Literacy and Complexity: On Using Technology within Emergent Learning Structures with Young Learners:

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This article presents and describes how we have used notions and structures informed by complexity thinking to shape new descriptions and approaches to understanding "new literacy" practices with young learners. Using data from two studies: a two year project working with kindergarten children using drama and digital tools to develop narrative, and the other an observational study of preschooler's multiliteracy practices occurring in their home settings, we explore how notions from complexity can offer innovative frames for teaching and learning and options for thinking about pedagogy differently. Our classroom and home observations of children's developing digital literacy practices suggest that using complexity-informed approaches to technology can include both theoretical orientation and practical possibilities for organizing classroom learning structures.

> …on the iWay to permanent connection…
> We're on, we're all on—it's what life's going to be.
>
> (cited in Stevenson, 2012)

Vignette: A Digitally Connected Contemporary Family

Andrew, a five-year old preschooler, is watching a LEGO 'video review' on his iPad on the kitchen table; his seven-year old sister is playing with a tea party game app on her iPad in her bedroom; his mother is checking work email on her iPad in the living room, and Andrew's father is participating in an online course using his iPad in his office. (Wong, Fieldnotes, 2013)

Contemporary childhood in the "iWorld" is undergoing considerable shifts, as the tools of new media become a part of childhood's everyday objects and materials of play (O'Mara & Laidlaw,

2011). Children exist in a rapidly emerging digital context that demands ever-increasing abilities to utilize and adapt alongside new technological tools and innovations (Knobel & Lankshear, 2010; Marsh, 2011; Plowman, Stevenson, Stephen, & McPake, 2012). As Honan (2012) reminds us, "literacy today is in the midst of tectonic change" and children's literacy practices are shifting and colliding with each other in complex, adaptive, and interconnected ways.

The repertoire of literacy practices needed to engage with contemporary texts continues to increase exponentially, transforming reading and other textual engagements (Coiro, Knobel, Lankshear & Leu, 2008; OECD, 2011). In a changing digital realm, children require a more complex array of textual practices, including traditional print literacy tools and skills, understandings of new digital practices and modes, and the capacity to continually adapt their own forms of reading and communication in response to constantly shifting new forms of texts.

Portable mobile touch screen devices such as smartphones and tablets are increasingly embedded in contemporary childhood experiences and environments. Digital devices such as iPads are also viewed as having great promise by school districts and education stakeholders (e.g. Dezuanni, Dooley, Gattenhof, & Knight, 2015; Government of Alberta, 2011). However, opportunities to use and create digital texts tend to occupy little space within primary grade and early childhood education curricula (Carrington, 2008; Marsh, 2010, 2011; Neumann & Neumann, 2014), as we have witnessed in our Canadian research and teaching contexts. Research in the area of digital technologies and new literacy modes for young learners is beginning to emerge more rapidly, with consistent reports that teachers of young children are particularly reluctant to embrace new textual practices and electronic technologies in the classroom (Burnett, 2009; Black, Korobkova, & Epler, 2014). O'Mara and Laidlaw (2011) suggest that digital devices such as iPads or iPods, as mobile, personal tools may require shifting pedagogical paradigms and working with learners in new ways, rather than taking up an "old wine in new bottles" approach to literacy education (Lankshear & Knobel, 2003), that often occurs when technology is introduced to classrooms. For example, devices such as iPads are sometimes used merely to create a 'flashier' replication of traditional pedagogical forms, used for drill and skill activities, gamified apps, or as electronic worksheets, rather than being used in ways that might engage the affordances of digital literacy tools. Instead, use of mobile touch screen devices could help to provoke more innovative learning approaches and provide children with opportunities to explore and develop new textual practices, where learning is framed as emergent, interconnected, and self-organization is supported.

Viewing the processes of technological change in literacy education through complexity thinking can offer some "spaces of possibility" (Cohen & Stewart, 1994) to allow teachers and students to step beyond top-down (teacher as expert), and instrumental approaches that have tended to structure how technology has been used with literacy learners, in the early years classrooms with which we are familiar. In this article, we present data from two qualitative studies: Wong's doctoral study examining preschool children's literacy practices in their homes and Laidlaw's classroom-based inquiry of four groups of Kindergarten children and their teacher, as they were introduced to iPads in a school setting. Bringing together insights from both studies, we explore how notions from complexity thinking can offer possibilities for

considering and structuring teaching and learning as teachers and learners approach new digital practices.

Changing Literacies

For the purpose of this paper, we are addressing literacy in relation to how instruction is enacted for children in school, and for young learners as they become familiar with the tools, practices and conventions they will bring with them to school. While traditionally, literacy has been defined as learning to read and write, and this aspect is significant, currently, the boundaries and definition are expanding. Literacy at school and at home involves multiple, intersecting dimensions, and following Green (1988), we understand this to involve the operational dimension (learning how to operate the features and tools required to produce text, such as learning to print, how to operate an iPad, follow the directions on an app etc.), the cultural dimension (understanding genre, knowledge about different kinds of texts and their content), and the critical dimension (being able evaluate the quality of texts, messages aimed at readers, awareness of expectations regarding being consumers of text etc.). Importantly, while Green (1988, 2012) addresses these dimensions as categories, they are intertwined. While often literacy instruction in elementary schools focuses on operational skills such as learning how to read and write, these are never separate from the realms of the cultural or the critical, or indeed the larger, nested aspects of literacy in the world(s) beyond those of schools.

Historically, the concept of literacy has never remained entirely stable, with technological changes such as the invention of alphabets, the printing press, new writing forms such as newspapers and novels leading to new literacy practices. Similarly, as digital media have rapidly emerged, a plethora of literacy forms and tools have become a growing part of children's literacy repertoires, something that is now becoming increasingly recognized in more formal institutional structures. For example, the OECD's PISA (Program for International Student Assessment) testing now includes a digital reading assessment. Curiously, international results of the 2009 PISA digital reading assessment found a relationship between students' computer use at home and stronger scores, while increased computer use at school was linked to lower scores (OECD, 2011). Such results compel a closer look at digital literacy practices and contexts as they are occurring in students' homes as well as those occurring in schools, although we also note that the OECD, itself, with the testing regime of PISA, has not entirely moved away from old textual practices, in the ranking and sorting of students and nations.

Even when the latest developments in digital technologies are introduced into the spaces of classrooms, practices may still perpetuate approaches to teaching and learning based on 20th century understandings. For example, it is not unusual to see structures that emphasize step-by-step linearity and the notion that the teacher should be the bearer of all expertise, even when the teacher may have less competence with digital tools and particular forms of text than his or her own students may possess. Attempts to translate unfamiliar digital structures into more familiar pedagogical structures often simply replicate 'old' forms in a digital mode. Instead, we suggest, instructional planning for work with digital texts and tools could lead to the development of different learning structures designed to offer new opportunities, affordances, and more explicit complex systems. As theorists working from complexity perspectives address (see Johnson, 2001, 2010; Gleick, 2011), digital tools and systems often demonstrate

characteristics of complex adaptive systems, such as nonlinearity, emergence, unpredictability, "adaptive-ness" and self-organization (Patton, 2011, p. 8). We note that theorists working in the area of digital literacies are using language, frames, and descriptions of phenomena that are increasingly aligned with complexity thinking, as Green (1988, 2012) and others have done (e.g. Kress, 2005, 2010; Gee & Hayes, 2011; Luke & Freebody, 1999), and ecological frames and perspectives are being increasingly recognized (Pahl & Rowsell, 2012).

Drawing from "Soft Complexity": Contexts for Learning

Our two studies explore the intersections among literacy practices, digital technologies and complexity: inquiring into how using digital tools such as iPads and iPods with young learners might provide opportunities for developing complexity framed approaches to learning. Following Davis and Sumara (2010) we locate our work in "soft complexity" as educational researchers, focusing on studies of literacy learning and systems, and interested in holistic rather than reductive notions of literacy education. Following several decades of back-to-basics approaches to literacy instruction that have focused on linear sequential understandings of learning and impacting Canadian and the wider range of North American literacy instruction, we see contemporary research in this subject area as providing new openings and recognition of emergence and nonlinearity. As Fenwick, Edwards and Sawchuk (2011) suggest, complexity offers "ways to analyse the simultaneous occurrences within and across systems that contribute to the appearance of the messy phenomena of education" (p. 35).

Johnson's (2010) notion that, "Some environments squelch new ideas; some environments seem to breed them effortlessly" (p. 16) is one that has provided useful insights into our two studies. We have been interested in applying Johnson's complexity-informed notions in analyzing contexts for learning and exploring how these might help to support the growth of innovative ideas and practices. We have used conceptual tools offered by educational complexivists (e.g. Davis & Sumara, 2006, 2008, 2010; Doll, 1993; Fenwick, Edwards & Sawchuk, 2011; Laidlaw, 2005; Patton, 2011) to inform our understanding of learning structures and ways of working with young learners, within and outside of classroom contexts. The notion of emergence and other ideas informed by complexity are not entirely new to early childhood and early literacy education with holistic approaches evident, for example, within the Reggio Emilia approaches to learning (see e.g. Project Zero & Reggio Children, 2001; Reggio Children, 2008; Wien, 2008). However, in light of the rapid uptake of digital practices we see an increased role for complexity theories, and in particular, "soft complexity" thinking, in addressing and describing nonlinear approaches and frames within the domain of early literacy teaching and learning.

Emergent Learning at Home and Emerging Digital Practices at School

In the two studies that comprise our data, we bring together our own individual research projects: one, an inquiry examining young children's literacy practices in their homes, and the other, a two-year study in a Kindergarten. Wong's doctoral project was a qualitative observational study of the literacy practices eleven preschool children were engaging with in their homes, over a two year period. This study was developed in connection to Laidlaw's Social Sciences and Humanities Council of Canada (SSHRC) funded research. The school-based

project, working with teacher/collaborator Lee Makovichuk, followed four Kindergarten classes (58 children) over two years, using pedagogical approaches informed by complexity thinking to develop narrative writing and oral story telling skills. The classroom work combined and remixed digital technologies, drama, and children's literature to extend students' capacities of reading, creating, and interpreting stories. Both inquiries used complexity to inform and frame data collection, recognizing the importance of examining phenomena in relationship with their contexts, and the value of engaging in analyses in micro- and macro-directions in order to observe the small details of the particular as well as broader holistic patterns. We present specific descriptions of the work of each project, attending to significant intersections and examining the particularity of individual contexts, locating them alongside one another in a larger bricolage (Johnson, 2010) and "considering all-at-once, the many layers of dynamic nested activity that are constantly at play" (Davis & Sumara, 2006, p. 28).

Literacy and Technology at Home

Wong's inquiry, informed by complexity thinking and ecological frames (Davis & Sumara, 2008; Doll, 1993; Doll, 2012; Waldrop, 1992), examined Canadian and Australian young children's varied literacy practices in their homes, as well as seeking parents' perspectives of these literacy practices and events. Eleven children between the ages of 3 to 5 years participated in the study, with four of the children located in Australia (2 rural, 2 urban) and seven children located in Western Canada (3 rural, 4 urban). The data collected included participant observation, informal and semi-structured 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 documentation of favourite websites, online video games, and applications (apps).

The young children in Wong's study engaged regularly with literacy practices that involved different types of media, ranging from forms such as paper and crayon, to digital modes created on iPads or computers.[1] Moreover, the literacy practices children were taking up often emerged from play that was connected to use of digital devices. Children's literacy learning, as documented in Wong's research, had a tendency to expand and extend in multiple directions, in a rhizomatic form. Children's diverse literacy practices were rooted in their daily lives and branched out further as they tried to make sense of the world around them.

We present one example from Wong's research, to illustrate the complex web of relationships, events, materials and contexts that are occurring for younger children. As presented in the vignette at the start of this article, each member of Andrew's family had an iPad and used it in ways that were adapted to individual interests and needs. Five-year-old Andrew used his iPad for entertainment and often to seek information in connection to his deep interest in LEGO construction, searching for, viewing, and creating videos on this topic. Andrew's engagements with iPads influenced and were interconnected with how Andrew engaged in other literacy practices and events. For example, he had learned how to build

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1 Within the past few decades, literacy theorists have named the changing nature and practices of literacy as "multiliteracies" (see New London Group, 1996), but for clarity and recognition that readers may be situated in different fields, we will refer to 'literacies' and describe specific forms or modalities.

elaborate spaceships with his LEGO bricks by watching LEGO 'reviews' that he found online as videos, and although not yet conventionally 'reading,' he followed pictorial instructions and diagrams provided in his construction sets, and 'read' the visual images and text from his collection of LEGO information picture books. He also discussed his ideas about LEGO construction with his father and his friends. His knowledge of his interest area (LEGO) and emerging literacy understanding involved an interweaving and layering of print-based texts, images from digital screens, graphics from manufacturer instructions and oral discussions with his father. In addition, Andrew often incorporated phrases, dialogue, and sound effects from digital videos he had viewed, as part of his own speech and dramatic play. These engagements with language and texts were part of his repertoire of literacy practices at home, and were often interconnected with his interest in LEGO construction, as part of an emergent system of knowledge and practices, connected to this interest area. During Wong's observations of Andrew, she observed him create, with help from his father, his own video 'review' of a spaceship he had constructed. He and his father later uploaded his video onto the Internet. While Andrew was not yet literate in the traditional sense (i.e., he could not read independently or print his name with a pencil), he was able to enter the letters of his name on the iPad, using this as his password, and he could spell and recognize the word "LEGO" in a search engine.

Andrew engaged in home literacy practices that involved a complex layering of interactions, artifacts, and tools, including both conventional literacy tools (e.g. paper, crayons) as well as digital devices, popular culture media, video, and applications (apps). Wong observed that for Andrew toys and play objects were interconnected to his digital world, similar to observations of Marsh and Bishop (2013) who have noted use of 'offline' toys that interact with a particular app or online game.

Current research in the area of literacy suggests that, because digital media are prevalent in many homes, children are increasingly drawing on digital experiences to make meaning and communicate ideas (Honan, 2012; Lynch & Redpath, 2012; Marsh, 2011; O'Mara & Laidlaw, 2011). Young children's digital literacy practices at home and at school often exhibit characteristics of complex adaptive systems, such as neighbor interactions (Doll, 1993; Waldrop, 1992). Davis and Sumara (2006) describe neighbor interactions as ways that agents within a complex system can affect one another's activities as "a key structure of the system" (p. 142). The "neighbors" in knowledge-oriented communities such as a classroom or family are not only physical bodies or social groupings, but also comprise "ideas, hunches, queries, and other manners of representation" (p. 142). In order for ideas to "bump" against one another, they must be represented in some way; in the example of Andrew, his conversations with his father (ideas represented verbally) and his interactions with the online LEGO communities (ideas represented through images, video texts etc.) provided neighbor interactions. As well, Wong often noted Andrew talking aloud to himself about different ideas or approaches in constructing his spaceships with LEGO bricks—his own ideas colliding and connecting with one another. Andrew's literacy learning at home, in connection to his deep interest in LEGO construction, emerged and was sustained through neighbor interactions, rather than through any deliberate step-by-step strategies organized by his parents. His family learning context provided a rich environment that supported his learning, with learning experiences emerging from interactions or events (Johnson, 2001). He was provided with support, materials,

relationships and "spaces of possibility" that encouraged him to develop and explore his own interests; his use of digital tools and modes was intertwined with 'old' literacy practices, as his individual complex literacy learning system developed and emerged.

Complex Explorations of Digital Tools and Stories at School

Following from the micro illustration of one child, we present a macro school-based project, from Laidlaw's research study. Within this classroom-based project, Laidlaw and the participating teacher, Lee, were interested in examining the 'new' literacy skills and understandings that young learners were bringing to school, and exploring ideas of innovative teaching practice. This project also investigated approaches informed by complexity thinking, emergent curriculum and influences from Italian Reggio Emilia early childhood education programs (e.g. Rinaldi, 2005). Over the two-year span of data collection, four Kindergarten classes participated: a morning and afternoon class in the first and second years of the project. Each class was comprised of 15 – 20 children between the ages of 4.5 and 6 years old, and included children who received additional classroom supports for special needs. Within the classroom, children engaged with a wide variety of media and text practices to develop ideas and story narratives, including use of digital tools (cameras, iPods, iPads, computers), dramatic play and activities, a variety of art, construction and traditional print materials, and other materials connected to classroom inquiries and children's collective and individual interests. The children were supported in their diverse expressions of ideas through an environment designed to respond and change in reciprocal ways, as the teacher listened and observed for possibilities that might be further extended. The classroom schedule also provided ample, uninterrupted time for self-selected (self-organized) groups to collaborate on ideas.

In the first year of the project, the teacher, teaching assistants, and researcher often took on the task of capturing images and recording video of children's work. Towards the end of the first year and to the end of the project, the children themselves took on more of this work, and had more active roles in directing, authoring, and producing classroom narrative structures. Students developed "storyplay" videos (their name for this new classroom form) and became active and critical viewers of video and photographed images. Often particular "good ideas" (Johnson, 2010) students shared through their video and digital images would often spread and even moved across to the other class that was 'separately present' during the other portion of the day (e.g. morning to afternoon group). Although these separate classes did not regularly interact with one another directly—the morning group's day ended before the afternoon group's class time began—the physical artifacts created by each group were a presence in the room and provided a physical and artifactual bridge of communication across both groups. As literacy researchers, Pahl and Rowsell (2012) suggest, "Artifacts open up stories and give opportunities for telling stories…artifactual literacy requires an understanding of literacy as a situated social practice together with literacy as materially situated" (p. 50). From a complexity perspective, the artifacts were an important part of the classroom system and learning, and for the spread of new ideas. The students were keenly interested in viewing their own and others' dramatized stories and with teacher support they developed several collaborative videos using sophisticated video formats (e.g. iMovie, video camera app) that were available on the iPads and iPods as these were introduced.

Connected, De-Centralized Learning

At the beginning of the second year of the project, three iPads, and three iPod Touch devices were introduced in the classroom, to the two new groups of students in the Kindergarten. Understanding that materials of expression and representation influence learners' experiences (Taguchi, 2010), Laidlaw and the classroom teacher selected applications (apps) for the mobile devices based on possibilities for creating or extending the development of children's narratives. They chose apps that were "open" rather than "closed" apps (Lynch & Redpath, 2012). The open apps were selected based on the multimodal opportunities they afforded (e.g. merging sound, text, images, drawing etc.) and stood in contrast to many of the closed literacy apps that were often categorized under Education categories available from various sources including the iTunes Store or listed in blog reviews at the time of the research.2 The apps selected for the project were those that might invite more creative and open-ended representations, providing narrative spaces for the children, emphasizing those that might extend children's capabilities. Apps that were used included: Garage Band, for creating background sounds and music tracks; a variety of different special effects apps that extended options for the built-in cameras on the iPads and iPods (e.g. Cam Wow, Photobooth); apps that offered potential for digital story creation (StoryKit, Toontastic); productivity apps that might be used in publishing children's stories (Keynote, Pages); and a selection of drawing and video recording applications.

After adequate time to play around with the apps and explore them through collaborative classroom work, children began to work with one another using *Toontastic*, *Story Kit* and various photography and video applications, with the aim of creating stories and narrative structures in connection to classroom inquiries. Using *Story Kit*, children could record audio, take photographs, draw, and type text to create individual digital books, while with *Toontastic* the children could select characters and settings, draw their own images, and add audio narration and background music scores to create a story arc. Students were also encouraged to create tiny videos, using the smaller and more portable iPods to record information about characters they had created in art and craft activities. These child-created stories, when played back, attracted the interest of other children, who then also learned more about what the devices could do. Ideas became contagious and spread. This structuring of the work of learners, supported by the affordances and capacities of the touch screen devices was co-emergent among learners, teachers and materials, and recursive. It represented "decentral-ized networks of human knowing" (Davis & Sumara, 2010).

Currently, popular media often express skepticism regarding use of digital technologies for young learners (see, for example, Rowan, 2014) and we see evidence of similar beliefs in some early childhood contexts. However, in the context of the Kindergarten study, we note that, following Yelland (2011) the use of digital devices could support the emergence of new ideas and teaching structures:

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2 Now, several years later, with rapid growth in the number and assortment of applications for iPads and iPods, we note that while closed and 'gamified' apps are still common, application development and classroom use is evolving into usage that increasingly takes up new affordances of touch screen tools and extends them in new ways.

> Not only are new technologies part of a repertoire of experiences for young children's learning but the teacher is able to scaffold this learning so that it is articulated and represented by children in a variety of modes (p. 8).

With the use of technologies as well as other aspects of children's learning engagements, considering complexity-informed structures and practices, such as that of "enabling constraints" (Davis, Sumara & Luce-Kapler, 2008), is critical to supporting, scaffolding and extending learning. Within the notion of enabling constraints, learning opportunities are simultaneously bounded but open to possibilities—too much choice, or too much direction can impede learning. While the apps children were using were open, children's narratives were bounded by the structure of the app, the focus of particular classroom projects (e.g. character development, folk tales), and student literacy abilities. Using the iPads and iPods provided a balanced 'open-and-boundedness' that supported student production of stories.

As the children discovered how the devices could be used, and shifted into new roles as creators and producers rather than as passive viewers or digital game players, they responded by developing new uses and practices, and a complex, network of digital stories began to emerge in the classroom as innovative uses, individual adaptions, and new ways of storytelling began to spread. In the digital work in the classroom, children created textual forms that they would not otherwise have been able to develop. For example, they blended and remixed different modes and representations to create 'magical' stories using special effects filters that inspired the creation of fictional narratives. Some children developed indepth video character studies, exploring the life of a puppet toy, using video, art materials, and editing tools to bring the character's story to life. Children who struggled with conventional literacy skills, such as getting their words or drawings onto the page using a pencil and crayons, were able to create coherent and powerful video representations that attracted the interest and attention of their peers. A quiet child who tended to be in the backdrop of the classroom social context became a renowned storyteller when his written texts were dramatized and video-recorded, to be viewed again and again, his ideas inspiring others to adapt and develop the story structures he had presented, as evolving forms of their own stories.

Emerging Digital Practices—A Call for Complexity

Within our research projects, Wong's study of young learners at home and Laidlaw's observational Kindergarten inquiry, we note how new ways of working with digital tools and practices, can provoke a deeper recognition of learning as collective (Davis & Sumara, 1997) and recursive (Doll, 1993). Notions from complexity thinking can provoke ways of thinking about and structuring literacy teaching and learning that are increasingly needed to respond to shifts in literacy through the emergence of digital practices and text. We turn to Kress (2005) who refers to old and new dispositions to text, where the traditional disposition views text as stable, linear, sequential, and monomodal, with "new disposition" text (represented by digital forms) as being unstable, fluid, nonlinear, multimodal and designed by producer and redesigned by readers. New disposition text, as emergent, adaptive and recursive, might be otherwise framed as what we understand to represent complexity thinking. Andrew's engagements with texts and multimodal literacy practices at home and the new digital 'curriculum' of the Kindergarten

classrooms seemed to be more aligned with rich complexity than more static instructional models or linear-sequential notions of learning

Digital media use is increasing as a social and educational phenomenon and is a growing focus for Canada, Australia, the UK, the U.S. and other OECD countries (Government of Alberta, 2010). Literacy theorist Allan Luke (2007) observes that, for older children, most of the learning that children are doing in relation to digital media is "being done after three o'clock, by them and not us." Wong's study suggests that digital media work is also significant for younger children, in their activities at home, and it will be important to follow these new digital generations of children as they enter classrooms and expect to continue to work with digital devices and texts in their early years classrooms. As Laidlaw's inquiry suggests, the presence of digital devices requires educators to think differently about learning and teaching, and to consider the influence of nonlinear, fluid, and multimodal text dispositions (Kress, 2010).

Across our two studies we observed the value of providing playful, open, and relational learning practices in connection to the use of digital tools, and note the value of supporting children's emergent uses of tools and practices. As Wong's research indicates, home environments seem to easily support nonlinear, interconnected, multilayered, textual learning practices. Within classroom spaces, working in a nonlinear, emergent and interconnected fashion can be more challenging when juxtaposed with institutional aspects of schools, linear curriculum outcomes and mandated assessment structures. However, over the two-year span of the classroom explorations, creating responsive learning environments and pedagogical provocations/perturbations, while sometimes requiring more planning time, was not an insurmountable task. As we have observed through both inquiries, the affordances of digital texts as nonlinear, fluid, unpredictable forms that offer oral and gestural modes (Gee & Hayes, 2011; Kress, 2005, 2010) can invite opportunities for complex learning engagements, and open possibilities for teachers to consider new ways of working. We suggest that digital literacy tools, texts and practices, as they are developing, might provide the sorts of perturbations within education systems to provoke innovation, change, and perhaps lead to new learning structures and systems of organization.

As we have developed through our various individual and collective research projects, frames and concepts from complexity thinking continue to inform our work with digital literacy teaching and learning. With digital literacy tools and practices creating the need for a new paradigm (Gov't of Alberta, 2011; Kuhn, 1962) for instruction, in response to rapidly changing communication modes and new literacy dispositions, complexity thinking presents possibilities for reframing and restructuring the ways we think about teaching, learning, and literacy.

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