Re-imagining Education Policy and Practice in the Digital Era

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Abstract:
New digital technologies are changing the nature and contexts of work in Canada. It is essential that education policy and practice acknowledge and respond to these changes. The impacts and implications of new and emerging technologies for work can be summarized within two paradigms: technology is replacing work through automation and digital Taylorism; and technology is changing communication, collaboration and knowledge creation. Derived from a SSHRC Knowledge Synthesis report, this article explores how nurturing uniquely human abilities by employing a threshold concept approach will help create education policy and practice that can better prepare students for the realities of the evolving knowledge-based creative economy. Highlighting the complexity and transdisciplinary nature of knowledge, *The New Literacies Threshold Concepts* in English Language Arts are presented as a curriculum heuristic that is well-suited to developing uniquely human abilities.

Keywords: digital Taylorism; Canadian labour pressures; algorithms; education planning; creative economy; threshold concept approach

In 2016, scholars at the University of Prince Edward Island engaged in a Social Sciences and Humanities Research Council (SSHRC) funded Knowledge Synthesis. This project extracted dominant technological paradigms and explored how education policy and practice can best prepare students for the changing employment landscape in the digital era. In many ways, digital and internet technologies have shifted everyday communication (Lenhart, Madden, & Hitlin, 2005) as well as cultural structures of knowledge and information production. Digital texts are often multimodal, non-hierarchical, requiring a diverse range of literacy skills (Beach, 2012; Beach, Anson, Breuch, & Swiss, 2009; Beck, 2009; Clark, 2010; Pegrum, 2009). Though most schools today have internet access, its usage is rooted in a pre-internet era framework. This framework involves using the internet primarily as a content-gathering tool or "digital textbook." This out-dated approach has limited applicability within the multimodal, ever-changing and participatory contexts prevalent in the digital age. Increasingly, workplaces use, adapt, and are characterized by, digital technologies in complex ways (Kiili, Laurinen, Marttunen, & Leu, 2012). By identifying the dominant technological paradigms that have shaped, and are shaping work, this article challenges the implicit purposes of education in the digital era. Key areas are identified where current educational approaches fail to prepare students for work or life in the knowledge-based creative economy. The implications for classroom instruction are then explored by detailing a threshold concept approach to English Language Arts (ELA), designed to support and enrich effective communication in any medium.

The Knowledge Synthesis Methodology

In the fall of 2016, a Knowledge Synthesis was undertaken for the Social Sciences and Humanities Council of Canada, exploring how emerging technologies and intelligent algorithms are creating a new form of digital Taylorism[1] that is impacting jobs across the employment hierarchy. The main focus of this Knowledge Synthesis was to consider how education can best prepare students for the realities of the perpetually evolving and potentially enigmatic knowledge-based economy. An intersectional qualitative content analysis approach was employed to systematically review peer-reviewed quantitative, qualitative, and mixed methods studies, with a primary focus on those based in a Canadian context, within the past 10 years. Policy and research documents from public, private and not-for-profit sectors (grey literature) were also collected and analysed, and compared and contrasted with scholarly sources in education and digital economy discourses. The following questions guided and framed our knowledge synthesis:

[1] Digital Taylorism refers to the ways that new digital technologies allow for work to be further simplified and segmented while also increasing employee monitoring and control (Parenti, 2001). Presently, advances in algorithmic programing and the internet of things are extending the reach and scope of digital Taylorism beyond more routine tasks, disrupting many middle class jobs previously thought to be beyond the reach of automation.

- What are the dominant technological paradigms, and in what ways have they enabled and constrained the educational landscape as it pertains to the social, political and economic relationships amongst and across populations and communities?
- In what ways is the digital variable reorienting understandings and blurring the boundaries of what counts as work or play, public or private, local or global?
- What threats and possibilities need to be identified so Canadians can better understand what is at stake in the relationship between education, credentialing, and expectations for meaningful employment, as well as individual, community and societal well being?

Peer-reviewed economics literature and relevant grey literature discussing the potential and realized impacts of the digital, knowledge-based economy on the Canadian labour market, society, and culture were gathered. Concurrently, peer-reviewed education research and relevant grey literature contextualizing education paradigms in the digital era were also collected. Scholarly literature was searched for and gathered through the University of Prince Edward Island Roberson Library One Search Database, the Education Resources Information Center (ERIC) database, and Google Scholar. Multiple searches were conducted over the duration of the knowledge synthesis, using varied combinations of the following key words: new digital technologies; digital Taylorism; algorithms; algorithmic programs; intelligent computers; globalization; Canadian; Canada; labour market; employment; future. Local and national news outlets, as well as popular websites, blogs and online journals that focus on economic and/or new technologies in Canada, were also monitored regularly and searched using the keywords listed above. For both grey and scholarly literature, priority was placed on the most recent publications. Influential sources referenced within these texts were also identified and gathered for inclusion in analysis.

A deductive framework methodology was employed, by thematically coding the data into initial categories that were redefined and expanded throughout the coding process (Finfgeld-Connett, 2014). The following broad areas of analysis were explored: impacts of digital technology on the economy, labour market and society; underlying and identified goals and purposes of education; opportunities and possibilities for local and provincial involvement in shaping education; and, intersecting inequalities as a mitigating or contributory factor. Throughout the analysis, techniques such as memoing, diagramming and reflection were employed. Using these techniques allowed for sub-themes to be developed, reviewed and adapted, and for alterations of the coding framework to materialize iteratively (Finfgeld-Connett, 2014). Findings from both economic and education literature were juxtaposed in order to identify synchronicity and/or divergence between the current educational paradigms and the digital economy discourse. This approach also facilitated consideration of extant gaps in how these studies explore and frame education in the digital age.

The knowledge synthesis revealed two dominant technological paradigms that are shaping work in the digital era: one is that technology is replacing work through automation and digital Taylorism; and the other is that technology is changing communication, collaboration and knowledge creation. This article provides a brief overview of the two dominant technological paradigms, followed by key recommendations for education policy and practice in the digital era.

Work and Play in the Digital Era: The Dominant Technological Paradigms

Paradigm 1: Technology is Replacing Work Through Automation and Digital Taylorism

The idea that technological innovations can replace paid work is not new. However, the reach and scope of technological displacement is accelerating. Automation has been an invasive and ongoing reality for decades, though resulting job losses have primarily been restricted to working class jobs in manufacturing and primary sectors. The introduction of new digital technologies has also seen the intensification of work standardization, surveillance, and employee time management in a wide range of employment areas (Parenti, 2001), including in social services and healthcare (Cumella, 2008). As new digital technologies continue to develop and permeate domains beyond routine tasks (Frey & Osborne, 2013), workers across the employment hierarchy have become increasingly vulnerable to the negative impacts of new organizational methods and technological displacement. McAfee and Brynjolfsson (2016) state that, "computers have been able to achieve human to super-human levels of performance in a range of tasks: recognizing street signs, parsing human speech, identifying credit fraud, modeling how materials will behave under different conditions, and more" (p. 140). Currently, advances in intelligent algorithmic programs or machine learning algorithms that can "discover unexpected similarities between old and new data" (Frey & Osborne, 2013, p. 16) are allowing computers to independently take on more complicated tasks (Deng & Yu 2013). Furthermore, McAfee and Rifken (2016) highlight that "in this expanding digital economy, private enterprises connected to the Internet of Things can use big data and analytics to develop algorithms that speed efficiency, increase productivity and dramatically lower the marginal cost of producing and distributing goods and services" (p. 9). Parenti (2001) surmised that the development and broad implementation of digital technologies that furthered labour standardization practices and allowed for increased surveillance and time management of workers constituted a form a 'digital Taylorism'. Today, the expression of labour arbitrage and new digital Taylorist labour practices is via algorithms, and middle class jobs are no longer immune to technological displacement.

Paradigm 2: Technology is Changing Communication, Collaboration and Knowledge Creation

The advent of the knowledge-based economy has also fundamentally altered the ways and reasons we communicate and interact with each other in both the public and private spheres. Internet technologies allow for connection and collaboration "with diverse others across globalized transnational spaces, multimodal texts, and distant, heterogeneous, and interactive audiences" (Hull & Stornaiuolo, 2014, p. 16), and have changed and are changing work: the ways we work, the types of work one can engage in, and from where. For example, media production, publication and distribution have been thoroughly disrupted and reimagined by digital technologies and social media. In recent years, an increasing number of mainstream media outlets are publishing articles written partially or completely by algorithmic software programs. While these programs are capable

of producing articles at a rapid rate, the content is basic and formulaic. However, for the average reader, computer-generated content is often indecipherable from human-created articles (Clerwell, 2014). Furthermore, computer-generated articles tend to be viewed as more accurate and less biased than human writing (Clerwell, 2014). At the same time, social media and the increasing availably of smartphones with internet access have broadly expanded the market for public communication. Within this current media milieu, paid work for traditional journalists has become increasingly precarious and scarce as many smaller local papers have been closed or subsumed by larger entities.

Globalization of work has also been expanded and intensified by internet technologies. Of course, globalization of work has been occurring for decades. For example, manual labour and frontline service work (such as call centers) have been regularly offshored to countries where workers are paid less, under lenient labour laws. Today, globalization of work continues to grow, and is now expanding into middle class jobs, including ICT (information communication technology) jobs themselves (Collins, 2013). The current technology-driven dynamic expansion in globalized work is primarily facilitated by two factors: firstly, ICT technologies, such as bandwidth, processing, storage and cloud computing, are rapidly becoming better and cheaper, transforming and growing the types of work that can be done remotely, for less (Brown et al., 2008; McAfee & Brynjolfsson, 2016); concurrently, the governments of emerging economies, such as China and India, are proactively investing in advanced ICT and engineering education "to leapfrog decades of industrial development to create a high-skill, low-wage workforce capable of competing successfully for hi-tech, high-value employment" (Brown et al., 2011, p. 3). Brown et al. (2008) give the example that "employing a chip design engineer in the United States is over four times more than a designer in Korea and 10 times or over the costs associated with the same workers in India and China" (p. 135). Surprisingly, the Information and Communications Sector Council of Canada predicts that training new workers in ICT to increase the "availability of Canadian solutions will ensure that outsourcing and offshoring do not increase" (Faisal et al., 2015, p. ii. Given the growing availability of highly qualified ICT professionals globally, the increasing ability of ICT technologies to facilitate outsourcing ICT work, and an established pattern of businesses offshoring work for financial gain whenever possible, Canada's ICT training mandate seems unsubstantiated at best. Situating new digital Taylorism within the broader historical context of capital and the globalization of work, it seems likely that within the existing capitalist market structure, labour market trajectories for ICT workers will follow that of other sectors open to global competition. It is reasonable to anticipate that a few ICT-based companies may utilize locally sourced workers to meet a niche consumer market. However, the majority of companies can be expected to seek out the lowest cost option globally and outsource work, whenever possible. Furthermore, internet-enabled labour exchanges are becoming more common and accessible for both workers and employers (Barnes, Green, & Hoyos, 2015). Many types of digital-based work can be crowdsourced in varying degrees. This is where a large group of independent workers each take on small parts of a project that in the past would have been completed by a single contractor. Much like traditional Taylorism, these parcelled out jobs tend to require less skill and are paid at a lower remuneration than other more comprehensive and complex work in the digital economy.

Together with enhanced and expanded instances of automation via new technologies, compartmentalizing and outsourcing residual work through crowdsourcing venues further enhances the scope and disruptive impacts of digital Taylorism for middle class workers. The increasing breadth of technological displacement and globalization of paid employment are already bringing to the forefront the limitations of market-based capitalism and the resulting impacts on the labour market in the digital era (see the Ontario Basic Income Pilot Project or the recently expanded Jobs for Youth programs in PEI). Yet, undoubtedly, moving forward, digital technologies and collaborative networks will also be integral to being able to effectively understand and address social, economic and environmental issues.

Forward Thinking: Education Systems and Policy in the Digital Era

The long-term broad and global impacts of technological displacement of work and the changing landscape of work within the digital era on capitalist economic systems are yet to be realized and are widely debated. However, it is apparent that as new technologies continue to evolve and expand in reach, scope and capabilities (Frey & Osborne, 2013), paid employment opportunities will continue to be shaped and/or engulfed by digital technologies. This will disrupt the work lives and earning potential for an increasing number of diverse workers from across the employment hierarchy. Increased part-time and contract work and decreased unionization, the prevalence of automation tools and techniques, and the redistribution of work across the globe are limiting opportunities for even the most highly skilled workers in some areas. Given these impacts of digital technologies, there is an urgent need for upgrades in education in Canada. The ability to effectively communicate, collaborate, and create with and within digital media, while exercising autonomy and flexibility (Pegrum, 2009), will be broadly essential for success, health and wellbeing at individual, community and societal levels. Communication technologies and platforms continue to permeate more and more areas of our lives and livelihoods. As such, providing students with opportunities to work with new technologies will be integral to future education plans. Students must be permitted space to use digital mediums to engage with others, to explore and contribute to solving relevant real life problems, and to understand and critically evaluate their applications, implications and outcomes (Dietrich & Balli, 2014).

The Creative Economy

Most importantly, the cumulative trajectories of the dominant technological paradigms (i.e., digital Taylorism replacing work, and new communication technologies changing work and play) are fundamentally merging the knowledge-based economy with a creativity-based economy, "where global economic success is increasingly being driven by ideas (creative economy) rather than the creation, distribution, and use of information (knowledge economy)" (Sameshima, in review). This fundamental shift brings to the forefront the worldwide studies that link weak creativity development at work and school to unhealthy economic and societal well being (see Vesela & Klimova, 2013; Yannig, 2012; White, 2010). Web-based technologies have been instrumental in the changing nature of how people connect, learn, use, and create knowledge (Thompson, 2010). Yet contrary to popular

notions that the "digital age" offers creativity building to all, the dilemma is that digital tools have primarily been used to *consume,* not *create* digital content (Wiebe, Gabriel, Campbell, MacDonald, & McAuley, 2010). While more and more people are using digital media to produce content in various ways (e.g., facebook, comment threads, vines, twitter, snapchat, etc.), these contributions are often superficial and formulaic. In addition, user-generated content involves issues of ownership and economic trade-off that are rarely considered or understood in practical application. Providing opportunities for students to practice meaningful engagement, creative expression and critical thinking must be central for effective participation and success within the emerging creative economy. Through digital and internet technologies, students can be part of innovative and critical learning (Harouni, 2009) and engage in online discussions with diverse and multiple audiences and in knowledge co-construction across disciplines (Beach, 2012).

Fullan (2013) argues that students, along with educators, must learn "how to work *with* machines, not *against* them, and not in ignorance of them" (p. 12). Traditionally, incorporating digital technologies into the classroom has situated students primarily as passive consumers of technology, rather than creators, collaborators and innovators. For example, some schools have installed expensive digital whiteboards in every classroom. Even with professional development training, these boards are mainly used as content projectors rather than to support students being creators, collaborators and innovators. Similarly, recent interest in teaching coding, which does start to move students beyond the limited role of technological consumer, is still justified in a literacies paradigm, trying to match skills to jobs. While teaching basic coding in high school will no doubt be an important gateway for the few students who will become highly skilled computer science professionals, not everyone will be suited for this type of work. Furthermore, ICT professions are not immune to technological displacement and digital Taylorism. As noted above, technical input-styled jobs will continue to be disrupted, and coding jobs are not an exception to that trend. Brown et al. (2011, p. 584) refer to matching skills to jobs as "the opportunity bargain, where the role of the state is limited to making opportunities for people through education." In the 21st century context, this opportunity bargain more closely resembles a Faustian bargain, as today's well-educated youth struggle to achieve the middle class ideal within an increasingly precarious globalized labour market. To move beyond an industrial revolution-based education paradigm of narrowly matching skills to anticipated future employment, the nature of the emerging economy calls for systems level change, and a reimagining of the forms and purposes of education in the digital era.

Nurturing Uniquely Human Activities

Although machine-learning algorithms are now able to take on more complex tasks, "machines do not bring about anything by themselves, any more than a given quantity of information (such as that purchased in a database) produces knowledge. Without human skills to set the equipment in motion, technology itself produces nothing by way of development or growth" (Boutang, 2011, p. 42). In today's digital world, innovation, collaboration, and social and emotional skills are readily identified as highly desired for work and life within the KBCE (Levin, 2012). These uniquely human qualities are also essential for maintaining a competitive labour force in the increasingly competitive

global labour market. The good news is that these intrapersonal and interpersonal competencies are malleable, and can be learned and developed through education and life experience (Pellegrino & Hilton, 2012). However, the prevailing organization of curriculum around teaching isolated, measurable and easily testable skills inherently fails to place sufficient time and resources on attainment of these "soft skills." Furthermore, some of the most significant, yet rarely identified, challenges presented by digital Taylorism and the globalization of work are that standardized, precarious labour conditions are a direct deterrent to innovation, collective action and critical thinking (Brown et al., 2011). Thus, the role of public education as a unique space for experiencing and developing these "soft skills" is becoming even more significant. Student-centered approaches that encourage the interests, creativity and independence of students more effectively nurture inter/intra personal skill development (Baeten, Kyndt, Struyven, & Dochy, 2010). For student-centred approaches to be most effective they must be implemented within learning environments that support "autonomy, competence and relatedness" (Appleton et al., 2008, p. 370), collaborative decision making and democratic engagement (Beane, 2005). Both in and outside of the classroom, students should be encouraged to ask questions, engage uncertainty, act creatively, take risks, think critically, and contribute to discussions that are important to the students' lives and communities (Beane, 2005; Harouni, 2009). At the same time, commitment to social and emotional learning in the classroom, as well as at the curriculum and policy level, will improve academic performance, enhance positive school atmosphere and teacher-student relationships (Durlack, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Schonfeld, Adams, Fredstrom, Weissberg, Gilman, Voyce, Tomlin, & Speese-Linehan, 2014), support the development of inter/intrapersonal skills that are highly valued in the labour market (Levin 2012), and encourage lifelong learning, personal development and emotional well-being (Sheard, Ross, & Cheung, 2013). While curriculum departments might argue that such skills are already addressed in the current offering of courses, there is strong evidence to suggest that the long history of schools focusing on individual content knowledge overshadows inter/intra personal skill development, collaboration, risk taking, and engagement of uncertainty (Dodge & Powers-Silverberg, 2015). Schools are hardly places where students are encouraged to fail as part of the learning process (Wagner, 2012).

We recommend the development of courses specifically designed to advance innovation, collaboration, and social and emotional skills in holistic ways and in collaborative environments. In addition, we argue for a shift away from the primacy of standardized tests to digital learning portfolios, which offer a more holistic, multifaceted, and pragmatic approach to assessing not only measurable progress, but process and personal growth, while also providing space for creativity, collaboration, and critical thinking (Beach, 2012; Chang, Liang, & Chen, 2013; Hubert & Lewis, 2014). The digital nature of e-portfolios also allows for web-based interactions such as peer and self assessment, sharing products and collaborating with audiences outside of the school, cumulative creation of meaningful and diverse work in multiple genres, as well as supporting teachers to monitor performance and provide ongoing feedback (Afflerbach et al., 2010). Using digital e-portfolios has been shown to enhance student writing (Beach, 2012), while also supporting students to critically evaluate and navigate their digital identities.

Implications for Classroom Instruction: A Threshold Concept Approach

Pegrum (2009) highlights that "effectively our whole culture has moved to perpetual beta, where changes happen so quickly, and are contributed to by so many diverse people and groups, that everything becomes provisional" (p. 20). Tomorrow's workers will need to adapt, collaborate and innovate using new technologies, often while identifying and actualizing opportunities interdisciplinarily. In a transdisciplinary employment context, separate disciplinary courses such as English, Biology, Technology, or Physics make less and less sense; neither does assessing measurable isolated skills (many of which are now or will be performed in some measure by machines/algorithms) to generate data for educational planning. Instead, effective education for 21st century learning calls for something more holistic, such as a threshold concept approach that focuses educational policy and practice based on the complexity and transdisciplinary nature of knowledge.

A threshold, in the most general sense, can be described as an entranceway or an in-between place that allows access to something, be it a place, time, understanding or ideology; picture an essential connector, without which that "something" would be inaccessible (Wiebe et al. in press). In education, a threshold concept is a metaphorical gateway of comprehension, exposing previously hidden ways of "understanding, or interpreting, or viewing something without which the learner cannot progress" (Meyer & Land, 2006, p. xv). A threshold concept approach shifts focus away from isolated skill attainment and proficiency, to integrated holistic awareness and creative development of skills in practical application. Threshold concepts can also highlight opportunities for integration of concepts between disciplines (Barradell, 2013). For example, when a key threshold concept is similarly situated within different disciplines (e.g., data), new opportunities arise for integrated learning reflective of the complexities of life beyond our current education silos. Identifying and applying threshold concept knowledge in practical applications supports students to readily see connections and overlaps, and to innovate in multiple fields.

Meyer and Land (2006) highlight that threshold concepts are often difficult or "troubling" for students to grasp, as crossing a threshold means letting go of previously held understandings (p. 8). By identifying and expanding key points of understanding, students are encouraged to challenge normative assumptions and embrace complexity, and to expect and invite feelings of "discomfort and uncertainty" as integral to the learning process (Cousin, 2008, p. 263). A threshold concept approach to teaching and learning emphasizes the transdisciplinary possibilities of knowledge, the iterative approach to innovation, and the design-creativity critical to new economies.

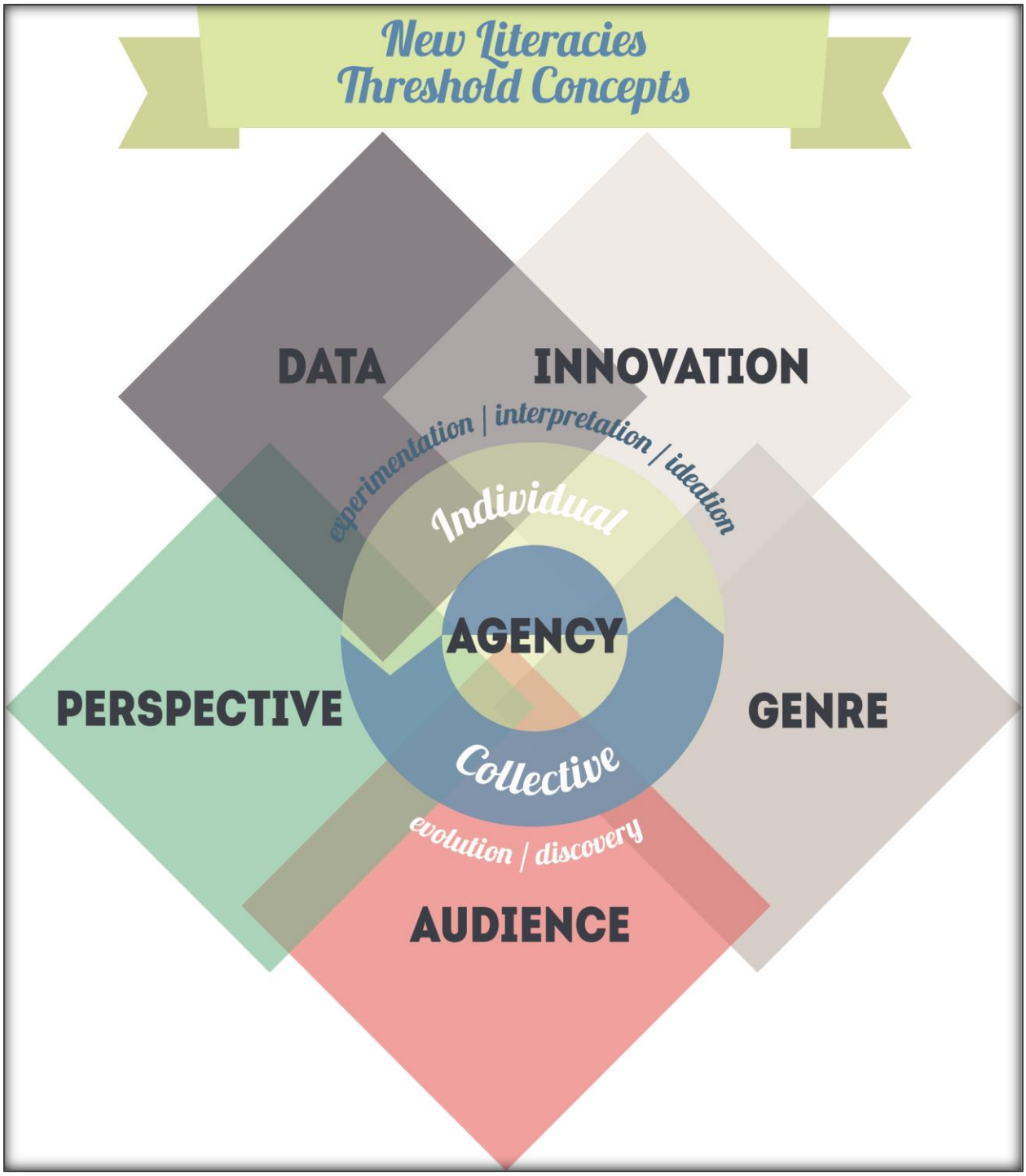
Identification and development of threshold concepts in English Language Arts (ELA) has been a primary focus of the SSHRC funded, multidisciplinary Digital Economy Research Team (DERT). Currently, ELA curriculum in most Canadian provinces is constructed based on the disciplinary organizers, reading/writing, speaking/listening, viewing/representing, which were developed during a time when film and television had become the dominant sources of information and entertainment (Altass & Wiebe, in press). These disciplinary organizers represent a complexity reduction that has helped to increase dependence on measurable tasks, isolated skills and formulaic writing. This outdated approach is misaligned with the evolving, collaborative nature of work within the

knowledge-based creative economy. Wiebe, Altass, MacDonald and McAuley (accepted, manuscript in preparation) highlight that "a computer's creative ability will always be limited by the design of the algorithmic program . . . . Human beings possess capacities for innovation, non-linear thinking, and collaborative knowledge creation that cannot readily be imitated or emulated by computers." Essentially, while intelligent algorithms can "learn," they can only learn as much as what is already in the data source, and they are most effective within closed systems, such as in a game of chess and poker. As such, supporting students to develop uniquely human skills beyond what computers can or will soon be able to achieve should be a central goal of contemporary public education. This fundamental shift toward uniquely human skill recognition and development can be facilitated by a threshold concept approach that privileges the situated and complex nature of human ability and knowledge within and across disciplines.

The ongoing work of the DERT at the University of Prince Edward Island illustrates the compelling potential of a threshold concept approach for education policy and practice in Canada. Based on an extensive literature review, constructive group discussions, and experiential knowledge, the DERT identified six new literacies threshold concepts for ELA: *Data*—the types of sources and quality of information; *Genre*—the forms or categories of expression; *Audience*—the individual(s) or group(s) involved; *Perspective*—the inherent and underlying knowledge, beliefs and ideologies; *Innovation*—creative reforming, rethinking and reframing; and *Agency*—making choices and being active agents, both individually and collectively. Independently, each of these threshold concepts has a rich and well-established scholarly literature. Incorporating these concepts within one framework highlights the essential role of each concept, and the interconnections between these concepts, for effective and creative communication in any medium.

> "When understood holistically, the New Literacies Threshold Concepts, and the points of relation between each of the threshold concepts, provide a clear, yet complex map of what's involved, what to be aware of and how to read/write, speak/listen and view/represent creatively and effectively" (Wiebe & Altass, accepted, manuscript in preparation).

Using the New Literacies Threshold Concepts Map, educators can create lesson plans that bring to the forefront one or two variables, while leaving the other variables holistic and in play, providing the scaffolding to engage with the complexities of the rhetorical context.



The New Literacies Threshold Concepts Map facilitates a reframing of the educational issue of how to best prepare students to communicate effectively in life beyond high school, by reimagining the application of tools or concepts already at hand . . . . Together, these threshold concepts highlight what is involved and what to be aware of in the rhetorical situation of writing and communicating. (Altass & Wiebe, in press)

Threshold concept approaches support curriculum innovations that encourage students to develop "proactive knowledge (that) goes beyond understanding to prepare the learner for the alert and lively use of knowledge" (Perkins, 2008, p. 3) that can be creatively, attentively, and critically applied in many different ways and contexts, both inside and outside of the classroom. Across the disciplines, identification and guided exploration of threshold concepts lays the foundation for lifelong learning, as new questions, ideas and challenges emerge through knowledge acquisition, as well as individual and collaborative development (Williamson, 2013).[2]

Education for an Informed and Engaged Citizenry

Developing and implementing threshold concept pedagogy at a curriculum or policy level is a significant and complex proposal, requiring broad-based systemic and operational changes. An essential first step toward making effective and sustainable improvements to education systems is to reveal and evaluate underlying ideological assumptions that have guided and shaped policy to date. Strongly coupled to educational policy are the following prevailing political and cultural narratives: firstly, meritocracy as the primary effective means to the middle class (Loveday, 2015), which, for education, means higher skills equals better jobs and a better economy, and that individuals are, and should be, independently responsible for their own well being and success (i.e., neoliberalism) (Corman & Luxton, 2007); and secondly, progress, including technological progress, is inevitable, thus taking away the responsibility of society to actively engage in making decisions about the future (Hornborg, 2014). Paradoxically, though these underlying ideologies guide and shape public policy and the social imaginary in complex and interconnected ways, they are rarely discussed outside of the critical literature. For example, that most policy makers would not identify themselves or their actions as neoliberal makes it difficult to identify and directly challenge neoliberal ideologies in the practical application of educational policies (Thorsen, 2010). Exposing these underlying ideologies invites curriculum and policy development that builds skills in collaboration rather than competition, collective agency rather than independent privilege, and global competencies rather than insular protectionism.

Within the evolving knowledge-based and increasingly globalized creative economy, "everything from individual tasks to entire industries is being disrupted, so it's foolish to try to lock in place select elements of the existing order" (McAfee & Brynjolfsson, 2016, p. 141). However, while we can identify and predict that many jobs are, or will soon be, partially or completely undertaken by computers, predicting what work, if any, might replace these jobs, or even how work will be understood and defined in the future, is far more challenging. Leopold, Ratcheva and Zahidi (2016) highlight that popular estimates have suggested up to 65% of children entering primary school today will end up working in jobs that don't exist yet (see https://shifthappens.wikispaces.com/). For

[2] For an example of how the New Literacies Threshold Concepts can be used in the classroom, please see the following: Wiebe, S., & Caseley Smith, C. (2016). A/r/tography and teacher education in the 21st century. *McGill Journal of Education.* 51(3), 1163-1178; Wiebe, S., & Caseley Smith, C. (2016). Student a/r/tographers creating cellphilms. In K. MacEntee, C. Burkholder, & J. Schwab-Cartas. (Eds.), *What's a Cellphilm? Integrating Mobile Phone Technology into Participatory Visual Research and Activism* (pp. 71-86). Rotterdam: Sense.

education to effectively prepare students, not only for the world of paid employment, but to actively engage in creating what the world of the future will look like, economically, environmentally and socially, calls for a re-imagining of segregated disciplines and the elimination of assessment models based on isolated skill development. It is crucial that diverse individuals within civil society develop an awareness of and the capacity to understand and engage with the forms and applications of new technologies as they emerge, in order to be capable of identifying and critically evaluating already realized and potential environmental, economic and social impacts of technological progress and expanding labour arbitrage.

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