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THE FUTURES OF LEARNING 1:

WHY MUST LEARNING CONTENT AND METHODS CHANGE IN THE 21st CENTURY?

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Redefining learning
content and
methods in the 21st
century

Drivers of change

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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 for learners to function effectively in the twenty-first century, and the pedagogy required to stimulate those capabilities. This is the first in a series of three papers based on a comprehensive review of the literature. The paper identifies multiple drivers working to transform what learners are taught and the methods used for teaching and learning. Experts offer diverse reasons for the need to transform learning content and pedagogy. Persistent disengagement among youth and high early dropout rates worldwide have increased calls for schools to become more relevant. Changing views on the merit of formal education and emerging student characteristics are also challenging the value of the curriculum. Shifts in labour market trends and skills shortages in the global workforce have highlighted widening inadequacies in students' preparedness to tackle twenty-first century challenges. Growing concern about potential economic and global crises ahead have also led many to question whether today's learners possess the combination of critical thinking, creativity, and collaborative and communication skills necessary to tackle future shifts in the marketplace. This paper explores these factors in depth and offering a sound rationale for redefining twenty-first century learning content and pedagogy.

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

REDEFINING LEARNING CONTENT AND METHODS IN THE 21st CENTURY

Preparing learners 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. Interest in these skills is not new; researchers at Harvard University have been studying student learning processes and approaches to teaching higher-order skills for over forty years (Saavedra and Opfer, 2012, p. 4).

Educators have repeatedly argued that present approaches to teaching and structuring learning environments are inadequate to addressing and supporting twenty-first century learning needs (Carneiro, 2007; Delors et al., 1996; P21, 2007; VISIR Consortium, 2012). As societies become more knowledge-based, schools must evolve to ensure the information and skills needs of students. The key focus of twenty-first century learning is adaptation to keep pace with demand and expectations (Punie, 2007). Current thinking about twenty-first century learning emphasizes the need to radically transform the purpose of schools and expectations of what students should learn in the classroom. Approaches to measuring school success must also therefore be re-evaluated (Bull and Gilbert, 2012; Facer, 2011; Leadbeater, 2008; Robinson, 2006). Overall, the focus has shifted away from access towards equitable quality education to lifelong learning, strengthened training and skills for work and life, and improved learning outcomes at all levels of education (Anderson, 2014; UNESCO and UNICEF, 2013).

The Delors Commission emphasized the need to pay attention to both the aims and means of education (Delors et al., 1996). Motivations for transforming twenty-first century learning range from emerging student characteristics, lack of motivation, disengagement and high dropout rates to different learning styles, lack of preparation for life and work, and the changing conditions and needs of the twenty-first century workplace (Cisco Systems, 2010). Additional reasons include potential global scenarios such as changes in global diversity, climate change, economic and social crises, and complex socio-political, demographic and environmental challenges (Leadbeater and Wong, 2010). However, experts agree that the integrated and humanistic vision of learning outlined in the Faure and Delors Reports remains relevant and that twenty-first century education must contribute to greater humanity in a rapidly changing world (UNESCO, 2015).

Regardless of the reasons, it is generally accepted that curricula and schools must be transformed to make new forms of learning possible. This paper analyses the current literature

on drivers calling for changes in the competencies learnt by students and explores why learning content and methods must be redefined for life and the workplace in the twenty-first century.

The future is commonly viewed as something to be managed and planned for rather than something to be actively shaped. The aim is not just to confront new challenges, but also to imagine and create a world for all. The future is a set of 'imaginative, material and political processes already in development in which it is both possible and ethical to seek to intervene' (Facer, 2011, p. 104). This same perspective applies to education. There are three fundamental questions: How much learning are students actually experiencing in school? What information and skills will they need to succeed in the future? How can those gains be expanded?

New challenges to learning are emerging and will affect societies and countries around the globe. Experts surveyed on the future of learning have confirmed the need to innovate and modernize school education to adequately prepare students for their future (Redecker et al., 2010). Projections indicate that in just fifteen years learning objectives will focus on competencies rather than knowledge. Learning will be more tailored to the needs of individuals and actively re-integrated into real life (Ala-Mutka et al., 2010; Learnovation, 2009). Research by Redecker et al. (2011) identified six key challenges:

- (i) multicultural integration to address immigration and demographic change;
- (ii) reducing early school leaving to combat unemployment and to promote a better educated workforce;
- (iii) fostering talent to develop a 'smart' economy based on knowledge and innovation;
- (iv) promoting a rapid and more fluent transition from school to work in order to reduce the barriers between the world of work and education;
- (v) facilitating re-entrance to the labour market especially to tackle long-term unemployment; and
- (vi) focusing on permanent re-skilling to enable all citizens to keep their competencies updated and to quickly respond to changing work environments (p. 12).

Considerable resources are earmarked worldwide to modernize educational systems and schools. However, as Prensky noted, 'what reformers have yet to understand is that it is not the "system" that we need to get right; it is the education that the system provides' (2012, p.15). Effecting this change means developing a future-oriented curriculum that engages young people and equips them with the knowledge and skills to overcome new challenges (Redecker et al., 2011). This will require effective pedagogies that meet their needs. Prensky stresses that 'unless we change how things are taught and what is taught, we will not be able to provide an education that has our kids fighting to be in school rather than one that effectively pushes one-third to one-half of them out' (2012, p. 15). Education must exploit the capacities of new technologies and

employ more effective pedagogies based on recent research about how people learn. Moreover, it must be fully cognizant of the characteristics of new learners, as today's students are no longer the individuals that educational systems were originally designed to teach.

DRIVERS OF CHANGE

The complexity of the present and future world means that learners must be equipped to navigate unexpected challenges ahead. Key drivers and challenges are redefining the competencies and skills that learners need to develop. These forces represent significant disruptive shifts that are likely to reshape the future landscape of education and work, and produce changes in the way people learn. These include drivers based on demographics, globalization trends, labour market fluctuations, environmental forecasts, and the pressures of immigration and their consequences for school curricula and pedagogy. The evolving sophistication of technology, global connectivity and new social media must also be taken into account when imagining the forms that twenty-first century learning may take (Davies, Fidler and Gorbis, 2011; Leadbeater and Wong, 2010; Redecker et al., 2011).

NEW COMPETENCIES FOR A COMPLEX WORLD

The twenty-first century promises uncertainty and complexity, and little respite is expected in the scale or pace of change (Carneiro, 2007). This complex environment rewards people with 'inclusive competencies, such as the ability to make local-to-global connections, recognize differing perspectives, think critically and creatively to solve global challenges, and collaborate respectfully in different types of social forums' (P21, 2007). Sawyer (2006) emphasizes the importance of preparing youth for these varying futures and collaborating across cultures to address likely environmental, sociological and political difficulties. Learning how to 'understand, adapt to and prosper in these turbulent times has become a critical competence' (Carneiro, 2007, p. 151). The world is becoming more interconnected and complex, and will require multifaceted responses. The response of education to these challenges will play a singular and active role in shaping the future.

The needs of twenty-first century citizenship must also be addressed and aligned with the development of twenty-first century skills. To make informed decisions and contribute responsibly at local, regional and national levels as informed voters and citizen advocates, youth must be prepared to tackle matters ranging from economics and geopolitics to cultural and social developments, and environmental and health concerns (P21, 2013).

CHANGING STUDENT CHARACTERISTICS

Another driver for change is learners themselves – their preferences, needs, social habits and technology choices.

University student profiles show that a large proportion of learners work and study online, expect continuous Internet connectivity and web-based services, and regard social networks as vital to their lives (Windham, cited in McLoughlin and Lee, 2010, p. 4). Conole and Creanor (cited in McLoughlin and Lee, 2010) report that today's students 'have high expectations of how they should learn, selecting the technologies and learning environments that best meet their needs with a sophisticated understanding of how to manipulate these to their advantage' (p. 3). Today's learners pursue learning by exploring, expressing and exchanging ideas using technological means (Ben-David Kolikant, 2010), often tinkering and using trial and error to try different strategies until they arrive at solutions (Papert, cited in Ben-David Kolikant, 2010; Facer, 2011).

YOUTH DISENGAGEMENT AND EARLY SCHOOL LEAVING

Youth born in or after 1985 have grown up in a world of computers, mobile phones and the internet, which have fundamentally shaped their behaviour and will continue to do so. By 2020, this demographic will number about 3.5 billion and comprise almost 50 per cent of the global population (Ericsson AB, 2012). Worldwide, youth face complex social, cultural and economic challenges that constitute obstacles to their continued education. The UNESCO Institute for Statistics' (UIS) *Global Education Digest* (2012) reveals that sub-Saharan Africa has the highest dropout rate of any region in the world with 42 per cent of schoolchildren leaving school early and about one in six leaving before Grade 2. In South and West Asia, the dropout rate was 33 per cent in 2009 (UIS, 2012, pp. 34-35), and in Latin America and the Caribbean the dropout rate was 17 per cent.

One in five high-school students in the United States of America drop out of school each year. A range of factors has been found to increase the risk of dropping out, including low levels of school engagement, apathy about attending school and high rates of absenteeism. Students who drop out are more likely to receive state assistance, be unemployed, homeless, arrested or incarcerated, and also experience higher numbers of early pregnancy and substance abuse problems. Overall, high-school dropout rates in the United States are declining but remain at an average rate of 7 per cent (2012). Dropout rates for learners with special needs are even higher. In 2011, 20 per cent of all special education students in the United States exited school by dropping out (NCES, 2013). In addition, 75 per cent of state prison inmates and 59 per cent of federal prison inmates in the United States are high-school dropouts. Furthermore, high-school dropouts are not eligible for 90 per cent of US jobs. It is unsurprising that efforts are underway in many US states to decrease the dropout rate by fundamentally rethinking the way school works (NDPC, 2005).

Early school leaving (ESL) among youth in Europe continues to present challenges. It creates countless hardships for individuals and vast costs for economies and welfare states. Studies on the long-term effects of youth unemployment report that exclusion from the labour market can have long-term negative effects on future employment prospects (TWG

on ESL, 2013). Young people who prematurely leave school and training are certain to lack skills and qualifications and face serious, persistent problems in the labour market. In the European Union, about 20 per cent of all EU citizens aged 18-24 years left school without completing secondary education (European Commission, 2013). This percentage translates into nearly 5.5 million early school leavers across Europe. On average, the unemployment rate of these early school leavers is over 40 per cent, compared to 23 per cent overall for youth unemployment across the European Union (TWG on ESL, 2013).

Early school leaving is a significant obstacle to economic growth. It reduces productivity and competitiveness and induces poverty, unemployment and social exclusion. Leaving school before completing upper secondary education is often the outcome of a progressive and cumulative process of disengagement. Experts believe that achieving a comprehensive reduction of ESL in Europe will mean rethinking the significance and applicability of skills and information taught in schools, and undertaking a critical revision of Europe's entire education and training system (TWG on ESL, 2013).

Early school leaving also has significant societal and individual consequences. Europe's average school leaving rate for migrant first-generation youth is double that of natives. In some European countries, more than 40 per cent of migrant youth are early school leavers and the risk of ESL is especially high for disadvantaged minorities, including Roma youth (Davidson et al., 2009; Redecker et al., 2011; TWG on ESL, 2013). Data show that some groups of young people are more at risk than others: disadvantaged students show consistently lower levels of engagement and boys are more likely to leave school prematurely than girls (Hampson, Patton and Shanks, 2011; NCES, 2013).

However, before discussing ways for schools to make learning more interesting, relevant and engaging, it is important to consider the fundamental and multiple reasons that contribute to disengagement. This requires a critical analysis of disengagement and reflection on alternative probable causes, such as the curriculum, learning activities, course requirements, staff-student-peer relationships and school culture. Once this research has been undertaken, efforts can turn to exploring the role of digital technologies and other innovations in addressing these issues (Selwyn and Facer, 2013).

CHANGING PERCEPTIONS ABOUT THE VALUE OF FORMAL EDUCATION

Today, a large proportion of young people drop out of school because they view formal education as irrelevant and become apathetic and disengaged with formal education. There is growing disillusionment with the value of education as a vehicle for social integration and greater well-being with many young people beginning to question the 'return on investment' of traditional 'high-status' educational routes (Facer, 2011, p. 25; UNESCO 2015). While many factors contribute to student disengagement, there is a general belief that secondary student dropout rates reflect an inability on the part of current education systems to link academic content to real-world

experience. In a recent poll, 80 per cent of US students failed to see how school contributes to their learning, and 60 per cent did not list learning as the reason they attend school (Price, 2013). About 98 per cent of US students admitted feeling bored at school at least some of the time, two-thirds feel bored every day and 17 per cent say they are bored every lesson (Yazzie-Mintz, 2010). Estimates of 14-16 year-olds in the United Kingdom who define themselves as 'disengaged' vary from 20 per cent to 33 per cent. These students are predominately white, male and from disadvantaged backgrounds, and are most likely to be truant (Price, 2013). In Canada, levels of participation and academic engagement fall steadily from Grade 6 to Grade 12, while intellectual engagement (personal, psychological and cognitive investment in learning) falls during the middle school years and remains at a low level (slightly above 30 per cent) throughout secondary school (Willems, Friesen and Milton, 2009).

SKILLS SHORTAGES

A significant and troubling skills gap among new workforce entrants already exists and skills shortages in the global workforce are expected in the very near future. A 2010 European Commission study reported that nearly one-third of Europe's population aged 25-64 have no or low formal qualifications. In addition, individuals who need the most training (i.e. those with low or irrelevant skills) tend to seek training the least (p. 10). Increasing the educational levels of low-skilled workers who face a substantially higher risk of being unemployed than medium and high-skilled workers represents a significant challenge (Redecker and Punie, 2013). Business and industry have complained that new employees lack crucial basic employment skills, such as problem-solving, working in teams and time management, and that school and college leavers require additional on-site training before they can perform their jobs (Hampson, Patton and Shanks, 2011).

In the coming decades, Europe and other regions of the world will face new demands arising from uncertain economies and shifts in the labour market. Redecker and Punie (2013) note that the share of jobs requiring high-level qualifications will likely rise from 29 per cent in 2010 to about 35 per cent in 2020, while the number of jobs filled by workers with low qualifications will fall from 20 per cent to 15 per cent. It is also expected that jobs will demand new and higher levels of skills. Filling these positions will require substantial investment to advance the competencies and skills of Europe's workforce (Gijssbers and van Schoonhoven, 2012). According to recent estimates, the cost of reforming the education system to provide adequate skills for all European citizens could also increase GDP by as much as 10 per cent in the long term (European Commission, 2010).

According to a 2011 Pew Research Center study, most US college graduates said that their college education was very useful in helping them to grow intellectually (74 per cent) and mature as a person (69 per cent), but only 55 per cent of graduates described their education as 'useful in helping to prepare them for a job or career' (p. 13). Herring noted that these findings are consistent with a 2009 study of American

corporations in which 51 per cent of those surveyed said that the skills of the current workforce had not kept pace with their company's strategy, goals, markets or business models (2012, p. 3). That same study maintained that 'the world now needs leaders and employees with foresight who can identify new opportunities, design creative solutions, and bring them to market. Workers who can adapt, understand context, judge situations, and deviate from established norms to create new, creative solutions to the challenges the world will face will be in high demand' (p. 3). This raises the question of how self-directed learners should be prepared, trained and inspired to meet today's challenges. Herring argues that the solution lies in technology-enabled informal learning outside the formal classroom environment. Such informal learning will enable collaborative learners to easily share and exchange knowledge, and self-directed learners to continue to teach themselves. Above all, he maintains that continual, self-directed, personalized learning will be the key to addressing existing skills gaps (2012, p. 1).

LABOUR MARKET TRENDS

A number of emerging market trends warrant consideration. These include global low-employment growth and weak links between education and employment. Qualified jobs for educated young people are becoming increasingly scarce (Li, 2013), while the ageing of the world's workforce will lead to the retirement of large numbers of employees and emerging labour shortages in many areas. Trends to be tackled include the increasing need for more knowledge workers and a corresponding decline in jobs requiring minimal education or training (Redecker et al., 2011). With almost 75 million young people under 25 out of work (out of a total of 200 million unemployed) global unemployment is clearly impacting the younger generation (ILO, 2012).

Motivation and the absence of it among workers are also critical issues affecting experimentation and innovation in world markets. Active disengagement among employees is already an immense drain on world economies. The estimated cost in lost productivity due to employee disengagement is staggering. Gallup Inc. (2013) estimates that active disengagement in the United States costs US\$450 billion to US\$550 billion per year. In Germany, the cost ranges from €112 billion to €138 billion (US\$151 billion to US\$186 billion). In the United Kingdom, actively disengaged employees cost between £52 billion and £70 billion (US\$83 billion and US\$112 billion) per year (Gallup Inc., 2013). Worldwide, actively disengaged employees outnumber engaged employees by nearly 2:1. East Asia has the lowest proportion of engaged employees in the world at 6 per cent, equivalent to less than half the global average of 13 per cent (Gallup Inc., 2013). This regional difference is driven predominantly by China, where only 6 per cent of employees report being engaged in their jobs – one of the lowest figures in the world. Among the 142 countries included in the Gallup 2013 study, the bulk of employees worldwide (63 per cent) are 'not engaged', indicating a lack of motivation and a lower likelihood of investing effort in organizational goals or innovation. Moreover, 24 per cent described themselves as 'actively disengaged' indicating that they are unhappy and

unproductive at work and liable to spread negativity to co-workers. This translates into approximately 900 million 'not engaged' and 340 million 'actively disengaged' workers around the globe (Gallup Inc., 2013). The highest levels of active worker disengagement in the world are located in the Middle East and North Africa region, especially in Tunisia (54 per cent), Algeria (53 per cent) and Syria (45 per cent). Regional high unemployment rates may be a factor in these results, causing many disengaged workers to remain in their jobs despite their unhappiness at work (Gallup Inc., 2013).

CHANGING MODELS OF LEARNING AND TEACHING

The current industrial model of schooling was designed to meet the production needs of a much earlier time and has outlived its usefulness (P21, 2007). Modes of learning have shifted dramatically over the past two decades with changes in the ways people access, exchange and interact with information. Schools have changed far more slowly with the fundamental aspects of learning institutions remaining essentially familiar for 200 years or more (Davidson et al., 2009).

Future educational systems are expected to transform from institutions with a strong emphasis on teaching to organizations with an increased emphasis on learning. Recognition of multiple pathways for acquiring skills will follow. Teachers will design challenging learning activities and students will learn anytime or anywhere at a pace comfortable for them, using whichever tools they choose. The roles of teachers will be transformed from experts on subjects to that of guides and coaches (Ericsson AB, 2012; Frey, 2007). Twenty-first century teachers will assess their students' skills and identify and design learning activities to help them achieve deeper understanding. Ongoing formative assessment is most effective for this approach as it allows teachers to adjust their strategies within lessons for maximum effectiveness.

AVAILABILITY OF NEW MEDIA AND OTHER TOOLS FOR LEARNING

Pedagogy 2.0 is a term for 'an emerging cluster of instructional practices that advocates learner choice and self-direction as well as engagement in flexible, relevant learning tasks and strategies' (McLoughlin and Lee, 2008a, p. 15). At the heart of Pedagogy 2.0 is freedom of choice that allows learners to select which media to access, which resources to exploit, which tools to use and how, when and where to use them. Learners now have many modalities available to them including text and web-based multimedia incorporating rich audio, photo and video capabilities. With so many choices available, it is important to raise awareness about which pedagogic approaches and tools best target the learning outcomes desired.

Students have always used tools to support their learning. Traditional examples include books, pencils, blackboards, paper, rulers, and calculators and slide rules. Digital technologies are also learning tools used to support student learning. Buckingham (2007) argues, however, that despite

'massive expenditures on the part of government and intensive promotion by industry, few teachers have made much use of technology in their teaching' (p. 177). In many cases, technology is viewed as an 'add-on'. He also notes that there has been 'little definitive evidence that the widespread use of technology has contributed to raising achievement – let alone to generating more creative or adventurous forms of learning for the majority of young people' (p. 133). Technologies in and of themselves do not drive learning. They are of very little use unless the learning task and framework are clearly defined. Instead, the benefits are derived from the collaboration, communication and creativity that these tools support. Ben-David Kolikant (2010) asserts that digital technologies alter the ways that people learn, as well as their values about learning. They also open up new tools and opportunities for creativity and collaboration. Eventually, these new tools and the teaching and learning practices that accompany them are projected to result in learning environments that are more personal, participatory, experiential and collaborative. Technologies in general, and information and communication technologies (ICT) in particular, 'constitute one of the main drivers for changing job structures and requirements, and for determining which skills people need to acquire' (Facer and Sandford, 2010; Redecker and Punie, 2013, p. 4). Digital technologies will not only alter what students need to learn in the future, but also how they learn (Redecker and Punie, 2013, p. 4).

Infrastructure for internet usage continues to improve. Latest figures show that almost 3 billion people (40 per cent of the world's population) have access to the internet, two-thirds of whom are in the global South. Close to one-third (31 per cent) of households in developing countries are connected to the internet, compared with 78 per cent in developed countries. The population on-line in Africa has doubled since 2010. In the Americas, some two out of every three people are online, the second highest penetration rate after Europe which reaches 75 per cent (ITU and United Nations, 2014). One-third of the population in the Asia-Pacific region is online by with around 45 per cent of the world's internet users expected to come from this region.

Some 45 per cent of the world's households have internet access at home. Growth rates for 2013-14 in the developing world were more than three times as high as those in the developed world (12.5 per cent growth compared with 4 per cent) with household internet access already approaching saturation levels in developed countries. The number of households with internet access in developing countries surpassed those in developed countries in 2013 and doubled between 2010 and 2014. By the end-2014, more than half of all households in the Commonwealth of Independent States (CIS) were connected to the internet. In Africa, only about one out of ten households is connected to the internet, yet household internet access continues to grow at double-digit rates (at 18 per cent in 2014, more than twice the world average). High-speed internet access continues to vary worldwide and disparities in broadband speed persist (ITU and United Nations, 2014).

Mobile technologies

As the organizers of UNESCO's Mobile Learning Week 2014 observed, 'mobile technologies hold the key to turning today's digital divide into digital dividends bringing equitable and quality education for all' (ITU and UNESCO, 2014, p. 1). Mobile learning involves the use of mobile technologies, either alone or in combination with other ICTs, to facilitate learning anytime and anywhere (UNESCO, 2013a). Different technologies have different capacities that make them particularly suited for specific learning tasks. For example, social media can extend classroom work providing opportunities for activities such as collaboration and co-authoring. Learning can unfold in different ways – people can use mobile devices to access educational resources, connect with others or create content, both inside and outside the classroom (Grimus and Ebner, 2013, p. 2029). In collaboration with effective learning methods, mobile technologies enable learners to gain insights, contend with contextually based problems, reflect and construct new knowledge, and develop new competencies and skills through simulations (Bates, 2011).

Mobile technologies are continually evolving. The variety of devices available in today's market is immense and includes mobile phones and smartphones, tablet computers, e-readers, portable audio players and handheld gaming consoles. The list will be different tomorrow (UNESCO, 2013a). An increasing number of projects show that mobile technologies provide an excellent medium for extending educational opportunities to learners who may not have access to high-quality schools (UNESCO, 2013a). In addition, because mobile devices are portable and owned by their users, they may be customized and personalized in a way that shared and tethered technologies cannot. Mobile devices are also used to create virtual communities of learners. Leaders of massive open online courses (MOOCs), for example, have experimented with a variety of approaches to encourage productive communication between learners taking the same class across different time zones (UNESCO, 2013a).

In general, mobile technologies have expanded the potential of personalized learning. As the amount and type of information they collect about their users increases, mobile devices will be better able to individualize learning. Intelligent mobile devices, many of which are already in the hands of millions of people, can offer students greater flexibility to learn at their own pace. The opportunity to follow their interests will increase student motivation to engage in lifelong learning opportunities (UNESCO, 2013a). A number of projects have already demonstrated that mobile technology can streamline formative assessments and provide learners and their teachers with immediate evidence of progress (Learnovation, 2009; UNESCO, 2013a).

The vast majority of mobile phone owners are not found in metropolises in the developed world, but instead in cities such as Cairo and Calcutta. Currently, the developing world accounts for over 70 per cent of mobile subscriptions worldwide; and thanks to rapidly declining prices, powerful mobile devices are increasingly within the reach of the poor. According to

estimates made by the International Telecommunication Union (ITU and United Nations, 2014), there are nearly 7 billion mobile phone subscriptions worldwide, equivalent to over 95 per cent of the world's population. Developing countries are home to more than three-quarters of these subscriptions. By 2016, Africa and the Middle East will overtake Europe as the second largest region for mobile subscribers. The ICT landscape is also changing as a result of newer technologies such as touchscreen tablet computers. Industry experts predict that sales of touchscreen tablets are likely to equal or exceed purchases of PCs as early as 2016. Already several countries, including Thailand and Turkey, have announced plans to distribute tablet computers in schools (NPD, cited in UNESCO, 2013a).

Access to robust mobile networks is nearly universal. Mobile networks supply coverage to 90 per cent of the world's population and 80 per cent of the population living in rural areas. Learners, who might not otherwise have access to high-quality education, schools or even books, generally have access to working mobile phones. According to a 2014 UNESCO report, 'United Nations data indicate that of the estimated 7 billion people on Earth, over 6 billion now have access to a working mobile phone. To put this number in perspective, worldwide, only 4.5 billion people have access to a toilet [...] collectively, mobile devices are the most ubiquitous information and communication technology in history' (UNESCO, 2014, p. 16).

Several countries and companies have recently advanced the development of high-quality digital resources and educational materials optimized for mobile devices. Ambitious projects in Asia, particularly in the Republic of Korea and Singapore, use mobile technology to make education more personalized and collaborative. The Government of the Republic of Korea has launched a nationwide initiative to move from paper to digital textbooks by 2015 with textbook content displayed on a variety of mobile devices including tablet computers (UNESCO, 2012b). Although critics of mobile learning claim that digital devices can be socially isolating and are a poor substitute for face-to-face interaction with teachers and peers, mobile phones can increase collaboration and teamwork among students. Learning projects in Latin America employ mobile phones to help students work together to solve authentic problems. Similar projects in Africa have moved away from 1:1 (one device per student) models of education to arrangements where multiple students cooperate while sharing a single device. These projects have proven effective in enhancing collaborative learning and are also less expensive than 1:1 model-based programmes (UNESCO, 2012a).

Finally, student safety is a key component of any discussion about mobile learning. Many school districts and governments have banned or seriously restricted the use of mobile phones in educational settings. This approach, however, is counter-intuitive. Students worldwide currently use mobile phones and will continue to do so regardless of whether or not schools prohibit them. If schools ban mobile technologies, these devices will not vanish, nor will the potential risks associated with their use. Instead sweeping prohibitions have driven a wedge between formal education and the realities of life outside of school (UNESCO, 2012a). A more appropriate

stance is to position schools as the place where students learn to use mobile technologies responsibly. When students are given appropriate instruction on good digital citizenship and allowed to use such devices in school, these devices become learning tools ideal for sharing, communication and information discovery (McLoughlin and Lee, 2007). Selwyn (2010) further maintains that schools ought to permit the use of digital technologies and introduce a form of 'Web 2.0-led informality to digital practices [...] without undermining the school's social order'.

Rich media

Today's students want an active learning experience that is social, participatory, supported by rich media and within learner control. The continual growth of web-based multimedia and social media incorporating text, audio, photo and video capabilities provide increasing opportunities for educational institutions to integrate these technologies into teaching, learning and assessment (McLoughlin and Lee, 2010). Such technologies and platforms must be integrated with sound pedagogical strategies and tied to learning goals, in order to facilitate genuine communication and interaction among students and to support their creation of user-generated content.

MANDATES FOR ASSESSMENT AND ACCOUNTABILITY

Another driver shaping formal education is the global push to assess learning performance and outcomes. The Programme for International Student Assessment (PISA) is just one example of worldwide efforts to document and track scholastic performance over time. Other national and international assessment frameworks have increased pressure to quantify the skills possessed by students and adults. In the United States such assessments include standardized tests associated with the 'No Child Left Behind' mandate and the National Assessment of Educational Progress (NEAP); international examples include the European Training Foundation (ETF) Competence Inventory, the Programme for the International Assessment of Adult Competencies (PIACC), and frameworks developed by the European Centre for the Development of Vocational Training (CEDEFOP) and the International Labour Organization (ILO). In a 2012 report, UNESCO noted that 'there is [also] evidence of increasing attention paid to the measurement of skills levels and the efficient matching of these skills with those required by the world of work. This is being done either through the development of outcome-based national and vocational qualifications frameworks or through large-scale assessments of skills levels among adults' (UNESCO, 2012b, p. 12). This drive to track and assess student performance is expected to increase throughout the twenty-first century.

AVAILABILITY OF ANYTIME/ANYWHERE LEARNING

Carneiro (2007, p. 11) emphasizes that 'school has lost its monopoly over the learning *locus*. The workplace, the home, the community and sheer mobility ("on-the-move") offer powerful sites for flexible learning'. Classrooms are no longer the only places in which learning can occur. Demand for and delivery of educational services are increasingly independent of location. As broadband networks become available across the globe, many new providers of educational content are expected to emerge. Open educational resources and open-source and user-produced content will also become widely available for use in formal, informal and specialized learning (Tuomi, 2007). The availability of smartphones and network coverage increasingly allows people to access learning regardless of time or place. This change forms part of a larger shift from traditional educational institutions toward mixed, diverse and complex learning landscapes in which both formal and informal learning are available through a wide variety of educational institutions and third-party providers. Institutional boundaries will weaken and enhanced capacity to collaborate at a distance will likely transform institutions and working practices. New public, private and third party providers will offer widely accessible face-to-face, remote, work-based and informal education. This shift will call for schools and universities to 'reposition themselves in the emerging learning landscape' (Gijssbers and van Schoonhoven, 2012, p. 3; Redecker et al., 2011, p. 12).

As learning moves out of the classroom and into homes and physical or virtual communities, 'teaching for transfer' (instruction that helps students link their learning to the real world) can encourage learners to become more self-directed. Leadbeater and Wong (2010) argue that 'schools are not the only, nor necessarily the most important, place where children learn. Children learn first in their homes, families, and communities' (p. 15). The places where people connect with the rest of the world and interface with society are changing. New touch points include personal computers, mobile phones, electronic newspapers, video magazines, MP3 players, handheld televisions and multi-player video games. Learning impediments will decrease as more touch points emerge (Frey, 2007). Learning will also need to take place in diverse settings to enable learners to transfer their knowledge and apply it in new contexts (Bolstad, 2011).

EXPONENTIAL GROWTH OF INFORMATION

There has been an explosive growth in the information available to learners. The total volume of information has increased and the variety of information produced has widened. Information now takes multiple forms encompassing text, graphics, audio and video (Frey, 2007). The challenge is to teach learners how to make sense of the vast amount of information they encounter, and in particular how to identify credible sources, and assess the reliability and validity of what they read; how to question the information's authenticity and accuracy; and how to connect this new knowledge with prior learning and discern

its significance relative to information they already understand (Facer, 2011; NZME, 2007).

TRANSITION OF LEARNERS FROM CONSUMERS TO PRODUCERS

The new generation of digital tools is allowing learners to become generators of content (Frey, 2007), instead of passive consumers of knowledge, indicating a preference for active approaches to learning (Klamma, Cao and Spaniol, 2007; McLoughlin and Lee, 2010). This change is a consequence of Web 2.0, the name given to the second stage of development of the World Wide Web, which is characterized by the move from static web pages to dynamic or user-generated content and the growth of social media (Wikipedia, 2014). Web 2.0 sites allow users to interact and collaborate as creators of user-generated content in a virtual community. This participatory culture provides greater opportunities to initiate, produce and share creations, and to engage in peer-to-peer learning. It encourages users to become global citizens, capable of communicating and working in diverse contexts.

Examples of user-generated online content include social networking sites, blogs, wikis, video-sharing sites, internet forums or communities, audio and video podcasts, peer-to-peer media-sharing applications, and the use of social and collaborative tagging (Wikipedia, 2014). Video-sharing sites such as *YouTube* have seen massive growth in users consuming and generating video content, while popular sites such as *SlideShare* allow users to post and access presentations. Users also create, post and view artwork on sites such as *deviantArt* and *Newgrounds* and share mobile photos and videos via pages on *Picasa* and *Flickr* (Crompton, 2012; McLoughlin and Lee, 2008b; Wikipedia, 2014). In addition, peer-to-peer media-sharing applications and user-created audio-sharing networks such as *SoundCloud*, an online audio distribution platform boasting 40 million registered users and 200 million listeners, showcase user-created audio productions. Table 1 in the annex provides specific examples of digital media used by people on a daily basis (Frey, 2012).

Web 2.0 has also made possible the building of communities of learners and scholars. Social learning tools such as *Second Life* facilitate the creation of online study groups in which learners work together. The *e-Science* movement is offering access to expensive and scarce high-level tools, presenting learners with unique opportunities to engage in the kinds of research conducted by professional scientists. Another example is the *Global Hands-On Universe (HOU)* programme, which is designed to promote collaborative learning in astronomy; while the Digital Humanities movement offers innovations such as the *Decameron Web*, which constitutes an excellent example of the Web providing access to scholarly materials and offering students opportunities to observe and emulate scholars at work (Brown and Adler, 2008; Facer and Selwyn, cited in Sharpe, Beetham and de Freitas, 2010; Punie, 2007).

Learners are also capable of creating and generating ideas, concepts and knowledge and are frequently inspired to do so. Blending, remixing and recombining ideas help students to formulate creative solutions. The ultimate goal of learning is to

encourage this form of creativity (McLoughlin and Lee, 2008a, p. 8). The move from Web content produced by traditional 'authoritative' sources towards user-generated content is also driving the move from instructor-dominated classrooms and curricula towards more flexible and interactive forms of learning. Students are taking control of their own learning process, making connections with peers, and producing new insights and ideas motivated by a spirit of inquiry (Lee and McLoughlin, 2007).

CONCLUDING REMARKS

This paper addresses the multitude of factors related to the future of learning in the digital age and examines why twenty-first century learning must change. Multiple factors are driving change in the way students are educated. Pressures vary from context to context but the message is the same: schools are failing to prepare children for the challenges ahead. Students are not learning adequately under the present education system and are not being equipped with the skills and knowledge to lead satisfying and productive working lives. In addition, nations are losing opportunities to prepare youth for citizenship and the economy is suffering from a lack of innovation. What can be done about this continuing loss of capacity?

The twenty-first century has immense potential to reaffirm the role of education with a view to equipping younger and older learners to address complex societal, economic and environmental issues. The transformation from teacher-led learning to self-directed learning to self-determined learning will provide learners with a range of competencies and skills needed to succeed in the modern global economy. Personalized and tailor-made instruction will help learners to reach their full potential. Learners will be better prepared to interact with their own communities, virtually and in person, and to deal confidently with people from different cultures, while continuing to learn throughout their lives.

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.

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. 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 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 replicated. Ultimately, the difficult work of radically transforming learning can be leveraged through international networks.

The roles of schools in the future and their capacity to radically transform themselves remains uncertain. Is it better to proclaim their impending obsolescence or to rethink the role of schools as a public resource and radically re-imagine how they might evolve? 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 students to compete in a global economy.

Every nation has its own vision of what a twenty-first century education should look like. Most are aware of new methods that have enjoyed at least some success in their region, both in terms of pedagogy and teacher development. Trilling and Fadel (2009) assert that every nation can contribute to a global pool of expertise on how best to implement twenty-first century learning. Investment that produces successful learning innovations 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.

There is broad agreement that in addition to literacy and numeracy, twenty-first century learning must include transferable skills such as critical thinking, problem-solving and civic values that prepare young people for the workforce and active participation as informed citizens (Anderson, 2014; Leadbeater and Wong, 2010). This concern is now clearly reflected among the education targets being proposed as part of the global Sustainable Development Goals being proposed for 2030.

ANNEX

TABLE 1. DIGITAL MEDIA AND WORLDWIDE USE (2014)

Type of media	Examples	Use statistics
Personal networks and social media	People are becoming increasingly reliant on personal networks such as <i>LinkedIn</i> , <i>Facebook</i> , <i>Twitter</i> and <i>Google+</i> for information. Social networking is one of the most popular online activities. As of 2014, there were 1.82 billion social network users worldwide.	
	Facebook	<i>Facebook</i> is the most popular online personal network based on active usage. As of the first quarter of 2014, <i>Facebook</i> had 1.28 billion monthly active users. <i>Facebook</i> accounts for 20 per cent of all page views on the Internet.
Personal networks and social media	Google+	<i>Google+</i> has over 540 million monthly active users and 1.6 billion total users.
	LinkedIn	<i>LinkedIn</i> has 187 million monthly active users.
	Pinterest	<i>Pinterest</i> has 40 million monthly active users and 70 million total users.
	Twitter	<i>Twitter</i> has 271 million monthly active users with 500 million Tweets sent each day. 78 per cent of active users access <i>Twitter</i> via mobile devices. <i>Twitter</i> supports 35+ languages, and 77 per cent of <i>Twitter</i> accounts are based outside the US.
Wikis	Wikipedia	There are currently 4,531,910 articles available in English on <i>Wikipedia</i> .
Open courseware and massive open online courses (MOOCs)	iTunesU	<i>iTunesU</i> provides free download of educational content from top schools, as well as prominent libraries, museums and organizations. It offers courses covering topics such as the arts, sciences, health and medicine, education and business. More than 500,000 courses are hosted. <i>iTunesU</i> features more than 1,200 participating universities and colleges from 26 countries, as well as 1,200 kindergartens through to grade 12 schools. There have been more than 1 billion downloads from <i>iTunesU</i> with more than 60 per cent originating from outside the US.
Open courseware and massive open online courses (MOOCs)	Open courseware projects	Open-education projects continue to attract large numbers of users each month. Examples include the <i>MIT Open Courseware</i> project, <i>MIT's Open Courseware (OCW) Scholar</i> , the <i>Open Courseware Consortium</i> , <i>Rice University's Connexions (OpenStax)</i> , <i>edX</i> , <i>Semester Online</i> , <i>Wikiversity</i> , <i>Curriki</i> , <i>FutureLearn</i> and <i>Khan Academy</i> .
	For-profit courseware	<i>Udacity</i> is a for-profit educational organization offering online courses developed and taught by experts at leading technology companies. As of April 2014, 1.6 million users were participating in 12 full courses and 26 free courses. <i>Coursera</i> is a for-profit educational technology company that offers massive open online courses (MOOCs). <i>Coursera</i> works with universities to make some of their courses available online, and offers courses in physics, engineering, humanities, medicine, biology, social sciences, mathematics, business, computer science and other subjects.
		<i>OpenLearning</i> was founded in Australia and has worked with the University of New South Wales and Taylor's University to deliver the first MOOCs in Australia and Malaysia respectively. In December 2013, <i>OpenLearning</i> launched a cloud-based software product for companies to create private educational portals on its platform.

Type of media	Examples	Use statistics
Open courseware and massive open online courses (MOOCs)	For-profit courseware	<p><i>ALISON (Advance Learning Interactive Systems Online)</i> is an e-learning provider and academy founded in Galway, Ireland, in 2007. It offers free courses to users with revenue gleaned mostly from advertising and sales of certificates. <i>ALISON</i> currently offers over 600 courses at certificate and diploma level in ten languages.</p> <p><i>ALISON's</i> stated objective is to enable people to gain basic education and workplace skills.</p> <p>Contrary to other MOOC providers with close links to American third-level institutions, such as MIT and Stanford University, the majority of <i>ALISON's</i> learners are located in the developing world with the fastest growing number of users in India.</p> <p><i>ALISON</i> reached 3 million registered learners in February 2014, making it one of the biggest MOOCs outside of the US.</p>
Presentations	Slideshare	<i>Slideshare</i> is the world's largest community for sharing presentations. With 60 million monthly visitors and 130 million page views, it is among the most visited 200 websites in the world.
Apps	Mobile apps are small programs designed to run on mobile devices such as smartphones or tablets. Apps can be downloaded through operating system-native distribution platforms, such as the play store for android devices, iTunes or the Apple app store for IOS devices.	<p>As of June 2014, there were over 1.2 million smartphone apps accounting for 35 billion downloads. The number of apps available will shortly exceed the number of books in print (3.2 million).</p> <p>In 2012, 57.33 billion apps were downloaded for free. In 2016, paid app downloads are projected to amount to 6.65 billion items, and free app download volume is projected to amount to 211.31 billion downloads.</p> <p>As of June 2014, the number of available apps in the <i>Apple</i> App Store is 1.2 million for iPhone, iPad and iPod Touch users in 155 countries around the world.</p>
Weblogs/blogs	Tumblr	There are 39 million <i>Tumblr</i> blogs worldwide.
	WordPress	There are 70 million <i>WordPress</i> blogs worldwide.
Podcasts		In 2014, 30 per cent of US adults listened to audio podcasts. While early adopters initially made up most of the podcast audience, listeners now more closely resemble mainstream media consumers.
Radio	Satellite radio	Satellite radio subscribers currently number 20 million. This number is projected to reach 35 million by 2020.
	Internet radio	Internet radio is projected to reach 196 million listeners by 2020. Listeners for satellite and internet radio combined equal the same number as terrestrial radio listeners.
Photos	Flickr	As of March 2013, <i>Flickr</i> had a total of 87 million registered members. More than 3.5 million new images are uploaded each day.
	Instagram	<p>Over 250 million photos are uploaded to <i>Instagram</i> every day. There are 200 million monthly active users, of which 65 per cent originate from outside the US.</p> <p>20 billion photos have been shared on Instagram since its launch in October 2010. On average, 60 million photos are shared each day.</p>

Type of media	Examples	Use statistics
Video	YouTube	<p>Video will comprise over 90 per cent of all internet content by 2015.</p> <p>More than 100 hours of video are uploaded to <i>YouTube</i> every minute, up from 72 hours per minute in May 2012.</p> <p>Over 350 million <i>YouTube</i> videos are shared on <i>Twitter</i> every year.</p> <p><i>Netflix</i> streams 2 billion videos per quarter. More than 1 billion unique users visit <i>YouTube</i> each month.</p> <p>Over 6 billion hours of video are watched each month on <i>YouTube</i> – almost one hour for every person on Earth.</p> <p>80 per cent of <i>YouTube</i> traffic comes from outside the US. <i>YouTube</i> is localized in 61 countries and across 61 languages.</p>
Digital books		<p>In January 2014, <i>USA Today</i> reported a post-holiday eBook 'surge' with 32 of the top 50 titles on its most recent list selling more copies in digital format than in print.</p> <p>Self-published e-books now account for 20 per cent to 27 per cent of digital book sales.</p>
Audiobooks		<p>Audiobooks are the fastest growing sector of the publishing industry. There is currently a shortage of audiobooks worldwide as publishers race to meet demand.</p> <p>In 2013, more than US\$1 billion worth of audiobooks were sold in the US alone.</p> <p>Less than 1 per cent of Amazon's book catalogue has so far been converted to audio.</p> <p>Over 5,000 public libraries now offer free downloadable audiobooks.</p>
Multimedia		<p>The internet encompasses a multitude of multimedia resources including online broadcasts and news, images, audio files and interactive websites.</p>
Online newspapers and magazines		<p>Online readership of newspapers continues to grow, attracting more than 113 million readers in January 2012.</p> <p>The print magazine industry declined 3.5 per cent last year. Industry print advertising revenues continue to drop and are presently at the same level as they were in 1950, when adjusted for inflation.</p>
Music		<p>The <i>iTunes</i> Store is the world's most popular music store with a catalogue of over 26 million songs.</p> <p>Over 25 billion songs have been downloaded, and the <i>iTunes</i> Store is now available in 119 countries.</p>
Television		<p>In 2012, there were 1.4 billion households with televisions worldwide. Of these, 801 million were in the Asia Pacific region, 282 million were in Europe, 129 million were in Latin America, 127 million were in North America, and 65 million were in the Middle East and Africa.</p> <p>Consumers currently receive an estimated 41 per cent of their information from television.</p>

Note: Adapted from Frey (2012). Additional data sources: Apple Inc, Statista Inc., YouTube, Facebook, Instagram, Wikipedia and Google Inc.

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