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THE FUTURES OF LEARNING 3:

WHAT KIND OF PEDAGOGIES FOR THE 21st CENTURY?

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PREPARING LEARNERS
FOR 21st CENTURY
COMPETENCIES
AND SKILLS

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OVERALL VISION
OF TWENTY-FIRST
CENTURY PEDAGOGY

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CONCLUSIONS,
NEXT STEPS AND
FUTURE ISSUES

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ABSTRACT

Since the emergence of a global movement that calls for a new model of learning for the twenty-first century, it has been argued that formal education must be transformed to enable new forms of learning that are needed to tackle complex global challenges. Literature on this topic offers compelling arguments for transforming pedagogy to better support acquisition of twenty-first century skills. However, the question of how best to teach these skills is largely overlooked. Experts recognize that the 'transmission' or lecture model is highly ineffective for teaching twenty-first century competencies and skills, yet widespread use of this model continues. In spite of worldwide agreement that learners need skills such as critical thinking and the ability to communicate effectively, innovate, and solve problems through negotiation and collaboration, pedagogy has seldom adapted to address these challenges. Rethinking pedagogy for the twenty-first century is as crucial as identifying the new competencies that today's learners need to develop. This paper, the third and last in a series on the *Futures of Learning*, explores pedagogies and learning environments that may contribute to the development and mastery of twenty-first century competencies and skills, and advance the quality of learning.

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PREPARING LEARNERS FOR TWENTY-FIRST CENTURY COMPETENCIES AND SKILLS

Rethinking pedagogy for the twenty-first century is as crucial as identifying the new competencies that today's learners need to develop. Traditional approaches emphasizing memorization or the application of simple procedures will not advance learners' critical thinking skills or autonomy. To develop the higher-order skills they now need, individuals must engage in meaningful enquiry-based learning that has genuine value and relevance for them personally and their communities. Real-world experiences merged with sustained engagement and collaboration offer opportunities for learners to construct and organize knowledge; engage in detailed research, enquiry, writing and analysis; and communicate effectively to audiences (Barron and Darling-Hammond, 2008).

How can teachers and educators best support learners develop essential skills for the twenty first century? People learn in a variety of ways, so the challenge for teachers is to discover which approaches help them learn *most effectively*. Until a teacher becomes familiar with a learner's individual strengths and needs, it is difficult to know which learning methods and pedagogy will have a positive impact on that person. Nevertheless, research suggests that some forms of pedagogy are consistently more successful than others in helping students acquire a deeper understanding of twenty-first century skills. Pedagogies that support deeper learning include personalized learning strategies, collaborative learning and informal learning (Gijsbers and van Schoonhoven, 2012; Leadbeater, 2008; Learnovation, 2009; Redecker and Punie, 2013).

Saavedra and Opfer (2012) argue that learners must hone their skills and enhance their learning as a matter of urgency to be able to address persistent global challenges. However, in spite of worldwide agreement that learners need skills such as critical thinking and the ability to communicate effectively, innovate and solve problems through negotiation and collaboration, pedagogy has not adapted to address these new challenges. The 'transmission' or lecture model still prevails as the dominant instructional approach in education throughout much of the world (Saavedra and Opfer, 2012). This approach typically leads to indifference, apathy and for most learners, boredom. Instead, learners need to dedicate time to interacting with mentors and peers and practising and applying newly acquired skills and knowledge. New learning must be assessed and shared with peers through well-designed collaborative encounters that support individuals in adapting their learning to new problems and contexts. Without opportunities to practise and apply new knowledge in a variety of contexts, adaptation and integration of new knowledge will not be achieved. In other words, unless learning environments offer opportunities to communicate new knowledge and solve complex problems through collaboration, it will stifle creativity (p. 8). All things considered, the 'transmission' model is highly ineffective for teaching twenty-first century skills.

Although it is generally recognized that twenty-first century competencies and skills are complex and often challenging to teach, Saavedra and Opfer (2012) argue that learners do not develop these competencies and skills unless they are *explicitly* taught. There is widespread agreement that learners should develop these skills through disciplinary study rather than standalone courses. According to the OECD's 2008 Teaching and Learning International Survey (TALIS), teachers in twenty-two out of twenty-three participating countries – most of which are Northern or Eastern European – favoured constructivist pedagogy. However, this survey also demonstrates that in participating countries, twenty-first century skills are not clearly emphasized 'even when teachers use active learning strategies, such as debate and structured classroom conversations' (OECD, cited in Saavedra and Opfer 2012, p. 7).

Leadbeater (2008) argues that the successful reinvention of educational systems worldwide depends on transforming pedagogy and redesigning learning tasks. Promoting learner autonomy and creativity is part of the solution. Technologies can be used to support efforts to transform pedagogy, but it is essential to recognize that twenty-first century learning experiences must incorporate more than just technology. Leadbeater also emphasizes that learning strategies for this century will not be limited to school, but will also encompass learning through peers, inter-generational partnerships and community relationships. Learning may take place outside of school in libraries, museums, community centres, local businesses or nearby farms, among others. Both Robinson (2006) and Leadbeater (2008) maintain that, ultimately, the idea of school as the sole provider of learning needs to be radically transformed.

Broad thinking around twenty-first century education acknowledges the need for new 'forms and functions' of learning to be added to worldwide education goals to boost the quality of learning. However, despite the prevalence of arguments for transforming pedagogy to better support the acquisition of twenty-first century skills, the question of how best to purposefully and explicitly teach these skills is largely overlooked (UNESCO-IBE, 2013).

OVERALL VISION OF TWENTY-FIRST CENTURY PEDAGOGY

Today's students are active learners rather than spectators. They view themselves as participants in creating information and new ideas (Leadbeater, 2008). Accordingly, twenty-first century instruction is based on three pedagogical principles – personalization, participation and productivity (McLoughlin and Lee, 2008a). This framework allows learning through authentic real-world contexts, carrying out projects from beginning to end, and solving problems as they arise, all of which constitute powerful learning strategies. Forming working relationships with teachers and partners in the community, and working

collaboratively with peers will also contribute to productive learning experiences for learners worldwide (Bolstad, 2011).

Above all, studies have found that learners are more successful at acquiring new competencies when they build strong metacognitive abilities, reflect objectively on new concepts learned, and integrate that information with their existing knowledge and skills. The process of adapting new knowledge for their own use and incorporating it into their existing conceptual frameworks will support further learning. Once new learning is integrated into existing 'ways of knowing', this in turn nurtures creativity and originality and establishes new cognitive habits. Critical thinking skills are also enhanced (Lai, 2011).

Metacognitive development is also encouraged by problem-based learning activities that require peer collaboration. The process of collaboration provokes learners to consider new uses for knowledge with their peers and develop new insights for future application (NZME, 2007). Teaching practices that create a positive learning community effectively support deeper learning through the acquisition of content knowledge and the development of intrapersonal and interpersonal competencies (National Research Council, 2012). By challenging their thinking, teachers can use learner responses as an opportunity to evaluate learner readiness for deeper understanding, and introduce new concepts accordingly (Bolstad, 2011; Leadbeater, 2008; NZME, 2007). Deeper learning results when individuals bypass expectations to memorize and repeat disconnected facts and knowledge (with limited application), and instead seize opportunities to grasp difficult concepts and complex ideas, evaluate newly presented ideas, and summarize their own reactions and insights (Sawyer, 2008).

For transfer to occur, individuals need to apply new learning and practise new skills in different situations and contexts. This also means that teachers must ascertain what knowledge individual learners have acquired, so as to decide whether to move forward with covering the curriculum, applying the new learning or reviewing existing material in greater depth. Curriculum coverage and learner understanding are in direct competition. Formative assessment thus helps teachers to establish whether individual learners have had sufficient experience to integrate and transfer new knowledge. If additional experience is required formative assessment can also help to identify appropriate practices and applications to support learners (NZME, 2007).

This process represents a significant transformation and one for which today's schools must be prepared. Twenty-first century pedagogy must employ innovative and research-supported teaching strategies, learning technologies and real-world applications (Saavedra and Opfer, 2012). Opportunities for learners to apply twenty-first century skills across content areas are also essential for deeper understanding. In particular, competency-based learning combined with innovative learning methods that make use of technologies, and enquiry and problem-based approaches, will help learners to develop 'higher-order thinking skills' (P21, 2007a).

Research about how individuals learn provides valuable insights into the ways different pedagogies support learners in mastering twenty-first century skills and competencies, and how best to engage and prepare them for a complex and ever-changing future. Saavedra and Opfer (2012, p. 1) suggest nine principles for teaching these skills:

> (1) make learning relevant to the 'big picture'; (2) teach through the disciplines; (3) develop lower and higher order thinking skills to encourage understanding in different contexts; (4) encourage transfer of learning; (5) teach how to 'learn to learn' or metacognition; (6) address misunderstandings directly; (7) promote teamwork; (8) exploit technology to support learning; and (9) foster students' creativity.

Which pedagogies offer learners the best opportunities to acquire competencies and skills needed to successfully navigate a complex and uncertain future? The following sections describe the specific pedagogies and perspectives that will promote such learning.

RENEW THE FOCUS ON QUALITY

The issue of quality and learning outcomes is back on the world's education agenda. Despite the numerous opportunities offered by the global, internet-based economy, there is still a critical need for universal access to quality education and visionary leadership (Cisco Systems, 2009, p. 3). The Sustainable Development Goal on education for 2030 aims to 'Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all' based on four priority areas: (i) expanded access to quality learning for all, at all levels of education; (ii) attention to the quality of education, including content and relevance, as well as learning outcomes; (iii) a greater focus on equity; and (iv) gender equality with a renewed focus on enhanced access for girls and women to post-basic and post-secondary education in safe and supportive learning environments. Fundamentally, quality learning requires highly competent and committed teachers employing active pedagogies (UNESCO-IBE, 2013). To achieve these goals, nations must 'ensure that there is an adequate supply of well-trained and motivated teachers and school leadership; improve teachers' training, conditions of service and deployment; and offer ample professional development opportunities' (UNESCO and UNICEF 2013a, p. 5). It comes as no surprise that the Education 2030 Sustainable Development Goal includes a target on teachers as a key means of implementation.

FOSTER PARTICIPATION

Participatory learning is neither unusual nor new to today's learners, but instead a familiar way for them to socialize and learn. Youth and adults entering educational systems already participate with peers in identifying new developments

occurring in and impacting their social networks and personal lives. Gone are the days when people learned and worked in isolation. Today, people regularly take part in online communities where they share opinions, critique ideas, swap insights and comment on each other's plans and aspirations (Davidson and Goldberg et al., 2009). Social media have transformed teaching and learning environments. Camera phones make sharing experiences with others in virtual space almost instantaneous. With the advent of *Instagram*, *Flickr* and *Twitter*, reports on learners' latest experiences are uploaded and remain open for public comment. As such, learners are accustomed to having a voice. McLoughlin and Lee (2007) emphasize the contributions that social media can make to learners' desires to participate and connect with others. They also recognize that social media can support personally meaningful learning through connection, collaboration and shared knowledge building (p. 669). With the advent of new pedagogies, now known as 'Pedagogy 2.0', the education system is witnessing a re-definition of the roles of both teachers and learners, with the latter assuming more active roles as contributors of course content, while demonstrating learning outcomes through performance and the production of ideas (McLoughlin and Lee 2008*a*, p. 18).

Teachers are also experimenting with social media to engage learners and open up new possibilities for collaboration, co-creation of new concepts, and application of twenty-first century pedagogies. Lee and McLoughlin (2007) offer examples of different pedagogies that illustrate 'new forms of participation' enabled by social media (p. 27). In one example, instructors host weekly informal discussions with learners following lectures. During these discussions, learners are able to seek clarification on the course material and talk about it in greater depth, as well as actively explore and discuss issues not covered during the lecture of interest and relevance to the group (in other words, *participation*). The discussions are recorded and made available to classmates as podcasts for individual listening (an opportunity for *personalization*). The process of creating and participating in these discussions becomes a form of student-generated content (also known as *productivity*). All students in the class are welcome to submit questions in advance via email or text. These are answered during the discussion along with questions asked by students attending in person (McLoughlin and Lee, 2008*a*, p. 18). McLoughlin and Lee (2007) stress that more, richer and engaging pathways to learning are available now than ever before; however, these opportunities demand that both teachers and learners experiment with new tools to explore their potential for enabling choice, creativity, participation, personalization, productivity and self-direction for learners (p. 672).

Social media now make it convenient for learners to engage with their peers, teachers, subject-matter experts and the community-at-large. Through these tools, individuals can create and maintain their own collections of ideas, photos and portfolios online. These creations, while enabling personal expression and publication, also allow for social constructivist forms of participation by allowing comments and annotations by others, and by sharing resources. This element of Pedagogy 2.0 is representative of the 'participation' model

of learning as opposed to the 'acquisition' model. Moreover, McLoughlin and Lee (2008*a*) point out that it adds a "further dimension to participative learning by increasing the level of socialization and collaboration with experts, community and peer groups, and by fostering connections that are often global in reach" (p. 17).

Ultimately, participatory learning is not simply a matter of interaction, but of interaction that results in the co-creation of learning. Moving towards a new pedagogy is not simply a matter of offering learners technologies they are likely to use in the knowledge society – these, like the knowledge itself, are subject to rapid change (p. 30). Rather, twenty-first century pedagogy will involve engaging learners in apprenticeships for different kinds of knowledge practice, new processes of enquiry, dialogue and connectivity (Beetham and Sharpe, 2013).

PERSONALIZE AND CUSTOMIZE LEARNING

The current education system is fragmented and learners' needs are often obscured as learners shift from one educational level or setting to another. As people learn in a variety of ways and may take multiple pathways to skills acquisition, education must be reorganized around each 'learner's journey' (Leadbeater, 2008). Twenty-first century education will require more personalized learning with an emphasis on supporting rather than stifling creativity. Redecker et al. (2011) stress that "personalization has implications for what, how and where we teach". Personalization occurs through collaboration, provides for more rapid sharing of innovation and good practice, and quickly captures information about learners' aptitudes and progress. Personalized learning is not an 'add-on' but a different way to undertake educational endeavours and includes peer-to-peer self-organized learning (Leadbeater, 2008). With personalized learning, individuals approach problems in their own way, grasp ideas at their own pace, and respond differently to multiple forms of feedback (Hampson, Patton and Shanks, 2011). Effective twenty-first century teachers cultivate learners' individual sense of wonder and inspire them to explore different applications for the knowledge and skills they have learned.

The purpose of personalized learning is to get away from the 'lesson' by designing project-based forms of learning. Lessons no longer have to adhere to the 'one-size-fits-all' approach characteristic of traditional education systems. Cognitive science research suggests that learners master core subject matter better and experience deeper understanding when learning emphasizes depth over breadth (Bransford, Brown and Cocking, cited in P21, 2007*a*). This approach helps individuals to invest in their learning and make it a habit, rather than viewing it as an activity forced upon them (Leadbeater, 2008). Effective twenty-first century teachers create regular opportunities for learners to select the types of experiences they want to further their own learning. This cultivates greater learner autonomy and inspires individuals to take control of their learning (Hampson, Patton and Shanks, 2011; NZME,

2007). The motivation and capacity to learn independently is crucial to personalization, because it reduces dependence on the teacher and traditional class-based styles of instruction. Individuals' innate thirst for learning requires that education reinforce their capacities for self-reflection and motivation (Leadbeater, 2008). Personalized learning is an ideal medium to enable such growth.

The structure of conventional settings generally thwarts the efforts of teachers to personalize learning. In most schools, after being grouped by age, learners study the same material, at the same time, in the same way. Leadbeater (2008) argues that learning is most engaging, "when it is personalized, when it means something to the learner" (p. 9). He further underscores the importance of innovation in educational environments. These approaches are supported by flexible curricula and formative assessments. In addition, electronic personal learning plans and e-portfolios will allow individual learners to record work and achievements and set personal targets and goals (Leadbeater, 2008; Redecker et al., 2011).

Ultimately, personalized learning is learner-driven within a framework of standards. As Leadbeater (2008) has repeatedly stressed, personalized learning allows for *common yardsticks* but *different expressions of achievement*. Conventional approaches to learning may eventually extinguish initiative and local innovation, making national targets difficult to achieve. However, when learning is personalized and customized, standards still count. Personalized learning inspires teachers to devise ways to reach learners individually, making targets and standards easier to achieve (Leadbeater, 2008). Personalized learning encourages teachers to disregard standard learning tools in favour of approaches that make learning more collaborative, interactive and project-based. Examples include dispersing technology beyond IT rooms, using intranets for lesson plans and content, presenting work in audio and video formats, and employing new and emerging technologies (e.g. mobile applications, e-books, music banks) (Leadbeater, 2008).

In the near future, customized learning opportunities and methods will be the norm (Davies, Fidler and Gorbis, 2011). Personalized learning is ultimately all about resources and how they are used. This includes the mobilization of resources and networks to meet diverse needs, and using them more flexibly to allow for greater differentiation. Personalized learning also enables the flexible use of space, which includes moving away from the classroom and into the community, and dividing up larger learning spaces into smaller ones.

Instructional design will play a central role in making twenty-first century learning successful. The creativity and ability of teachers to design engaging learning activities are crucial in this regard. McLoughlin and Lee (2008a) conclude that the personalized practices that underpin effective, innovative pedagogy will differ according to the subject area, but are likely to emphasize some or all of the following: digital competencies focusing on individual creativity and performance; strategies for meta-learning, including learner-designed learning; inductive and creative modes of reasoning and problem-solving; learner-driven content creation and collaborative knowledge-building; horizontal (peer-to-peer) learning; and social tagging, collaborative editing and peer review (p. 12).

EMPHASIZE PROJECT AND PROBLEM-BASED LEARNING

Today's learners face a difficult, uncertain and complex future. Accordingly, the education sector must work to equip learners with the skills they need to confront new challenges. McLoughlin and Lee (2007) highlight the opportunities afforded to students by Pedagogy 2.0 to direct and manage their own learning process. They also cite evidence about the effectiveness of giving learners control over and responsibility for their learning (p. 8). This is the main concept behind project and problem-based learning and is central to twenty-first century pedagogy. With project and problem-based learning, students learn by designing and constructing actual solutions to real-life problems (Cornell University, 2014a).

Trilling and Fadel (2009) note that effective project learning has five key characteristics:

- ➤ Project outcomes are tied to curriculum and learning goals;

- ➤ Driving questions and problems lead students to the central concepts or principles of the topic or subject area;

- ➤ Learners' investigations and research involve enquiry and knowledge building;

- ➤ Learners are responsible for designing and managing much of their learning; and

- ➤ Projects are based on authentic real-world problems and questions that students care about (p. 109).

Project and problem-based learning are ideal instructional models for meeting the objectives of twenty-first century education, because they employ the *4Cs Principle* – critical thinking, communication, collaboration and creativity – alongside 'teaching for transfer' and learning structured in real-world contexts. Solving real-world problems draws on multiple forms of expertise (P21, 2007b). Carrying out projects in teams which require learners to research across subject boundaries, take responsibility for different parts of their project, critique each other's work and create a professional quality product, will help develop real-world problem-solving skills. In addition, motivating learners to manage their own time and efforts and publically present their work will equip them with valuable skills for the twenty-first century workplace (P21, 2007b).

Research on project-based and problem-based learning has found that learner gains in factual learning are equal to or better than gains achieved employing more traditional classroom instruction. However, when studies took the time to measure gains on other learning skills, in particular higher-order twenty-first century skills, learning gains were significantly higher with

project and problem-based learning than with traditional methods (Trilling and Fadel, 2009, pp. 110-111).

Research also found that learners who struggle with traditional textbook-and-lecture methods benefited from a project learning approach which was better matched to their learning styles or preferences for working in groups (p. 111). Other comparative studies documented a variety of benefits of project and problem-based learning, such as increased ability to define problems, improved ability to reason using clear arguments and better planning of complex projects. Improvements in motivation, attitudes toward learning and work habits were also found (p. 111).

Project and problem-based learning encourage flexibility regarding where and how learning will occur and which places make appropriate learning environments (Leadbeater, 2008). Leadbeater argues that learning does not need to be confined to a single space or a single source. Multiple perspectives, resources and environments for learning, both real and virtual, are encouraged (McLoughlin and Lee 2008*a*, p. 15). The knowledge and skills that twenty-first century learners develop in formal settings will need to be applied in the workplace, at home, in their communities and in future study (P21, 2007*a*, p. 8). Research by Bransford et al. (cited in P21, 2007*a*, p. 8) indicates that students are more successful at applying what they have learned when instruction explicitly highlights the process of transfer by using real-world contexts. *Transfer* means just that, the ability to transfer learning from one setting to another.

Finally, a growing body of research shows that deeper learning takes place when learners can apply classroom-gathered knowledge to real-world problems and take part in projects that require sustained engagement and collaboration (Barron and Darling-Hammond 2008, p. 3). Active and collaborative learning practices have a more significant impact on student performance than any other variable, including student background and prior achievement (p. 8). Furthermore, learners are most successful when they are taught *how* to learn as well as *what* to learn (p. 8). Deeper learning typically involves sharing what has been learned and interacting with others in a community (National Research Council, 2012). However, for project and problem-based approaches to work well, teachers must design and plan activities that match the interests and needs of learners and the curriculum. Project and problem-based learning may not easily fit into the standard 50-minute classroom period, so alternative scheduling should be considered (Trilling and Fadel, 2009, pp. 114-115). Woods (2014) notes that project or problem-based approaches ultimately require a change in the role of teachers from being the 'source of knowledge' to coaches and facilitators for acquiring knowledge. This shift from teacher-centred learning to student-centred learning may be uncomfortable for many educators.

ENCOURAGE COLLABORATION AND COMMUNICATION

Collaboration is a twenty-first century trend that shifts learning from teacher or lecture-centred settings to collaborative ones. With the development of new ICTs innovative forms of collaboration are also emerging (Leadbeater, 2008, p. 10). Collaborative learning – the intentional grouping and pairing of learners for the purpose of achieving a learning goal – has been widely researched. Smith and MacGregor (cited in Barkley, Cross and Howell Major, 2014) note that collaborative learning is a broad term for a 'variety of educational approaches involving joint intellectual effort by learners, or learners and teachers together. In most collaborative learning situations, learners work in groups of two or more, mutually searching for understanding, solutions, or meanings, or creating a product' (pp. 4-5). Intentional design, co-labouring of group members and meaningful learning are three essential components of collaborative learning. The collaborative learning environment challenges learners to express and defend their positions, and generate their own ideas based on reflection. They discuss their ideas with peers, exchange different points of view, question others, seek clarification, and participate in higher-order thinking such as managing, organizing, critical analysis, problem resolution, and the creation of new learning and deeper understanding.

What makes this approach particularly appealing is that all members of the group are responsible for teaching their peers and managing questions and clarifications. In other words, learners are responsible for each other's learning as well as their own (Srinivas, cited in Laal, Laal and Khattami-Kermanshahi, 2012). There is compelling evidence that enquiry-based collaborative approaches to learning benefit both individual and collective knowledge growth. Learners engaged in enquiry-based learning develop content knowledge and learn increasingly important twenty-first century skills, such as the ability to work in teams, solve complex problems, and apply knowledge gained through one lesson or task to other circumstances (Barron and Darling-Hammond, 2008, p. 12). In contrast to traditional lecture-based learning, collaborative learning is a form of learner interaction developed through an interactive, group knowledge-building process.

What does research say about the effectiveness of project, enquiry and collaborative approaches to learning? Learners working in small teams on collective tasks have been the subjects of hundreds of studies. The research evidence is conclusive: enquiry, design and collaborative approaches to learning build a powerful combination of content understanding, basic skills and applied twenty-first century skills. E-drafting, critique and exhibition are critical tasks that inspire high-quality work from learners and advance the very skills – commitment, problem-solving and adaptability – that employers demand of twenty-first century graduates (Hampson, Patton and Shanks, 2011).

Collaborative learning embodies free thinking and even dissent, its end goal being to create new knowledge. It prepares learners for real-life social and employment situations and is learner-centred. Learners benefit from group interactions

through exposure to differing points of view and diverse backgrounds. In such situations, learners must defend their ideas and articulate their positions. They learn to assimilate, process and synthesize ideas and to engage one other by supplementing and revising existing knowledge.

Collaborative learning also leads to the development of metacognition, improvement in formulating ideas, and higher levels of discussion and debate. It teaches learners to monitor each other, detect errors and learn how to correct their mistakes. Overall, collaborative learning improves student participation in formative assessment (self, individual and group assessment) and increases attendance (Laal et al., 2013; Trilling and Fadel, 2009, p. 107).

What ultimately makes collaborative learning successful? Leadbeater (2008) stresses that 'learning is best done *with* people rather than *to* or *for* them. It is more effective when learners are participants rather than merely recipients' (p. 19). Deeper learning is supported by 'doing and using' and students are motivated through highly participative and dynamic learning activities. Emphasis is placed on the process of teaching and learning, with effective learning organized to create maximum opportunities for learners and teachers to talk, meet, ask questions, share information and exchange ideas. Learners are more engaged in learning and can tackle bigger, more sophisticated projects when they collaborate with others both inside school (Vockley and P21, 2007) and within and between communities (Carneiro, 2007). Ultimately, there are few places and situations in the current workplace where people truly work alone. The ability to collaborate and communicate is therefore essential.

ENGAGE AND MOTIVATE LEARNERS

Davidson, Goldberg et al. (2009) argue that there is a fundamental mismatch between the excitement generated by informal learning and the routine learning so common to many systems of formal education. Transmission and rote memorization of factual knowledge – elements of the standard model used most frequently in schools – can make any subject matter seem irrelevant (Saavedra and Opfer, 2012, p. 7). Saavedra and Opfer (2012) stress that a 'standard transmission' model undermines the possibility of developing skills because lack of relevance leads to lack of motivation, which ultimately results in decreased levels of learning (p. 9). In a twenty-first century learning environment, new and engaging ways must be developed that depart from the standard school 'transmission model' and increase community-based learning.

Given the importance of fostering motivation for independent learning, research emphasizes the importance of the teacher's role in motivating learners and finding ways for them to build intrinsic motivation (Malone and Smith, cited in Meyer et al., 2008). According to these authors, motivation is based on developing the interest of learners, maintaining their involvement and encouraging confidence in their abilities to perform a specific task (p. 36). Teachers can foster learning and

motivation by ensuring that success is recognized and praised. Malone and Smith (cited in Meyer et al., 2008) also suggest that teachers should foster motivation by clarifying the purpose of lessons with learners and sharing their long-term learning goals. However, they note that while it is important for teachers to focus on long-term goals, it is also vital to recognize when learners cannot immediately achieve those goals. In these cases, teachers should set intermediate targets for learners by breaking down learning into meaningful segments, so that interest is sustained.

Ensuring that tasks provided during independent learning are based on relatable, realistic scenarios can increase student motivation. Meyer et al. (2008) suggest that these scenarios can be created by organizing learning activities around a key question – one that is meaningful, worthwhile and feasible (p. 35). Active participation in high-level strategizing and decision-making can also help learners to acquire attributes in high demand in the twenty-first century, such as social responsibility, cross-cultural sensitivity and emotional intelligence (Facer, 2011). Outcomes have been very positive in schools that have chosen to share responsibilities with students in an authentic and meaningful way. Results show improvement in academic achievement, as well as increases in the quality, frequency and flexibility of learning relationships, which lead to deeper student motivation and engagement, and the creation of school communities where students, teachers and families collaborate to optimize education and learning (Hampson, Patton and Shanks, 2011).

Growing calls for pedagogical innovation reflect the view that twenty-first century learning will become a process of knowledge creation managed through personalized modes of learning and individualized teacher support. In this context, creativity and originality on the part of teachers and learners will be highly valued and must be fostered (Paavola and Hakkarainen, cited in McLoughlin and Lee 2008*a*).

CULTIVATE CREATIVITY AND INNOVATION

Innovation and creativity are very valuable competencies in knowledge societies. Yet one question remains – do educators have the courage to disrupt conventional wisdom and encourage learners to improvise and pursue innovations that matter the most? In today's economy, innovations emerge from improvisational teams (Sawyer, 2006). Creativity is deeply social, with most creative insights typically emerging from collaborative and creative circles. Few schools teach students to create knowledge; instead learners are taught that knowledge is static and complete, and they become experts at consuming knowledge rather than producing it. McLoughlin and Lee (2008*a*) argue however that the ultimate goal of learning is to stimulate learners' capacities to create and generate ideas, concepts and knowledge. To this end, there is a need for meaningful learning experiences that tap into and expand learners' creativity, not extinguish it (Robinson, 2006). Teachers can play a key role by encouraging, identifying and fostering creativity (Saavedra and Opfer, 2012, p. 17). Encouragement

helps students to recognize and develop creative capacities in themselves that they might otherwise overlook. And as with metacognition, teaching about the creative process and what inspires or suppresses it contributes to creative development (p. 18).

Cultivating creativity and innovation also demands that learning environments be transformed to support such growth. According to Sawyer (2008), environments that prepare learners for a knowledge intensive society will look very different from the standard model (p. 9). The standard learning model, Learning 1.0, evolved in the early part of the twentieth century and incorporates the aspects of schooling generally considered 'normal and proper: students divided by grades, lessons by subjects, tests at the end of the year, and high school units collected until graduation' (Kerchner, 2011). In this model, schooling and most other forms of formal learning are built on the principle of acquisition and storage of information with a view to analysing and eventually using it (p. 1). 'Pedagogy becomes the means to transfer knowledge through known and authoritative channels' (p. 2). Traditional roles prevail – in other words, teachers teach and students learn.

This model has outgrown its usefulness. Kerchner (2011) argues that Learning 2.0 is a very different proposition, consisting of a more flexible, personalized and experiential form of learning. He attributes the inspiration for this model in part to the network-based technologies that underpin the internet, but mainly to recent changes in how people think about learning (p. 3). Learning 2.0 draws several elements from emerging learning innovations and the rapidly growing research literature on learning, technology and open education. These include:

- A mix of acquisition and practice of project-based learning and other immersive pedagogies;

- Individual education plans for all;

- The realization that learners, not only teachers, are the workers in the education system;

- The unbundling of teaching, learning and the assessment of competence; and

- The inclusion of essential twenty-first century skills such as learning how to solve difficult, ill-defined problems and learning how to collaborate (p. 3).

Redecker et al. (2009) contend that the greatest potential for Learning 2.0 lies in its capacity to facilitate pedagogical innovation (i.e. transforming learning and teaching approaches to better address and achieve learning goals). Specifically, Learning 2.0 approaches can inspire:

- New ways of collaborating;

- The creation and exchange of new learning content and meta-data;

- New ways to communicate among learners and teachers/trainers;

- More personalized and learner-centred environments;

- New forms of blended learning approaches (formal/ informal, classroom/distance, intra/extra-institutional and mixed learning);

- New ways to document learner's competencies (e.g. e-portfolios, personal learning plans and learning diaries); and

- New motivations through the use of active, discovery-based learning approaches, and learners' increased ownership of content (pp. 39-40).

EMPLOY APPROPRIATE LEARNING TOOLS

The transformation of pedagogy goes beyond the idea that new technologies will produce new forms of learning and new competencies. While technological developments play an important role in learning and can create new and unprecedented opportunities, technology alone cannot ensure a successful learning experience (Davies, Fidler and Gorbis, 2011). There are many different instructional tools available to teachers to stimulate learning and help learners create new knowledge in collaboration with their peers.

STRATEGIC QUESTIONING

Questioning is an effective technique to engage learners. Asking probing questions can foster curiosity and teaching learners to ask questions gives them practical tools to decipher challenging content. Cornell University's Center for Teaching Excellence (2014b) notes that students who can ask insightful questions are more likely to be successful in school. While questioning is a means to measure what learners know or assess their understanding of specific concepts, effective open-ended questions that probe and elicit expanded thinking and processing of information can be instrumental in stimulating deeper learning. Divergent questions have multiple possible answers and encourage learners to be creative and share their insights. Asking appropriately challenging and engaging questions stimulates discussion and creative and critical thinking. Questions encourage learners to explore and redefine their understanding of key concepts.

CAPITALIZE ON LEARNERS' INTEREST IN MOBILE TECHNOLOGIES

Interaction with digital technologies is now commonplace among young people. However, mobile technologies still play only a minor role in education. When used appropriately, technologies can offer multiple forms of learning, rather than functioning as mechanisms to replace teachers. Solis (2014) argues that the use of mobile technology has the potential to improve the dynamics of learning. However, the key is to view technology not as the sole solution, but as an enabler within a culture of learning and collaboration.

UNESCO (2013*a*) notes that initiatives which transform mobile devices into tools for learning, and which support equitable opportunities for students who cannot afford them, generally provide affordable solutions to educational challenges. Research by Redecker et al. (2011) suggests that a mix of different technologies will transform learning by offering a diversity of learning activities, tools and materials, and by providing tools that enable continuous monitoring, and support diagnostic, formative and summative assessment (p. 62). Making educational resources openly available is another gain for learners (p. 12). As web-based multimedia production and distribution tools incorporating text, audio, photo and video capabilities continue to grow, teachers at all levels will be faced with new opportunities to integrate social media and technologies into teaching, learning and assessment (McLoughlin and Lee, 2010, p. 28). However, pairing this technology with new teaching practices is essential to realize its potential (Brown, 2005).

Future learning processes will inevitably take place in environments in which learners select their own modes of learning and bring personal technologies into education. Mobile devices will facilitate learning by reducing the boundaries between formal and informal learning. By using a mobile device, learners can independently and easily access supplementary materials to clarify ideas and share that knowledge with others (UNESCO 2013*a*, p. 21). UNESCO (2012) believes that the portability and widespread use of mobile devices will make them ideal tools to influence teaching and learning in ways that surpass the use of personal computers. Likewise, the World Wide Web also continues to evolve in response to new technologies and changing user expectations. The next phase (Web 3.0) will analyse the question, search the internet for all possible answers and then organize the results, it will act like a personal assistant (Strickland, 2008). Bates (2011) adds that twenty-first century mobile devices can provide 'instant access to vast libraries of expert and amateur-sourced information, creating seekers, communicators and self-directed problem-solvers from youth already using technology outside of school' (p. 2). Due to their portability, mobile devices can also provide remarkable opportunities for 'situated learning' (i.e. learning in the field, at the point of contact, in settings that maximize understanding). Site-specific mobile applications can now facilitate learning in varied disciplines. Students studying botany, for example, can use mobile devices and discipline-specific applications to learn about particular plants while inspecting them in their natural habitats (UNESCO, 2012, 2013*a*). The evolving capacity of Web 3.0 will soon allow learners to make such connections.

In the past, video, *PowerPoint* and computer-based resources were used in combination with teacher-centric educational models. However, Bates (2011) argues that current web-based technologies empower learners and support the shift to more learner-centred approaches 'to create, adapt, share, disseminate and apply knowledge' (p. 2). Indeed, a wide array of software devices and applications have been used for educational purposes. However, as Prensky (2012) points out, 'it is not the tools themselves that we need to focus on, but rather the products, creativity and skills that the tools enable

and enhance' (p. 25). Digital tools for learning and education will continue to evolve. Learners carrying their own devices will continue to adapt new technologies to enhance functionality, access and productive learning possibilities. In twenty-first century learning environments, teachers will need to transform their roles from 'content conveyors to content curators' (Institute for the Future, 2013). The ability to identify and locate information and resources for learning is a critical skill and teachers can support learners in identifying the necessary resources. Tools and platforms to engage learners and guide them to appropriate learning opportunities will grow in importance. However, creating teacher-designed content and applications to transform emerging technologies into tools for learning is an essential next step.

MAKE THE MOST OF SOCIAL MEDIA

Using social media in traditional education and training appears to be a promising strategy for facilitating and improving learning opportunities (Redecker and Punie, 2010). Facer (2009) states that social media can be used as a means to implement pedagogical strategies that support, facilitate, enhance and improve learning processes (p. 3). Additional research by Redecker et al. (2009) suggests that using social media in learning promotes pedagogical innovation by encouraging teaching and learning processes based on personalization, collaboration and changing interaction patterns between and among learners and teachers (p. 70).

The use of *cloud* capacity to access networks and ensure continuous connection to knowledge, resources, people and tools on demand will soon be taken for granted. *Cloud computing* in combination with personal mobile technologies will make it easier for people to manage their own information systems and social networks, rather than accessing them via institutions or other providers (Facer, 2012). Facer (2012) further notes that the rise in mobile and personal technologies and the lowering of barriers to data storage will allow individuals to bypass third-party providers and 'wrap their information landscape around them', rather than managing it through institutions.

New technologies are important for searching, filtering, processing, evaluating and managing information, and making these tasks more efficient (Ala-Mutka et al., 2010; Learnovation, 2009). The Partnership for 21st Century Skills (P21, 2007b) describes the potential of digital communication technology to transform schools as well as curricula. Bransford et al. (cited in P21, 2007*b*) point out that communication technologies facilitate giving and receiving feedback and 'allow students to progressively revise their work – all instructional strategies that have been shown to enhance learning' (p. 4). Today's digital tools and social media make it possible to transcend classroom borders and integrate resources (e.g. scientific data, library collections, video and film archives) into the curriculum from across the globe. As noted earlier, instruction that emphasizes real-world context facilitates the transfer of learning from school to life (p. 4). Digital communications allow users to import the wisdom and live experience of individuals in the community,

as well as experts from science, business, government and higher education, into the learning experience to instil new excitement and relevance into education (p. 2).

DESIGN RELEVANT AND REAL-WORLD LEARNING ACTIVITIES

To ensure effectiveness, any curriculum must be relevant to the lives of students (Mansilla and Jackson, 2011; Perkins, cited in Saavedra and Opfer, 2012). Learning activities that are designed to connect student experiences to real-world problems will transform their focus. The Partnership for 21st Century Skills (P21, 2007b) echoes this point: 'when students realize the connection between what they are learning and real-world issues that matter to them, their motivation soars, and so does their learning' (p. 3). Students' experiences in school differ markedly from their lives outside school. The increasing likelihood of school becoming irrelevant to interests and issues that affect them is therefore of real concern. As Buckingham (2007) notes, bridging this gap will require more than superficial attempts to combine education and entertainment, or use of the latest technological devices. McLoughlin and Lee (2008a) stress that, above all, learning tasks should be authentic, personalized, experiential, learner-driven and designed, and enable the creation of content and innovative ideas by learners (p. 15). More active learning, more relevant curricula, more real-world learning and better-trained teachers will improve the quality of education overall and increase student engagement (Redecker and Punie, 2010).

In a recent foresight study on the future of learning, Redecker and Punie (2013) found that 90 per cent of experts polled agreed that schools must increase efforts to open up to society and integrate real-life experiences into teaching practices (p. 9). The use of real-world contexts is a key component of twenty-first century learning and instruction. According to the Partnership for 21st Century Skills (P21, 2007b), research suggests that 'when teachers create meaningful learning activities that focus on the resources, strategies and contexts that students will encounter in adult life, absenteeism rates fall, cooperation and communication grow, and critical thinking skills and academic performance improve' (p. 3).

TEACH METACOGNITIVE SKILLS

Put simply, metacognition is 'thinking about one's thinking'. More precisely, it refers to the processes used to plan, monitor and evaluate one's understanding and performance. Metacognition reflects an individual's critical awareness of how they think and learn, and their assessment of themselves as a thinker and learner. Metacognition is not solely an intrinsic talent; it can be taught and cultivated. Teachers can cultivate a metacognitive culture that promotes greater learning by giving learners 'permission' to identify their confusion, asking them what they find confusing and acknowledging their difficulties,

integrating reflection into credited course assignments, having instructors model metacognitive thinking in their teaching, and offering learners explicit instructions on how to think in a metacognitive fashion.

For learners to use metacognition successfully, they must be taught explicitly about the concept and its language. As Weimer (2012) notes:

> [I]t is terribly important that in explicit and concerted ways we make students aware of themselves as learners. We must regularly ask, not only 'What are you learning?' but 'How are you learning?' We must confront them with the effectiveness (or ineffectiveness) of their approaches. We must offer alternatives and then challenge students to test the efficacy of those approaches (p. 1).

This kind of explicit instruction will give learners a way to talk about their learning and thinking. Students can then compare strategies with their peers, and expand or replace existing learning strategies with new and more effective ones. This process will result in learners thinking about their learning becoming much more transparent. Ultimately, this will allow them to make more informed learning choices and strengthen their individual judgment and sense of autonomy.

BUILD THE RIGHT RELATIONSHIPS FOR LEARNING

Relationships for learning are gaining new importance in the twenty-first century. New learning experiences will be collaborative, project or problem-based, and supported by relationships that allow students to practise new competencies of collaboration and communication until they master these skills (RAND Corporation, 2012). Quality learning and teaching are grounded in powerful relationships built on mutual respect and trust. Learning often results from the way in which ideas are shared, including between the teacher and the student. Leadbeater (2008) emphasizes that learners need relationships that will motivate them to learn (p. 15). Motivating someone generally requires building trust, confidence and capability; boosting aspirations and ambitions; setting achievable goals and structured challenges; and offering relevant rewards and recognition. Good teachers already have these motivational skills, but good motivators can also include other children, older peers, siblings, parents and other adults, such as teaching assistants and role models in the community.

Individuals learn best when they are supported by the right set of relationships that motivate, engage, care about and reward them (p. 22). Such relationships offer them opportunities to actively participate in learning and co-create new knowledge. Relationships for learning truly recognize individuals. Recognition is critical to young people trying to establish their sense of identity. Often the disaffection that some young people feel for education can be explained by their search for recognition and reputation outside education, at its most

extreme through involvement in drugs, crime, sex and gangs (p. 20).

Relationships for learning make people feel safe and cared for. Having others treat you with respect and dignity, and having someone attend to your needs, all matter. Care and support may come from peers, teachers, experts or community members. Providing care generally involves being attentive, sensitive, noticing or even anticipating when someone might be in need, being responsive, engaging with the person to understand what they need, and being respectful of them as a person (Leadbeater, 2008).

INCLUDE EVERY LEARNER THROUGH TECHNOLOGY

The quest for a new knowledge paradigm cannot be separated from the goal of inclusion and more equitable distribution of knowledge in societies. Accessibility remains a significant obstacle to inclusion. Equity demands more focused attention to groups of low-achievers often neglected in traditional education systems. Mobile devices have proven very useful in enhancing inclusion. For instance, they can help students with disabilities gain access to the curriculum via applications that make text more readable or read text aloud, increasing reading speed and comprehension for students with dyslexia (UNESCO, 2013a). Mobile technology also supports teachers in individualizing instruction to accommodate students' unique needs. Making learning responsive to individual differences, and empowering and enabling each and every student to engage in learning, will help to re-create excitement for learning.

Ultimately, education must respond more flexibly to cultural diversity and changing labour market expectations (Gijsbers and van Schoonhoven, 2012). Without question, such a move makes sense in places such as Africa, where twenty times more people connect to the internet through mobile phones than through fixed-line computers. In Colombia, mobile devices are being used instead of traditional desktop or laptop computers to address an illiteracy crisis in rural areas. In 2012, the Colombian government purchased 250,000 mobile devices equipped with interactive educational software and delivered them to illiterate young people and adults. Other countries have similar, albeit still unrealized, plans to launch mobile learning projects in an effort to increase educational opportunities for people in underprivileged communities (UNESCO, 2012).

Inclusion is at the heart of personalized learning which readily acknowledges individual learning styles. This acknowledgement, in turn, produces more motivated and engaged learners. However, enabling environments need to be created. Educational environments must promote inclusion and provide support (Carneiro and Draxler, 2008). *Inclusive* education is based fundamentally on human rights and the transformation of educational systems – both formal and informal – into environments more responsive to the diversity of learners' needs. Personalized learning has the potential to

be highly inclusive, but this process will not occur automatically. Learners with disabilities, disadvantaged persons, those who want to relearn, and those previously unable to benefit from traditional compulsory education must all have the opportunity to benefit. Social media applications can be used to integrate learning into a wider community by reaching out to people from other age groups and socio-cultural backgrounds (Redecker and Punie, 2010, p. 314). Linking learners to experts, researchers and practitioners in specific fields of study will also open up alternative channels for gaining knowledge and enhancing skills.

HIGHLIGHT LEARNER-CENTRED MODELS

Twenty-first century learning must be relevant, engaging, effective and learner-centric (Vockley and P21, 2007). It is therefore essential to replace outmoded 'closed classroom' models of teaching and learning, which emphasize delivery of information by an instructor and/or from a textbook, with new more learner-centric models (McLoughlin and Lee 2008a, p. 641). Tailoring learning pathways to the characteristics and aspirations of individual learners will undoubtedly demand significant organizational changes in schools (Furlong and Davies, 2012; ISC-I, 2004).

Other critical changes include a greater emphasis on learners taking responsibility for their own learning and the development of education systems that nurture such responsibility (Davies, Fidler and Gorbis, 2011; Facer, 2011). Research has shown that learners' attitudes, ownership of learning and level of independence are all affected when they take responsibility for their learning (Meyer et al., 2008). Adapting education to the needs of the twenty-first century learner means adopting a flexible curriculum and provide learning that is individualized and self-regulated. This places additional demands on learners to make the right choices (Ericsson AB, 2012) and on teachers to facilitate learner autonomy and independence.

Teachers must become comfortable with managing new forms of classroom dynamics and supporting multiple teams of students working independently, as they explore and gain new understandings and skills to prepare them for twenty-first century life (Trilling and Fadel, 2009, p. 115).

PROMOTE LEARNING WITHOUT BORDERS (ANYTIME AND ANYWHERE)

The emergence of learning spaces beyond classrooms and schools, and growing recognition of the importance of learning and relearning outside the formal education and training system, offer learners many new options (Taddei, 2009). The meaningful use of new technologies in the home may also increase opportunities for learner-driven forms of learning (Furlong and Davies, 2012).

People can learn anytime and anywhere. However, in a knowledge society, memorization of facts and procedures will not be enough. Sawyer (2008) maintains that educated graduates will need a deeper understanding of complex ideas and the ability to work in global teams to generate new ideas, new theories, new products and new knowledge (p. 49). Learners will continue to seek and acquire knowledge wherever and whenever they need it from a variety of sources including books, websites, informal learning, third-party educational providers, social media and experts around the globe (p. 58).

Mobile devices will also make learning possible anywhere and at any time, and new technologies will provide opportunities to rethink scale. Learning to adapt to extreme scales will be important, making it possible to offer highly personalized courses yet having the capability to reach many more learners when needed. Leadbeater and Wong (2010) stress the need to create new ways to discover which learning mechanisms will work on a mass scale for millions of young people in the developing world (pp. 26-27).

Finally, new incentives need to be created to encourage learners to engage in 'learning without constraints and without borders'. Today's learners must recognize that learning and relearning can occur outside classrooms and schools throughout their lives. It is likely that these learners will require an introduction to learning options available to them now and in the near future. Fostering this commitment to lifelong learning will ensure that learners remain open to new developments and opportunities as they arise.

ENCOURAGE LIFELONG LEARNING

There is growing awareness that lifelong learning embodies the philosophy, conceptual framework and organizing principle for education in the twenty-first century, with the idea of learning for empowerment at its centre. UNESCO-ERF (2013) emphasizes the importance of advocating a 'lifelong learning framework that creates comprehensive and flexible pathways combining formal, non-formal and informal learning opportunities to accommodate differences in learning needs' (p. 3). Mega-trends such as slowing population growth, the ageing global population, continuing threats from climate change and the eastward shift in global markets all have an impact on current learning and the level of relearning called for in future years. Ease of access to mobile technologies and the rapid assimilation of mobile communications into the lives of those aged 25 years and under have increased the availability of continuous learning. This trend has the potential to transform the ways in which today's learners contend with the complex problems ahead (Brown, 2005; Underwood, 2007).

Carneiro (2007) notes that people will face meta-learning challenges throughout their lives. They will likely include learning to organize multiple sources of information, learning to learn from experience and deal with the social dimensions of knowledge formation, learning to self-regulate time and effort to learn, learning to forget and to un-learn whenever necessary,

and learning to make room for new knowledge (p. 6). The ready availability of lifelong learning will provide pathways to learning only imagined before. In the future, learners of all ages will be able to access knowledge needed to solve simple or complex problems as they appear without the need to enrol in formal degree programmes, leave their jobs to attend school, or spend considerable sums of money to upgrade their skills. Indeed, perceptions about the value of education are expected to change as lifelong learning makes access to education much easier and people's dreams of achievement are progressively realized (Carneiro, 2007; P21, 2013).

Facer (2012) and Redeck and Punie (2013) raise another concern that warrants consideration that of demographic change and the need for effective lifelong learning programmes and retraining options for workers with outdated or mismatched skills or who are seeking to retrain in a different field (p. 4). In addition to the technological changes and advances mentioned hitherto, private industry will also become a key player in the provision of lifelong learning opportunities.

RECOGNIZE LEARNING THROUGH OPEN EDUCATION

There is a gradual move away from classroom-based learning towards anyplace, anytime learning and open education. The Partnership for 21st Century Skills (P21, 2007b) maintains that developing a robust, engaging twenty-first century curriculum and employing twenty-first century pedagogies require educators to 'look outside schools and seek ideas, resources, and expertise where they are found – in their communities; in professional and educational groups; and in individuals, schools, and organizations around the world' (p. 1).

The Open Education movement is inspired by the trend for making open source software available free of charge. These courses are designed to cater for tens of thousands of students at a time and are accessible via a number of different web-based portals. Massive Open Online Courses (MOOCs), originally offered university-style courses, but now focus more on vocational courses for professionals. There are plenty of initiatives worldwide at present, no *one* open courseware initiative stands out, but over time an industry leader is expected to emerge (Frey, 2007). In 2014, Google released *MOOC.org*, an open-source platform accessible by any university. International universities also use *Learning Management Systems (LMS)* to support on-campus courses. These systems provide online discussion forums, electronic delivery of readings and assignments, and electronic return of graded assignments. Currently, products such as *Blackboard*, *Moodle* and *Sakai* are widely available, while new products such as *Piazza* and *Classroom Salon* are integrating social networking features similar to those available on *Facebook*.

ACCREDIT AND CREDENTIAL NON-TRADITIONAL LEARNING

How will accreditation and credentialing of informal learning activities be addressed in the twenty-first century? While formal qualifications will most likely remain central to gaining new employment, informally acquired skills must be better acknowledged. Redecker and Punie (2013) argue that mechanisms must be established to allow learners to obtain formal recognition of efforts to upgrade work skills through informal training, both inside and outside the workplace. Experts polled by Redecker et al. (2011) noted repeatedly that informally acquired skills must be better recognized and structures put in place to allow people to obtain formal recognition for their experiences and skills. UNESCO (2012) has echoed these views, stating that there is a need to assess and validate skills and competencies developed beyond formal education and training. The formal, non-formal and informal pathways through which they were acquired, including self-learning, peer learning, work-based learning (including internships and apprenticeships) or on-the-job training, should not be an issue.

In the case of MOOCs, completion rates are generally quite low (*Coursera* currently has a course completion rate of only 5% of enrolled students). However, that number increases dramatically when students are offered the opportunity to obtain completion certificates or credentials provided by online course providers. Efforts to recognize informal learning are now underway. *Credentialing through Badging* proponents envision a time when employers will look to badge portfolios as a way to determine whether potential hires have acquired the tangible skills needed in their organization.

In 2012, the European Commission adopted a formal recommendation to support the validation of non-formal and informal learning throughout Europe. The recommendation calls for EU Member States:

> to put in place, by no later than 2018, arrangements to enable individuals to have their knowledge, skills and competences acquired via non-formal and informal learning validated, and to be able to obtain full qualification, or, where applicable, part qualification on the basis of validated non-formal and informal learning experiences (European Commission, CEDEFOP and ICF International, 2014).

The latest inventory of this initiative indicates that 'validation strategies and legislation have been developing slowly but steadily' across thirty-three European countries (CEDEFOP, 2014). Riddell (2013) has provided a comprehensive list of existing alternative credentialing approaches to validate informal learning.

Educational researchers in the United States have suggested that certificates of competency should be created for all new Common Core State Standards with national certification exams open to learners whenever they feel ready, regardless of how the competence was acquired. Such a system, if examinations are rigorous and their validity has been demonstrated, would certainly provide an alternative route for certifying learners' college and career readiness to universities and potential employers (Collins and Pea, cited in USDOE, 2013). Other credentials might be earned only after students demonstrate mastery of skills that are not formally recognized in a traditional classroom. In either case, badges could be collected and aggregated into online student portfolios that document and certify their interest-driven achievements.

A total of 75 per cent of experts consulted online by Redecker et al. (2011) believe that by 2025 there will be abundant training and employment opportunities available to assist people in converting professional experiences and personal skills into competences relevant for new job profiles (p. 76). However, not all of these opportunities will lead to formally recognized qualifications. ICTs can support the documentation and validation of these informally acquired skills (p. 76), but accreditation frameworks and mechanisms must be established to make individuals' learning portfolios relevant and valuable for career development (p. 15).

ASSESS FOR DEEPER UNDERSTANDING AND COMPETENCY

Assessment is inextricably linked to instruction and should be used to inspire deeper learning. To evaluate deeper understanding, it is essential to assess the extent to which learners' knowledge is integrated, coherent and contextualized (OECD, 2008b). It is not possible to address the issue of transforming twenty-first century instruction without also addressing formative assessments – assessments that enable a teacher to evaluate learning *while* it is occurring. Formative assessment in the form of continuous feedback will take the lead in twenty-first century assessment. It is especially beneficial for clarifying learning goals, ensuring continuous monitoring, providing feedback, responding to learners' progress, encouraging adaptation and improvements in learning outcomes, and involving students in meaningful self and peer assessment (Facer, 2011; National Research Council, 2012). Formative assessments enable diagnosis of learning gaps, so they can be addressed before they lead to more fundamental misunderstandings of knowledge or misapplication of skills. Rubrics and other formative assessment tools will play an essential role in the twenty-first century classroom by providing teachers and students with clear guidelines on what constitutes acceptable levels of achievement (P21, 2007b). Learners must also be taught how to evaluate their own learning (Ala-Mutka et al., 2010). This will help them to master content and improve their metacognitive skills, including the ability to learn how to learn and to reflect on what they have learned (Saavedra and Opfer 2012, p. 13).

According to Leadbeater (2008), the notion that education is 'just a system of schooling' invites the idea that improvement is best achieved through 'mass customization, efficiency and quality improvement, driven by central targets, large-scale high-stakes testing, national strategies and inspection regimes'. He argues that such thinking could not be more

'off the mark' and repeatedly emphasizes the importance of taking standards seriously and embracing what they represent, while ensuring learners have opportunities to create personal expressions of achievement (p. 9).

REDEFINE TEACHER ROLES AND FUNCTIONS

Statistically speaking, high-quality teachers are the strongest influence on learner achievement. Many factors contribute to a learner's academic performance, including individual characteristics and family experiences. But research consistently suggests that, among school-related factors, teachers matter most. When it comes to learner performance on reading and math tests, a teacher is estimated to have two to three times the impact of any other school factor (RAND Corporation, 2012).

NEW TEACHER ROLES

Although their roles in the digital age of learning are still evolving, teachers and other learning professionals remain central, no matter how education is conceptualized (UNESCO, 2013b). However, the role of teachers in the twenty-first century must move away from imparting knowledge, towards guiding, discussing and measuring the progress of learners (Hampson, Patton and Shanks, 2011; Sawyer, 2006). In classrooms of the future, teachers may also assume the role of 'invited professors' to support student learning (Learnovation, 2009). Learners are now facing a rich digital educational landscape outside of school. 'Folk educators' are building massive online educational resources that include videos, feedback and online support. There are also numerous online tutorials and online brokering resources that allow prospective learners and teachers to find each other outside of formal educational institutions (Facer, 2011, p. 133).

If the main goal of twenty-first century education is to build the learning capacity of individuals and support their development into lifelong, active, independent learners, then teachers need to become 'learning coaches' – a role very different from that of a traditional classroom teacher. Learning coaches may provide guidance to help students develop skills, but their main role is to offer the kinds of support that will help students attain their learning goals. Teachers as learning coaches will encourage students to interact with knowledge – to understand, critique, manipulate, design, create and transform it. Teachers will need to reinforce learners' intellectual curiosity, problem identification and problem solving skills, and their capacity to construct new knowledge with others (Bull and Gilbert, 2012). Twenty-first century teachers will not be proficient in every topic on the curriculum, but must become experts in figuring out, along with their students, 'how to do something, how to find out something or how to use something to do something new'. A key part of their role will be to model confidence, openness, persistence and commitment for learners in the face of uncertainty (Bull and Gilbert, 2012).

Rather than serving exclusively as instructors or lecturers on personalized learning, teachers will be free to take on different roles as moderators, mentors and designers of projects that highlight the real-world relevance of subject material. Teachers' roles will evolve from being 'dispensers of information and knowledge' to becoming 'facilitators and enablers of learning' (Tawil, 2013). This shift creates the potential for teachers to have deeper, more fulfilling engagement with students and a more creative role in the design and delivery of curricula (Hampson, Patton and Shanks, 2011). However, teachers will need time to design their own units or access educational content provided by third-party enterprises, and incorporate those offerings into learning activities (USDOE, 2013). Teachers will also need substantive professional development to support their transformation, especially regarding the potential and range of social media and Web 3.0 applications.

Teachers must also evolve into creative workers, jointly constructing knowledge with learners in the classroom. Teachers will stimulate deepening engagement and articulation by guiding learners to develop skills such as formulating arguments to support their positions, sharing and communicating these arguments to others using multimedia (including image, text, sound, movement, sequence and interactivity), constructing their own meaning, and collaborating with others to extend that meaning (Bolstad, 2011; Brown, 2005; Gijsbers and van Schoonhoven, 2012). Teachers must also become learning resource coordinators and mediators.

Teachers may benefit from experimenting with new designs and strategies to be ready to offer relevant, effective and high-quality learning experiences in the future. Teachers may build better links with colleagues (e.g. through cross-discipline projects and modules within schools), build stronger links to people and organizations within their communities, emphasize learners' growth through real-world research projects, perfect their skills in teaching learners to work together in small groups, and focus on helping students to understand each discipline (or subject) as a system of thought (with its own codes, methods, strengths and limits), rather than on transmitting content (Gilbert, 2005).

MEANINGFUL PROFESSIONAL DEVELOPMENT

Meaningful professional development obviously involves far more than simply adding new knowledge and technical skills to teachers' existing repertoires. It requires teachers to '"shift their paradigm" – to break with and replace their past ways of thinking and knowing with a totally new understanding of their role and its purpose' (Bull and Gilbert, 2012, p. 6). However, transforming the skills of individual teachers will not be enough. Bull and Gilbert stress that change needs to take place *across* the system, through purposeful interaction between individuals at all levels (p. 8). This is a significant undertaking and teachers will need new forms of professional development to support them. If today's teachers are to meet the needs of twenty-first century learners, they must not only develop *what* they know, but also *how* they know. The twenty-first century learning

literature focuses on the need to develop learners' cognitive, inter and intra-personal capacities. However, a necessary precursor to this is strengthening teachers' capacity for and awareness of their own learning. Bull and Gilbert (2012) state that any twenty-first century form of professional development must 'address and integrate both individual and organizational development. It will need to build individual learning, but also collaborative learning as teachers move forward together to develop their "communities of practice"' (p. 7).

INNOVATIVE TEACHER EDUCATION

Pre-service teacher education programmes must also shift their orientation to twenty-first century principles of teaching and learning. Redecker et al. (2011) maintain that twenty-first century teacher education must place greater emphasis on instructional design, team-building, facilitating learning and new ways to foster creativity and innovation. ICTs must be integrated into teacher education programmes and become commonplace as a tool used throughout teaching careers (Ó Grádaigh, 2014). Ala-Mutka et al. (2010) state that teacher education must be renewed to support skill development in new technologies. They also place substantial emphasis on the need to design learning activities to support the skills that twenty-first century learners must master.

For teachers educated in a twentieth century view of schooling, learning and knowledge, these are new approaches, and ones that do not naturally build on prior experience. Adopting twenty-first century pedagogy requires teachers to rethink their reasoning about *what* they teach and *why*, and to rethink *who they are* as teachers. It requires them to 'resituate themselves professionally, not as a traditional teacher, but as a highly skilled advanced learner' (Saavedra and Opfer 2012, p. 6). Informal groups and networks are already emerging across the globe to identify promising practices, challenges and trends that will support the educational changes ahead. Teachers will benefit from accessing these resources as they emerge (Brown-Martin, 2014; Future of Learning Group, 2014; Johnson et al., 2014; Leadbeater, 2012).

CONCLUSIONS, NEXT STEPS AND FUTURE ISSUES

This paper addresses the many possible futures and forms of learning in the digital age and the pedagogies that support learners in acquiring new competencies and skills to tackle twenty-first century challenges. 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.

Many factors are driving change in the ways that learners are educated. Pressures may vary from nation to nation, but the message is fundamentally the same: education is failing to prepare learners for the challenges ahead. Students are not learning under the current system of education and are being short-changed. Learners are missing out on experiences that will prepare them for more satisfying lives and productive work. Nations are also losing opportunities to prepare youth for citizenship, and economies are suffering from a lack of innovation. The twenty-first century has immense potential to reaffirm the role of education with a view to equipping young and old 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 modern global societies. 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.

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. Education providers must adopt curricula that are comprehensive yet flexible, and centre on content that extends thinking and reasoning, so as to equip learners to tackle twenty-first century challenges and pressures. There is also a strong need for curricula that are open to learner input, interdisciplinary in focus, and effectively blend informal and formal learning.

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 commitment of educators to lifelong learning, through ongoing professional development, professional learning communities and mentoring, will form the foundation of this new pedagogy. The next step is to combine all of 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-centred pedagogy such as problem, inquiry and project-based learning, students will gain insights, understanding, increased capacities 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 learners to participate in more personalized and equitable learning opportunities,

through collaboration with their own communities and teams of learners separated by time and distance.

Implementation of a Pedagogy 2.0 approach will present challenges. Pedagogical innovation must equip learners with the skills and competencies to function in a digital culture, using media and informal pathways to enrich their learning and develop essential forms of literacy. Teachers will require meaningful support and time to exploit available resources and tools to create tailor-made learning experiences that are motivating and engaging, yet efficient, relevant and challenging. Traditional educational institutions must experiment with alternative structural formats and strategies for learning and teaching that respond more flexibly to individual learners' needs and changing labour market requirements. Assessment that focuses on student mastery of core academic content and the development of deeper learning skills (i.e. critical-thinking, problem-solving, collaboration, communication and metacognition) will be a high priority. Radical changes in teacher education will be essential.

What adaptations can be expected in education in the near future? Teachers will remain, but their roles will be extended as mentors, mediators and guides, facilitators, learning coordinators, assessors, and designers and compilers of learning tools. Testing will most likely continue, but assessment will become more individualized and formative. Learning will become more personalized and customized to reflect students' individual needs and interests, and informal learning opportunities will become recognized alternatives to traditional formal education. Transformed learning environments will encompass customized learning for each student, wider availability of diverse sources, and collaborative group learning (students will learn together as they work collaboratively on authentic, enquiry-oriented projects). Real-world experience will permeate learning activities. Most likely, schools will remain but classrooms will become more open to diverse learning experiences and instruction will likely move out into the community. Education providers will still offer face-to-face learning, but this will be supplemented by informal and virtual opportunities. Self-responsibility for learning will be essential and learners can expect to determine what their learning profile will look like. New tools for learning will be developed. Technology will support personalized learning processes and facilitate inclusion and equity. With the emergence of lifelong learning as the paradigm for the future, it is reasonable to expect that learning strategies and pedagogical approaches will undergo drastic changes and create new pathways for learners of all ages and abilities. The contribution of ICTs will allow for more learner-centred approaches, making personalized learning possible.

Some have expressed concern that without more solid curricula, more engaging pedagogy and more balanced assessments, the emphasis on twenty-first century skills will be superficial, sacrificing long-term gains for the appearance of short-term progress. These policies and practices are new, and effecting change from the current system to one with the capacities and structures needed for success will require professional, organizational and political action. Ministries of education worldwide must find better ways to balance their dual roles of regulatory oversight and capacity building and support. Change must take place not just inside classrooms, schools and central management, but also outside – in the culture, systems, policies and structures that shape and support what happens in the classroom.

What is next for schools? 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. Every nation can contribute to a global pool of expertise on how best to implement a twenty-first century education system. Nations can form alliances to find solutions to the 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. Regional inventories are needed to assess the state of policies and practices. 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 schools 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. 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.

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