WINTER 2016 EDITION

PHASE 1 Towards Defining 21st Century Competencies for Ontario

21ST CENTURY COMPETENCIES

FOUNDATION DOCUMENT FOR DISCUSSION

support every child
reach every student

Ontario

The Ontario Public Service endeavours to demonstrate leadership with respect to accessibility in Ontario. Our goal is to ensure that Ontario government services, products, and facilities are accessible to all our employees and to all members of the public we serve. This document, or the information that it contains, is available, on request, in alternative formats. Please forward all requests for alternative formats to ServiceOntario at 1-800-668-9938 (TTY: 1-800-268-7095).

CONTENTS

Une publication équivalente est disponible en français sous le titre suivant : *Compétences du 21e Siècle: Document de Réflexion. Phase 1: Définir les Compétences du 21e Siècle pour l'Ontario. Édition de l'automne, 2016.*

PREFACE

Ontario is committed to helping every child and student achieve success and well-being. The primary goal of the province's education system is to enable students to develop the knowledge, skills, and characteristics that will lead them to become personally successful, economically productive, and actively engaged citizens.

Researchers acknowledge that the need to engage in problem solving and critical and creative thinking has "always been at the core of learning and innovation" (Trilling & Fadel, 2009, p. 50). What's new in the 21st century is the call for education systems to emphasize and develop these competencies in explicit and intentional ways through deliberate changes in curriculum design and pedagogical practice. The goal of these changes is to prepare students to solve messy, complex problems – including problems we don't yet know about – associated with living in a competitive, globally connected, and technologically intensive world.

This document will provide a focus for discussions among ministry and external education, policy, and research experts about how best to shape provincial policy to help students develop the 21st century competencies they need to succeed. These discussions will build on the consultations to renew Ontario's vision for education that took place in the autumn of 2013.

Key findings from in-depth literature reviews on 21st century competencies, completed by the Ministry of Education in 2014, are summarized in this foundation document. The full in-depth reviews will be made available in the near future.

The document comprises the following five sections:

1. *Introduction* – The rationale for defining and supporting the development of 21st century competencies.
2. *Defining 21st Century Competencies* – A high-level overview of the 21st century competencies that are most prominently featured in provincial, national, and international research and intellectual debate.
3. *The Ontario Context* – A high-level overview of the work being done in Ontario to identify and define 21st century competencies in teaching and learning.

4. *Implications for Practice* – A summary of the new learning partnerships and pedagogical and assessment practices that researchers identify as being required to support the development of 21st century competencies.
5. *Implications for Policy* – An outline of key questions for consideration in determining policy related to the development of the competencies for the Ontario education system.

The overarching questions that have guided the ministry's investigation of 21st century competencies to date include the following:

- What are the competencies students need to succeed now and in the future? Which competencies have been most widely accepted by international education thought leaders, scholars, labour market experts, and education jurisdictions? Which methods of classifying the competencies contribute most to our understanding of teaching and learning?
- What does the research tell us about which competencies are most clearly associated with positive outcomes for individuals in many spheres of life, including educational attainment, transitions to postsecondary education and training, employment, and health and well-being?
- How do other education jurisdictions integrate 21st century competencies into learning? What is the role of curriculum and other policies and programs in supporting the process?
- What pedagogical and assessment approaches are necessary to support teaching and learning of the competencies? How can competencies be assessed, particularly non-cognitive competencies? What alignments can be made between 21st century competencies and the existing learning skills and work habits?
- How can we best prepare educators, leaders, parents, and partners in education for the transformations that may be needed to bring a focus on the competencies into instruction and learning?

Introduction

Many international thought leaders and business leaders – and many young people, too – are increasingly asking education systems to prepare students with "21st century" competencies[1] that will enable them to face complex challenges now and in the future. These competencies – knowledge, skills, and attributes that help children and youth to reach their full potential – are additional to the important foundational skills of literacy and mathematics, and to the core learning in other subjects.

What's new about "21st century" competencies?

Changing times are transforming the nature of competencies that have been valuable throughout history, such as communication and collaboration.

The nature of collaboration, for example, is evolving to require an increasingly sophisticated set of competencies. As Dede (2010) explains, "In addition to collaborating face-to-face with colleagues across a conference table, 21st century workers increasingly accomplish tasks through mediated interactions with peers halfway across the world whom they may never meet face-to-face. Thus, even though perennial in nature, collaboration is worthy of inclusion as a 21st century skill because the importance of cooperative interpersonal capabilities is higher and the skills involved are more sophisticated than in the prior industrial era" (p. 53).

1. Other labels associated with the term "21st century competencies" include "deeper learning", "21st century skills", "global competencies", "college and career readiness", "student-centred learning", "next-generation learning", "new basic skills", and "higher-order thinking". These labels are typically used to include both cognitive and non-cognitive skills, knowledge, and attitudes.

The reasons why it is increasingly important to focus on 21st century competencies are multifaceted and well addressed in research studies, but are beyond the scope of this paper to explore in depth. In brief, calls for education systems to keep pace with changing times are often linked to:

- changes in the work force from an industrial model of production to a rapidly transforming, technology-driven, and interconnected globalized knowledge economy. Such an economy requires competencies suited to dynamic and unpredictable models of economic and social development;
- emerging evidence on how to optimize learning, including the use of technological innovations to deepen and transform learning; and
- changing expectations on the part of learners, who are demanding an education system that is more connected and relevant to their everyday lives.

(Tapscott, 1999; Prensky, 2001; Rychen & Salganik, 2001; Levy & Murnane, 2004; Ananiadou & Claro, 2009; Dumont, Istance, and Benavides, 2010; Dede, 2010; Griffin, McGaw, & Care, 2012; Pellegrino & Hilton, 2012; Fullan & Langworthy, 2014)

The Organisation for Economic Co-operation and Development (OECD) has called on international governments to "make an effort to properly identify and conceptualise the set of skills and competencies required so as to incorporate them into the educational standards that every student should be able to reach by the end of compulsory schooling" (Ananiadou & Claro, 2009, p. 5).

Ontario's renewed vision for education, outlined in *Achieving Excellence* (Ontario Ministry of Education, 2014), articulates a commitment to define and measure 21st century competencies. This commitment is highlighted by the *2014 Ontario Budget* statement that, "By 2025 . . . Ontario will be a world leader in higher-order skills, such as critical thinking and problem solving, which will allow Ontario to thrive in the increasingly competitive global marketplace" (Sousa, 2014, p. 9).

Research-based knowledge about 21st century competencies is dynamic and evolving. To remain current with developments in this field, Ontario is committed to periodic reviews of the research and ongoing revisions of previous perspectives. In this context, Ontario has the opportunity to take a leading role in identifying the 21st century competencies that will be of benefit to all students, while acknowledging the need to review and revise its understanding as we learn our way forward.

Defining 21st Century Competencies

> Fortunately, groups developing conceptualizations of 21st century skills have built sufficiently on each other's ideas to avoid speaking a different language about the same topic. . . . Each organization also introduces complementary ideas to the concept of 21st century skills. (Dede, 2010, pp. 72–73)

Groups like the OECD, the European Commission, the Partnership for 21st Century Skills (P21), and the U.S. National Research Council have brought rigour to the research and intellectual debate regarding 21st century competencies. There is considerable congruence among the various competency frameworks, indicating a degree of consensus among researchers in the field.

Various Competency Frameworks

Similar conceptual understandings of the competencies are reflected in the frameworks developed by the following:

- Assessment and Teaching of 21st Century Skills (ATC21S)
- Association of American Colleges and Universities
- Australia
- Canadian provinces of Alberta, British Columbia, and Quebec
- Canadians for 21st Century Learning (C21 Canada)
- Dede
- England
- European Commission
- Finland
- Fullan
- International Society for Technology in Education (ISTE)
- Japan
- Jenson
- Metiri Group and North Central Regional Educational Laboratory (NCREL)
- National Academy of Sciences (National Research Council)
- Northern Ireland
- Organisation for Economic Co-operation and Development (OECD)
- Partnership for 21st Century Skills (P21)
- Scotland
- Singapore
- U.S. Department of Labor

See Appendix A for a comparison of frameworks.

Skills versus Competencies

In the research, the terms "skills" and "competencies" are sometimes used interchangeably and sometimes with distinct meanings. For the purposes of this document, "competencies" are seen to differ from "skills" in the following way:

"A competency is more than just knowledge or skills. It involves the ability to meet complex demands, by drawing on and mobilising psychosocial resources (including skills and attitudes) in a particular context. For example, the ability to communicate effectively is a competence that may draw on an individual's knowledge of language, practical IT skills and attitudes towards those with whom he or she is communicating." (OECD, 2003, p. 4)

The European Commission's Cedefop glossary (Cedefop, 2014) approaches "skills" and "competencies" as follows: a skill is seen as the ability to perform tasks and solve problems, while a competency is seen as the ability to apply learning outcomes adequately in a defined context (education, work, personal or professional development). A competency is not limited to cognitive elements (involving the use of theory, concepts, or tacit knowledge); it also encompasses functional aspects (involving technical skills) as well as interpersonal attributes (e.g., social or organizational skills) and ethical values. A competency is therefore a broader concept that may actually comprise skills (as well as attitudes, knowledge, etc.).

Although they may have approached the topic from different angles, researchers nevertheless appear to be in broad agreement about the following characteristics of 21st century competencies.

21st century competencies are associated with growth in the cognitive, interpersonal, and intrapersonal domains.

Traditionally, cognitive competencies in critical thinking, analysis, and problem solving have been regarded as key indicators for success. However, changing economic, technological, and social contexts in the 21st century mean that interpersonal and intrapersonal competencies have become much more important than in the past. Employers are increasingly valuing "soft" skills such as teamwork and leadership skills. Pellegrino and Hilton (2012, p. 55) cite evidence that "people skills" are "an important determinant of occupations and wages", concluding that young people's social skills affect their job prospects in adulthood.

Studies in health and well-being have found that characteristics such as perseverance, grit, and tenacity are sometimes a more accurate predictor of success than IQ scores. For example, among intrapersonal competencies, the characteristic of conscientiousness (a tendency to be organized, responsible, and hardworking) is "most highly correlated with desirable educational, career, and health outcomes" (Pellegrino & Hilton, 2012, pp. 4–5).

The Conference Board of Canada (2000) has identified employability skills in three areas: **Fundamental Skills** (Communicate, Manage Information, Use Numbers, Think, and Solve Problems); **Personal Management Skills** (Demonstrate Positive Attitudes and Behaviours, Be Responsible, Be Adaptable, Learn Continuously, Work Safely); and **Teamwork Skills** (Work with Others, Participate in Projects and Tasks). It has also profiled innovation skills in the following areas:

- creativity, problem-solving, and continuous improvement skills
- risk-assessment and risk-taking skills
- relationship-building and communication skills
- implementation skills

By thinking in terms of the cognitive, interpersonal, and intrapersonal domains (Figure 1) and by recognizing that various competencies may be associated with more than one domain, we can develop a better

understanding of the interplay of competencies that is required to support deep learning practices (discussed later in this paper). This also encourages a more balanced approach to assisting students in developing the knowledge, skills, and characteristics that will lead them to become personally successful, economically productive, and actively engaged citizens.

Figure 1: "21st century skills" grouped into three broad domains
(National Research Council, July 2012, p. 2)

21st century competencies have measurable benefits for multiple areas of life and therefore are critical for all students.

Key competencies can be identified on the basis that they make a measurable contribution to educational attainment, relationships, employment, and health and well-being outcomes, and do so for all individuals, not only those in a specific trade, occupation, or walk of life (Rychen, 2003, pp. 66–67).

The most prominent 21st century competencies found in international frameworks[2] that have been shown to offer measurable benefits in

2. See Appendix A for an overview chart, developed by The Learning Partnership as an unpublished internal document, of competencies included in prominent frameworks across Canada and internationally.

multiple areas of life are associated with critical thinking, communication, collaboration, and creativity and innovation.

1. **Critical Thinking –** Critical thinking in the 21st century is described as the "ability to design and manage projects, solve problems, and make effective decisions using a variety of tools and resources" (Fullan, 2013, p. 9). Drake (2014) highlights the challenge of designing educational experiences that address local issues and real-world problems for which there may be no clear answer. Thinking critically requires students to "acquire, process, interpret, rationalize, and critically analyze large volumes of often conflicting information to the point of making an informed decision and taking action in a timely fashion" (C21, 2012, p. 10). Digital tools and resources can support the process of critical thinking, particularly when used to create authentic and relevant learning experiences that allow students to "discover, create, and use new knowledge" (Fullan & Langworthy, 2014, p. 35).

   > The knowledge and digital era is demanding people with higher order thinking skills; the ability to think logically, and to solve ill-defined problems by identifying and describing the problem, critically analyzing the information available or creating the knowledge required, framing and testing various hypotheses, formulating creative solutions, and taking action. (C21 Canada, 2012, p. 10)

2. **Communication –** Communication in a 21st century context refers not only to the ability to "communicate effectively, orally, in writing, and with a variety of digital tools" but also to "listening skills" (Fullan, 2013, p. 9). Many frameworks include information and digital literacy in the concept of communication (e.g., the British Columbia Ministry of Education's Cross-Curricular Competencies). Other frameworks, such as P21, have distinct information, media, and technology skills. Some jurisdictions (e.g., England, Norway) include information and communications technology (ICT) skills with literacy and numeracy as foundational curriculum. Digital tools and resources represent a new realm of communications interaction in which the ability to navigate successfully is essential for success in the 21st century. Each tool has its own rhetoric (e.g., an effective blog post is different from an effective tweet or persuasive essay). The issue is not just learning to use new communication tools but mastering many forms of rhetoric – a more challenging task.

3. **Collaboration –** Collaboration in a 21st century context requires the ability to "work in teams, learn from and contribute to the learning of others, [use] social networking skills, [and demonstrate] empathy in working with diverse others" (Fullan, 2013, p. 9). Collaboration also requires students to develop collective intelligence and to co-construct meaning, becoming creators of content as well as consumers. New skills and knowledge are necessary to enable team members to collaborate digitally and contribute to the collective knowledge base, whether working remotely or in a shared physical space.
4. **Creativity and Innovation –** Many studies demonstrate the importance of creativity for social development, the ability to compete in business, and the ability to generate economic growth. PISA 2012 results (OECD, 2014b) note the connection between high academic achievement, problem solving, and creativity. Creativity is often described as the pursuit of new ideas, concepts, or products that meet a need in the world. Innovation contains elements of creativity and is often described as the realization of a new idea in order to make a useful contribution to a particular field. Creativity includes concepts of "economic and social entrepreneurialism . . . and leadership for action" (Fullan, 2013, p. 9). The People for Education's "Measuring What Matters" report *Creativity: The State of the Domain* (Upitis, 2014) suggests that creativity in schools gives "students experiences with situations in which there is no known answer, where there are multiple solutions, where the tension of ambiguity is appreciated as fertile ground, and where imagination is honoured over rote knowledge" (p. 3).

Competencies in the intrapersonal domain contribute significantly to students' well-being, character development, and success.

Recently, the Boston-based Center for Curriculum Redesign (CCR) published a Character Qualities Framework that identifies six essential character qualities – mindfulness, curiosity, courage, resilience, ethics, and leadership – that have emerged from its research. Bialik, Bogan, Fadel, and Horvathova (2015) make the case for CCR's framework and focus on character qualities by arguing that "facing the challenges of the 21st century requires a deliberate effort to cultivate in students personal growth and the ability to fulfill social and community responsibilities as global citizens" (p. 1).

As mentioned previously, there is a growing body of research (Dweck, 2010; Duckworth, Matthews, Kelly, & Peterson, 2007; Tough, 2012) demonstrating that non-academic, intrapersonal competencies such as perseverance, grit, tenacity, and a growth mindset have a strong relationship with an individual's capacity to overcome challenges and achieve long-term success. These competencies are often linked to well-being and can be found in various competency frameworks under labels such as "Life and Career Skills" (P21, 2009), "Character Education" (Fullan, 2013), and "Lifelong Learning, Personal Management, and Well-being" (Alberta Education, 2011).

According to Tough's (2012) research on how children succeed, helping children at a young age to learn how to manage failure (in "child-sized adversity") is important to building the self-confidence, self-regulation skills, sense of efficacy, and resilience that enable children to persist and overcome challenging circumstances. Research in the areas of innovation, entrepreneurship, and leadership also notes the importance of cultivating workforce capacities for risk-taking, perseverance, and managing for failure. Research is under way to improve our understanding of how learning environments can more effectively support the development of competencies in the intrapersonal domain.

Motivation and emotion play a central role in the development of intrapersonal competencies, and are also recognized as important determinants of thinking and learning. An understanding of the factors that influence motivation and emotion is therefore essential to providing a learning environment that promotes student success. An OECD report found that "students' learning goals and goals in life, their thoughts about their own competence . . . their attributions of academic success or failure on various potential causes,

and their interests and hobbies all contribute to the complex interplay of cognition and motivation" (Schneider & Stern, 2010, p. 82). Research by Professor Carol Dweck (2010) shows that "students' mind-sets have a direct influence on their grades and that teaching students to have a growth mind-set raises their grades and achievement test scores significantly" (p. 26).

Understanding the growth mindset is key to addressing the needs of the whole child. *Stepping Stones*, Ontario's resource on positive youth development (Ontario Ministry of Children and Youth Services, 2012), highlights the interrelated and interdependent nature of human development through the cognitive, emotional, social, and physical domains. These domains are affected by the environment or context in which the student lives, and all reflect the core sense of self/spirit (see Figure 2).

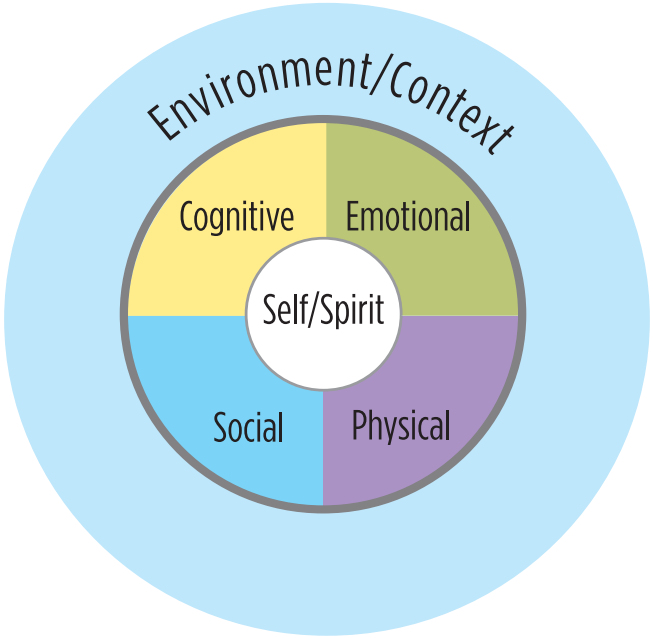


Figure 2: Interrelated and interdependent nature of human development
(Ontario Ministry of Children and Youth Services, 2012, p. 17)

Competencies associated with metacognition and a growth mindset are essential for ongoing success in the 21st century.

Researchers have identified students' awareness of how they learn and their ability to learn on their own as essential educational outcomes for ongoing success in today's and tomorrow's world. Hattie (2012), Fullan and Langworthy (2014), as well as the Waterloo Global Science Initiative (Brooks & Holmes, 2014) are among those who make the case that "learning the process of learning" must become the core purpose of education in the 21st century. Fullan and Langworthy (2014) describe metacognition, or learning to learn, as a 21st century competency that enhances students' ability to acquire skills, knowledge, and attitudes that are relevant to new areas of learning. Finland and Hong Kong are two jurisdictions that place major emphasis on developing students' capacity for metacognition (Saavedra & Opfer, 2012).

Researchers and thought leaders see that metacognition and a growth mindset (including self-regulation skills and ethical and emotional awareness), while always important, are much more so in a connected, global context that requires an ability to communicate, work, and learn with diverse groups of individuals and teams worldwide. Value systems that respect differences and diversity are viewed as increasingly necessary to personal and professional success, and to social cohesion.

The European Commission's key competencies for lifelong learning include metacognition. Learning to learn is described as:

> the ability to pursue and persist in learning, and to organise one's own learning including through effective management of time and information, both individually and in groups. This competence includes awareness of one's learning process and needs, identifying available opportunities, and the ability to overcome obstacles in order to learn successfully. This competence means gaining, processing and assimilating new knowledge and skills as well as seeking and making use of guidance. Learning to learn engages learners to build on prior learning and life experiences in order to use and apply knowledge and skills in a variety of contexts: at home, at work, in education and training. Motivation and confidence are crucial to an individual's competence. (2007, p. 8)

Competencies related to local, global, and digital citizenship enhance individuals' ability to respond constructively in changing or challenging circumstances.

Several frameworks recognize the set of competencies that relate to students' identity both as individuals and as members of their community, society, and the world. Sometimes these competencies are grouped as "personal and social competency" (British Columbia Ministry of Education, 2013), "civic literacy, global awareness, and cross-cultural skills" (Singapore Ministry of Education, 2010), or "ethical citizenship" (Alberta Education, 2011). Fullan and Langworthy (2014) describe citizenship as "global knowledge, sensitivity to and respect for other cultures, [and] active involvement in addressing issues of human and environmental sustainability" (p. 22). These descriptions of citizenship highlight the importance of inclusion and respect for diversity, particularly as collaboration across international and cultural boundaries increases.

Technology is changing the shape of civic education in the 21st century. Haste (2009) describes the "bottom-up" rather than "top-down" structure of ICT that allows an individual to become the "agent" rather than merely the "recipient" of or "participant" in knowledge, democracy, and civic action. Haste defines civic education in the 21st century as "the capacity to manage diversity, ambiguity, and uncertainty, essential for being able to engage in democracy and social progress" (p. 214).

Digital citizenship is emerging as a local priority among Ontario school boards as a result of a recent emphasis on technology-enabled transformative pedagogy through the 21st Century Innovation Research initiative (2011–14). Digital citizenship requires greater awareness of the importance of respecting and protecting privacy and information, given the volumes of information to which we have access through digital networks (C21 Canada, 2012, p. 38).

Citizenship education is an important facet of students' overall education in Ontario. In every course in the Grade 9 and 10 Canadian and World Studies curriculum, and particularly in the Grade 10 Civics and Citizenship course, students are given opportunities to learn about what it means to be a responsible, active citizen, both in the classroom and in the diverse communities to which they belong, within and outside the school. It is important for students to understand that they belong to many communities and that, ultimately, they are all citizens of the global community. (See Appendix B for Ontario's Citizenship Education Framework.)

Competencies associated with creativity and innovation are important elements in entrepreneurial activity.

For the most part, the term "entrepreneurship" is not widely used in competency frameworks, but the concept is conveyed implicitly or explicitly in some overarching vision statements, including Ontario's, and through notions of creativity and innovation.

Achieving Excellence: A Renewed Vision for Education in Ontario specifies that achievement "also means raising expectations for valuable, higher-order skills like critical thinking, communication, innovation, creativity, collaboration, and entrepreneurship. These are the attributes that employers have already told us they seek out among graduates" (Ontario Ministry of Education, 2014, p. 3).

Entrepreneurship is sometimes the result of a combination of competencies in the interpersonal, intrapersonal, and cognitive domains (e.g., creativity and innovation, collaboration/teamwork, leadership, perseverance). It is described as:

> the process of creating and implementing innovative ideas to address economic opportunities or social problems, whether that is through enterprise creation, improved product development, or a new mode of organization (Volkmann et al., 2009). Research in recent decades has indicated that the quantity of entrepreneurial activity is a critical determinant of the economic vitality of industries, communities, regions and countries (Audretsch, 2007; Florida, 2002; Hart, 2003). (Cited in Sá, Kretz, & Sigurdson, 2014, p. 5)

As Hoffman and Casnocha argue in *The Start-Up of You*, everyone has to think like an entrepreneur and an innovator.

> What's required now is an entrepreneurial mindset. Whether you work for a ten-person company, a giant multinational corporation, a not-for-profit, a government agency, or any type of organisation in between – if you want to seize the new opportunities and meet the challenges of today's fractured career landscape, you need to think and act like you're running a start-up: your career. . . . The conditions in which entrepreneurs start and grow companies are the conditions we *all* now live in. . . . You never know what's going to happen next. Information is limited. Resources are tight. Competition is fierce. The world is changing. . . . This means you need to be adapting all the time. (Hoffman & Casnocha, 2012, p. 8)

The European Commission included a "sense of initiative and entrepreneurship" in its recommended key competencies. In this framework, "entrepreneurship" refers to:

> an individual's ability to turn ideas into action. It includes creativity, innovation and risk-taking, as well as the ability to plan and manage projects in order to achieve objectives. This supports individuals, not only in their everyday lives at home and in society, but also in the workplace in being aware of the context of their work and being able to seize opportunities, and is a foundation for more specific skills and knowledge needed by those establishing or contributing to social or commercial activity. This should include awareness of ethical values and promote good governance. (European Commission, 2007, p. 11)

An entrepreneurial mindset requires not only entrepreneurial skills developed by formal education but also a culture in which real-world organizations welcome entrepreneurship and change and a culture of lifelong learning. It is important for educational institutions, in particular, to model this welcoming of entrepreneurship by both students and educators.

Alberta's *Framework for Student Learning* (2011) provides an example of how the entrepreneurial spirit is incorporated as an overarching goal for education (Figure 3).

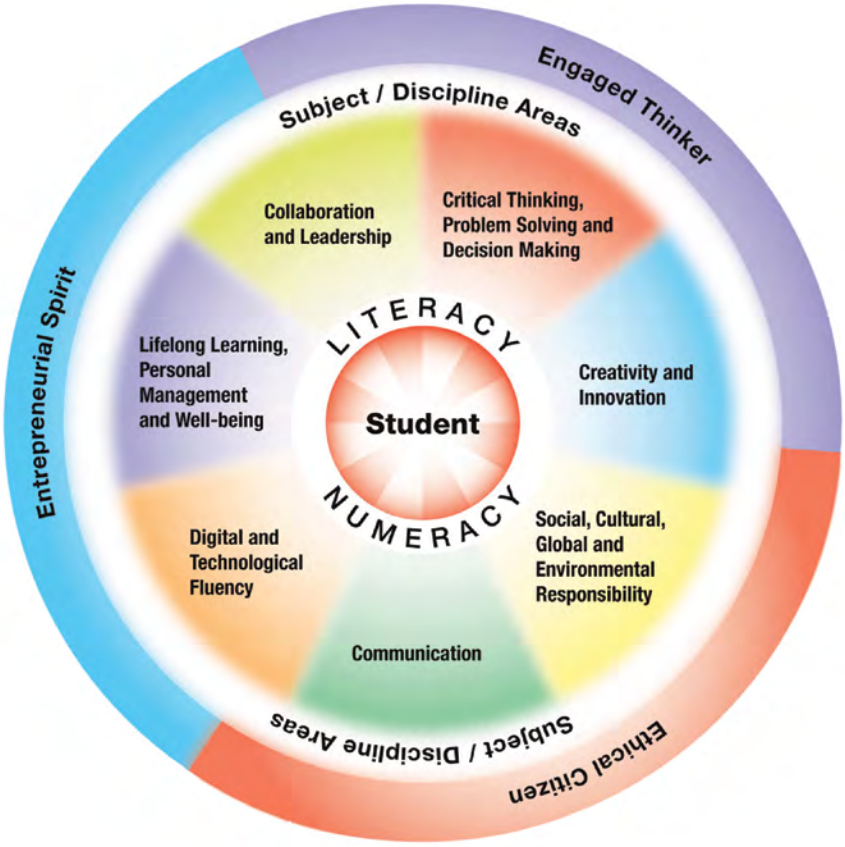


Figure 3: Alberta's "Framework for Student Learning"
(Alberta Education, 2011, p. 2)

Comparing International and National Perspectives on Competencies

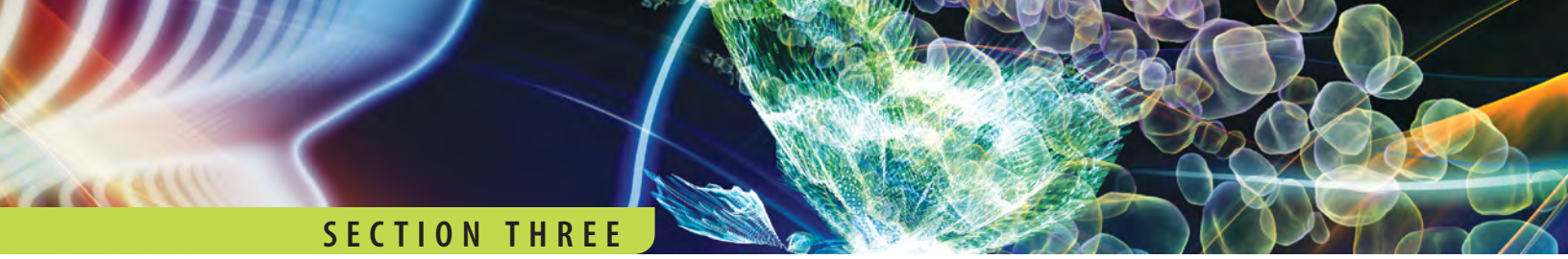
The Assessment and Teaching of 21st Century Skills (ATC21S) Project (Griffin, McGaw, & Care, 2012) compared a number of international competency frameworks. Table 1 provides a summary of the 21st century competencies identified by ATC21S alongside sample 21st century competencies identified in *Achieving Excellence: A Renewed Vision for Education in Ontario* and the *2014 Ontario Budget*. The table also highlights competencies identified by Dr. Michael Fullan in 2013 that have been adopted by some district school boards in Ontario.

Table 1: Sample competencies and frameworks

Ontario Vision/Budget Based on Results of Public Consultations (2014)	ATC21S (2012) (Summary of International Frameworks)	Fullan and Scott (2014) The Six Cs
"Achievement also means raising expectations for valuable, higher-order skills like **critical thinking, communication, innovation, creativity, collaboration,** and **entrepreneurship**." (*Achieving Excellence*, p. 3) "[O]ur learners will also need to develop characteristics such as **perseverance, resilience**, and **imaginative thinking** to overcome challenges. Combined with a deep sense of **compassion** and **empathy** for others, our learners will develop the skills and knowledge they need to become actively **engaged citizens**." (*Achieving Excellence*, p. 5) "To achieve success, Ontario will: . . . Foster more young entrepreneurs in Ontario schools by increasing training in **innovation, creativity**, and **entrepreneurship**. . . . " (*Achieving Excellence*, p. 6) "By 2025 . . . Ontario will be a world leader in higher-order skills, such as **critical thinking** and **problem solving**, which will allow Ontario to thrive in the increasingly competitive global marketplace." (*2014 Ontario Budget* [Sousa, 2014], p. 9)	***Ways of Thinking*** 1. Creativity and innovation 2. Critical thinking, problem solving, decision making 3. Learning to learn, metacognition ***Ways of Working*** 4. Communication 5. Collaboration (teamwork) ***Tools for Working*** 6. Information literacy 7. Information and communication technology literacy ***Living in the World*** 8. Citizenship – local and global 9. Life and career (including adapting to change; managing goals and time; being a self-directed learner; managing projects; working effectively in diverse teams; being flexible; producing results; guiding and leading others) 10. Personal and social responsibility (including cultural awareness and competence)	1. **Character** – "qualities of the individual essential for being personally effective in a complex world including: grit, tenacity, perseverance, resilience, reliability, and honesty." (Fullan & Scott, 2014, p. 6) 2. **Citizenship** – "thinking like global citizens, considering global issues based on a deep understanding of diverse values with genuine interest in engaging with others to solve complex problems that impact human and environmental sustainability." (Fullan & Scott, 2014, p. 6) 3. **Communication** – the "mastery of three fluencies: digital, writing, and speaking tailored for a range of audiences." (Fullan & Scott, 2014, p. 6) 4. **Critical Thinking** – "critically evaluating information and arguments, seeing patterns and connections, constructing meaningful knowledge and applying it in the real world." (Fullan & Scott, 2014, p. 7) 5. **Collaboration** – "the capacity to work interdependently and synergistically in teams with strong interpersonal and team-related skills including effective management of team dynamics, making substantive decisions together, and learning from and contributing to the learning of others." (Fullan & Scott, 2014, p. 6) 6. **Creativity** – *"having an 'entrepreneurial eye' for economic and social opportunities, asking the right questions to generate novel ideas, and demonstrating leadership to pursue those ideas into practice." (Fullan & Scott, 2014, p. 7)*

IMPLICATIONS

Despite similarities among the frameworks in the broad competencies they identify as important to success, there is considerable variation in the way different constituencies choose to represent them, and there is no single "best" framework that is applicable to all circumstances. It is important for Ontario not only to benefit from the insights of other jurisdictions but also to integrate them into a framework that addresses the specific needs and goals of Ontario educators and students.



SECTION THREE

The Ontario Context

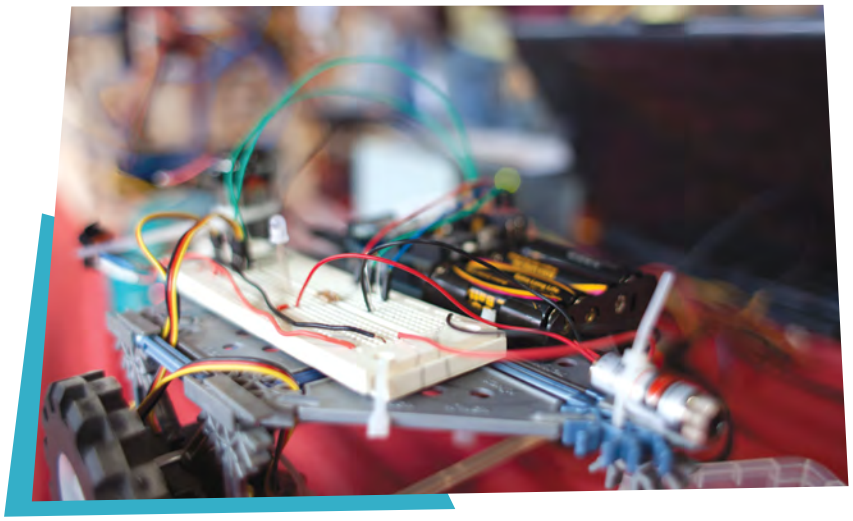
Ontario is actively engaged at many levels and through a variety of initiatives in the emerging policy field of 21st century learning – also referred to by some as "technology-enabled learning" and/or "deep learning". Key examples of these initiatives follow.

Ontario is working with provinces across Canada to identify pan-Canadian 21st century/global competencies.

Ontario has been working with the Council of Ministers of Education, Canada (CMEC) and the Advisory Committee of Assistant Deputy Ministers of Education (ACDME) to explore pan-Canadian 21st century/global competencies and provincial approaches to the adoption of frameworks. (A draft document that was developed to support these discussions is included in Appendix C.)

At the provincial level, Ontario's renewed vision for education and the *2014 Mandate Letter: Education* (Wynne, 2014) emphasize the need to "define and develop measures for higher-order skills" (Ontario Ministry of Education, 2014, p. 7).

The Ontario curriculum articulates expectations for student learning in the province. Currently, there are opportunities across the curriculum and within the education experience for teaching and learning much of the knowledge and many of the skills and attitudes that are commonly linked to 21st century competencies, particularly in the cognitive domain. In the Grade 10 Civics and Citizenship course, students are given opportunities to learn about what it means to be a responsible, active citizen in the various communities to which they belong. As well, the curriculum renewal process makes it possible



to focus increased attention on the development – across the cognitive, interpersonal, and intrapersonal domains – of evidence-based, transferable competencies that will be increasingly needed in our changing society, economy, and the classrooms of tomorrow. A focus on 21st century competencies has implications not only for curriculum design and development but also for curriculum implementation and support.

In addition, there is ongoing work in assessment that relates directly to 21st century competencies. For example, the ministry is working with individual districts to enhance the teaching and assessment of the learning skills and work habits, many of which are closely linked to 21st century competencies. Work is also being done on strategies to support assessment *as* learning, which is integral to the development of metacognition, and on collaborative inquiry projects intended to develop students' ability to become independent, self-directed learners. Currently, a number of key competencies are incorporated in the Achievement Chart and the sample behaviours identified in the outline of learning skills and work habits, providing a solid foundation upon which to build.

Many district school boards are moving ahead to define 21st century competencies and embed these in their vision and strategic plans.

As of August 2014, more than half (39) of Ontario English-language district school boards (DSBs) and two-thirds (8) of the French-language school boards had independently identified specific 21st century competencies as

a focus for their districts, and had communicated this through their public websites.

Ontario DSBs are drawing on Fullan's "6 Cs", International Society for Technology in Education (ISTE) standards, the Partnership for 21st Century Skills (P21), the Assessment and Teaching of 21st Century Skills (ATC21S), or a combination of these frameworks to determine a local focus for 21st century competencies.

Since 2011, Ontario's seventy-two district school boards, provincial schools, and school authority boards, in collaboration with the Ministry of Education and the Council of Ontario Directors of Education, have been investigating the impact of innovations in technology-enabled teaching and learning models on students' engagement, achievement, well-being, and development of 21st century higher-order competencies. This work provides important, Ontario-based research evidence to inform future policy work in defining and measuring 21st century competencies.

Ontario's twelve French-language school boards, in partnership with the ministry, have developed a digital resource (accessible through the province's Virtual Learning Environment) that includes a literature review of education systems in Canada and abroad (primarily in French-speaking jurisdictions) that have adopted 21st century competencies and approaches to teaching and learning. This resource is part of a larger package of supports requested by the French-language boards to assist them in moving forward with innovative, technology-enabled pedagogical approaches.

In addition to participating in the collaborative 21st Century Innovation Research project, Ontario district school boards are taking part in a number of new activities and initiatives to explore aspects of 21st century competencies. For example:

- In 2014–15, approximately twenty-five students in each district school board received training in "Innovation, Creativity and Entrepreneurship" (ICE) as part of their Specialist High Skills Major (SHSM) program. This training is designed by the Ministry of Education in partnership with the Rotman School of Management at the University of Toronto, and is intended to be expanded to reach more SHSM students in subsequent years.
- In 2014–15, district school boards participated in forty-five experiential learning projects to look at new, innovative, and creative models in the area of experiential learning connected to the community, with a view to broadening the delivery of these types of relevant and engaging learning opportunities to enhance student success. The criteria for participation in the projects included students' acquisition of 21st century competencies such as critical thinking, problem-solving, communication, and collaboration.
- School boards are using hybrid courses in the provincial virtual learning environment to enhance access to the courses adult learners need to earn a high school diploma and transition to postsecondary education and training.
- Student Achievement Officers, in partnership with educators internal and external to the ministry, used video pedagogical documentation of students engaged in solving a rich, open-ended mathematics task to explore task-based creativity in mathematics. The team wrote a paper and presented a description of the project at the Psychology of Mathematics Education conference in July 2014; findings were presented at the Canadian Society for the Study of Education in May 2015.
- Robotics kits were provided to the summer learning programs in the summer of 2015. This created a hands-on learning experience connected to technology, science, and mathematics.
- Situated within a school board-ministry-university partnership, the Knowledge Building project is a collaboration of the Hamilton-Wentworth District School Board, the Toronto Catholic District School Board, the Toronto District School Board, the Institute for Knowledge Innovation and Technology (housed at the Ontario Institute for Studies in Education at the University of Toronto), and the ministry. By exploring ways of

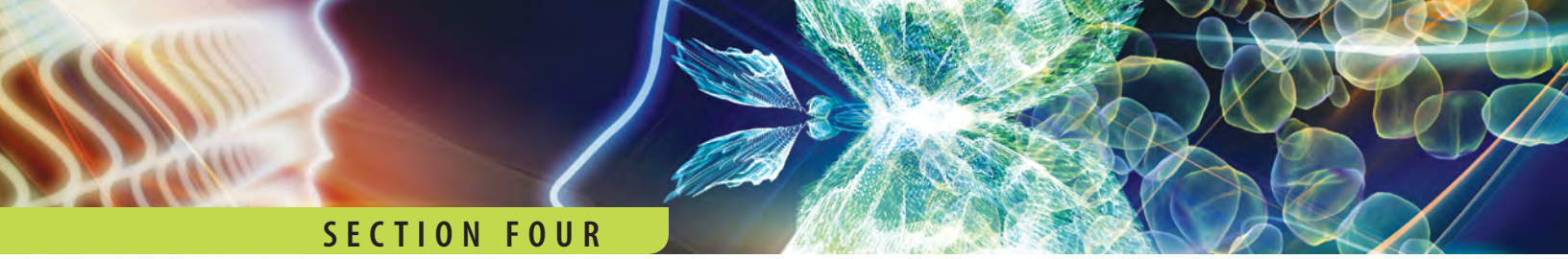
giving students the opportunity to refine their knowledge-building competencies through the exchange of ideas and opinions within a community of learners, this project highlights new possibilities for thinking, learning, and sharing within school systems. Findings from this project have been presented at the Canadian Society for Studies in Education.

- A number of district school boards have partnered with Dr. Michael Fullan on the New Pedagogies for Deep Learning Global Partnership (*see*: www.newpedagogies.info).
- District school boards are offering "Character Education" programs, based on the 2008 ministry document *Finding Common Ground: Character Development in Ontario Schools, K-12*.
- District school boards are implementing strategies to enhance the safety and inclusiveness of schools, guided by documents such as *Supporting Minds: An Educator's Guide to Promoting Students' Mental Health and Well-Being* (Ontario Ministry of Education, 2013), and the Accepting Schools Act, which emphasizes educators' responsibility to help students become productive, contributing, and constructive citizens in the diverse society of Ontario.
- The full-day Kindergarten program is designed to support children's development in the cognitive and non-cognitive domains.

- In June 2015 the ministry released *Ontario's Strategy for K–12 International Education* (Ontario Ministry of Education, 2015), a document that provides the framework for developing high-quality international education programs and services for students and educators. The strategy supports a range of education initiatives and experiential learning opportunities to develop global competencies and foster ethical citizenship in the context of 21st century teaching and learning.
- People for Education's "Measuring What Matters", a multi-year initiative by experts and stakeholders, including the Ministry of Education and other areas of government, is designed to develop a new set of measures and performance standards for schools that include indicators for the broad range of skills that graduates need. The initiative includes outreach and piloting with Ontario schools.

IMPLICATIONS

The activities outlined above provide a solid basis for the development of a competency framework for Ontario. Identifying and defining competencies and incorporating them into the curriculum expectations and learning experiences for every student in Ontario can help to ensure that all Ontario students have equitable opportunities to develop the skills and knowledge needed to succeed, now and in the future.



SECTION FOUR

Implications for Practice

The implementation of a 21st century competencies framework to guide teaching and learning in Ontario will require innovative thinking and/or action in the following areas:

***Curriculum:* Significant reviews of curricula to embed 21st century competencies are required (and are being undertaken by a growing number of countries).**

21st century competencies are frequently included within new and revised curriculum documents. Most countries report that the competencies are not taught as separate subjects but are integrated across the curriculum. A study commissioned by the Ministry of Education as part of the curriculum review process confirms this finding (Kane & Ng-A-Fook, 2013). Research has identified the importance of developing competencies in relation to specific subjects, rather than as topics for separate teaching. However, few of the frameworks and curricula of national systems provide clearly elaborated curriculum standards for these competencies. Nor do many of them supply detailed descriptions either of what a curriculum shaped by the broader aims of a framework will actually look like or of how it will be experienced by learners (Binkley, Erstad, Hermna, Raizen, Ripley, Miller-Ricci, et al., 2012; Ananiadou & Claro, 2009).

The U.S. National Research Council (2012) confirms that a curriculum designed to develop the "full range of 21st century competencies . . . will require systematic instruction and sustained practice" (p. 3). It will be necessary to dedicate instructional time for students to develop these competencies. It will also be necessary to provide both resources and professional learning opportunities for educators to support and advance these sophisticated learning goals.

***The Focus of Teaching:* "Deeper learning" practices and new learning partnerships are required for students to develop 21st century competencies.**

"Deeper learning" is "the process through which an individual becomes capable of taking what was learned in one situation and applying it to new situations" (Pellegrino & Hilton, 2012, p. 5). This is also known as the development and cross-disciplinary application of transferable skills. Deeper learning involves the interplay of cognitive, intrapersonal, and interpersonal competencies.

An emphasis on "deeper learning" requires a shift in the role of teaching from "focusing on covering all required content to focusing on the learning process, developing students' ability to lead their own learning and to do things with their learning. Teachers are partners with students in deep learning tasks characterised by exploration, connectedness and broader, real-world purposes" (Fullan & Langworthy, 2014, p. 7).

Teaching Strategies: A broad repertoire of pedagogical strategies is required to support the emphasis on deep learning and new learning partnerships.

Hattie's achievement-related meta-analysis (2009) presents a collection of research into what actually works in improving student learning in schools. As Fullan and Langworthy note, strategies "may range from project-based learning through direct instruction to an inquiry-based model" (2014, p. 20). The teacher uses different strategies depending on the needs of a specific student or task and analyses which strategy works best (Fullan & Langworthy, 2014).

As stated earlier, the goal of these innovations in practice is to prepare all students for success in a dynamic knowledge society and economy characterized by complexity, unpredictability, global connectedness, change, and opportunity.

One researcher notes that:

> The increased complexity of these challenges makes it all the more important that we do a better job preparing our students as problem solvers. We must provide students with improved strategies to help them deal with problems – this is what holds the most promise in our education system. Problem-based learning is one such strategy . . . teachers not only present information but they also learn along with students and help them become more skillful problem solvers. In this capacity, students are no longer passive recipients of knowledge; they are decision makers about the nature and structure of their own learning. . . . (Barell, 2010, pp. 177, 178–79)

The Role of Technology: **In addition to developing students' technological skills, technology-enabled teaching and learning practices play a significant role in supporting the development of the full range of 21st century competencies.**

The Partnership for 21st Century Skills (P21, 2009) draws on a number of research papers to identify the most important ways in which technology can enhance student learning and promote mastery of 21st century competencies. These include:

- **increasing student engagement and achievement.** Research shows that students are more engaged, intrinsically motivated to learn, and more successful when they can connect what they are learning to situations they care about in their community and in the world. Technology can provide access to real-time data, simulations to situate learning in the real world, and opportunities for students to link learning to their personal interests. Technology also provides for multiple and varied representations of complex concepts. Dede (2014) explains that digital teaching platforms provide "visual representations that students can use to study new concepts and demonstrate their own ideas, and students can manipulate those representations in order to see how other, contrasting ideas play out" (p. 9). In Ontario, virtual manipulatives are among the digital learning resources available through a provincial virtual learning environment that is accessible to all schools. Students are able to use virtual manipulatives, augmented realities, and other digital tools and resources to "master abstract principles and skills through the analysis of real-world situations" (Dede, 2014, p. 2).

- **assisting in the assessment of student performance.** Technology can support assessment *for*, *as*, and *of* learning, providing real-time assessment information that deepens our understanding of student learning gains and challenges. Technology can also support the tasks of gathering and analysing assessment information about student learning, thereby facilitating instructional decision making. Ontario's 21st Century Innovation Research project is showing that "technology is facilitating assessment practices, especially assessment *as* and assessment *for* learning. Student questions, inquiries, and demonstrations of their learning are captured through technology and provide a reference for teachers when planning instruction and in addressing learner needs" (Curriculum Services Canada, 2015b, p. 6).
- **facilitating communication and collaboration.** Communication technologies provide pathways for connections among students, parents, and educators (P21, 2009, p. 18). Online learning fosters the exchange of ideas and effective practices with peers for both students and educators. "Digital teaching platforms have been found to provide powerful support for collaborative learning. . . . Since representations of student thinking and work can be rapidly distributed in a networked classroom, teachers have the opportunity to direct everyone's attention to specific participants and their contributions", and students are able to build their knowledge through the contributions of their peers (Dede, 2014, p. 10).

Researchers have found that, when used strategically and effectively, specific digital tools and resources can aid in the service of deeper learning. Dr. Puentedura's work (2013a, 2013b) with colleagues at the Horizon Project on the *EdTech Quintet* provides an organizer for the selection of technologies (social, mobility, visualization, storytelling, and gaming) that support transformational or deep learning practices. Fishman and Dede (in press) found that collaboration tools, online and hybrid educational environments, tools that support learners as makers and creators, immersive media, and games and simulations "can help prepare students for life and work in the 21st century" (quoted in Dede, 2014, p. 6).

The following chart (Table 2) lists the technologies used by Ontario district school boards and identifies the key transformational learning practices they support and their contribution to the development of specific competencies observed by 21st Century Innovation Research in Ontario in relation to the work of both the Horizon Project (2013a, 2013b) and Fishman and Dede (in press, quoted in Dede, 2014, p. 6).

Table 2: Connections between digital tools and resources, key transformational learning practices/contexts, and competency development

Technologies	Key Transformational Learning Practices/Contexts	21st Century Competencies
Social and Collaboration Support knowledge building Examples: • Blogs • Online discussions • File sharing	• Authentic audiences • Student voice and choice • Student creation and iteration of knowledge (deeper learning) • New partnerships in learning • Inquiry-based learning (including project- and problem-based learning) • Timely, descriptive feedback	• Communication • Collaboration • Negotiation • Leadership • Intellectual openness • Conscientiousness • Critical thinking • Digital citizenship
Hybrid and Mobile Broaden access to education beyond the school walls Examples: • Tablets • Laptops • Cloud technology	• Student-driven inquiry • Self-directed learning • New partnerships in learning • Equity of access • Authentic, real-world learning tasks	• Responsibility • Productivity • Analysis • Decision making • Information literacy
Visualization Help students to master abstract concepts Examples: • 3D printers • Interactive maps • Graphing tools • Concept mapping tools	• Differentiated instruction • Student discovery/mastery • Elimination of barriers to higher-order thinking • Learner autonomy • Timely, descriptive feedback	• Coordination • Communication • Metacognition • Analysis • Numeracy • Problem solving and reasoning
Storytelling and Creation Develop students as knowledge creators and communicators Examples: • Video/music production tools • Presentation tools	• Student choice and voice • Student creation and iteration of knowledge (deeper learning) • New partnerships in learning • Authentic, real-world learning tasks and audiences	• Communication • Collaboration • Intellectual interpretation • Creativity • Innovation • Digital literacy • Digital citizenship
Immersive Media and Simulation Situate learning in real-world and augmented realities Examples: • Virtual worlds • Interactive games	• Authentic, real-world learning tasks • Student creation • Student discovery/mastery • Personalized learning • Timely, descriptive feedback	• Cooperation • Conflict resolution • Curiosity • Grit and perseverance • Self-efficacy, initiative • Problem solving and reasoning • Creativity and innovation • Critical thinking

***The Role of Informal and Experiential Learning:* Life-wide informal learning and experiential learning play an important role in the development of 21st century competencies.**

Studies of informal learning environments provide some evidence that informal learning can be used to teach cognitive, interpersonal, and intrapersonal competencies in ways that promote deeper learning and the transfer of learning. "Informal learning takes place in a variety of settings, including after-school clubs, museums, science centers, and homes, and it includes a variety of experiences, from completely unstructured to highly structured workshops and educational programs" (Pellegrino & Hilton, 2012, p. 153).

The development and ubiquity of digital tools is having an impact on how students both interact with and respond to the world. The use of digital technologies, including social media and gaming, is a way of life for young people that can no longer be ignored if schools are to remain relevant. Technological innovations afford new opportunities for learning in and out of school and for connecting learning communities around the world, augmenting the role of non-formal learning. A U.S. National Research Council study points to research on specific technologies, such as gaming used in after-school clubs, that have been shown to have "positive effects on students' computer literacy, comprehension, problem solving, and strategic efficiency" (Pellegrino & Hilton, 2012, p. 154).

The innovations that make it easier to connect people, information, and digital resources from across the globe also call for new knowledge, skills, and social behaviours to ensure that these powerful tools are used in ways that promote deep learning and transfer of skills and knowledge.

Lemke (2010) describes the growing influence of informal learning opportunities and the resulting impact on formal education systems as follows:

> The democratization of knowledge provides the opportunity for lifelong individual and group learning. For students to leverage that opportunity fully requires critical thinking, information literacy, and a measure of self-direction, all of which need to be developed in part by our school systems. The democratization of knowledge also provides tremendous opportunities for educators to begin transforming their schools into physical and virtual places of 21st century learning. . . . Educators are at a crossroads. They can embrace this democratization of knowledge by authentically connecting their students' formal and informal learning. Or, they can ignore it and run the risk of obsolescence, becoming certification mills for the interactive learning that takes place out of school. (p. 263)

Research has found that experiential learning that takes place in the community contributes to the development of 21st century competencies "by giving opportunities for authentic learning, engaging students actively, fostering co-operation and collaboration, meeting individual interests, empowering learners and extending horizons beyond comfort zones" (Furco, 2010, p. 227). Examples of experiential learning include internships, field studies, volunteerism, and academic service-learning.

Academic service-learning (often referred to simply as "service learning") may warrant particular attention as a lever for developing students' 21st century competencies. It is a community-based experiential learning opportunity conducted in partnership with communities with the intention to benefit both the provider and the recipient of the service. "[T]he research on academic service-learning suggests that it can enhance students' academic, civic, personal, social, ethical, and career development" (Furco, 2010, p. 235).

> Academic service-learning is an experiential learning pedagogy in which education is delivered by engaging students in community service that is integrated with the learning objectives of core academic curricula . . . premised on providing students with contextualised learning experiences that are based on authentic, real-time situations in their communities. . . . Today, service-learning is one of the fastest growing educational initiatives in contemporary primary, secondary and post-secondary education. (Furco, 2010, p. 228)

Assessment Practices: Transformative pedagogical approaches will necessitate changes to assessment practices.

"The research clearly shows that whatever is measured matters" (Binkley et al., 2012, p. 20). If there is value in promoting new pedagogical models that make it possible for students to apply their learning to real-world problems with authentic audiences, then assessments will need to be adapted to widen the range of skills and knowledge being observed. A number of authors make the case for authentic learning tasks that provide opportunities for students to "experience what it is like to perform tasks like those in the workplace and other real-life contexts, which tend to be complex and messy" (Wiggins & McTighe, 2005, p. 154).

A comprehensive discussion regarding the implications for assessment of a focus on 21st century competencies is beyond the scope of this paper. Issues related to the assessment of 21st century competencies include the tension between assessments for the purpose of providing descriptive feedback on the one hand, and large-scale assessments for public accountability on the other. Researchers recognize that technology-based assessments have the potential to provide unprecedented diagnostic information and support for the personalization of curriculum (Binkley et al., 2012). "Computers allow students to work with complex data sets of a sort that would be very difficult to work with on paper. Tools like computer-based simulations can, in this way, give a more nuanced understanding of what students know and can do than traditional testing methods (Bennett et al., 2003)" (quoted in Binkley et al., 2012, p. 32). New pedagogical models (e.g., the flipped classroom, blended learning, collaborative problem solving, inquiry, interdisciplinary projects, immersive authentic simulations, digital teaching platforms) also have implications for assessment practices.

Internationally, the OECD administers its large-scale Programme for International Student Assessment (PISA) every three years to measure fifteen-year-olds' competencies in the areas of reading, mathematics, science, and problem solving. In each cycle, it has "the ability to provide insight in a new area, as has been the case with the evolution of problem solving from paper-based in 2003 to computer-based individual problem solving in 2012 to computer-based collaborative problem solving in 2015" (OECD, 2014a, p. 2). A framework is in development for PISA 2018 to measure "global competencies" as well as to provide a sound basis for computer-based assessment (OECD, 2014c, p. 12).

The Assessment and Teaching of 21st Century Skills (ATC21S) research project is exploring methods to assess communication, collaboration, problem-solving, and ICT literacy competencies, working with jurisdictions in Australia, the United States, Finland, Singapore, Costa Rica, and the Netherlands.

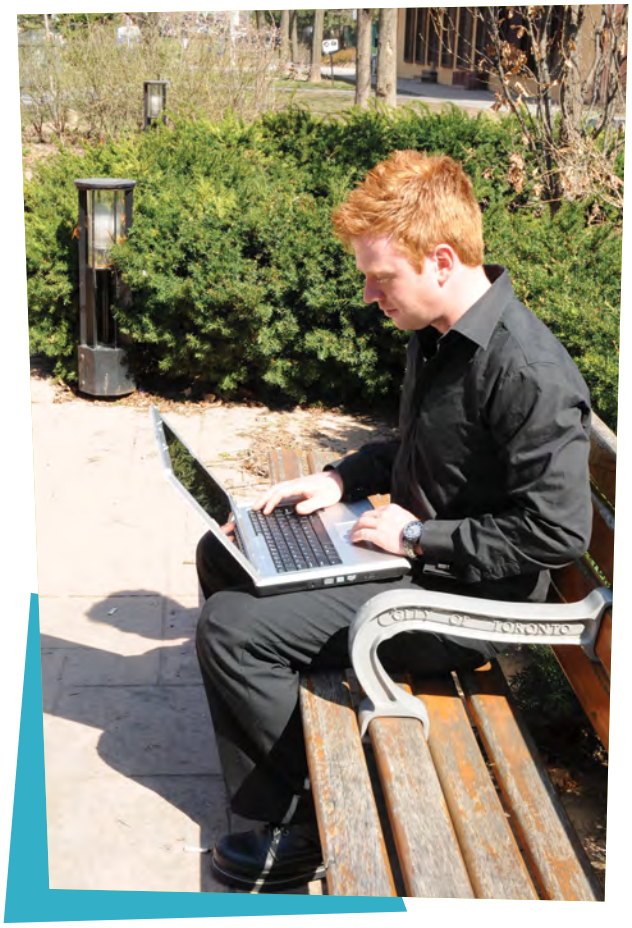
At a national level, the U.S. Department of Education is addressing the need to measure student progress against the Common Core state standards. It has awarded substantial grants, totalling approximately $330 million, to two consortia for the development of innovative, large-scale assessments that are to be used nationwide. These assessments are expected to "make widespread use of smart technology . . . provide students with realistic, complex performance tasks, immediate feedback, [and] computer adaptive testing, and incorporate accommodations for a range of students" (Duncan, 2010, p. 2).

In Ontario, the Education Quality and Accountability Office (EQAO) is exploring technology-enabled assessment, beginning with the use of computer-based assessments as an alternative to paper-and-pencil tests, with the hope of moving towards more transformative-based assessments in the future.

A variety of challenges have been identified in international research that would need to be addressed in order to develop the assessments required for 21st century competencies. The U.S. National Research Council study *Education for Life and Work* (Pellegrino & Hilton, 2012, pp. 11–12) organizes these challenges according to four main themes:

1. **a multiplicity of competency frameworks:** Research to date has produced many different lists and rankings of competencies. Attention needs to be focused on identifying a subset of competencies that properly define what expectations for students would look like;
2. **psychometric challenges:** The National Research Council study explains that "further research is needed to develop assessments of intrapersonal and interpersonal competencies. . . . Cognitive competencies are measured using well-established and validated standardized testing methods. By contrast, non-cognitive competencies are almost always measured by ratings rather than tests – either self-ratings or ratings by observers who are not experts" (Pellegrino & Hilton, 2012, pp. 12, 52). In Ontario, teachers continue to build their understanding of assessment and evaluation of students' learning skills and work habits. This serves as an important building block as Ontario establishes its approach to defining and measuring 21st century competencies, particularly in the intrapersonal and interpersonal domains;

3. **economic and accountability influences on the development and use of assessments:** Researchers caution that, in the face of current fiscal constraints and accountability demands, "standardized, on-demand, end-of-year tests that are easily scored and quantified for accountability purposes" may be favoured over "richer, performance- and curriculum-based assessments that can better support the development and assessment of 21st century competencies" (Pellegrino & Hilton, 2012, p. 12);
4. **teacher capacity:** Teacher preparation programs need to help teacher candidates develop pedagogical strategies that promote deep learning. "Both novice and experienced teachers will need time to develop new understandings of the subjects they teach as well as the understanding of how to assess 21st century competencies in these subjects, making ongoing professional learning opportunities a central facet of every teacher's job" (Pellegrino & Hilton, 2012, p. 12).



***Physical Space:* Research supports the notion that *where* we learn affects the quality of *how* we learn.**

Georgetown University researchers have found that improving a school's physical environment can increase test scores by up to 11 per cent (cited in P21, 2009, p. 7).

Researchers have identified the features of physical space that effectively support the teaching and learning of 21st century competencies. Schools need to:

- **design for flexibility:** "Since no one can predict how educational technologies and teaching modalities will evolve, learning spaces must adapt to whatever changes the future may hold. . . . To achieve this flexibility, architects are designing classrooms . . . with moveable furniture and walls that can easily be reconfigured for different class sizes and subjects" (P21, 2009, p. 7). "Maker-spaces" provide space and tools (e.g., 3D printers, robotics, design software) to enable student creation. Technologies are increasingly mobile, with access provided through wireless broadband. Some thought leaders (e.g., Fielding, Nair, & Lackney, 2005) are creating a new language of school spaces in order to change the mental model, using terms such as "learning studios", "learning plazas", "collaboration zones", and "project-planning rooms". Flexibility should also be thought of in terms of more "malleable units of time" (P21, 2009, p. 13);
- **design to facilitate constructive relationships:** School spaces should be designed to promote "cooperation and interaction and reduce the tensions that can lead to inattentiveness, acting up, and bullying. . . . Educators need tools and spaces that enable collaborative planning and information sharing" (P21, 2009, p. 8);
- **reconfigure the library as a "hub" of learning:** The library should offer places for "formal learning in which large groups can gather"; places for "social learning where teams can collaborate"; and places for "individual learning" (P21, 2009, p. 11). It becomes a place to connect students to the wider world by providing "audio and video communication technologies that build bridges between people and places all over the globe" (P21, 2009, p. 12). Some school libraries are transforming themselves into "learning commons" (an idea pioneered in higher education) that "support learners by providing library resources, IT tools and support, tutoring, and other academic support services all in one central location" while at the same time becoming a "design studio to spur creativity and collaboration" (P21, 2009, p. 12);

- **design to facilitate connections with the wider community:** Schools can encourage learning that extends out into the local community through service projects, internships, and innovative sharing of space with the school's local community (P21, 2009, p. 9). "Architects and school planners strongly suggest that educators seek input from the community when designing a new school or undertaking a major renovation" (P21, 2009, p. 9).

IMPLICATIONS

Tran sformations in pedagogical practice, new learning partnerships, enhanced use of digital tools and resources, and physical and virtual spaces designed to support learning are required to ensure students' development of 21st century competencies. In addition, assessment policies and practices need to be aligned with the new pedagogical approaches appropriate to a focus on 21st century competencies. A culture of innovation, risk-taking, and continuous learning together with capacity building guided by knowledge of the approaches and practices most likely to prove effective are key to achieving this goal.

SECTION FIVE

Implications for Policy

Questions that need to be considered in determining next steps are presented below to focus discussion and stimulate thinking.

1. There are many different approaches to representing 21st century competencies and no single "best" framework that is applicable to all circumstances. Ontario needs to reconcile the different approaches and develop an evidence-based framework that will meet the needs of Ontario educators and students. Such a competency framework would continue to recognize the important foundational skills of literacy and numeracy and core learning in other subject areas. It would be reviewed periodically as we continue to learn our way forward in this dynamic field.

The following categories of 21st century competencies have been shown to have measurable benefits in multiple areas of life:

- **critical thinking and problem solving**
- **innovation, creativity, and entrepreneurship**
- **communication**
- **collaboration (teamwork)**
- **a growth mindset (metacognition / learning to learn, perseverance, and resilience)**
- **local, global, and digital citizenship**

See Appendix C for a draft discussion paper that was developed to support Ontario's and the Council of Ministers of Education's (CMEC's) considerations for defining and developing measures for assessing 21st century competencies. This paper expands on the competency categories listed above in that it includes draft descriptors and identifies connections between the proposed 21st century /global competencies and related CMEC areas of priority.

Questions to be explored in this area include the following:

- Are any competency categories or descriptors missing from those listed in Appendix C?
- What approaches to defining a competency framework best promote student well-being?
- What approaches to defining a competency framework best support and integrate global competencies that will advance the goals of Ontario's new strategy for K–12 international education (Ontario Ministry of Education, 2015)?

2. There is an opportunity to build on the groundwork that has been done to take the next big step in Ontario – to define a competency framework. Competencies that are properly identified and conceptualized and incorporated into the curriculum expectations and experience for every student in Ontario would ensure that all Ontario students have equitable opportunities to develop the skills and knowledge needed to succeed now and in the future. Curriculum policy, school programs, and graduation requirements are the primary means for incorporating 21st century competencies into the educational expectations and experiences of all students.

Questions to be explored in these areas include the following:

- How should curriculum policy be reconceptualized to strengthen a focus on 21st century competencies?
- What is the student's role in the learning and development of 21st century competencies?
- What changes are needed to the structure of curriculum policy documents (including their front matter, subject-specific content, achievement charts, and instructional prompts) to ensure that the identified competencies are addressed in all learning opportunities?
- What can be done to provide students with improved access to experiential learning opportunities that build 21st century competencies, including opportunities for academic service-learning connected to their community?
- How can graduation requirements authentically reflect the fact that students develop competencies not only through formal learning but through informal learning as well?

3. A culture of innovation, risk taking, and continuous learning as well as capacity-building activities are key to the transformations in pedagogical practice, new learning partnerships, enhanced use of digital tools and resources, and strategic design of learning spaces required for the development of 21st century competencies.

Questions related to capacity building include the following:

- What levers can be used to promote educators' understanding of their roles and responsibilities in creating conditions that will encourage students' development of 21st century competencies?
- How can both novice and experienced educators enhance their professional knowledge about the competencies and their ability to implement the pedagogical and assessment practices that support the development of the competencies?
- What resources and strategies are needed to build on the new pedagogical approaches that support the development of 21st century competencies?
- What initiatives are needed to ensure the effective use of digital tools and resources for deeper learning?
- What skills are needed to underpin 21st century learning and the use of digital tools for deeper learning?
- What opportunities are available to schools for reconceptualizing learning spaces to support the development of 21st century competencies?

4. New pedagogical approaches and a focus on 21st century competencies require a corresponding realignment of assessment policies and practices.

Questions raised by this requirement include the following:

- Different dimensions are used to assess different competencies. How can we ensure that assessment and reporting practices effectively and equitably address this diversity?
- What should be the relationship among the competencies, the learning skills and work habits, and the overall and specific expectations found in the curriculum? Are there opportunities to integrate them, or should these be treated separately?
- What are the next steps in developing and implementing new assessment practices that align with new pedagogies for deep learning, including new technology-enabled pedagogies?

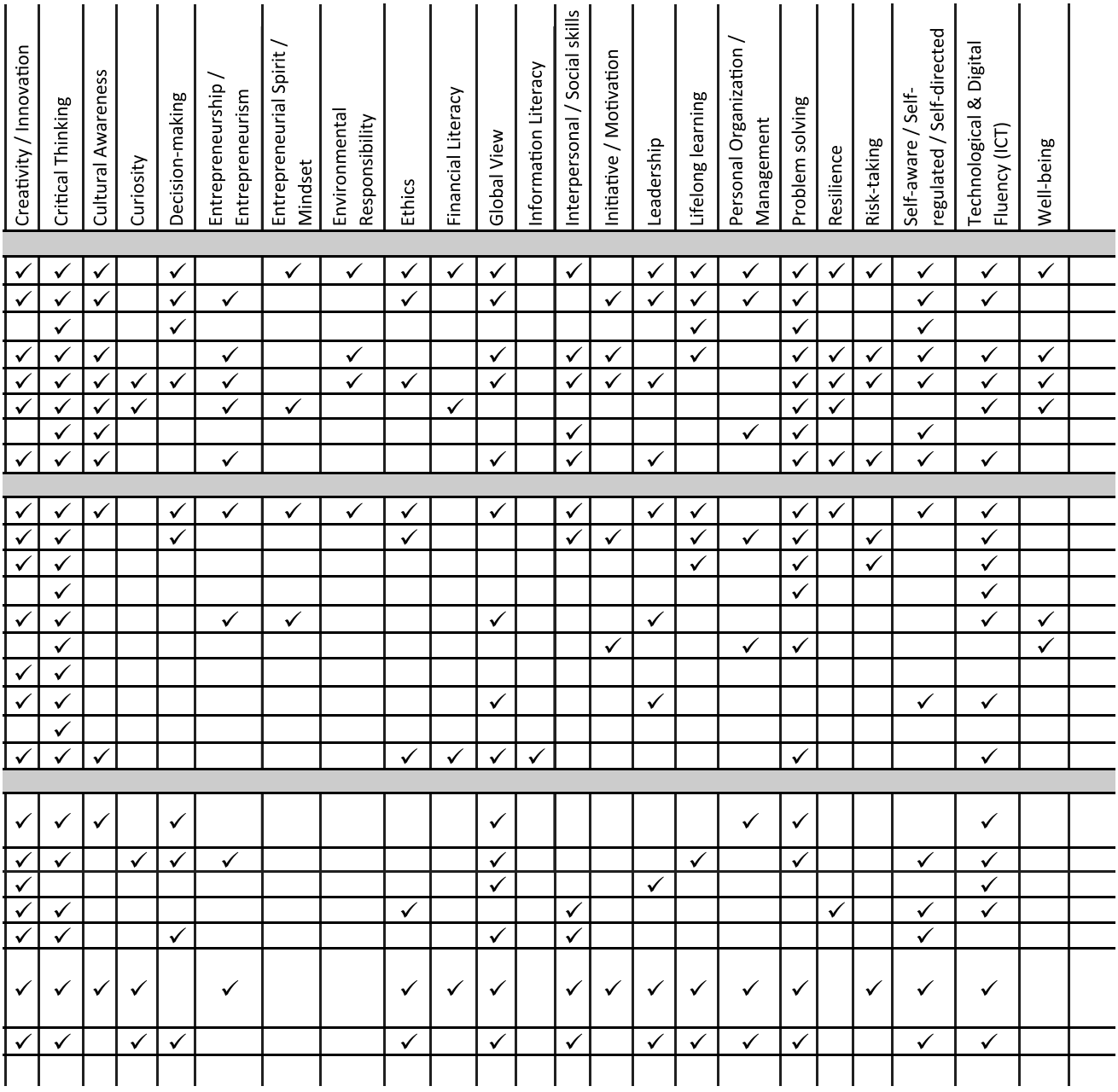
- Why and in what ways will co-learning and facilitation be influential in teaching and learning in the future?
- What is an appropriate balance among the various purposes that assessment serves? These purposes include assessment to provide descriptive feedback that supports individual growth and progress as well as large-scale assessments that provide data for monitoring system performance and public accountability.
- How will we support educators in developing sound assessment practices – as outlined in the ministry document *Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools* (2010) – that further our transformational goals for learning, teaching, leading, and assessing students' acquisition of 21st century competencies for deeper learning?

APPENDIX A

Competencies Included in Frameworks across Canada and Internationally

21st Century Skills Frameworks Across Canada and Internationally (as of July 2014)

	Accountability / Responsibility	Adaptability / Flexibility	Analytical skills	Character	Citizenship / Civic & Community	Collaboration / Teamwork	Communication
CANADA: Government/Education							
Government of Alberta: Education and Training (2013)	✓				✓	✓	✓
British Columbia Ministry of Education: Premier's Technology Council (2010)		✓			✓	✓	
Employment and Social Development Canada (2014)						✓	✓
New Brunswick Department of Education: Anglophone Sector (2010)	✓	✓	✓		✓	✓	✓
Nova Scotia School Boards Association (2014)	✓	✓		✓	✓	✓	✓
Ontario Ministry of Education: Achieving Excellence (2014)					✓	✓	✓
Ontario Ministry of Training, Colleges, and Universities (2012)							✓
Prince Edward Island: Minister's Summit on Learning (2010)	✓	✓	✓		✓	✓	✓
CANADA: Other							
Canadians for 21st Century Learning: C21 Canada (2012) - Non-profit	✓			✓	✓	✓	✓
Conference Board of Canada (2012) - Non-profit	✓	✓				✓	✓
Canadian Council of Chief Executives (2012) - Non-profit		✓				✓	✓
Council of Ontario Directors of Education (2012) - Non-profit						✓	✓
Don Tapscott (2008) - Canadian Businessman						✓	✓
Education Quality and Accountability Office (2012) - Non-profit			✓				✓
Michael Fullan (2013) - Canadian Educator				✓	✓	✓	✓
Pearson Canada (2014) - Corporate		✓				✓	✓
Royal Bank Canada (2014) - Corporate						✓	✓
Seneca College (2014) - Postsecondary Institution	✓		✓				✓
INTERNATIONAL							
Assessment and Teaching of 21st-Century Skills (2012) - Finland, Singapore, USA, Australia, University of Melbourne, Microsoft, Intel, and Cisco	✓				✓	✓	✓
Cisco Systems, Inc. (2008) - Corporate		✓				✓	✓
Deloitte International (2014) - Corporate		✓				✓	
Organisation for Economic Co-operation and Development (2012) - Non-profit		✓				✓	✓
Singapore Ministry of Education (2014) - Government	✓			✓	✓		
The Partnership for 21st Century Skills (2009) - U.S. Department of Education, AOL, Apple, Cable in the Classroom, Cisco, Dell, Microsoft, National Education Association, and SAP	✓	✓			✓	✓	✓
U.S. National Research Council (2012) - Non-profit	✓	✓	✓		✓	✓	✓



Source: The Learning Partnership (unpublished internal report; reprinted with permission)

APPENDIX B

The Citizenship Education Framework

Source: Ministry of Education, 2013, p. 10

APPENDIX C

Ontario's Draft 21st Century/Global Competencies

(December 2015 – Draft for Discussion)

Achieving Excellence: A Renewed Vision for Education in Ontario

Jurisdictions around the world are exploring how to prepare their students to lead fulfilling lives, be productive contributors in a knowledge economy, and thrive in an information and technology-intensive globalized world. Within this context, Ontario continues to be focused on the province's core priorities of high levels of student achievement, ensuring equity, promoting well-being, and enhancing confidence in publicly funded education.

In the fall of 2013, individuals and organizations from across the province were consulted on a new vision for education, which included a focus on the skills and knowledge Ontario learners will need in the future. The government received input from representatives both within and outside the education system.

Based on this input, the government developed and released *Achieving Excellence: A Renewed Vision for Education in Ontario*, which made transforming education a key goal. To support this goal, the government committed to defining and developing measures for higher-order skills, such as critical thinking, communication, collaboration, and entrepreneurship, or what can be called "21st century competencies".

21st Century Competencies Discussion Document: What We've Learned

Ontario's *21st Century Competencies: Foundation Document for Discussion* builds on what was learned during the Achieving Excellence consultation and is informed by the latest research on 21st century competencies from both a local and an international perspective.

Research supports the need for today's students to engage in "deeper learning" – or learning that allows students to take what is learned in one situation and apply it to new situations. Deeper learning involves the interplay of the cognitive (thinking/reasoning), intrapersonal (behaviour/emotions), and interpersonal (communication/collaboration). Through the process of deeper learning, students develop 21st century competencies, which can be defined as *knowledge and skills that are transferable*. The deeper learning domains can be viewed in the visual below.

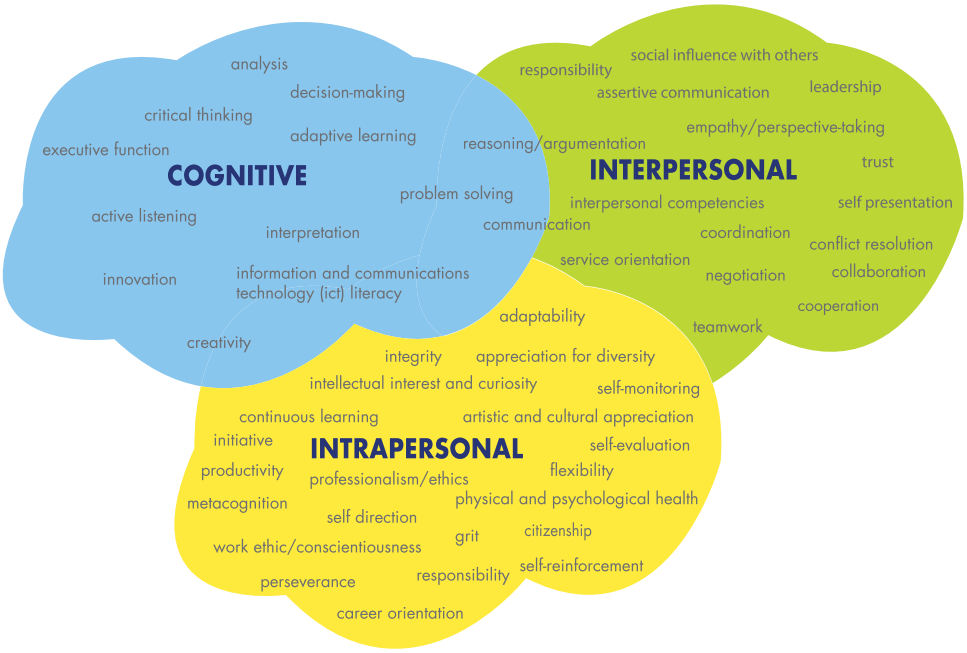


Figure 1: "21st century skills" grouped into three broad domains
(National Research Council, July 2012, p. 2)

Educators play an important role in providing the context for deeper learning, which is supported through new teaching practices that include the following elements (Fullan & Langworthy, 2014):

- The creation and use of new knowledge in the real world
- Learning partnerships between and among students and teachers that focus on the *process* of learning
- Access to digital tools and resources both inside and outside of school

Technology is playing more of a role in society as well as in the classroom and can be a powerful tool in enabling deeper learning. However, technology is only effective when used to provide access to richer content, develop stronger teaching practices, make links between classrooms and life, and enable assessments that align with new teaching practices.

Ontario's renewed vision for education to transform teaching and learning will ensure that students develop the knowledge, skills, and characteristics to become personally successful, economically productive, and actively engaged citizens.

Four goals guide ministry and sector efforts to achieve this vision:

- Achieving Excellence
- Ensuring Equity
- Promoting Well-being
- Enhancing Public Confidence

The competencies listed on the next page support the development of learning in all subject areas, including foundational skills in literacy and numeracy, and apply to both the face-to-face and the online world. (*The numbers in parentheses after certain descriptors relate those descriptors to priority areas identified by the Council of Ministers of Education, Canada [CMEC], which are shown at the bottom of the page.)*

Critical Thinking and Problem Solving

- Solves meaningful, real-life, complex problems (1), (6)
- Takes concrete steps to address issues
- Designs and manages projects
- Acquires, processes, interprets, and analyses information to make informed decisions (critical and digital literacy)
- Engages in an inquiry process to solve problems (1)
- Makes connections and transfers learning from one situation to another (1), (6)

Innovation, Creativity, and Entrepreneurship

- Contributes solutions to complex problems (3)
- Enhances a concept, idea, or product
- Takes risks in thinking and creating
- Makes discoveries through inquiry research (1)
- Pursues new ideas to meet a need of a community (3), (6)
- Leads and motivates with an ethical entrepreneurial spirit (1), (3)

Learning to Learn / Self-Aware & Self-Directed Learning

- Learns the process of learning (metacognition) (1),(3),(4),(5),(7)
- Believes in the ability to learn and grow (growth mindset) (1), (4), (5)
- Perseveres and overcomes challenges to reach a goal (1), (5)
- Self-regulates in order to become a lifelong learner (1), (4), (5), (7)
- Reflects on experience to enhance learning (1), (7)
- Cultivates emotional intelligence to understand self and others (1), (2),(4)
- Adapts to change and shows resilience to adversity (1), (5)
- Manages various aspects of life – physical, emotional (relationships, self-awareness), spiritual, and mental well-being (5)

Collaboration

- Participates in teams; establishes positive relationships
- Learns from, and contributes to, the learning of others (1)
- Co-constructs knowledge, meaning, and content (1)
- Assumes various roles on the team
- Manages conflict
- Networks with a variety of communities/groups
- Respects a diversity of perspectives (2), (3)

Communication

- Communicates effectively in different contexts in oral and written form in French and/or English
- Asks effective questions to acquire knowledge (6)
- Communicates using a variety of media (1), (5)
- Selects appropriate digital tools according to purpose (1)
- Listens to understand all points of view (2), (3), (6)
- Gains knowledge about a variety of languages (2), (6)
- Voices opinions and advocates for ideas

Global Citizenship

- Contributes to society and the culture of the local, global, and digital community in a responsible, accountable, and ethical manner (2), (6)
- Engages in local and global initiatives to make a difference (6)
- Learns from and with diverse people (2), (5), (6)
- Interacts safely and responsibly within a variety of communities (5), (6)
- Creates a positive digital footprint
- Relates to the environment and is mindful of the importance of all living things (2), (3)

GLOBAL COMPETENCIES DRAFT SCOPING PLAN AND RELATED CMEC AREAS

(1) Teaching and Learning	(2) Aboriginal Education	(3) Education for Sustainable Development	(4) Early Childhood Education and Development	(5) Wellness and Mental Health	(6) Experiential Learning	(7) Assessment

REFERENCES

Alberta Education. (2011). *Framework for student learning: Competencies for engaged thinkers and ethical citizens with an entrepreneurial spirit.* Edmonton: Author. Retrieved from: http://education.alberta.ca/media/6581166/framework.pdf.

Ananiadou, K., & Claro, M. (2009). *21st century skills and competences for new millennium learners in OECD countries*. OECD Education Working Papers, No. 41. Paris: OECD Publishing. Retrieved from: http://dx.doi.org/10.1787/218525261154.

ATC21S (Assessment and Teaching of 21st Century Skills). *See* Griffin, McGaw, & Care, 2012.

Audretsch, D.B. (2007). *The entrepreneurial society.* Oxford: Oxford University Press.

Australian Curriculum, Assessment and Reporting Authority (ACARA). (2013, January). General capabilities in the Australian curriculum. Retrieved from: www.acara.edu.au.

Barber, M., Donnelly, K., & Rizvi, S. (2012). *Oceans of innovation: The Atlantic, the Pacific, global leadership and the future of education*. London: Institute for Public Policy Research. Retrieved August 2012 from: www.ippr.org/assets/media/images/media/files/publication/2012/09/oceans-of-innovation_Aug2012_9543.pdf.

Barell, J. (2010). Problem-based learning: The foundation for 21st century skills. In J. Bellanca and R. Brandt (Eds.), *21st century skills: Rethinking how students learn* (pp. 175–99). Bloomington, IN: Solution Tree Press.

Bennett, R.E., Jenkins, F., Persky, H., & Weiss, A. (2003). Assessing complex problem solving performances. *Assessment in Education: Principles, Policy and Practice*, *10*(3), 347–59. Retrieved from: http://dx.doi.org/10.1080/0969594032000148181.

Bialik, M., Bogan, M., Fadel, C., & Horvathova, M. (2015, February). *Character education for the 21st century: What should students learn?* Boston, MA: Center for Curriculum Redesign. Retrieved from: www.curriculumredesign.org.

Binkley, M., Erstad, O., Hermna, J., Raizen, S., Ripley, M., Miller-Ricci, M., & Rumble, M. (2012). Defining 21st century skills. In P.E. Griffin, B. McGaw, and E. Care (Eds.), *Assessment and teaching of 21st century skills* (pp. 17–66). Dordrecht: Springer. Retrieved from: www.atc21s.org.

British Columbia Ministry of Education. (2013). *Defining cross-curricular competencies: Transforming curriculum and assessment.* Draft. Retrieved from: www.bced.gov.bc.ca/irp/docs/def_xcurr_comps.pdf.

Brooks, M., & Holmes, B. (2014). *Equinox blueprint: Learning 2030*. A report on the outcomes of the *Equinox Summit: Learning 2030* convened by the Waterloo Global Science Initiative. Retrieved from: www.wgsi.org/sites/wgsi-live.pi.local/files/Learning%202030%20Equinox%20Blueprint.pdf.

C21 Canada (Canadians for 21st Century Learning and Innovation). (2012). *Shifting minds: A 21st century vision of public education for Canada*. Retrieved from: www.c21canada.org/wp-content/uploads/2012/11/Shifting-Minds-Revised.pdf.

Cedefop (2014). *Terminology of European education and training policy (Second Edition) – A selection of 130 key terms*. Luxembourg: Publications Office. Retrieved from: www.cedefop.europa.eu/EN/Files/4117_en.pdf.

Conference Board of Canada. (2000). *Employability skills 2000+*. Retrieved from: www.conferenceboard.ca/topics/education/learning-tools/employability-skills.aspx.

Curriculum Services Canada. (2015a, February). *A passport to a changing landscape: Advancing pedagogy and innovative practices for knowledge mobilization and skill development in the 21st century*. (Local innovation research projects in Ontario – Round 3). Available at: www.ontariodirectors.ca.

Curriculum Services Canada. (2015b, August). *A synopsis of the final research report: Exploring specific features that impact sustainable practices on the 21st century digital learning landscape*. Local Innovation Research Projects in Ontario – Round 4. Available at: http://www.ontariodirectors.ca/.

Dede, C. (2010). Comparing frameworks for 21st century skills. In J. Bellanca & R. Brandt (Eds.), *21st century skills: Rethinking how students learn* (pp. 51–76). Bloomington, IN: Solution Tree Press.

Dede, C. (2014). *The role of digital technologies in deeper learning.* Students at the Center: Deeper Learning Research Series. Boston, MA: Jobs for the Future.

Drake, S.M. (2014). Designing across the curriculum for "sustainable well-being": A 21st century approach. In F. Deer, T. Falkenberg, B. McMillan, & L. Sims (Eds.), *Sustainable well-being: Concepts, issues, and educational practice* (pp. 57–76). Winnipeg, MB: Education for Sustainable Well-Being (ESWB) Press. Retrieved from: www.eswb-press.org/uploads/1/2/8/9/12899389/sustainable_well-being_2014.pdf#page=65.

Duckworth, A., Matthews, M.D., Kelly, D.R., & Peterson, C. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality and Social Psychology*, *92*(6), 1087–1101.

Dumont, H., Istance, D., & Benavides, F. (Eds.). (2010). *The nature of learning: Using research to inspire practice*. Paris: Educational Research and Innovation, OECD Publishing. Retrieved from: http://dx.doi.org/10.1787/9789264086487-en.

Duncan, A. (2010, September 2). *Beyond the bubble tests: The next generation of assessments – Secretary Arne Duncan's remarks to state leaders at Achieve's American diploma project leadership team meeting.* Washington, DC: U.S. Department of Education. Retrieved from: www.ed.gov/news/speeches/beyond-bubble-tests-next-generation-assessments-secretary-arne-duncans-remarks-state-leaders-achieves-american-diploma-project-leadership-team-meeting.

Dweck, C.S. (2010). Mind-sets and equitable education. *Principal Leadership*, *10*(5), 26–29.

European Commission, Directorate-General for Education and Culture, European Reference Framework. (2007). *Key competences for lifelong learning – a European framework.* Luxembourg: Office for Official Publications of the European Communities. Retrieved from: www.alfa-trall.eu/wp-content/uploads/2012/01/EU2007-keyCompetencesL3-brochure.pdf.

Fielding, R., Nair, P., & Lackney, J. (2005). *The language of school design: Design patterns for 21st century schools* (2nd ed.). Minneapolis, MN: DesignShare. Retrieved from: www.designshare.com/index.php/language-school-design.

Finnish National Board of Education. (2015). *Learning and competence 2025*. Retrieved from: www.oph.fi/download/164907_learning_and_competence_2025_finnish_national_board_of_education.pdf.

Fishman, B., & Dede, C. (In press). Teaching and technology: New tools for new times. In D. Gitomer & C. Bell (Eds.), *Handbook of research on teaching* (5th ed.). American Educational Research Association. New York: Springer.

Florida, R. (2002). *The rise of the creative class: And how it's transforming work, leisure, community and everyday life*. New York: Perseus Book Group.

Fullan, M. (2013). *Great to excellent: Launching the next stage of Ontario's education agenda*. Toronto: Ontario Ministry of Education. Retrieved from: www.edu.gov.on.ca/eng/document/reports/FullanReport_EN_07.pdf.

Fullan, M., & Langworthy, M. (2014). *A rich seam: How new pedagogies find deep learning*. London: Pearson.

Fullan, M., & Scott, G. (2014). *New pedagogies for deep learning whitepaper: Education PLUS*. Seattle: Collaborative Impact SPC.

Furco, A. (2010). The community as a resource for learning: An analysis of academic service-learning in primary and secondary education. In H. Dumont, D. Istance, & F. Benavides (Eds.), *The nature of learning: Using research to inspire practice* (pp. 227–49). Paris: Educational Research and Innovation, OECD Publishing. Retrieved from: http://dx.doi.org/10.1787/9789264086487-en.

Gouvernement du Québec. (2007). *Québec education program (secondary cycle two). Chapter 3: Cross-curricular competencies*. Retrieved from: www.mels.gouv.qc.ca/sections/programmeFormation/secondaire2/medias/en/3_QEP_Chap03.pdf.

Griffin, P.E., McGaw, B., & Care, E. (Eds.). (2012). *Assessment and teaching of 21st century skills (ATC21S)*. Dordrecht: Springer. Retrieved from: www.atc21s.org.

Hart, D.M. (2003). *The emergence of entrepreneurship policy: Governance, start-ups, and growth in the U.S. economy*. Cambridge: Cambridge University Press.

Haste, H. (2009). What is "competence" and how should education incorporate new technology's tools to generate "competent civic agents"? *Curriculum Journal*, *20*(3), 207–23.

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. London: Routledge.

Hattie, J. (2012). *Visible learning for teachers: Maximizing impact on learning*. London: Routledge.

Hoffman, R., & Casnocha, B. (2012). *The start-up of you: Adapt to the future, invest in yourself and transform your career*. New York: Crown Business.

International Society for Technology in Education (ISTE). (2015). *ISTE standards*. Retrieved from: www.iste.org/standards.

Japan, Ministry of Education, Culture, Sports, Science and Technology. (2012). *2012 white paper on education, culture, sports, science and technology*. Retrieved from: www.mext.go.jp/b_menu/hakusho/html/hpab201201/1344897.htm.

Jenson, J., Taylor, N., & Fisher, S. (2010). *Critical review and analysis of the issue of "skills, technology and learning": Final report*. Toronto: Faculty of Education, York University.

Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2014). *NMC Horizon Report: 2014 higher education edition*. Austin, TX: The New Media Consortium. Retrieved from: www.nmc.org/pdf/2014-nmc-horizon-report-he-EN.pdf.

Kane, R., & Ng-A-Fook, N. (2013). *A review of the research and inter-jurisdictional practice related to the integration of 21st century skills and attributes across the curriculum: Final report.* Unpublished report submitted to the Ontario Ministry of Education in response to a Request for Services.

Lemke, C. (2010). Innovation through technology. In J. Bellanca & R. Brandt (Eds.), *21st century skills: Rethinking how students learn* (pp. 243–72). Bloomington, IN: Solution Tree Press.

Levy, F., & Murnane, R.J. (2004). *The new division of labor: How computers are creating the next job market*. Princeton, NJ: Princeton University Press.

Liberal Education and America's Promise (LEAP). (2007). *College learning for the new global century: A report from the National Leadership Council for LEAP*. Washington, DC: Association of American Colleges and Universities. Retrieved from: www.aacu.org.

Marzano, R.J., & Heflebower, T. (2012). *Teaching and assessing 21st century skills.* Bloomington, IN: Marzano Research Laboratory.

Mayer, R.E., Blanton, W.E., Duran, R., & Schustack, M.W. (1999). *Using new information technologies in the creation of sustainable afterschool literacy activities: Evaluation of cognitive outcomes.* Final report to the Andrew W. Mellon Foundation. Santa Barbara, CA: University of California, Department of Psychology.

National Foundation for Educational Research (NFER), Eurydice at NFER. (2012). *Key competencies in the curriculum: Northern Ireland.* Retrieved from: www.nfer.ac.uk/shadomx/apps/fms/fmsdownload.cfm?file_uuid=28CF022B-C29E-AD4D-0FEC-25B2D4DD936F&siteName=nfer.

National Research Council. (2012, July). *Education for life and work: Developing transferable knowledge and skills in the 21st century.* Report Brief. Washington, DC: National Academies Press. Retrieved from: http://sites.nationalacademies.org/cs/groups/dbassesite/documents/webpage/dbasse_070895.pdf.

NCREL (North Central Regional Educational Laboratory). (2003). *enGauge 21st century skills: Literacy in the digital age.* NCREL and the Metiri Group. Retrieved from: www.ncrel.org/engauge.

OECD (Organisation for Economic Co-operation and Development). (2003). *Key competencies for a successful life and well-functioning society. The definition and selection of key competencies: Executive summary.* Summary of report by S.D. Rychen & L.H. Salganik (Eds.). Göttingen: Hogrefe and Huber Publishers. Retrieved from: www.oecd.org/dataoecd/47/61/35070367.pdf.

OECD (Organisation for Economic Co-operation and Development). (2013, June). *Education policy outlook: Australia.* Education Policy Outlook series. Retrieved from: www.oecd.org/education/EDUCATION%20POLICY%20OUTLOOK%20AUSTRALIA_EN.pdf.

OECD (Organisation for Economic Co-operation and Development). (2014a). *Beyond PISA 2015: A longer-term strategy of PISA*. Retrieved April 13, 2015 from: www.oecd.org/pisa/pisaproducts/Longer-term-strategy-of-PISA.pdf.

OECD (Organisation for Economic Co-operation and Development). (2014b). *PISA 2012 results: Creative problem solving (volume V): Students' skills in tackling real-life problems*. Paris: PISA, OECD Publishing. Retrieved from: http://dx.doi.org/10.1787/9789264208070-en.

OECD (Organisation for Economic Co-operation and Development). (2014c). *PISA 2018: Call for tender 100000800*. Retrieved from: www.oecd.org/callsfortenders/2014%2002%2021%20FINAL%20CFT%20PISA%202018%20Cores%20A%20B%20EDU.pdf.

Ontario Ministry of Children and Youth Services. (2012). *Stepping stones: A resource on youth development*. Toronto: Author. Retrieved from: www.children.gov.on.ca/htdocs/English/documents/topics/youthopportunities/steppingstones/SteppingStones.pdf.

Ontario Ministry of Education. (2008). *Finding common ground: Character development in Ontario schools, K–12*. Toronto: Author. Retrieved from: www.edu.gov.on.ca/eng/document/reports/literacy/booklet2008.pdf.

Ontario Ministry of Education. (2013a). *The Ontario curriculum, Grades 9 and 10: Canadian and world studies (revised)*. Toronto: Author.

Ontario Ministry of Education. (2013b). *The Ontario curriculum, social studies, Grades 1–6; history and geography, Grades 7 and 8 (revised)*. Toronto: Author.

Ontario Ministry of Education. (2013c). *Supporting minds: An educator's guide to promoting students' mental health and well-being (draft version)*. Toronto: Author. Retrieved from: www.edu.gov.on.ca/eng/document/reports/SupportingMinds.pdf.

Ontario Ministry of Education. (2014). *Achieving excellence: A renewed vision for education in Ontario*. Toronto: Author. Retrieved from: www.edu.gov.on.ca/eng/about/renewedVision.pdf.

Ontario Ministry of Education. (2015). *Ontario's strategy for K–12 international education*. Toronto: Author. Retrieved from: www.edu.gov.on.ca/eng/policyfunding/strategyK12.pdf.

P21 (Partnership for 21st Century Skills). (2009). *Learning environments white paper.* Washington, DC: Author. Retrieved from: www.p21.org/storage/documents/le_white_paper-1.pdf.

P21 (Partnership for 21st Century Skills). (2011). *Framework for 21st century learning*. Retrieved from: www.p21.org/our-work/p21-framework.

Pellegrino, J.W., & Hilton, M.L. (Eds.). (2012). *Education for life and work: Developing transferable knowledge and skills in the 21st century*. National Research Council. Committee on Defining Deeper Learning and 21st Century Skills, Board on Testing and Assessment and Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

Prensky, M. (2001). Digital natives, digital immigrants, part 1. *On the Horizon*, *9*(5), 1–6. Retrieved from: www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf.

Puentedura, R.R. (2013a, June 6). *Paths to transformation: Putting SAMR and the Horizon Report to work*. Retrieved from: www.hippasus.com/rrpweblog/archives/2013/06/06/PathstoTransformation.pdf.

Puentedura, R.R. (2013b, August 8). *Putting SAMR and the EDTech Quintet to work.* Retrieved from: www.hippasus.com/rrpweblog/archives/2013/08/28/PuttingSAMREdTechQuintetToWork.pdf.

Ripley, M. (2007). *E-assessment: An update on research, policy and practice*. Bristol: Futurelab. Retrieved from: http://archive.futurelab.org.uk/resources/documents/lit_reviews/Assessment_Review_update.pdf.

Rychen, D.S. (2003). Key competencies: Meeting important challenges in life. In D.S. Rychen & L.H. Salganik (Eds.), *Key competencies for a successful life and a well-functioning society* (pp. 63–107). Göttingen: Hogrefe & Huber Publishers.

Rychen, D.S., & Salganik, L.H. (Eds.). (2001). *Defining and selecting key competencies.* Göttingen: Hogrefe & Huber Publishers.

Rychen, D.S., & Salganik, L.H. (Eds.). (2003). *Key competencies for a successful life and a well-functioning society*. Göttingen: Hogrefe & Huber Publishers.

Sá, C., Kretz, A., & Sigurdson, K. (2014). *The state of entrepreneurship education in Ontario's colleges and universities.* Toronto: Higher Education Quality Council of Ontario.

Saavedra, A.R., & Opfer, V.D. (2012). *Teaching and learning 21st century skills: Lessons from the learning science*. Report for the first Asia Society Global Cities Education Network Symposium. Santa Monica, CA: RAND Corporation. Retrieved from: http://asiasociety.org/files/rand-1012report.pdf.

Schneider, M., & Stern, E. (2010). The cognitive perspective in learning: Ten cornerstone findings. In H. Dumont, D. Istance, & F. Benavides (Eds.), *The nature of learning: Using research to inspire practice* (pp. 69–90*)*. Paris: Educational Research and Innovation, OECD Publishing. Retrieved from: http://dx.doi.org/10.1787/9789264086487-en.

Scottish Qualifications Authority (SQA). (2003). *Key competencies – some international comparisons.* Bulletin number 2: Policy and Research. Retrieved from: www.sqa.org.uk/files_ccc/Key_Competencies.pdf.

Singapore Ministry of Education. (2010). *Framework for 21st century competencies and student outcomes.* Retrieved from: www.moe.gov.sg/education/21cc/.

Sousa, C. (2014). *2014 Ontario budget: Building opportunity, securing our future*. Retrieved from: www.fin.gov.on.ca/en/budget/ontariobudgets/2014/papers_all.pdf.

Tapscott, D. (1999). *Growing up digital: The rise of the net generation*. New York: McGraw-Hill.

Tough, P. (2012). *How children succeed: Grit, curiosity, and the hidden power of character*. Boston: Houghton Mifflin Harcourt.

Trilling, B., & Fadel, C. (2009). *21st century skills: Learning for life in our times.* San Francisco: Jossey-Bass.

United Kingdom, Secretary of State for Education and Skills. (2003, July). *21st century skills: Realising our potential – individuals, employers, nation.* Retrieved from: www.gov.uk/government/uploads/system/uploads/attachment_data/file/336816/21st_Century_Skills_Realising_Our_Potential.pdf.

Upitis, R. (2014, November 8). *Creativity: The state of the domain*. In People for Education, Measuring What Matters. Toronto. Retrieved from: http://peopleforeducation.ca/measuring-what-matters/domain/creativity-and-innovation/.

U.S. Department of Labor. (2000, August). *Workplace essential skills: Resources related to the SCANS competencies and foundation skills*. Developed by ACT, Inc., under the direction of the U.S. Department of Labor, Employment and Training Administration, and the U.S. Department of Education, National Center for Education Statistics. Retrieved from: http://wdr.doleta.gov/opr/fulltext/00-wes.pdf.

Volkmann, C., Wilson, K.E., Mariotti, S., Rabuzzi, D., Vyakarnam, S., & Sepulveda, A. (2009). *Education the next wave of entrepreneurs: Unlocking entrepreneurial capabilities to meet the global challenges of the 21st century*. A report of the Global Education Initiative. Switzerland: World Economic Forum.

Wiggins, G., & McTighe, J. (2005). *Understanding by design*. Alexandria, VA: Association for Supervision and Curriculum Development (ASCD).

Wynne, K. (2014, September 25). *2014 Mandate Letter*: *Education*. Letter to the Honourable Liz Sandals. Retrieved from: http://www.ontario.ca/government/2014-mandate-letter-education.

Printed on recycled paper

15-083

ISBN 978-1-4606-5838-3 (Print)
ISBN 978-1-4606-5839-0 (PDF)