video camera on a tripod for wide-angle recordings, one hand-held camera for close up recordings, and an audio recorder on a table for general voice recordings.

Video and audio recordings of home observations and interviews were transcribed, and field notes were juxtaposed with the video- and audio-recordings' transcripts. The raw data was coded after the transcripts and field notes were read several times. After the initial coding process, themes were created and critically, systematically and comparatively analyzed according to the research questions and issues identified in the literature. In this paper, I selected one exemplar in the form of a detailed research vignette to convey the essence of several themes that emerged in this study.

Parental Dispositions Toward Technologies

Similar to the findings of Stephen, McPake, Plowman et al. (2008), I found that access to and use of technology tools at home was not dependent on socioeconomic status, family circumstances, or family composition; the technology tools that were available for children depended primarily on their parents' attitudes toward, dispositions, and interactions with technology tools at home. During the initial data analysis, the families were categorized into three groups:

- "New digital disposition" families and early adaptors of new technology tools: these were families that tended to have a wide range of technology tools for their children to use at home, with children and adults having their own digital devices. Typically, the parents in this group were enthusiastic and competent users of technology; they are often relaxed and comfortable about their children's independent use of technology tools at home and seldom monitor their children's screen time. Parents in this group tended to be opened to a "disorganized" or "messy" household, that is, their children did not have to "clean up" their games, toys, or dress-up clothes daily. For instance, a child could leave his Lego construction intact or incomplete puzzles and return to them later. Figure 1 shows a family's technology and traditional literacy tools in this category.

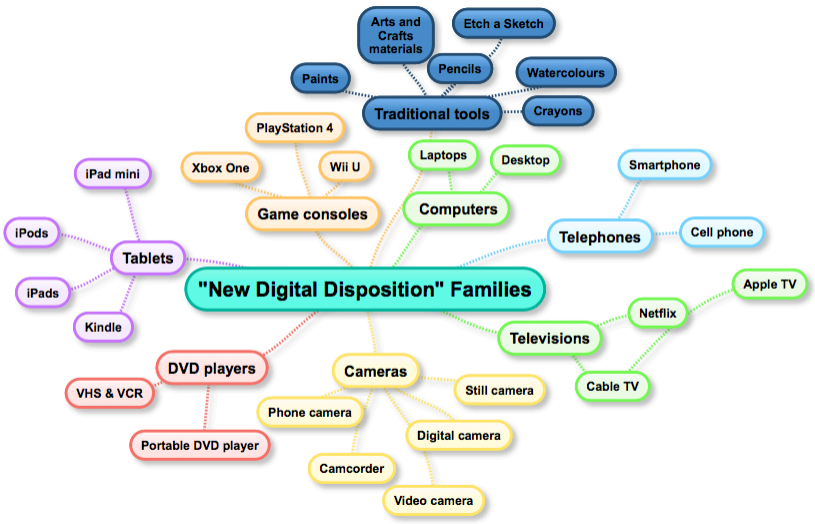

Figure 1. Technology tools available in a typical "new digital disposition" family.

- "New and old dispositions" families with mixed values of "traditional" literacy tools and new digital tools: these families tended to have a desktop and/or laptop computer, a television, a tablet, and/or a smartphone in the house for the whole family to use and share. The parents in this group sometimes supervised their children's use of technology tools closely and monitored their children's screen time at home. They often encouraged their children to explore both the traditional literacy tools and the new digital tools. The families in this group also had a large volume of traditional print-based books along with their digital reading and viewing materials at home.

- "Traditional literacy disposition and willing to explore with new digital tools" families: these families tended to have one computer, a television, and a smartphone in the home, but children were not permitted to use them freely without parental supervision. The parents' attitudes toward technology tended to be guarded and parents often worried about the safety of their children using the Internet, however, they were willing to explore the affordances of new digital devices with their children together. Traditional print-based text and books were highly valued by parents in these homes.

Themes that emerged from each group were categorized and analyzed using Green's (1988, 2012) 3D literacy model and through a complexity thinking lens (Davis & Sumara, 2008). One theme that emerged was that digital devices are impacting the ways preschoolers engage with multiliteracy practices at home. In the next section I present an example drawn from data gathered in this study to illustrate the ways a preschooler used digital devices in his daily home multiliteracy practices.

The Participant

Andrew (pseudonym) is a 5-year-old who lives with his parents and a 7-year-old sister in an urban centre of southern Australia. Andrew's parents are competent users of current digital devices; his father works in the information communication technology sector and his mother relies on technologies at work and at home. Each member of Andrew's household has an iPad with a secured password. Andrew is not yet literate in the traditional sense (i.e., he cannot read text or print his name with a pencil) but he can key in the letters of his name on the iPad and uses his name as an iPad password, and he can spell and recognize the word Lego™[3] in the search engines.

In Andrew's bedroom, there are books of many different genres (e.g. picture books, information books on Lego, comics, magazines, and junior novels), toys ranging from a lightsaber[4] to Lego sets, dress-up clothes, musical instruments (e.g., drums, a guitar) and an iPad, which usually travels with him throughout the house. In the family's living room, there is a large bag full of Lego bricks and several elaborate Lego structures strewn on the floor. Andrew often takes photos of Lego structures with his iPad before he disassembles them. Lego structures built by Andrew, his sister, and their father are used to decorate the home (e.g., a Christmas manger created out of Lego bricks is sitting under the Christmas tree). Toys, digital objects such as his iPad, books, and musical instruments help Andrew make sense of the world because "literacy is embedded in 'things,' that is, objects, artifacts, the 'stuff' of life" (Pahl & Rowsell, 2014, p. 164). Andrew took his iPad to his childcare centre to video record his play activities with his playmates, but the childcare worker disallowed further use of the iPad in the childcare centre. The following excerpt reveals how the iPad contributes to Andrew's motivation and independent learning in playful ways at home.

[3] Lego is a line of construction toys that consist of colourful interlocking plastic bricks.
[4] A lightsaber is a fictional energy weapon featured in the Star Wars universe.

Vignette 1 Multimedia, Multimodal Devices and Motivation to Learn

Andrew is sitting in the living room surrounded by a brand new Lego building set[5]. He opens the Lego set and begins to construct a Star Wars spaceship.

Andrew: *This is what it looks like.* (He points to the picture on the box. After a few minutes, his facial expression shows frustration.)

Andrew: *What…? Where do these go?* (He points to pieces of Lego bricks and compares his spaceship to the picture on the box. He reaches for the instructions pamphlet that comes with the Lego box and begins to examine the diagrams. With the instruction diagrams open, he tries to connect the Lego bricks together according to the diagram; see Figure 2.)

Andrew: *No! This is not right!* (He puts the "under construction" spaceship on the floor and runs to his bedroom to retrieve a book about Lego.)

Suzanna: *Why are you using that book?*

Andrew: *There's a Starfighter in here. I remember it.* (He flips through the pages of the book.)

Suzanna: *What is a Starfighter?*

Andrew: *A spaceship with retractable landing gear.* (He leaves the printed book page open, reaches for his iPad, scrolls through his YouTube videos playlist, taps on the video review of Starfighter, and begins to watch a video reviewing[6] this new Lego set.)

Suzanna: *Is that a movie on Lego?*

Andrew: *It's a Lego review … it tells me about the Starfighter.* (He pays close attention to the video presenter who appears to be a teenager.)

Suzanna: *Why are you watching it?*

Andrew: *I want to make my own review. He is not very good. My dad can video me with my iPad tonight.*

(Transcript from video recording, January 2013)

In analyzing the preceding vignette, it revealed that Andrew has demonstrated his competency in Green's operational dimension of literacy practices; he has a good understanding of the purposes of various kinds of language and texts (e.g., he uses conventional books, construction diagrams from his Lego sets, and digital texts in overlapping ways), an emerging understanding of conventional orthography (e.g., he can key in the letters of his name as a password, and type Lego in the search engine). Andrew is also competent in the critical dimension of literacy because he could tell me that a Lego reviewer was "not very good." As well, Andrew understands that a Lego reviewer must have some knowledge and expertise of the Lego set being reviewed. This indicates that Andrew is aware of the cultural dimension of literacy practices in the online Lego

[5] The Lego subculture encompasses books, movies, and online games.

[6] The Lego reviews Andrew watches are YouTube videos posted by Lego enthusiasts who share their ideas and opinions about certain Lego products. Users gather information on specific Lego sets by watching these videos.

review community. During this interaction with multimedia and multimodal tools, Andrew has engaged and made meaning within all three dimensions of literacy practices simultaneously.

Figure 2. Watching Lego Reviews critically while constructing a Lego spaceship.

The preceding vignette also illustrated what Kress (2005) refers to as a new disposition to text. Whereas traditional disposition to text is stable, sequential, has linear order, is composed by the writer and interpreted by the reader, the new disposition to text is multimodal, radically unstable, designed by the producer, and redesigned by the reader (p. 3). Contemporary children often must apply the new disposition to text to achieve their goals (O'Mara & Laidlaw, 2011). The iPad enables children to become producers and designers at a very young age. Andrew searches for information using a search engine and analyzes information on YouTube to help him produce a Lego construct. His multiliteracy practices are multilayered and often involved a recursive pattern.

I repeatedly noted that 5-year-old children like Andrew, who had limited traditional reading and writing skills, searched for information online with the assistance of the word prediction or completion feature[7] on a search engine and they appeared to be confident with the results of their Internet searches (Wong, 2013). The new disposition to text seems to be a natural extension of preschoolers' oral language literacy learning practices. The flexibility and responsiveness of digital media offer very young children "hybridized" literacy practices (Marsh, 2011) that combine some of the characteristics of traditional literacy resources with the speed of new technoliteracies. That is, new technology tools afford new ways of working and playing with texts (Durrant & Green, 2000) that are available in print and in digital form. Andrew's iPad clearly impacts his literacy practices, and his literacy development emerges in a recursive pattern.

Vignette 2 – Developing Independence and Confidence

The iPad affords opportunities for independent exploration and creation and can motivate children to learn traditional literacy skills that will enable them to utilize the iPad functionalities. The iPad can enable Andrew's independent attempt to create his own Lego review. He wants to video-record his own Lego review and to post it on YouTube. He asks his father to assist him in this video production by recording the video on a

[7] Word prediction or completion feature provided by many web browsers that predict the word or phrase a user wants to type in without the user actually typing it in completely.

smartphone instead of on his iPad because he recognizes that it will be difficult to video record and demonstrate what his Lego structure can do at the same time. However, there is another reason to use his father's smartphone that he reveals in the following excerpt. He organizes his spaceship construction and mentally prepares the monologue that will be recorded in the video.

Suzanna: *Why are you using your dad's iPhone to record?*
Andrew: *To upload it on YouTube.*
Suzanna: *What about your iPad? You can upload a video with your iPad.*
Andrew: *I am not allowed. I am a kid.*
Suzanna: *Why are you doing a review?*
Andrew: *The reviews are not very good! I want to post my own review because I love Lego. My review is short* (most reviews are under 2 to 3 minutes).
Suzanna: *Who do you think will watch your video?*
Andrew: *Everybody! Some grow-ups watch them too … only good ones.*
Suzanna: *Really?*
Andrew: *Yeah, dad and I watch them all the time!* (He smiles at his dad.)
(Transcript, 2013)

Andrew's father sets up his iPhone on a small tripod and begins to video record his son's Lego review. After several retakes, Andrew is unsatisfied with all of the recordings. He decides to rehearse his monologue some more before he tries again. From his insistence on improving his presentation, Andrew appears to understand the appropriate cultural dimension of literacy practices of the Lego review community on YouTube. He realizes he needs to make sure his review is concise, clear, and shows his expertise with this particular Lego set. The preceding vignette shows that Andrew is also aware of the rules for posting videos on YouTube channels. Andrew's venture into YouTube Lego reviews reveals that children's multiliteracy practices can involve Green's (1988, 2012) three dimensions of literacy practices simultaneously and holistically. His literacy learning and development were expanding in multiple directions and had many interacting components of a complex learning system.

Andrew's complex multiliteracy practices and learning processes matched well with the multiliteracy pedagogies of Cope & Kalantzis (2009) and the New London Group (1996). He used digital technologies and other modalities (e.g., his Lego spaceship as visual representation, body gestures, oral storytelling) to support his construction of knowledge and meaning making (New London Group, 1996). Although Andrew cannot read or write in a traditional sense, he was able to share his experiences, knowledge, and interest to a large audience using his voice, Lego construction, and gesture in a video production (Kress, 1997). His home multiliteracy practices were interconnected and interrelated; they involved a new disposition to texts—embracing the combination of traditional and digital tools, print-based text, and digital text. Today's young children do not have to wait until they become fluent in reading and writing in the traditional sense before they engage in multiliteracy events. Their early experiences with multiliteracies and technologies at home play an important part in their development of literacy skills, communicative and creative competency (Marsh, 2011; Neumann & Neumann, 2014; Pahl, 2006). In Andrew's home learning environment, he interacted with his parents,

sister, toys, books, and online video games; new ideas often emerged within his multiliteracy practices.

Discussion

A growing body of research (Marsh, 2014; Rideout, 2013; Stephen, Stevenson, & Adey, 2013) suggests that young children are incorporating digital devices such as tablets and smartphones in their home literacy practices. New technologies and new forms of literacy practices are wide spread in many children's homes such as Andrew's household. The portability of tablets and their touchscreen responsive interface make them accessible; that encourages young children to explore their own creations and productions with some assistance from parents or older siblings.

The increased use of digital devices in the home for work, communication, entertainment, and information searching makes them naturally attractive to toddlers and preschoolers who learn to communicate by observing and interacting with parents and older siblings. The vignettes presented in this paper depict a shift in the home literacy practices of a contemporary young child who is coming under the influence of new technology tools. In this example, a child's parents intentionally scaffold his early literacy learning and development by encouraging him to engage in multimodal and multimedia activities at home, in addition to providing traditionally dominant print-based text. Furthermore, the online experience taught the child the etiquette expected of a member of an online community.

The study examines the range of multiliteracy practices that young children engage in at home. The combination of technoliteracy and traditional print-based literacy competencies I observed some children developing over the course of the research will be of great value when they start formal schooling. Through complex interactions with multiliteracy practices at home, many of the preschoolers are gaining knowledge in the operational, cultural, and critical dimensions of literacy. I suggest that connections between home and school multiliteracy practices can be strengthened by recognizing that children are learning valuable literacy skills and are gaining knowledge about their world through multimodal tools. These young children will have a wide range of knowledge related to multiliteracy practices when they begin formal schooling. Early childhood educators need to acknowledge, accept, and value the "funds of knowledge" (Moll, Amanti, Neff, & Gonzalá, 2005) these young children bring with them when they enter formal schooling. The insights gained in this study can inform early childhood educators and help them to plan literacy practices that recognize the expanded expertise of modern multiliterate preschoolers. If formal school learning is to build on the experiences and strengths that young children bring to early childhood education settings, then, how can what is happening at home be bridged to school practices using technologies with literacy?

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