

**Engaging School Districts in Evaluative Thinking and Research-Based Inquiry to Advance 21st Century Teaching and Learning**

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## **Abstract**

This paper examines Ontario's multi-phased approach from 2011 through 2013 to engage all 72 school districts in voluntary, collaborative, inquiry-based research to investigate the impact of over 100 technology-based local innovation projects on instruction and student engagement, and ultimately on learning and achievement. It situates Ontario's approach, methodology, and results of the two-year research investigation within the wider provincial context of Ontario's education agenda and success as a world leader in education. Ontario's approach to focused innovation is aimed at the instructional core, driven by strong pedagogy that is evidence- and research-informed, enabled by technology, where appropriate, to support learning goals.

The *21st Century Innovation Research*, co-sponsored by the Ministry of Education and the Council of Ontario Directors of Education (CODE), contributes to international research evidence and discourse about the impact of technology-enabled 21st century teaching and learning practices and the development of next generation, higher order 21st century competencies. Collective case study methodology was used by an external research team to understand the unique particularities of individual innovation projects and for gathering data on what might be seen as common across a diversity of multifaceted projects at varying stages of development (emerging, applying, integrating, transforming). The research study demonstrates how local control over technology-based school innovations can be partnered with a systemic approach and central support to contribute to improved learning outcomes. The findings may prove useful to other jurisdictions seeking to engage districts, schools, educators, and students in technology-based, pedagogy-driven teaching and learning in a knowledge- and technology-intensive age.

## **Introduction**

Ontario continues to build upon its reputation as a world leader in education by helping more students to succeed than ever before, while maintaining high expectations and standards for all learners and promoting safe, accepting, and inclusive schools. Ontario's accomplishments in education have been guided by an unwavering focus on three core priorities: increasing student achievement; closing gaps in achievement; and increasing public confidence in publicly-funded education.

Looking to the future, Ontario, like many jurisdictions around the world, is taking steps to ensure the ongoing relevance and effectiveness of its learning opportunities that prepare students for success in a complex, dynamic, knowledge- and technology-intensive world. The forces that are driving shifts in educational objectives and practices come from many sources: changing needs for economic and social development; mounting research evidence from the learning sciences about instruction that promotes deeper learning in connection with whole system change; and new and emerging opportunities for both technology-enabled learning at school and informal media-based learning environments outside the school. These forces and changing expectations among learners, employers, and citizens are affecting "what is taught, how it is taught, and how learning is assessed" (Bransford, Brown, & Cocking, 2000, p. 13).

Ontario has made significant progress in a number of areas including: child care and full-day Kindergarten; high quality teaching and learning from Kindergarten to Grade 12; a robust leadership

strategy; healthy, safe, accepting, and inclusive school policies; hands-on and engaging secondary programming; an internationally respected curriculum benchmarked to international jurisdictions and based on extensive research and consultations; an e-Learning strategy; a First Nation, Métis and Inuit education policy framework; improved school board governance; the *Politique d'aménagement linguistique*; parent engagement; and a prominent role for the student voice.

Today, Ontario's publicly-funded education system is recognized as among the best in the world. A decade ago, only 68% of Ontario students graduated<sup>1</sup>, and only 54% of children in grades 3 and 6 were achieving the provincial standard in literacy and numeracy<sup>2</sup> as measured by Ontario's Education Quality and Accountability Office<sup>3</sup>, an arms-length agency providing information about student achievement. In 2012-13, those numbers stood at 83%<sup>4</sup> and 71%<sup>5</sup> respectively.

Taken together, these initiatives and resulting gains in student achievement have provided a foundation on which to build the next phase of Ontario's education strategy and ensure that Ontario's students continue to benefit from relevant, enriching, and effective learning experiences that prepare them for today and the future.

Ontario's continuous improvement in student achievement for more than a decade has drawn interest from international delegates and the wider research community curious to learn about Ontario's theory of action and the active ingredients behind this sustained success at whole system reform. As noted by the OECD (2012a), contributing factors to success in Ontario's approach include clear recognition that reform is a two-way street, rather than simply something imposed from the top, as well as a focus at the school level where change has to happen, premised on a sense of shared understanding and common purpose at every level of the system, and founded on respectful relations and government confidence in the quality of its teaching force. Ontario's approach has also paid special attention to leadership development, especially for school principals and vice-principals. It has intentionally given prominence to the importance of student voice and choice in a number of ways, including through the establishment of formal structures such as the Minister's Student Advisory Council (MSAC) as well as vehicles for supporting students' active role as researchers (Students as Researchers projects) and change agents (Speak Up projects).

Other factors attributed by the OECD to the sustained success in Ontario's education reforms include the framing of advanced literacy and numeracy skills as a means to enable students to solve real-world problems, and an approach to critical and creative thinking where "the development of these skills and habits of mind are not the subject of a single course or strand of the curriculum, but rather are woven

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<sup>1</sup> Ontario Ministry of Education, "Getting Results" at <http://www.edu.gov.on.ca/eng/gettingResultsGrad.html>

<sup>2</sup> Ontario Ministry of Education, "Education Test Scores Continue to Rise: Ontario Public Schools Preparing Students for Success" at <http://news.ontario.ca/edu/en/2013/08/education-test-scores-continue-to-rise.html>

<sup>3</sup> Education Quality and Accountability Office, "Report of Provincial Results" at [http://www.eqao.com/pdf\\_e/03/03P031e.pdf](http://www.eqao.com/pdf_e/03/03P031e.pdf)

<sup>4</sup> Ontario Ministry of Education, "Getting Results" at <http://www.edu.gov.on.ca/eng/gettingResultsGrad.html>

<sup>5</sup> Ontario Ministry of Education, "Education Test Scores Continue to Rise" at <http://news.ontario.ca/edu/en/2013/08/education-test-scores-continue-to-rise.html>

into virtually all aspects of schooling.” (OECD, 2012a, p. 144) The OECD notes that “(t)his focus can be found across the curriculum as well as in the increasing attention Ontario schools have paid to the use of formative assessments at the school level. But most critically, this focus has driven deep, sustained investments in building the capacity of Ontario’s teaching force to work collaboratively to examine their own practices and the effect of those practices on the quality of student work. As Ontario’s curriculum, assessment, and reporting system has moved from an emphasis on mastery of facts to an understanding of ‘big ideas’ and the ability to apply one’s knowledge to the problems one confronts in everyday life, the teacher-learning agenda has kept pace accordingly.” (OECD, 2012a, p. 144)

Ontario’s theory of action recognizes a need to both balance and blend knowledge from professional practice and research. The approach also acknowledges the importance of including supports for capacity building and knowledge mobilization as a means for supporting teachers and school and system leaders in shifting their practice to integrate promising innovations that make a demonstrable difference for student engagement and success.

Moreover, Ontario is committed to mobilizing research, data, and effective practices as a strategy for continuous improvement. Two examples of this commitment are the Managing Information for Student Achievement (MISA) initiative, and, the Ontario Education Research Symposium, which the ministry has hosted annually for the past nine years to support knowledge mobilization activities.

## **The Ontario Context**

### Ontario’s Landscape

Ontario is the home for almost 40% of Canada’s 35.1 million people (it is the largest population by province)<sup>6</sup>. Nearly 40% of the 260,000 immigrants who come to Canada annually, settle in Ontario<sup>7</sup>.

Ontario covers an area of over 415,000 square miles, an area greater than the size of France and Spain combined<sup>8</sup>. The province is characterized by its large urban centres in the south located beside or close to the Great Lakes, surrounded by rural, agricultural areas and by increasingly less populated areas as one travels north as far as Hudson Bay.

“Overtime, Ontario’s economic trend away from its traditional industrial and resource-based sectors has created a demand for increasingly sophisticated workers with strong fundamental skills and, increasingly, with post-secondary education or training” (Ontario, 2007). “New technology and innovations continue to transform the economy and heighten the demand for a more highly skilled workforce” (Ontario, 2013). Added to that, Ontario has been considering how best to support the development of global citizens who bring the competencies and qualities that the employers of today and tomorrow are looking for, and that are needed to thrive in a rapidly changing, technology-driven, globalized world.

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<sup>6</sup> Statistics Canada “Population by year, by province and territory (number)” at <http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo02a-eng.htm>

<sup>7</sup> Citizenship and Immigration Canada, “Canada Facts and Figures” at <http://www.cic.gc.ca/english/pdf/research-stats/facts2012.pdf>

<sup>8</sup> Ontario, “About Ontario” at <http://www.ontario.ca/government/about-ontario>

## Ontario's Education System

Public elementary and secondary education is a provincial responsibility in Canada. There is no national education ministry. Ontario's education system is organized on three levels, within which the Ministry of Education, school districts, and schools, form the nucleus of the system.

There are nearly 5,000 schools in Ontario<sup>9</sup>. The schools are administered through 72 school districts, with five sites, administered by the Ministry of Education, that operate provincial and demonstration schools for pupils who are deaf, blind, deafblind or have severe learning disabilities. The fact that educational services are provided over a substantial geographical area means that schools and school districts in urban, rural, and remote communities have distinct needs and face unique challenges.

Ontario has 2.1 million students, of which 27% are born outside Canada.<sup>10</sup> Ontario enjoys one of the most diverse multicultural populations in the world, particularly centred in the province's urban areas; the school system plays a critical role within the province's network of services for newcomers, with a large annual influx of English- and French- language learners.

The province provides educational services through both public and Catholic schools and school districts. Students in Ontario also have an entitlement to education in either of Canada's two official languages, English and French; accordingly Ontario provides educational services in both English-language and French-language, and in public and Catholic schools and school districts.

Ontario school districts employ over 115,000 full-time equivalent teachers (elementary/secondary)<sup>11</sup> and over 7000 early childhood educators as a result of recent reforms that will enable all four- and five-year olds to attend full day kindergarten programs in publicly-funded schools by September 2014. The teaching profession is self-regulated by the Ontario College of Teachers, which has a mandate to license and regulate the Ontario teaching profession in the public interest. The College is governed by a council comprised of members elected by their peers and members appointed by the provincial government.

Ontario's publicly funded education system uses a province-wide curriculum from Kindergarten through Grade 12 that identifies the knowledge and skills that students are expected to develop in each subject/discipline by the end of each grade level. By defining the curriculum to be used by all Ontario teachers, the Ministry sets standards for the entire province; standards informed by currently available research and benchmarked against national and international education standards.

Ontario has been a leader in promoting online learning for students since 2007 through its e-Learning Ontario strategy, with over 110 online courses for credit currently on offer. More recently, the Ministry began profiling blended learning, supported by investments in a dedicated staff position responsible for

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<sup>9</sup> Ontario Ministry of Education, "Building the Next Phase in Ontario's Education Strategy" at <http://www.edu.gov.on.ca/eng/parents/BuildNextPhase.pdf>

<sup>10</sup> Ontario Ministry of Education, "Building the Next Phase in Ontario's Education Strategy" at <http://www.edu.gov.on.ca/eng/parents/BuildNextPhase.pdf>

<sup>11</sup> Ontario Ministry of Education, "Education Facts" at <http://www.edu.gov.on.ca/eng/educationFacts.html>

local capacity building and professional learning (eLearning contacts) in all school districts, funded by the Ministry.

Funding for public education in Ontario in 2012-13 was approximately \$21 billion (CDN).<sup>12</sup> Education is second only to health in its share of the Ontario budget.<sup>13</sup> The Grants for Student Needs (GSN) provide funding components, among others, for computers in the classroom and special education supports that include funding for assistive and adaptive technologies.

### Foundations for Success

Education in Ontario has seen significant positive growth and progressive improvements in promoting student success over the past ten years. As noted, a decade ago, only 68% of Ontario students were graduating<sup>14</sup>, and only 54% of children in Grades 3 and 6 were achieving the provincial standard in literacy and numeracy<sup>15</sup> (as measured by Ontario's Education Quality and Accountability Office, an arms-length agency providing information about student achievement). In 2012-13, those numbers stood at 83%<sup>16</sup> and 71%<sup>17</sup> respectively.

While Ontario has made significant progress in closing achievement gaps for several groups, there is more work to do. Aboriginal learners, youth in care, learners with mental health issues, and those in need of special education support still struggle within the system. The Ministry of Education continues to work with its education partners to provide targeted supports and programs to support all learners.

With the strength of the education community, Ontario has been able to introduce multi-faceted reforms to the publicly-funded education system, making it the system of choice for 95% of Ontario's students and their families<sup>18</sup>.

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<sup>12</sup> Ontario Ministry of Education, "School Board Funding Projections for the 2012-13 School Year" at <http://www.edu.gov.on.ca/eng/funding/1213/funding12.pdf>

<sup>13</sup> Ontario Ministry of Education, "School Funding – A Guide for Parents" at <http://www.edu.gov.on.ca/eng/parents/funding/provincial.html>

<sup>14</sup> Ontario Ministry of Education, "Getting Results" at <http://www.edu.gov.on.ca/eng/gettingResultsGrad.html>

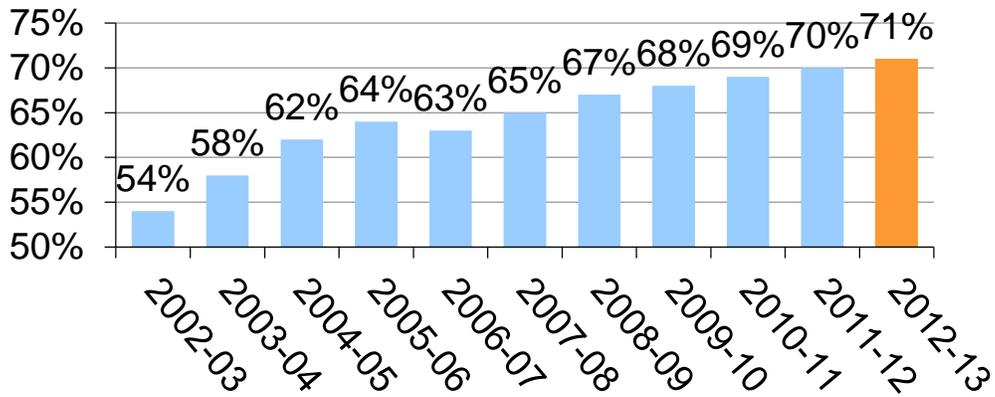
<sup>15</sup> Ontario Ministry of Education, "Education Test Scores Continue to Rise" at <http://news.ontario.ca/edu/en/2013/08/education-test-scores-continue-to-rise.html>

<sup>16</sup> Ontario Ministry of Education, "Getting Results" at <http://www.edu.gov.on.ca/eng/gettingResultsGrad.html>

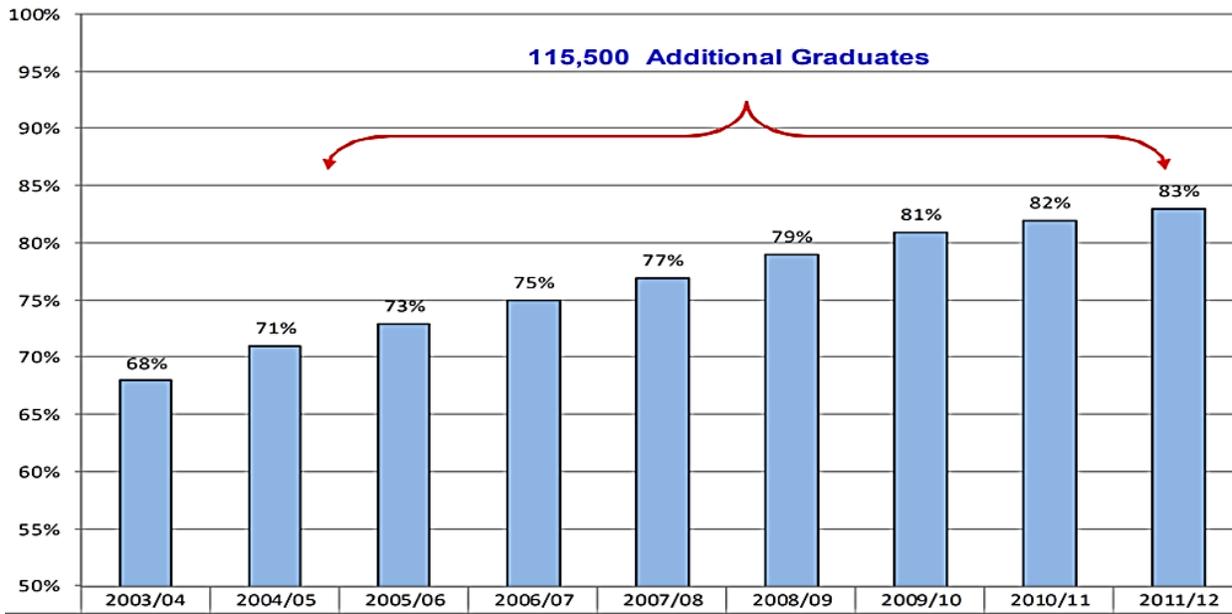
<sup>17</sup> Ontario Ministry of Education, "Education Test Scores Continue to Rise" at <http://news.ontario.ca/edu/en/2013/08/education-test-scores-continue-to-rise.html>

<sup>18</sup> Ontario Ministry of Education, "Building the Next Phase in Ontario's Education Strategy" at <http://www.edu.gov.on.ca/eng/parents/BuildNextPhase.pdf>

**Overall Elementary Achievement Growth, 2002-03 to 2012-13<sup>19</sup>**



**The Graduation Rate<sup>20</sup>**



<sup>19</sup> Ontario Ministry of Education, "Building the Next Phase in Ontario's Education Strategy" at <http://www.edu.gov.on.ca/eng/parents/BuildNextPhase.pdf>

<sup>20</sup> Ontario Ministry of Education, "Building the Next Phase in Ontario's Education Strategy" at <http://www.edu.gov.on.ca/eng/parents/BuildNextPhase.pdf>

## Why 21st Century Teaching and Learning?

We live in an age of acceleration that looks ahead to unimagined possibilities and challenges in an unknowable future. As the OECD's Andreas Schleicher (n.d.) portrays vividly, schools need to embrace 21st century learning in order to equip young people for success in a fast-changing world and for "jobs that have not yet been created, technologies that have not yet been invented, and problems that we don't yet know will arise."

Many international thought leaders, business leaders, and young people themselves argue the case to address '21st Century skills,' 'higher order skills,' 'next generation learning,' 'deeper learning,' and 'connected learning' as part of policy and planning. These calls for change are multi-faceted, well-addressed in research studies, and beyond the scope of this paper to address in any depth. In brief, calls for schools and education jurisdictions to keep pace with changing times are often presented in terms of: changing expectations of society and a rapidly transforming, technology-driven, and connected globalized knowledge economy; changing expectations of 'new millennial learners' for whom digital and social media, mobile technologies, and access to online and self-directed learning feature prominently in their everyday lives outside of school; and emerging evidence of the power of technological innovations to enable, enhance, extend, and transform learning.

Calls for change acknowledge the economic requirements for a highly skilled, adaptive labour force and citizenry committed to lifelong learning in a dynamic, increasingly competitive economy where creativity and innovation are viewed as capacities that set apart successful individuals, businesses, societies, and economies from others (Ontario (2013), Dede (2010), U.S. Department of Education (2010), European Union (2006, n.d.), OECD (2012b), Hagel et al (2010), McKinsey (2007), Conference Board of Canada (n.d.). As one Ontario business leader and economist stated succinctly, "(i)f the next 15 years are anything like the last, during which we restructured how we work (Internet, mobile), communicate (smartphones), interact (Facebook, Twitter), shop (Amazon, eBay), listen to music (iTunes, iPods), plan trips (TripAdvisor, Expedia) and find information (Google, Yahoo), then literacy, numeracy, creativity, adaptability and entrepreneurship will be the name of the talent game." (Kevin Lynch, 2014)

The U.S. Committee on Defining Deeper Learning and 21st Century Skills provides helpful insights and best-evidence research in this complex field of inquiry, adding to the calls for change in education and across societies. They offer a definition and persuasive rationale for the growing importance of supports for 'deeper learning'. The committee defines 'deeper learning' as the "process through which an individual becomes capable of taking what was learned in one situation and applying it to new situations (i.e., transfer)...The product of deeper learning is transferable knowledge, including content knowledge in a domain and knowledge of how, why, and when to apply this knowledge to answer questions and solve problems. We refer to this blend of both knowledge and skills as '21st century competencies'" (National Research Council, 2012). The Committee illuminates the importance of deeper learning over other kinds of learning (e.g., factual recall), stating that, "(w)hile other learning may allow an individual to recall facts, concepts or procedures, deeper learning allows the individual to transfer what was learned to solve new problems" (Pellegrino, J.W. & Margaret L. Hilton (ed.), 2012). This capacity of knowledge transfer to solve new problems, by individuals, organizations, companies and nations, is

arguably ever-more important in the context of a dynamic, unpredictable and increasingly connected knowledge economy and civilization, such as the earlier description of the future provided by Schleicher. Fullan and Langworthy (2013) similarly make the case for “deep learning goals enabled by new pedagogies and accelerated by technology,” and present new research evidence that shows that when individuals are exposed to real-world problem solving experiences as part of their schooling, it contributes to higher quality work at later stages. The Committee, like others (including Saavedra & Opfer, 2012), presents a case for why jurisdictions and nations increasingly now view the so-called 21st century competencies to be of high importance for *all* students and citizens in an emerging global innovation economy. In the past, such high level proficiencies might not have been required of all members of society for individual success and a nation’s economic prosperity. Moreover, the National Research Council report cited earlier notes that, “(t)he pervasive spread of digital technologies has increased the pace at which individuals communicate and exchange information, requiring competence in processing multiple forms of information to accomplish tasks that may be distributed across contexts that include home, school, the workplace, and social networks” (Pelligrino, J.W. & Margaret L. Hilton (Eds.), 2012).

At the same time, there is heightened recognition, in the context of economic constraints, for evidence-based decisions broadly-speaking. Much is known about evidence-based high-yield instructional practices as made prominent in recent years by John Hattie’s (2009) landmark comprehensive education report, *Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement*. More is required to support changes in teaching methods to integrate proven high-yield practices, such as the importance of timely quality feedback, so they become ubiquitous pedagogical practices in all classrooms. As noted above, substantive evidence from the science of learning is coming to the fore and increasingly guides education policy in jurisdictions that include, for example, British Columbia, Alberta, the United States, and member jurisdictions in the European Union, among others. For examples, see the U.S. Department of Education’s *Transforming American Education: Learning Powered by Technology: National Education Technology Plan* (2010); and, Alberta Education’s *Framework for Student Learning: Competencies for engaged thinkers and ethical citizens with an entrepreneurial spirit* (2011).

In tight fiscal times, there is an even greater need for cost-effective and efficient education delivery options that support more flexibility and personalization in learning opportunities for learners, including anytime, anywhere, any device, cross-platform virtual learning opportunities. Increasing student choice and voice in learning, whether offered in traditional, virtual, or blended learning environments, is also associated in research evidence with effective learning outcomes through greater student engagement and intrinsic motivation to invest the time, effort, and perseverance required for success in learning (OECD (2010), Canadian Education Association (2009), Wideman (2013), Saavedra & Opfer (2012)). Emerging evidence from the science of learning is profiling practices that are more effective than others in promoting knowledge transfer, deeper learning, resilience, creative and adaptive capacity, self-directed learning, learning to learn skills, and civic/global responsibility, among other desired learning outcomes that are connected in the emerging literature and public discourse on 21st century learning. On this last point, Fullan and Langworthy (2014) present a concise and helpful summary of four key

foundations from the learning sciences body of literature (e.g., Dumont et al 2010; Bransford et al 2000) as part of their case for ‘new pedagogies’ that promote ‘deep learning’ by students. The authors note that educators will be familiar with these foundations from the past century of education theory and research--knowledge construction, real-world problem solving, feedback, and the importance of meta-cognitive strategies.

Even though the policy field of 21st century learning is an emerging one, already many stakeholders are championing change and pointing the way forward, including the voices of innovative Ontario classroom educators who engaged in the province’s collaborative 21st century teaching and learning innovation research initiative. Twenty-first century learning is a field with a research foundation that draws heavily from earlier research on information and communications technology (ICT) in education, instructional design, and more recently, blends research evidence from the cognitive sciences on how people learn with research evidence on effective whole system change, change leadership, and effective 21st century learning environments. It takes in technology-enabled instructional design; and yet, as Ontario researchers Jenson, Taylor and Fisher (2010, p. 4) note, 21st century skills “..are not always or necessarily ICT-dependent (Annetta et al., 2010; OECD, 2009)”.

Twenty-first century learning (or 21st century skills) as an emerging policy field remains loosely defined (Jenson et al, 2010; OECD, 2012c) and in need of greater precision (Fullan, 2010). There is as yet no internationally agreed upon blueprint for 21st century teaching and learning, nor common definition of a 21st century competencies framework. As noted by the OECD (2012c, p. 36), “...although the promising concept of 21st century skills seems to be already well known and established in the public discourse, many would agree that its actual meaning remains ill-defined. Despite many inspiring attempts (Trilling & Fadel, 2009, DeRuro & Silva, 2010), teachers and students may still find it difficult to see the real implications of this public discourse on their daily professional practice.”

Yet, as the OECD also argues, “(b)ecause of the growing importance of connectedness, schools and teachers must cope with new responsibilities related in particular to skills with which they may not be as familiar as necessary... . Schools play a pivotal role in digital skills development, mitigating forms of digital exclusion... . Schools should take a major responsibility for supporting children and their parents in gaining digital literacy and safety skills... . Evidence from OECD studies in initial teacher training also suggests that the issue of technology use is not addressed adequately and that student teachers are not receiving enough training or practical experience in how they can use technology in innovative ways that can improve or transform their classroom experience” (OECD, 2012c, p. 164). Ontario is at the forefront in addressing this last point. Beginning in 2015, all initial teacher education programs in Ontario are required to include mandatory components including provision of opportunities for teacher candidates to practise their learning on pedagogy-driven, technology-enabled teaching and learning practices, set within foundational knowledge from the science of learning.

### **The Role of Technology**

Technology and technology-driven innovation have become ubiquitous in our society. Recent studies assert that e-learning and mobile learning are primary ways in which schooling will be transformed in

the future (Davis, Eickelmann, & Zaka, 2013; UNESCO, 2012). In Ontario, transformations are underway to support a world-class post-secondary education system that is a leader in innovation and online learning as part of the government's economic plan to invest in people, to build modern infrastructures, and to support a dynamic and innovative business climate (Ontario Ministry of Training, Colleges and Universities, 2013). In January 2014, the Minister of Training, Colleges and Universities (MTCU) announced Ontario Online, a collaborative Centre of Excellence to be governed and operated by colleges and universities. Ontario Online will leverage existing strengths in the system and allow institutions to share best practices in pedagogy, collaborate on research, and facilitate the offering of in-demand, state-of-the-art online courses that are recognized for credit across multiple institutions. In the elementary and secondary education sector, during 2013 consultations to renew Ontario's education vision, public input called for greater prominence in age-appropriate technology-enabled learning opportunities for students in Kindergarten to Grade 12. Ontario's well-established eLearning strategy and provincially-licensed virtual learning environment provide a foundation for the future, offering more than 110 online courses for credit, and more recently fostering increased opportunities for blended learning, supported by ministry-funded eLearning contacts in every school district.

While considerable research has been published about technology in education, one European Union report noted that, for a variety of reasons including the complexity of studying knowledge creation and knowledge building in a technological platform, "we still know little about the impact and effectiveness of ICT in education" (Scheuermann & Pedró (Eds.), 2009, p.69). Greater understanding is needed into the role of technology as a tool for improving the teaching and learning process: how technology enables customization of the educational process; how technology-enabled teaching and learning support the development of 21st century skills and competencies that are gaining increasing profile among educators, researchers, jurisdictions, and employer groups; what system level approaches can avoid the emergence of a digital divide; and what indicators and impact measures are useful and appropriate for gathering evidence of improved student engagement and achievement through technology-enabled 21st century teaching and learning environments.

As noted, Ontario's theory of action recognizes a need to both balance and blend knowledge from professional practice and from research use. It stresses the importance of evidence- and research-informed decision making.

When the Ministry of Education partnered with school districts to learn from technology-enabled teaching and learning innovation projects, teacher-leaders and school- and system-leaders were all among the prime advocates for pedagogy-driven innovation. In the words of one Director of Education, "We've learned so much about how effective teaching and learning happens in the province of Ontario, and we need to hold onto that learning and figure out how technology makes it richer...We're on a strong teaching and learning journey and now we're incorporating technology into it" (Ontario, 2014).

Ontario's approach to focused innovation is aimed at the instructional core. The multi-phased, multi-year approach to defining Ontario's 21st century teaching and learning plan is driven by strong pedagogy that is evidence- and research-informed, enabled by technology, where appropriate, to

supporting learning goals; rather than being centred on the adoption of specific digital devices, tools, or platforms as a starting point.

This paper examines Ontario's approach from 2011 through 2013 to engage *all* 72 school districts in voluntary, collaborative, inquiry-based research to investigate the impact of technology-enabled teaching and learning practices on instruction and student engagement, and ultimately on learning and achievement, with a focus on important higher order, 21st century competencies.

### **A System Approach to 21st Century Teaching and Learning Innovation**

In pursuing the path forward to ensure that Ontario students continue to benefit from relevant, enriching, and effective learning experiences, Ontario continues to rely on standards and processes that ensure excellence in policy development and delivery. These standards are guided by Ontario's Quality Policy Framework and include: outcomes-focused, evidence-based, transparent, fiscally sound, engaged, and horizontal dimensions.

Respectful relations and engagement among education partners are hallmark characteristics of Ontario education today and are also important factors contributing to our system-wide successes in student achievement to date. As such, respectful engagement with education partners has been an intentional feature in the Ministry of Education's multi-phased development of a 21st century teaching and learning plan for Ontario. Acknowledging the rapid nature of change in technology tools available for teaching and learning and associated new pedagogical models, the Ministry of Education is committed to "learning our way forward" with our education partners. This commitment to collaborative partnerships with education leaders at every level (provincial, district, school), as well as the need for evidence-informed decision making, are instrumental to the concept and design of the technology-enabled teaching and learning innovation research initiative.

Scaling up and systematizing evidence-based effective teaching and learning practices are challenges faced by many education jurisdictions (McKinsey, 2007; Fullan 2012, Hargreaves in Ballanca et al, 2010). Ontario's 21st century teaching and learning innovation research initiative is designed to address these challenges directly and has resulted in some early-stage successes. Over the course of two years, over 100 local innovation projects contributed impact evidence through the involvement of more than 4500 teachers and 100,000 students in over 1600 schools. An external research team reported on overall findings and trends across all projects.

Results of the study are informing system scaling and sustainability for Ontario's 21st century teaching and learning plan and enlightening the next phase of Ontario's education strategy. This approach to innovation research reflects and builds on a culture committed to "leveraging evidence about effective practices within and across Ontario, to sharing and learning about such evidence nationally and internationally, and to being part of an international debate and body of evidence about educational improvement and connecting research to policy and practice" (Campbell et al, 2012).

## **Ontario's Approach to Innovation Research to Advance 21st Century Teaching and Learning**

In Ontario, as this research paper attests, all 72 school districts, thousands of innovative educators, and over 100,000 students are championing 21st century learning practice in a very real and applied way in their classrooms, schools, and local jurisdictions. Through their voluntary participation in this innovation work and province-wide research study, they are actively contributing to the local, provincial, and international knowledge base around effective technology-enabled 21st century teaching and learning.

Ontario's 21st century teaching and learning innovation research builds upon and benefits from a culture of inquiry that has been actively fostered among its educators, through various interrelated initiatives and efforts sponsored by, for example, the Literacy and Numeracy Secretariat (LNS) and the Teacher Learning and Leading Program (TLLP). Since 2004, the LNS's goal has been to help boost student achievement by working directly with schools and school districts in building capacity and implementing strategies to improve reading, writing, and mathematics skills. The TLLP empowers classroom teachers to engage in authentic learning and share their expertise with colleagues. It is a well-established feature in Ontario's education landscape and has been co-sponsored by the Ministry of Education and the Ontario Teachers' Federation (OTF) for the past seven years. "Research on school change that takes a position of honouring teachers' calling to serve students within their professional practice..." is what Goodlad (1991) and Sergiovanni (2007) think of as teacher stewardship. It is a stance within educational change that places student actions and learning as the predominant rationale and motivation of and for teacher action, learning, and change (Greenfield, 1991). (Ryerson et al., n.d.) As Fullan and Langworthy (2014) express eloquently, and to which Ontario ascribes, "(a)t the heart of most teachers' motivation is the desire to ignite learning in others, to kindle curiosity and creativity, and to light up the potential of the human mind." This kind of professional motivation is what powers Ontario's 21st century innovation research pilots.

In Ontario, classroom educators, as well as school and system leaders who participated in the project, approached learning tasks in new ways, applying professional judgment in changing pedagogical practices to leverage technology to improve student engagement, learning, and achievement. These educators have systematically documented their inquiry investigations and resulting impact evidence, sharing this knowledge openly with their peers and the wider provincial and international research community. In doing so, they fulfill an important expectation of transparency set by this 21st century innovation research initiative.

The focus on collaborative knowledge creation and exchange of effective technology-enabled practice that is evidence- and research- informed is a key design feature of Ontario's approach. This disciplined approach is intended to accelerate awareness, uptake, and systematizing of promising practices in technology-enabled, 21st century teaching and learning in ways that promote acquisition of important higher order 21st century competencies.

The approach is consistent with international research on effective strategies to foster education innovation. "Openness about one's innovation is the second way in which horizontal systems of innovation differ from conventional modes of innovation. Freely revealing new solutions and ideas is a

necessary condition for the functioning of communities of users. In these communities multiple potential sources of innovation are identified and each member of the community can benefit from them” (OECD, 2004, p. 49).

Ontario educators and Ontario’s approach are contributing valuable insights and impact evidence in an emerging field, where, to date, the overall research evidence supporting claims for student benefits has been newly-forming, thin and/or on a small-scale. As Jenson et al. (2010), noted in a ministry commissioned policy scan, “Almost a decade since the 2001 publication of *Oversold and Underused: Computers in the Classroom*, Larry Cuban’s study of computer integration in California schools, research in the area of technology-enabled instruction continues to point to the same fundamental issue. Despite massive investment in digital technologies for education over the last two decades, there remains little evidence of its impact on student achievement. As well, the research consulted for this report points to inconsistent, uneven, and inconsequential implementation of ICT to advance the teaching and learning of 21st century skills.”

With the emphasis on evidence- and research-informed decision making, and the generation of local artefacts to illustrate what ‘21st century learning’ looks like in practice, Ontario’s approach seeks to address another aspect of the knowledge gap on effective and changing pedagogy. “Education also constitutes a realm where knowledge is little codified .... As a rule, the profession of teaching is not organised to keep informed of alternative approaches and solutions tested by others; instead they proceed by intuition and imitation of recognized practices in the repertoire of ‘master teachers.’ There are only weakly developed mechanisms whereby communities of educational practitioners collectively can capture and benefit from the individual discoveries made by their members. Opportunities for regular knowledge exchanges between educational researchers and teachers are few and far between (Hargreaves, 1999).” in OECD (2004), p. 31.

In 2012 and 2013, all school districts participating in Ontario’s 21st century teaching and learning innovation study were invited to send teams of three to contribute to a one-day face-to-face round table organized for sharing promising practices with one another, thus situating each district’s local experience within a broader provincial and international research context. Dr. Chris Dede, Harvard Graduate School in Education, provided the keynote address at the 2013 provincial round table event and served as discussant to a panel of local innovation leaders to help connect Ontario’s current practices with international trends in 21st century learning. On that day, participants were also invited to contribute to the Ministry of Education’s wider consultation throughout the province on developing a renewed vision for publicly funded education going forward.

Overall, the research findings profile growing momentum in all school districts to embed the change forces of pedagogy, technology, change knowledge, and change leadership that mounting research evidence associates with effective 21st century teaching and learning practice (Fullan, 2012; Fullan & Langworthy, 2013; Hargreaves in Ballanca et al 2010; OECD, 2010, 2012b). Further, taken as a whole, Ontario’s innovation projects embody changing teaching and learning practices enabled by technology that are more characteristic of ‘high level uses of technology’ than ‘basic uses’ as defined by Fullan &

Langworthy (2014) and centre on learning tasks that involve, for example, use of technology to ‘create multimedia presentations,’ ‘collaborate with peers on learning,’ ‘analyse data or information,’ ‘write or edit stories, reports or essays,’ and ‘find information on the internet.’ In their discussion of ‘new pedagogies for deep learning,’ Fullan & Langworthy (2013) associate ‘high level’ uses of technology with knowledge building types of ‘deep learning’ goals, in contrast with ‘basic’ uses of technology that focus on more passive ‘information consumption’ types of activity.

## **Methodology and Key Findings from Ontario’s 21st Century Innovation Research Initiative**

### Conceptual Framework and Methodology

This research investigation was conducted in two phases from 2011 to 2013, applying the same framework and methodology during both phases. The research team built a conceptual framework based on models (OECD, 2009; Fullan & Barber, 2010) used to guide systematic study into technology effectiveness in education. Models that examine technology-enabled initiatives in education sometimes are limited in scope, are utilized over a fixed time, and result in a range of outcomes. The framework for this research investigation was broadly defined to allow for ongoing insight into the role of technology in changing teaching practice and in strengthening student engagement, learning, and achievement. The research strategy was intentionally broad to enable collection of data from a diverse array of multi-faceted projects and to be adaptable for the various stages of development of technology-enabled projects that school districts were undertaking (emerging, applying, integrating, and transforming). In building the framework, further consideration was given to the diverse contributions to be recognized within the study: French- and English-language school districts, urban and rural communities, Kindergarten to Grade 12 involvement, choice of technologies, areas of focus, and scope of the projects.

The framework provided a foundation for documenting school districts’ diverse, locally chosen, and experimentally-controlled technology-enabled projects and guided school districts in reporting within a common research structure. The framework also supported the research team in analysing data and identifying key findings across projects. The framework structure required school districts to identify potential implications for local and provincial policy and programming that were evident from project activities and to reflect on the systemic consequences of their projects on areas such as capacity building, knowledge mobilization, and leadership development. Throughout the research study, innovation participants were invited to join online communities of practice sponsored by the research team to promote the exchange of knowledge among researchers and teachers, as well as a means of gathering research evidence.

Since case study methodology (Stake, 2005) lends itself to the gathering of both qualitative and quantitative data, this methodology was used as a means of gathering and explaining particularities about individual projects, and also about what might be seen as common across projects. The data reported by school districts provided quantitative information about the scope and involvement for each project initiative and captured details for a rich qualitative description of the impact of technology on 21st century teaching and learning. This methodology allowed the research team to present a detailed picture of each site or case according to the comprehensive self-reporting guide supplied to project leaders and supported through webinar sessions, online discussions, personal

interactions by phone, and in visits to a cross section of school districts where field researchers met and interviewed individuals attached to projects and visited classrooms to see technology in use.

Descriptors of the 90 innovation projects funded in Round 2 (2012-13) are included in the full research study available at [www.curriculum.org](http://www.curriculum.org) and at [www.eduGAINS.ca](http://www.eduGAINS.ca).

### Findings

The research investigation into the impact of digital technology on 21st century teaching and learning was accomplished in two phases. From Round 1 (2011-2012), the collected data reflected Fullan's perspective (2012) that pedagogy, technology, and change are three main drivers needed to move education forward in the 21st century. In Round 2 (2012-2013), these areas of focus remained central as data from projects in all school districts across the province were gathered and examined for evidence of changing practice and strengthening student engagement, learning, and achievement; of connecting student learning with 21st century skills; and of effective practices suited to system scaling and sustainability.

The key findings for both phases were reported under the themes pedagogy, technology, and change. Utilizing these three themes provided a concrete connection between the data reported by the school districts and the global context described in the ever-growing literature on 21st century teaching and learning (Fullan, 2012, 2013; Fullan & Donnelly, 2013; Fullan & Langworthy, 2013; McLoughlin & Lee, 2010; OECD, 2010). From the theme areas and the data disseminated in these international studies, the topics, issues, and challenges similar to those in the global community are being addressed in all school districts across Ontario.

### Pedagogy

There was repeated and accepted acknowledgement that school districts are making inroads that effectively integrate technology, pedagogy, and learning. There was consistent and clear evidence across projects that pedagogy is the driving force for technological innovation as contained in the school districts' reporting on their project successes, areas of impact, and future directions. This represented a positive approach to student engagement, student achievement, professional learning, and district-wide systems thinking.

There was increased evidence that: teachers who use technology increasingly saw themselves as co-learners with their colleagues and students; teachers believe they now have the tools and strategies to better reach and engage every student; and school cultures are shifting to where teachers respect the differences in the ways students gain knowledge and skills in today's digital world.

While the majority of projects focused on student engagement, with a few exceptions, little was reported in the area of concrete or measurable achievement. This outcome aligned with what Fullan & Langworthy (2013) noted more globally as, "The absence of a robust evidence base that shows how new pedagogical models [mobilize] ... for deep learning." The data reported by school districts pointed to the fact that, in these early stages of 21st century learning, excitement about teaching and learning was a key ingredient in building a sense of empowerment that lays the groundwork for substantiating any

changes in student learning with discernible achievement results as effective innovation practices are systematized going forward.

Discernible progress was reported by three district school boards that collaborated on a common project to conduct a formative evaluation of the implementation, use, and impact of bringing cloud-based learning tools and resources into classroom practice within their respective districts. This joint innovation project's research report stated that, among the 175 teacher respondents to a survey, "significant and often dramatic increases in student engagement and persistence were almost universally seen, and appeared to be independent of either the particular type of cloud application being used or the nature of the task being done...Students' greater engagement and on-task persistence when utilizing the cloud in their activities was seen to be a critical causal factor in leading students to make greater use of and further develop 21st century learning skills" (Wideman, 2013, p. 68). The study also found that "forty-two percent of those surveyed indicated that the average quality of student work had increased by one level on the provincial four-level scale" (Wideman, 2013, p. 69).

Professional activities have started to move from a focus on teachers' understanding of how to use hardware and software to building teacher confidence and sense of efficacy in using digital technology as tools to support and enhance instruction and learning. While the shift in teacher vision from 'sage on the stage' to facilitator or, 'activator of learning,' as Hattie (2014) characterizes the changing role for teachers, is still a challenge, school districts are embarking on various approaches for supporting change in practice and are searching for supports, resources, and models to assist teachers as they connect pedagogy and technology in effective and innovative teaching practices.

To illustrate, one district's innovation project that was focused on blended learning approaches reported that, "(a)fter the professional learning, participants improved the level of proficiency in their teaching practice for generic classroom teaching and significantly for inquiry-based classroom teaching and student learning...The initiative was grounded in the belief that learning is the work. What was unique and innovative about this project is, while educators were engaged as a professional learning community in designing rich problem-based learning for students using technology as the key to increasing student engagement, they were also at the same time learning to use technology as tools for learning, thinking and working among themselves" (Toronto District School Board, 2013).

There seemed to be a growing understanding that building capacity in digital teaching and learning among teachers and school district personnel will lead to the sustainability of educational initiatives and their scalability across schools, school districts, and the province as a whole.

### Technology

Over the course of the two phases of the study, many positive changes were noted across projects in terms of technology use in diverse learning environments and teaching practice. For example, technology is providing opportunities for cross-curricular learning in manageable and efficient ways; technology seems to promote more collaboration among teachers and among students; and technology

seems to afford partnerships with parents by giving them access to information so that they can support their children's learning.

Projects had multiple aspects and differing combinations of activities related to the scope, use, training, and pedagogical basis of their technology-enabled project. The array of technologies included: use of mobile technology, (e.g. tablets, smart phones, e-readers, netbooks); cloud technologies and related infrastructure and wireless networks; and use of whiteboards and related technologies. Beyond the type of technology, a broad array of uses of the technologies emerged (e.g., assistive use of technology, use of technology coaches, technology and leadership development, online courses, blended learning, digital citizenship, bring your own device policies, impact of digital textbooks, learning commons and digital libraries...).

However, the bigger picture surrounding structural and instructional changes for school districts in terms of technological use appears to be in the early stages of being addressed. School districts are grappling with various aspects of technology and its overall use for 21st century teaching and learning. Among these are: issues surrounding safe and ethical use of technology in the school culture; equalizing digital access (e.g., use of personal devices, immediate access to technology, bringing the wider community/world into classrooms in isolated geographic areas); the constant and rapid change in the technologies that are available, how these technologies are used, and how information is accessed, shared and stored; and long-term system planning). The local innovation projects are contributing artefacts for accelerating knowledge transfer about modernized, effective practice to other schools and school districts. To lessen the digital divide for learners, school districts are sharing practices such as establishing learning commons, and are developing 'responsible use' policies.

School districts are investigating and implementing new organizational structures that embed coordinated approaches to using technology. They are in the early stages of aligning departments and jurisdictional responsibilities to enable system-wide approaches to 21st century teaching and learning (e.g., establishing working relationships between IT and curriculum, involving personnel at multiple levels within and across school systems).

From the reporting in all projects, it was clear that there was repeated and accepted acknowledgement that school districts are at a new threshold in terms of incorporating technology into pedagogical understanding in teaching and learning. There was an increased sense of excitement and enthusiasm evident in the reporting from school districts and more concrete direction was emerging in terms of sustainability and scalability in the convergence of pedagogy and technology.

### Change

Overall, there was indication that school districts are solidifying their vision and basing their planning and actions on an increasing body of research literature about digital teaching and learning and the central importance of 21st century skills. The fact that all school districts chose to participate in these projects indicated there was increased recognition and understanding that skills and attitudes for 21st century teaching and learning are of critical importance.

There was a sense that school districts and schools have moved beyond trying out various digital tools and programs in classrooms as a means of incorporating technology into isolated elements of the program, to a deeper understanding of what the shift toward 21st century teaching and learning means holistically for an education system. The brief descriptor that follows provides a concrete example of what this shift looks like in the Waterloo Region District School Board's *The Futures Forum, a recipient of the Canadian Education Association's Ken Spencer Awards 2014 for innovation in teaching and learning*. "Teachers across all high schools in this district have connected their classrooms to provide students with innovative, technology-enabled authentic learning opportunities. The Futures Forum classrooms combine English, Civics, and Career courses into an extended block, tied to the district's student success plan, where students can explore their interests in the parameters of the curriculum as they become independent learners. Futures Forum is an inquiry-based, cross-curricular, project-oriented approach to learning that uses technology to support the development of students' 21st century skills in critical thinking, communication, and collaboration through "real world" tasks. For example, students have become motivated writers by having authentic audiences and creating a narrative with purpose through blogging. The impact is seen in changing relationships between teachers and students. Teachers are "coaching" students to think more deeply and students are taking greater ownership in their learning. There is greater personalized instruction and formerly disengaged students are now active learners and contributors."

Several comments by school districts offered insight into increased understanding of possibilities for scalability and sustainability at the system level. There appeared to be a change in understanding the importance of shifting projects from classrooms and schools to whole system learning. These comments were aligned with recent literature and thinking regarding the cultural shift in embracing system change, and as necessary actions and directions for moving forward with 21st century system learning in a more global context. Fullan and Langworthy (2013) noted the importance of adequately developing four elements to connect theory and practice for deep learning: policies and system-level strategies that enable diffusion; accepted ways of measuring deep learning; adoption of new pedagogical models that foster deep learning; and, knowledge of how students adopt deep learning practices. They further noted: "When there is this kind of system-wide shared purpose, collective will becomes the core driver, and change becomes much easier than previously thought... . This orientation toward system-wide diffusion of new pedagogies begins with cultural coherence and initial engagement, and then brings in tools and programs to support realignment." As a whole, the projects provided evidence that school districts across Ontario are engaged in moving along this continuum as they build capacity for technology-supported pedagogy.

There was evidence of concrete direction emerging in terms of sustainability and scalability that capitalized on the convergence of pedagogy and technology. System-based recognition for technology use included the importance of designing ongoing professional development at multiple levels; school district departments working together; and policy development that promotes sustainability and scalability.

Over the course of the research investigations, it became evident that school districts have moved into “promoting system-ness,” understood in new and more far reaching ways that reflect positive and progressive moves forward in district-wide, holistic thinking germane to sustainable technology-enabled practices.

Ontario is moving forward and making the necessary shifts in practice for effective, evidence- and research-informed, 21st century teaching and learning as a system. As the research findings on Round 2 (2012-13) reported, *“(a)ll the school boards across Ontario are now actively engaged to varying degrees in a shift toward connecting with what Fullan (2012, 2013) has described as essential forces coming together to create the ground for 21st century learning: pedagogy, technology, and change”* (Curriculum Services Canada, 2013).

### **Conclusion**

Ontario continues its disciplined learning journey through a multi-phased, multi-year approach to focused innovation and defining a 21st century teaching and learning plan for the province. This paper presents evidence of the province’s early stage successes in engaging the education system as a whole since 2011 to build innovation capacity and commitment toward a shared understanding of what is required to equip young people for living, learning, working, and responsible citizenship in a dynamic and complex knowledge- and technology-intensive world.

Ontario’s collective and system-wide engagement of all education partners involved in professional risk-taking, innovation, and knowledge creation in leveraging technology to improve the instructional core has fostered a dynamic process of continuous professional learning, engagement, and optimism for learning. There is energy and optimism in school districts, schools, and classrooms across the province for this innovation effort, building on a vibrant culture of inquiry in the Ontario teaching profession. In the words of one school principal, *“(w)e are on the cusp of a new era of learning and teaching. We will make that shift...momentum is building... and people are understanding that schools are changing dramatically for the better”* (Ontario Ministry of Education, 2014). The momentum for innovation across the sector that has been engendered through these innovation projects and captured through this collaborative research study, continues in Round 3 (2014) and serves as a strong foundation for future reforms ahead as Ontario moves forward on a renewed vision for education, focused on preparing our students to thrive in the knowledge economy and society of the 21st century.

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