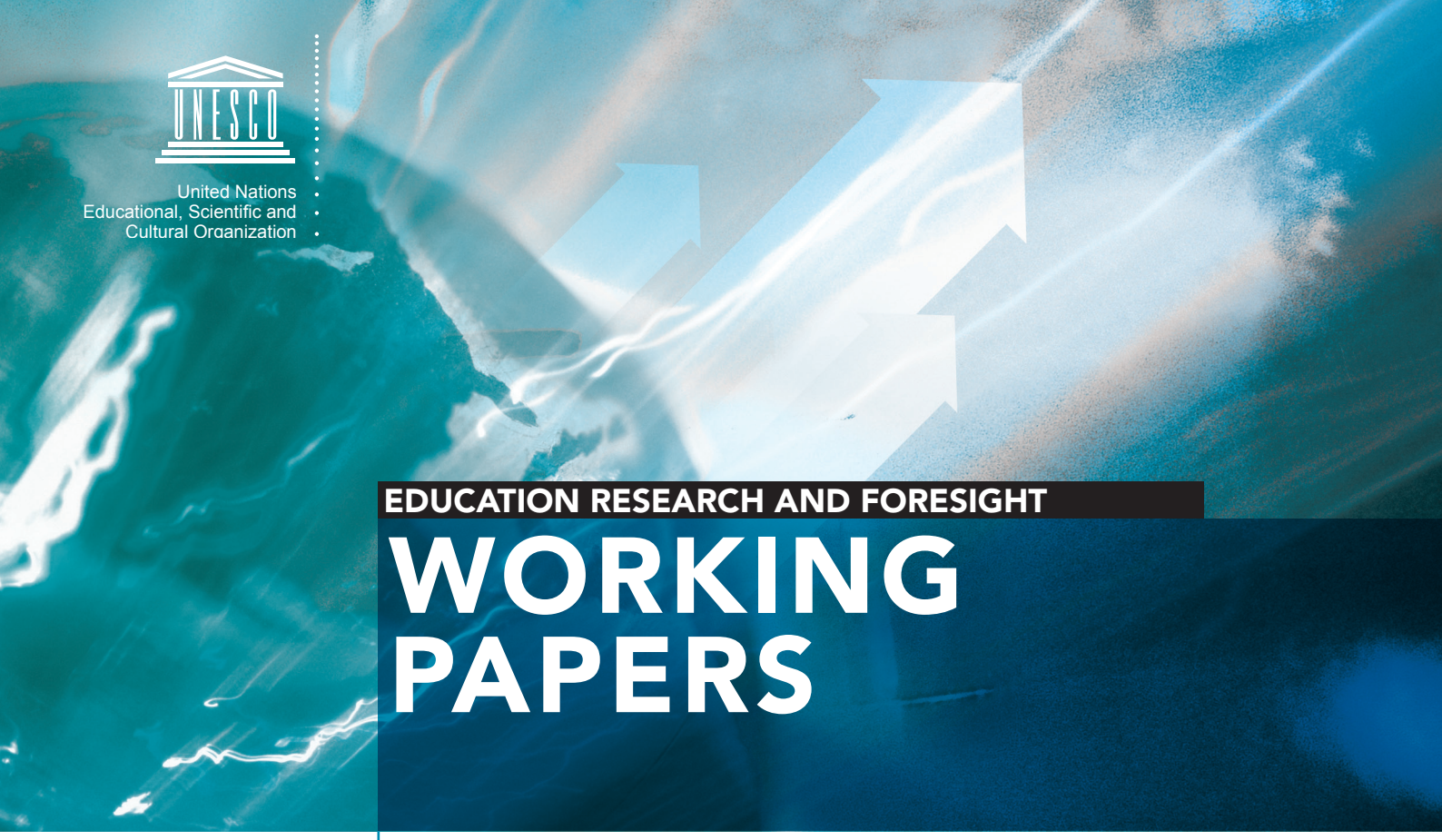

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THE FUTURES OF LEARNING 2:
WHAT KIND OF LEARNING FOR THE 21st CENTURY?

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ABSTRACT

The past two decades have seen the emergence of a global movement that calls for a new model of learning for the twenty-first century. There is now a significant body of literature focusing mainly on three topics – motivations for a new model of learning, the specific competencies and skills needed to function effectively in the twenty-first century, and the pedagogy required to stimulate those capabilities. This is the second in a series of three papers based on a comprehensive review of the literature. It addresses the competencies and skills that are deemed necessary for today's societies. While it is generally accepted that formal education must be transformed to enable the new forms of learning needed to tackle the complex global challenges ahead, there is no single prescribed approach to educating young people for the twenty-first century. Multiple sources have identified a variety of competencies and skills that warrant consideration, most of which are absent from current learning processes. Growing concern about potential economic and global crises ahead are leading many to question whether today's learners possess the combination of critical thinking, creativity, and collaborative and communication skills, necessary to tackle the unexpected developments they will face. This paper explores these skills in depth and highlights several key elements for learning in the twenty-first century including personalization, collaboration, communication, informal learning, productivity and content creation. It also underlines the importance to the twenty-first century workplace of personal skills such as initiative, resilience, responsibility, risk-taking and creativity; social skills such as teamwork, networking, empathy and compassion; and learning skills such as managing, organizing, meta-cognitive skills and 'failing forward'.

1 This paper was prepared for UNESCO when the author was a Fulbright Scholar at the National University of Ireland.

INTRODUCTION

Preparing students for work, citizenship and life in the twenty-first century is daunting. Globalization, new technologies, migration, international competition, changing markets, and transnational environmental and political challenges all drive the acquisition of skills and knowledge needed by students to survive and succeed in the twenty-first century. Educators, education ministries and governments, foundations, employers and researchers refer to these abilities as twenty-first century skills, higher-order thinking skills, deeper learning outcomes, and complex thinking and communication skills. This report concentrates on the competencies and skills that are deemed necessary for today's societies and addresses questions regarding how these may help learners navigate the challenges of the twenty-first century.

What critical skills does tomorrow's workforce need to develop and master today? What capabilities will young people need to tackle the volatile and unexpected challenges they will face in the future? Debate regarding the competencies and skills learners need to cope with the unforeseen challenges ahead has given rise to a significant body of literature. There is a clear consensus that new approaches to learning must accommodate the characteristics of today's students, become more inclusive and address twenty-first century interdisciplinary themes (Carneiro, 2007). Furthermore, the development of twenty-first century skills should not be delayed or reserved solely for higher-level students. Instead, it is essential to support students to cultivate meta-cognitive competencies and skills from the earliest stages of formal education.

As a result of the persistent use of digital and mobile technologies, most students today are natural investigators, researchers and synthesizers of information. These skills can be put to strong use in the classroom to unlock student engagement. Technologies in which students are already well versed are an effective way to support independent and enquiry-based learning, and to allow for instant and reflective forms of assessment.

OVERALL VISION OF TWENTY-FIRST CENTURY LEARNING

Personalization, collaboration, communication, informal learning, productivity and content creation are central to the competencies and skills learners are expected to develop and the way in which these skills are taught. These elements are key to the overall vision of twenty-first century learning (McLoughlin and Lee, 2008; Redecker and Punie, 2013). In addition, personal skills (initiative, resilience, responsibility, risk-taking and creativity), social skills (teamwork, networking, empathy and compassion) and learning skills (managing, organizing, meta-cognitive skills and 'failing forward' or altering perceptions of and response to failure) are vital to peak performance in the twenty-first century workplace (Learnovation, 2009). While many of these competencies and skills may seem modern they 'are not new, just newly important' (Silva, cited in Salas-Pilco, 2013).

Over the last two decades, no fewer than ten international organizations and commissions, governments, private consortia and private institutions have proposed frameworks and outlined competencies needed to address twenty-first century challenges. Dede (2010) and Salas Pilco (2013) compared several frameworks to identify the evolution of themes over time and the points they have in common. While there is no single prescribed approach to educating young people for the twenty-first century, a variety of competencies and skills warrant consideration (*cf.* Table 1). While frameworks differ in complexity, each is useful for the specific context for which it was developed. The comparison also draws attention to the absence of these competencies and skills from current learning processes.

The Delors Report (1996) produced by the International Commission on Education for the Twenty-first Century proposed one of the first frameworks to identify competencies needed in the coming century. The four visions of learning outlined in this landmark report – knowledge, understanding, competencies for life and competencies for action – remain appropriate reference points and organizing principles for identifying competencies for twenty-first century learning. The Delors Report also formulated four principles identified as the Four Pillars of Education: *Learning to Know, Learning to Do, Learning to Be* and *Learning to Live Together.* The Delors framework remains relevant today and can be redefined and expanded for the twenty-first century.

Perhaps the most obvious gateway for innovation is the curriculum in combination with choices on teaching and learning approaches. For the most part, curriculum development worldwide has not kept pace with current expectations about learner competencies and skills or new tools to support learning. What changes should be made to curricula in the twenty-first century? Fifteen years from now, schools will likely make greater use of technology, conduct formative assessments and grading to inform instruction, cooperate more closely with industry and universities, and become more customized towards individual needs and interests (Leis, 2010).

However, the process of reforming schools and learning does not imply an immediate overhaul of the curriculum or the transformation of schools and classrooms with new technology and organizational schemes. Instead, the first priority is to ascertain what elements should be removed from an already over-burdened curriculum (e.g. less relevant knowledge), before embedding new competencies and skills or transforming the way class time is used. Meta-layering (e.g. interdisciplinary themes, learning how to learn) and personalized learning approaches will then complete this transformation (Center for Curriculum Redesign and OECD, 2012).

There are a number of effective, research-based curriculum models capable of guiding twenty-first century learning. Sternberg and Subotnik (2006) argue for a curriculum

focused on fostering learners' capabilities in 'The other 3 Rs': *Reasoning* (analytical, critical thinking and problem-solving skills), *Resilience* (life skills such as flexibility, adaptability and self-reliance) and *Responsibility* (wisdom or the application of intelligence, creativity and knowledge for a common good)' (p. 1).

Wagner (2010) and the Change Leadership Group at Harvard University identified another set of competencies and skills. Informed by several hundred interviews with business, non-profit and education leaders, Wagner stressed that students need seven survival skills to be prepared for twenty-first century life, work and citizenship:

- Critical thinking and problem solving
- Collaboration and leadership
- Agility and adaptability
- Initiative and entrepreneurialism
- Effective oral and written communication
- Accessing and analysing information
- Curiosity and imagination (p. 4).

Wagner et al. (2006) advocate a curriculum founded on very different principles – 'The new 3 Rs': *Rigour, Relevance* and *Respect*. *Rigour* refers to the abilities and capacities students acquire as a result of their learning. *Relevance* refers to their understanding of how their learning connects to current real-world challenges and future work. *Respect* refers to the promotion of respectful relationships among teachers and students that foster academic and social competence (pp. 1-2).

Ackerman and Perkins (1989, pp. 80-81) have endorsed 'thinking skills being taught as a "meta-curriculum" interwoven with traditional core subjects'. Conley (2007) emphasizes the importance of learners developing 'habits of mind' including analysis, interpretation, precision and accuracy, problem-solving, and reasoning to support thinking and reflection. Levy and Murnane (2004) favour building skills in 'expert thinking' and the use of detailed knowledge and metacognition to support decision-making (p. 75).

Prensky (2012) advocates a student-centric curriculum founded on 'The 3 Ps'; these consist of '*Passion* (including character), *Problem solving* (including communication) and *Producing* what is required with creativity and skill' (pp. 23-25).

Perkins (cited in P21, 2007b, p. 2) has endorsed the teaching of 'thinking skills' … as a "meta-curriculum" interwoven with traditional core subjects'. Tucker and Codding of the US-based National Center on Education and the Economy (1998) also urge schools to adopt 'a thinking curriculum – one that provides a deeper understanding of the subject and the ability to apply that understanding to the complex, real-world problems that the student will face as an adult' (pp. 76-78).

The notable features of the above models are inquiry, design and collaborative learning for effective instruction. A curriculum based on these learning methods blended with more direct forms of instruction is necessary to build knowledge, understanding, creativity and other twenty-first century skills (Trilling and Fadel, 2009, pp. 134-135).

Research carried out by OECD/CERI on 'New Millennium Learners' (Ananiadou and Claro, 2009) described three dimensions for learning in the twenty-first century — *information, communication*, and *ethics and social impact*. An international survey of CEOs carried out by IBM (2010) also found that chief executives believe *creativity* will be essential to successfully navigate an increasingly complex world.

The Assessment and Teaching of 21st Century Skills project (ATC21S)[2] categorized twenty-first century skills internationally into four broad categories – *ways of thinking*, *ways of working*, *tools for working* and *skills for living in the world* (Griffin, McGaw and Care, 2012). Meanwhile, the US-based Apollo Education Group, a leading provider of higher education programmes for working adults, cited ten skills needed by students to survive as twenty-first century workers (Barry, 2012) – *critical thinking, communication, leadership, collaboration, adaptability, productivity and accountability, innovation, global citizenship, entrepreneurialism,* and *the ability to access, analyse and synthesize information*.

The Asia-Pacific Economic Cooperation (APEC)[3] has identified the development of twenty-first century competencies among youth as a 'pressing international concern'. These competencies are defined as the knowledge, skills and attitudes necessary to be competitive in the twenty-first century workforce participate appropriately in an increasingly diverse society, use new technologies and cope with rapidly changing workplaces. APEC members defined four 'overarching 21st century competencies' that should be integrated into existing educational systems – *lifelong learning, problem solving, self-management* and *teamwork* (APEC, 2008).

Lastly, the US-based Partnership for 21st Century Skills (hereinafter P21), a coalition of business leaders and educators, proposed a *Framework for 21st Century Learning*, which identified essential competencies and skills vital for success in twenty-first century work and life (P21, 2007a, 2011). These included *'The 4Cs' – communication, collaboration, critical thinking* and *creativity*, which are to be taught within the context of core subject areas and twenty-first century themes. This framework is based on the assertion that twenty-first century challenges will demand a broad skill set emphasizing core subject skills, social and cross-cultural skills, proficiency in languages other than English, and an understanding of the economic and political forces that affect societies (P21, 2007a, 2013).

The following sections discuss these potential competencies and skills in greater detail, organized according to the Four Pillars of Education outlined in the Delors Report.

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2 ATC21S is a worldwide multi-stakeholder partnership consisting of the University of Melbourne, Cisco, Intel and Microsoft, based in Australia, Costa Rica, Finland, the Netherlands, Singapore and the United States, with more than 250 researchers spread across sixty institutions worldwide.

3 APEC is an alliance of twenty-one Pacific Rim member economies promoting free trade, economic cooperation and economic growth throughout the Asia-Pacific region.

LEARNING TO KNOW

There is general agreement that mastery of core subjects and learning around twenty-first century themes are essential for today's students. Identified core subjects include: Grammar, Reading or Language Arts; World Languages; Art; Mathematics; Economics; Science; Geography; History; and Government and Civics, with a balance between education in technical and natural science subjects and culture and humanities (Davies, Fidler and Gorbis, 2011; Gardner, 2008; P21, 2007*a*, 2007*b*; Salas-Pilco, 2013). Above all, twenty-first century competencies must be founded on sound and integrated content knowledge, rather than sets of compartmentalized and de-contextualized facts. Twenty-first century learners must also commit themselves to lifelong learning; they must continually assess what they know and still need to understand for success in work and life, and be ready to retrain themselves when new situations require new skills (Gijsbers and van Schoonhoven, 2012; P21, 2007*a*, 2011; Redecker et al., 2011).

In addition, educational theorists and organizations stress that schools must weave twenty-first century interdisciplinary themes into core subjects. There are four themes with special relevance for modern life: global awareness; financial, economic, business and entrepreneurial literacy; civic literacy; and health literacy including health and wellness awareness. In recent years, professional educational groups have advocated introducing these themes into the curriculum to better prepare students for the demands of adult life and work (P21, 2007*a*).

LEARNING TO DO

Carneiro (2007) notes that both students and adults alike need academic *and* applied knowledge, and must be able to 'connect knowledge and skills, learning and competence, inert and active learning, codified and tacit knowledge, and creative and adaptive learning and transform them into valuable skills' (p. 156). Above all, these skills stress active learning.

CRITICAL THINKING

Critical thinking is considered fundamental to twenty-first century learning (Ananiadou and Claro, 2009; Gardner, 2008; P21, 2013; Redecker et al., 2011; Trilling and Fadel, 2009; Tucker and Codding, 1998). The US Department of Labor's Secretary's Commission on Achieving Necessary Skills (SCANS) (1991) identified critical thinking skills or the capacity for active investigative thinking as one of three foundational skill sets vital to workplace success. Critical thinking involves accessing, analysing and synthesizing information, and can be taught, practised and mastered (P21, 2007*a*; Redecker et al., 2011). Critical thinking also draws on other skills such as communication, information literacy and the ability to examine, analyse, interpret and evaluate evidence.

In spite of significant efforts to equip learners with appropriate research skills for the digital age, recent studies suggest that many secondary and university students lack the necessary competencies to navigate and select relevant sources from the overabundance of available information (Windham, cited in McLoughlin and Lee, 2008). Essential digital literacy and critical thinking skills are required to locate quality sources and assess them for objectivity, reliability and currency (Katz and Macklin, cited in McLoughlin and Lee, 2008). Critical thinking is also an essential skill outside formal education. Today's citizens need to be able to compare evidence, evaluate competing proposals and make responsible decisions. Private businesses must also employ critical thinking to better serve their customers and develop innovative products within the changing economy (NEA, 2010).

PROBLEM-SOLVING

Another basic competency of twenty-first century learning is problem-solving (Ananiadou and Claro, 2009; P21, 2007*a*, 2007*b*, 2013; Redecker et al., 2011; Sternberg and Subotnik, 2006; Trilling and Fadel, 2009). Research and problem-solving skills include point identification and the ability to search for, select, evaluate, organize and weigh alternatives and interpret information. Problem-solving in the twenty-first century also requires individuals to draw from multiple domains to find solutions to complex issues. This ability to scan multiple domains is especially valued in today's highly competitive workplace (P21, 2007*a*).

To be effective, lifelong learners must be self-reliant and acquire higher-order cognitive competencies. By promoting the capacity to learn and grow, learning and innovation skills facilitate the mastery of other twenty-first century skills such as the capacity to recognize perspectives, communicate ideas, take creative action, and draw on relevant disciplinary and interdisciplinary expertise to solve complex problems (Mansilla and Jackson, 2011; P21, 2007a). Educated workers in the twenty-first century need to be able to understand and work with complex ideas and be able to critically evaluate information. Other vital skills include the ability to discern relationships between existing and new information, and between new contexts and goals, and to locate new knowledge when needed (Facer, 2011; Gijsbers and van Schoonhoven, 2012; Redecker et al., 2011).

Problem-solving has always involved teamwork and cooperation. Successful problem-solving in the twenty-first century requires effective and creative collaboration between learners, who must keep pace with evolving technology and handle vast amounts of often-contradictory information. Discovering solutions to today's complex problems demands a broad range of skills linked to critical thinking, innovation and creativity (P21, 2007a). To resolve a problem it is important to first define it and understand its constituent elements. In addition, it is necessary to identify the resources and strategies needed to solve the problem (e.g. skills related to information literacy, scanning data and extracting relevant information). Critical thinking skills are fundamental to this process. Learners must also be able to apply the appropriate tools and techniques

effectively and efficiently and persist in the face of obstacles. Flexibility and self-direction are therefore critical to problem-solving. Finally, success often depends on knowing when and how to access the expertise of others (P21, 2007a).

COMMUNICATION AND COLLABORATION

Strong communication abilities including the capacity to express thoughts clearly and persuasively both orally and in writing, articulate opinions, communicate coherent instructions and motivate others through speech, are highly valued in the workplace and public life (NEA, 2010). According to experts, coordination and collaboration will also be essential skills for productive participation in society in the twenty-first century (Redecker et al., 2011). However, recent research shows that normalizing collaborative learning will require changes in curricula, instruction, assessment practices, learning environments and the professional development of teachers (Trilling and Fadel, 2009, p. 115).

Educators already use cooperative learning throughout Europe, North America and many other parts of the world due to its high success rate. In a meta-analysis of 164 research studies, Johnson, Johnson and Stanne (2000) concluded that students who work cooperatively show dramatic increases in academic achievement, self-esteem and positive social skills. Overall, the authors discovered over 900 research studies validating the effectiveness of cooperative learning. Cooperative efforts have been found to result in higher individual achievement than either competitive or individualistic efforts. In addition, cooperative learning tends to trigger other positive outcomes, such as higher-level reasoning, increased transfer of learning, greater motivation to succeed, stronger social and cognitive development and increased time-on-task. Additional positive outcomes include reductions in stereotyping and prejudice, a greater appreciation of diversity, development of social skills and improvement in the quality of learning environments.

Communication and collaboration are highly regarded in the adult world, while empathic and social skills carry significant value. Communication skills are also embedded in information, media and ICT competencies (P21, 2007*a*, p. 17). It is important to consider how words and images are shaped by present day technologies, taking into account the large proportion of messages that are mediated by one or more digital devices. In this context, effective communication and collaboration skills can help to avoid misunderstandings and miscommunications.

Collaboration and teamwork in the twenty-first century will be developed within schools, between schools, and between in-school and outside-school experiences (P21, 2007*a*). Students will learn together as they work collaboratively on authentic project-based assignments and develop skills by teaching their peers in groups. In the future workplace, workers can expect to engage in highly networked collaborations, separated from colleagues by considerable distance and situated far from the physical location of information resources (Facer, 2009). People will need to be comfortable with collaborating at a distance, and simulating those interactions in education will have clear benefits. It is more important than ever to function as clear and effective communicators, skilled in the use of technologies and social media that allow collaboration with international teams (P21, 2007*a*, pp. 16-17).

CREATIVITY AND INNOVATION

In a speech at the 2006 TED Conference, Sir Ken Robinson, a leading thinker and speaker on creativity remarked, 'We do not grow into creativity, we grow out of it – or rather, we are educated out of it'. Traditional education, with its emphasis on rote learning and memorization of static facts, has long valued conformity over novelty of thought (Wan and Gut, 2011). However, in today's world of global competition and task automation, innovative capacity and a creative spirit are fast becoming requirements for professional and personal success. Robinson (2006) argues that humanity's future depends on the ability to 'reconstitute our understanding of human capacity and place creativity and innovation in the forefront of our educational systems'. Divergent thinking (the courage to 'seize' problems) and enthusiastic experimentation boost creativity and innovation even further (Center for Curriculum Redesign and OECD, 2012). The capacity to 'break new ground', invoke fresh ways of thinking, put forth new ideas and solutions, pose unfamiliar questions, and arrive at unexpected answers further advance innovation and creativity (Gardner, 2008; Sternberg, 2007). Successful individuals will be those who possess the creative skills to envision a strategy for making the world a better place for all (P21, 2007*a*, p. 14).

INFORMATION, MEDIA AND TECHNOLOGY LITERACY

The complexity of today's world increasingly demands the ability to *access, evaluate and use* information (Trilling and Fadel, 2009). Information literacy has a truly transformative effect, one that makes possible the acquisition of other skills essential for a successful twenty-first century life (Wan and Gut, 2011, p. 54). According to the P21 (2007a), a media-literate person is one who uses the process skills of awareness, analysis, reflection and action to understand the nature of media messages (p. 19). Media literacy provides a framework to access, analyse, evaluate and create messages in a variety of forms, creates an understanding of the role of media in society, and builds essential skills of inquiry and self-expression. Media literacy is not solely limited to interpretation; it also encompasses the ability to create messages for self-expression and to influence and inform others (Wan and Gut, 2011, p. 164).

INFORMATION, COMMUNICATION AND TECHNOLOGY (ICT) LITERACY

Being ICT literate means possessing the ability to easily access, manage, integrate, evaluate and create information through the use of digital communication and technologies (ETS, 2007). ICT literacy centres on using progressively higher order cognitive skills to make sense of – while making use of – the information, media and technologies in the surrounding environment. According to the International Literacy Panel convened by ETS, a non- profit assessment organization, (2007)

every nation must widely cultivate ICT skills in its population or risk being excluded from today's technology-driven knowledge economy. There are many linkages among these three forms of literacy – information communication, media and technology. Once mastered, these forms of literacy, just like traditional forms, enable the mastery of other competencies and skills needed for twenty-first century success (Trilling and Fadel, 2009).

LEARNING TO BE

A significant body of literature has emerged on preparing youth for life in the twenty-first century. Academic and cognitive skills, essential as they are, are not the only skills necessary for a successful life. Just as cognitive competencies are fundamental, so are the personal qualities that shape learners' identities, guide their responses to failure, conflict and crisis, and prepare them to tackle the difficult twenty-first century problems they will face. In particular, young people need to be able to work with and learn from diverse groups in a variety of work and social settings, and be able to adapt to changing times (P21, 2007*a*, p. 21).

SOCIAL AND CROSS-CULTURAL SKILLS

Good social and cross-cultural skills are crucial to successful functioning both in school and life. These skills allow individuals to interact effectively with others (e.g. knowing when to listen and when to speak, and how to conduct oneself in a respectable, professional manner), work effectively in diverse teams (e.g. respecting cultural differences and collaborating with people from a wide range of social and cultural backgrounds), be open-minded to different ideas and values, and use social and cultural differences to generate ideas, innovation and better quality work. Good social skills help learners make good choices. The extent to which children and adolescents possess good social skills can influence their academic performance, behaviour, social and family relationships, and involvement in extracurricular activities. Social skills are expected to grow in importance in the twenty-first century, in particular the ability to empathize (National Research Council, 2012; P21, 2007*a*). Opportunities to develop emotional resilience and empathy must be designed explicitly to allow learners to develop these skills (Leadbeater, 2008). Steedly et al. (2008) echo the belief that children generally acquire positive social skills through daily interactions with adults and their peers. However, it is important that educators and parents reinforce this casual learning with direct instruction.

PERSONAL RESPONSIBILITY, SELF-REGULATION AND INITIATIVE

The high level of interaction and teamwork expected in the twenty-first century workplace has heightened the importance of personal qualities among learners. The ability to self-govern is at the heart of twenty-first century learning. Self-directed learners take personal responsibility for their learning and are willing to improve their capabilities throughout their careers. Herring (2012) argues that self-directed learners are intrinsically motivated. They understand that their passion for learning is fundamentally tied to their ability to succeed in the workplace. Herring also states that risk-taking and commitment to continuous learning are the hallmarks of self-directed learners, who will succeed by differentiating their skills and exploiting the broad array of informal learning technologies available to them (pp. 1-2).

Adaptability – the capacity to change in response to shifting conditions in the economy and marketplace and quickly master new skills – has been identified as one of the top three competencies required in the twenty-first century workforce (Association for Talent Development, cited in Herring 2012, p. 2). Nurturing flexibility in a variety of work and social settings and demonstrating initiative and resourcefulness are also essential, especially as rapidly changing expectations in the workplace become the norm. Fostering mental agility and curiosity among learners is vital and a myriad of web-based technologies (including social, mobile, video, games and personalized portals) are available to support this aim. The use of technology-enabled informal learning resources also allows collaborative learners to easily share and exchange knowledge, and self-directed learners to continuously teach themselves (Herring, 2012, p. 2). The ability to reflect on personal strengths and weaknesses and improve time management is also useful. Training in school to enhance these skills can help prepare learners for twenty-first century work and life (P21, 2011, p. 11).

SENSE-MAKING SKILLS

Today's youth inhabit a world that will present numerous challenges, many of which are as yet undefined. Mansilla and Jackson (2011) stress that twenty-first century students must develop the ability to make sense out of significant and complex global issues. They need to be prepared to tackle a wide range of pervasive problems, including human conflict, climate change, poverty, the spread of disease and energy crises. Schools should provide youth with opportunities, guidance and support to make sense of real-world roles and responsibilities. Bolstad (2011) states that students must develop competencies that allow them to make sense of new situations and environments including those characterized by a high degree of complexity, fluidity and uncertainty.

METACOGNITIVE SKILLS

P21 has identified self-directed learning as one of the life and career skills necessary to prepare for twenty-first century education and work (P21, 2007*a*). Simply expressed, teaching metacognition improves learning. Metacognition is defined as 'thinking about thinking'. Possessing metacognitive knowledge means an individual is aware of how much they understand about a topic and the factors that might affect their understanding (Lai, 2011, p. 5). Metacognition skills can increase learners' comprehension. Lovett and Ormand (2008) identify three critical steps to teaching metacognition:

- Teach that learning is not a fixed quantity and that a person's ability to learn can change;
- Teach how to set goals and plan to meet them;
- Give learners ample opportunities to practise *accurately* monitoring their learning and adapting it as necessary (p. 1).

ENTREPRENEURIAL THINKING SKILLS

Creativity and entrepreneurial thinking are essential skills for the twenty-first century (Robinson, 2006). Many fast-growing jobs and emerging industries rely on the creative capacity of workers including the ability to think unconventionally, question conventional wisdom, imagine new scenarios and produce astonishing work. Possessing an entrepreneurial mindset – the ability to recognize and act on opportunities and the willingness to embrace risk and responsibility – enables individuals to create jobs for themselves and others (P21, 2008, p. 10). Learners must therefore be taught to 'think on their feet'. They must also be coached on inventive thinking and to observe and evaluate opportunities and ideas that may be new to them, but which hold merit or promise to positively affect the organizations and communities in which they work and live (Metiri Group and NCREL, 2003). Entrepreneurial activities in school should be designed to enable students to lead and cultivate greater autonomy (P21, 2008).

LEARNING-TO-LEARN AND HABITS OF LIFELONG LEARNING

The pace at which people encounter new information and the evolution of knowledge itself will continue to change. Bolstad (2011) argues that future-oriented schools must therefore expand the intellectual capacity of learners and strengthen their willingness and ability to keep learning throughout their lives. Learning-to-learn skills and the openness and commitment of students to lifelong and life-wide learning are crucial to the ability to adapt. Key competencies based more on the ability to learn than on the accumulation of knowledge are likewise essential (Carneiro and Draxler, 2008).

The concept of lifelong learning needs to be revised to include the four pillars of education outlined by the Delors Report (Tawil and Cougoureux, 2013, pp. 1-10). This framework will function as an organizing principle for education and training systems, and for building 'knowledge societies'. Herring (2012) emphasizes the importance of this approach for continuous employee and economic growth:

> We face clear challenges. We must find new ways to help yesterday's knowledge workers take responsibility for their own development, and to see that development as central to not just their employer's value creation, but their own value creation as well. We must help the knowledge workers of yesterday move beyond their comfort zones to become the innovation workers of tomorrow… they [must] embrace self-directed, continuous development in order to differentiate their skills and make themselves invaluable contributors to our economy (p. 3).

LEARNING TO LIVE TOGETHER

There is persuasive evidence that cooperative teams achieve higher levels of thought and retain information longer than learners who work in isolation. Shared learning gives learners an opportunity to engage in discussion, continually monitor their learning and become critical thinkers (Johnson and Johnson, cited in Laal, Laal and Khattami-Kermanshahi, 2012).

SEEK AND VALUE DIVERSITY

In the twenty-first century, learners must take part in educational activities that help them develop competencies in living and working together in culturally diverse societies and organizations. They must learn the value of not only *welcoming*, but also *seeking out* and *engaging* the talents and ideas of diverse participants. This is an essential skill that learners must cultivate and practise frequently. It involves respecting and valuing the concerns of people and cultures different from their own and acquiring the social and cross-cultural skills to seek out the views of others (Barrett et al., 2014). It also involves building awareness of and appreciation for differences among individuals and communities (Pink, 2005). The school environment offers the possibility to design learning activities that give young people opportunities to value and practise getting along and living peacefully in a highly diverse world population – highly valued skills in a twenty-first century world. There is therefore an urgent need for teachers to design collaborative and authentic learning activities that develop students' understanding, skills and values with a view to negotiating viable solutions to worldwide political conflicts, environmental challenges and cultural divisions that will undoubtedly continue into the next century (UN, 2012).

TEAMWORK AND INTERCONNECTEDNESS

As fresh concerns surface over global competitiveness, applied skills have once again emerged as a key educational concern. These skills are essential in both the community and the workplace. The 2006 Conference Board survey found that professionalism, a good work ethic, oral and written communication, teamwork, collaboration, critical thinking and problem-solving were the most important skills cited by employers. These skills will help citizens to thrive in collaborative working environments (Redecker et al., 2011). Among the critical qualities in a diverse twenty-first century world are the ability to foster interdisciplinary cooperation and the global exchange of ideas to counter potential discrimination due to origin, gender or age (Leis, 2010).

CIVIC AND DIGITAL CITIZENSHIP

Civic literacy and digital literacy go hand-in-hand. Civic literacy is an essential skill that consists of knowing how to exercise the rights and obligations of citizenship at local, state and national level; developing the motivation, disposition and skills for civic participation; and understanding the local and global implications of civic issues (P21, 2007*a*, 2013). Responsible

citizenship is informed, engaged and energetic. Locally, young people will need support and encouragement to engage in their communities and understand how these communities are organized and governed (UN, 2012).

Another vital skill set for twenty-first century learners is digital citizenship – knowing how to participate productively and responsibly online (P21, 2013). It is essential to help students understand how to participate intelligently and ethically as responsible citizens in virtual communities (P21, 2013). This involves learning how to assess the reliability and quality of information found on the internet and using information gained in a responsible manner (Davies, Fidler and Gorbis, 2011). Schools may offer the most appropriate setting for individuals to learn and practise how to use technology in a responsible manner (e.g. issues of data access, privacy protection, fraud detection, plagiarism, intellectual property rights and anonymity) and how to become good digital citizens (Leis, 2010).

GLOBAL COMPETENCE

Globally competent learners are able to take action in many ways, they tend to think of themselves as world citizens, rather than citizens of their particular nation or homeland. Globally competent learners use critical thinking skills to survey and thoughtfully prioritize problems, identify possible solutions, assess options and plan actions based on evidence, and are equipped to assess the potential impact and consequences of actions under consideration (Mansilla and Jackson, 2011).

Globally competent learners are careful to consider previous approaches and the perspectives of others, they act ethically and collaboratively – in creative ways – to contribute to local, regional or global development. Globally competent learners do not presume they are equipped to handle complex challenges alone. They reflect candidly on their capacity to complete an assigned task and seek out collaborative opportunities to join with others whose strengths complement their own (Mansilla and Jackson, 2011).

INTERCULTURAL COMPETENCE

The ability to understand and communicate with each other across cultural barriers is a fundamental prerequisite for making societies work. All learners need to acquire intercultural competence. For this reason, intercultural education, which aims to develop and enhance this ability, can make an essential contribution to peaceful co-existence and inclusive learning (Barrett et al., 2014). However, intercultural competence is not acquired automatically, but instead needs to be learned, practised and maintained throughout life. Educators at all levels play an essential role in facilitating the development of intercultural competence among learners (Barrett et al., 2014).

Within culturally diverse societies, respect and tolerance are vital to ensuring that the views of individuals from all cultural backgrounds are fully acknowledged and respected. It is essential that students learn how to fully listen to others, demonstrate flexibility, and cooperate with contributors in interdisciplinary and intercultural teams. These are essential competencies that twenty-first century citizens cannot do without (Barrett et al., 2014; Levy and Murnane, 2004; P21, 2007*a*; UNESCO 2013*a*). It is clear that education has a significant, even fundamental, role to play in offering twenty-first century learners opportunities to develop the competencies that make living together possible (Carneiro and Draxler, 2008).

CONCLUSIONS, NEXT STEPS AND FUTURE ISSUES

This paper examines the many possible futures and forms of learning in the digital age. Education should prepare learners to tackle collaborative problem-solving scenarios that are persistent and lack clear solutions. Real-world challenges are highly complex, often ill-defined and interdisciplinary in nature, spanning multiple domains (social, economic, political, environmental, legal and ethical). Learners must have opportunities to reflect on their ideas, hone their analytical skills, strengthen their critical and creative thinking capacities, and demonstrate initiative. In particular, the ability to evaluate new inputs and perspectives, build new capacities and strengthen autonomy will be crucial.

Transforming twenty-first century education is about making sure that all learners are prepared to thrive and succeed in a competitive world – a world with many opportunities for highly skilled individuals, yet limited options for others. Twenty-first century life and work environments require far more than thinking skills and content knowledge. The ability to navigate these complex environments in a globally competitive information age requires learners to develop appropriate life and career skills, as they need them. The increased tempo at which new developments are emerging will demand that young people quickly recognize the importance of lifelong learning. Re-skilling and updating competencies will enable learners of all ages to adapt to new expectations in the twenty-first century workplace and life. To equip learners to tackle twenty-first century challenges and pressures, schools must adopt curricula that are comprehensive yet flexible, and centre on content that extends thinking and reasoning. There is a need for curricula that are open to learner input, interdisciplinary in focus, and blend informal and formal learning in an effective manner. Problem-solving, reflection, creativity, critical thinking, metacognition, risk-taking, communication, collaboration, innovation and entrepreneurship will become key competencies for twenty-first century life and work. While mathematic, verbal, scientific and digital forms of literacy will remain essential building blocks, it will become increasingly important for citizens to have a solid grasp of civic issues. A dynamic twenty-first century curriculum will enrich these new competencies and skills, while reaffirming the importance of core academic subjects and forms of literacy.

Pedagogy 2.0 approaches such as participation, collaborative learning, personalized learning, teaching for transfer, project-based learning and real-world contexts will be the key to stimulating such growth. The next step is to combine these educational innovations and supports for the betterment of every student. Twenty-first century learners can expect

to be part of a culture that values participation, with ample opportunities to initiate, produce and share one's creations. They will be expected to communicate and collaborate in a variety of contexts, engage in peer-to-peer learning and develop as global citizens. Through applying learner-centered pedagogy such as problem, inquiry and project-based learning, individuals will gain insights, understanding, increased capacity and confidence by grappling with real-world questions and problems. Approaches that lead learners to question their own beliefs and those of their peers will enhance reflection, metacognition and the construction of new knowledge. Networked education will enable students to participate in more personalized and equitable learning opportunities, through collaboration within their own communities and as part of teams of learners separated by time and distance. These pedagogies are further examined in the third report in this series.

Just as teachers cannot overhaul the education system alone, nations cannot counteract worldwide deficiencies in education systems in isolation. All countries will face consequences if today's learners are not adequately prepared to collaborate and resolve the world's economic, environmental, health, social and political challenges. Trilling and Fadel (2009) state that every nation can contribute to a global pool of expertise on how best to implement twenty-first century learning. Nations must form alliances in order to overcome obstacles to overhauling education. Each nation must examine new ideas put forward by its citizens and increase the collective impact of the resulting innovation by tackling these challenges through regional partnerships and coalitions that accommodate local needs and contexts. The elements and benefits of promising practices and innovations can be shared and those that work can be scaled. Ultimately, the difficult work of radically transforming learning can be leveraged through international networks, some of which are already emerging.

The roles of educational institutions in the future and their capacity to radically transform themselves remain uncertain. Nations must acknowledge the many reasons why twenty-first century learning must be different. They must critically evaluate traditional education to determine whether schools are living up to current expectations and ask how successful their schools actually are in equipping learners to compete in a global economy. Every nation has its own vision of what a twenty-first century education should look like. Innovations that produce successful learning in one nation can have a ripple effect as other nations adopt and adapt these methods for their own use. With increased international cooperation and collaboration, each nation can participate in building a global learning network as dominant and pervasive as existing international networks in business, finance and communications.

ANNEX

TABLE 1. ESSENTIAL COMPETENCIES AND SKILLS FOR TWENTY-FIRST CENTURY LEARNING

Competencies and skills	Source	Competencies and skills	Source	Competencies and skills	Source	Competencies and skills	Source
Learning to know, learning to do, learning to be and learning to live together	International Commission on Education for the Twenty-first Century (1996)	*The other 3 Rs*: *Reasoning* (analytical, critical thinking and problem-solving skills); *Resilience* (flexibility, adaptability and self-reliance); and *Responsibility* (application of intelligence, creativity and knowledge for a 'common good')	P21 (2007*a*, 2007*b*) Sternberg and Subotnik (2006)	*Entrepreneurial skills*: ability to 'think on your feet', observe and evaluate opportunities and ideas that may be new, autonomy, the ability to think unconventionally, imagine new scenarios and question conventional wisdom	P21 (2007*a*, 2008) Robinson (2006) Wagner (2010)	*Teamwork and interconnectedness*: capacity for collaborative teamwork, good written and oral presentation skills, professionalism, a good work ethic, ability to foster interdisciplinary cooperation and global exchange of ideas, ability to counter discrimination due to origin, gender or age	Conference Board et al. (2006) Leis (2010) Redecker et al. (2011)
The 4 Cs (communication, collaboration, critical thinking and creativity) taught within the context of core subject areas: social and cross-cultural skills; proficiency in languages other than English; understanding of economic and political forces that affect societies and twenty-first century interdisciplinary themes; global awareness; financial, economic, business and entrepreneurial literacy; civic literacy and health literacy, including health and wellness awareness	Conference Board et al. (2006) P21 (2007*a*, 2013)	Innovation skills, creativity, divergent thinking, courage to 'seize' problems, enthusiastic experimentation; the capacity to 'break new ground', invoke fresh ways of thinking, put forth new ideas and solutions, pose unfamiliar questions, and arrive at unexpected answers	Barry (2012) Center for Curriculum Redesign and OECD (2012) Gardner (2008) P21 (2007*a*, 2013) Robinson (2006) Sternberg (2007)	Capacity for collaboration and teamwork using authentic, project-based learning; ability to teach peers in groups; ability to engage in networked collaborations either locally or at a distance	Facer (2009) P21 (2007*a*)	*Communication and collaboration*: ability to express thoughts clearly and persuasively both orally and in writing, articulate opinions, communicate coherent instructions, and motivate others through speech	Barry (2012) Levy and Murnane (2004) P21 (2007*a*, 2013)
Rigour, relevance and respect: *Rigour* (what students are able to do as a result of their learning); *Relevance* (understanding of how learning connects to current real-world challenges and future work); *Respect* (promoting respectful relationships among teachers and students that foster academic and social competence)	Wagner et al. (2006) P21 (2007*a*, 2007b)	Critical thinking; capacity for active investigative thinking and inquiry; ability to access, analyse interpret, apply and synthesize information; ability to examine, interpret and evaluate evidence, and ask relevant questions; ability to integrate ideas from different disciplines or spheres into a coherent whole and communicate that integration to others	Ackerman and Perkins (1989) Barry (2012) Bransford (2007, cited in P21 2007*b*) Gardner (2008) P21 (2007*a*, 2007*b*) Redecker et al. (2011) Tucker and Codding (1998) US Dept. of Labor, SCANS (1991) Wagner (2010)	Collaborative, empathic and social skills; communication skills	P21 (2007*a*, 2013)	Academic and applied knowledge; ability to connect knowledge and skills, learning and competence, inert and active learning, codified and tacit knowledge and creative and adaptive learning	Carneiro (2007)

Competencies and skills	Source	Competencies and skills	Source	Competencies and skills	Source	Competencies and skills	Source
Core subjects include English, Reading or Language Arts; World Languages; Art; Mathematics; Economics; Science; Geography; History; Government and Civics with a balance between education in technical and natural science subjects, and culture and humanities; mastery of major schools of thought, including science, mathematics and history	Davies, Fidler and Gorbis (2011) Gardner (2008) P21 (2007*a*, 2007*b*) Salas-Pilco (2013)	Technical and complex problem solving skills; communication; collaboration; willingness to grapple with tough challenges and problems with elusive solutions; clear and effective oral and written communication	Conference Board et al. (2006) P21 (2007*a*) Tucker and Codding (1998) Wagner (2010)	*Civic citizenship*: civic literacy, capacity to understand the local and global implications of civic issues	P21 (2007*a*, 2013)	*Metacognition*: self-directed learning; planning; goal-setting; monitoring one's own progress; adaptability; ability to set learning goals, and plan and monitor your own learning; ability to assess progress and take action with results; self-efficacy	Bransford (2007, cited in P21 2007*b*) P21 (2007*b*)
Information, media and technology literacy: ability to access, evaluate and use information; capacity to understand and analyse the nature of media messages; ability to analyse, evaluate and create messages in a variety of forms; ability to create messages as self-expression and to influence and inform others; digital citizenship	Davies, Fidler and Gorbis (2011) ETS (2007) Leis (2010) P21 (2007*a*, 2007*b*, 2013) Prensky (2012) Trilling and Fadel (2009) Wan and Gut (2011)	*Social and cross-cultural skills*: ability to interact effectively with others (knowing when it is important to listen and when to speak, and how to conduct oneself in a respectable, professional manner); ability to work effectively in diverse teams (respecting cultural differences and collaborating with people from a wide range of social and cultural backgrounds); awareness of and appreciation for differences among individuals and communities; capacity for openness to different capacity for openness to different ideas and values; social skills; emotional resilience; empathy	Gardner (2008) Leadbeater (2008) National Research Council (2012) P21 (2007*a*, 2013) Pink (2005)	Skills related to thinking and reflection taught as a 'meta-curriculum' and interwoven with traditional core subjects; 'habits of mind' (analysis, interpretation, precision and accuracy, problem solving, reasoning); sense-making; and using expert thinking (detailed knowledge and metacognition) to support decision-making	Ackerman and Perkins (1989) Bolstad (2011) Conley (2007) Levy and Murnane (2004) Mansilla and Jackson (2011) P21 (2007*a*, 2007b)	*Intercultural competencies*: ability to understand and communicate with others; respect and tolerance; ability to listen attentively to others; capacity for flexibility and negotiation; global competence; ability to cooperate with contributors in interdisciplinary and intercultural teams	Barrett et al. (2014) Carneiro and Draxler (2008) Levy and Murnane (2004) Mansilla and Jackson (2011) P21 (2007*a*) UNESCO (2013*c*)
Curiosity, adaptability and commitment to continuous learning	Gijsbers and van Schoonhoven (2012) Herring (2012) P21 (2007*a*, 2011) Redecker et al. (2011)	Ways of thinking, ways of working, tools for working, and skills for living in the world	Griffin, McGaw and Care (2012)	*Seeking and valuing diversity*: ability to live and work together in culturally diverse societies and organizations; ability to welcome, seek out and engage the talents and ideas of diverse participants; ability to respect and value the concerns of different people and cultures; willingness to acquire the social and cross-cultural skills needed to seek out the views of others; capacity to value and practise living peacefully as part of a highly diverse, global population; ability to understand how to negotiate solutions to worldwide political conflicts and environmental challenges	Barrett et al. (2014) UN (2012)	*Personal responsibility, self-management and reflection*: capacity for leadership, resourcefulness, self-control, empathy, ethics, integrity, flexibility, adaptability, initiative, self-direction; inventive thinking, risk-taking, reflection, productivity, accountability, fulfillment of one's responsibilities as a worker and as a citizen; teamwork and time management	Gardner (2008) Metiri Group and NCREL (2003) National Research Council (2012) P21 (2007*a*, 2013) Prensky (2012) US Department of Labor, SCANS (1991)

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