Chapter 1: Curriculum in the 21ˢᵗ Century: Issues and challenges

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The curriculum in times of change

Curriculum usually refers to the content, objectives and organization of learning (Walker, 2003). Within curriculum the classsical question - what should be learnt and taught in schools and why – is the quest for the right balance between knowledge domains that are considered important, preparation for society and the personal development of students (Tyler, 1949) in today's societies. Curriculum therefore expresses simultaneously a legacy from the past and aspirations and anxieties about the future." (Williamson, 2013, p. 2). As such, it is an important instrument for change and development.

The curriculum expresses the educational policies, strategies, priorities and ideas that influence an education system. At its narrowest it specifies goals to be learned. More broadly it describes the values, content and aims used to justify the program of an educational system or an institution and all of the educational processes and learning that go on within it. (Williamson, 2013, p. 15-16). Curricula are defined at various levels, the state (macro) and school/ classroom (meso/micro) level being the most well known. Because of this, curriculum is not only a concern of governments, but also of schools and teachers. However, increasingly, due to globalization of society curriculum questions are also a concern of supranational levels, such as the Organisation of Economic Cooperation and Development (OECD) and the European Union (EU). And because of the attention for individualization in the post-modern society curriculum as personal learning trajectories are called for as well (van den Akker, 2003).

The knowledge society and developments in information and communication technologies in particular, are considered an argument for redefining the role and function of the curriculum as well as a means to facilitate the enactment of the curriculum in practice (cf. Voogt et al.,

2013). Surprisingly however, not much has been written about the curriculum in the digital age (Williamson, 2013). Rather, the main focus for the last decades, across different countries and cultures, has been on 'core curriculum content standards' (Binkley et al., 2012) and ways that curricula as political documents define educational models and practices (Alexander, 2001).

The important question for this chapter is "What might be (the future of) the curriculum in the digital age?" (cf. Williamson, 2013, p. 2). In this chapter we will explore this question by reviewing some of the key conceptual frameworks defining future competences that contemporary curricula may need to address, and discuss some of the main issues and challenges of curriculum and curriculum implementation within broader perspectives of schooling and learning in the 21st century.

Rationales guiding curriculum change in the 21st century

During the last two decades knowledge and creativity have reached higher economic and cultural value than manufacturing and economic restructuring. On a global scale there are changes in labor markets and the competences needed for future working life. According to Trilling and Fadel (2009, p. 3), the year 1991 marks a shift in American economy since it was the first year when society spent more economic funds on infrastructure and initiatives of the knowledge society than on infrastructure and initiatives of the industrial society. Because of this they argue changes in the needs of the future work force and thus the curriculum. Consequently, greater emphasis is put on education to teach socio-cognitive skills associated with knowledge work, with the production of ideas, knowledge, and information rather than material "stuff." (Williamson, 2013, p. 19).

Another important influence on curriculum in the transition to the 21st century has been the growth of the learning sciences since the 1990s (Sawyer, 2006). This field of research brought together key insights from research on 'how people learn' (Bransford et al., 2000). An important point was that there seemed to be a mismatch between what research could document about the ways people learn and the ways schools and curricula were organized around core content, age based classes, specific subject domains and test-oriented assessment procedures. These tensions also raised issues about how prepared our education system is for 21st century living and learning (Wells & Claxton, 2002; Sawyer, 2006; CERI, 2008). Related to designing for 21st century learning some key issues and principles are often emphasized

based on the influence from the learning sciences. Some of the key issues are: deep learning, collaborative problem solving, personalized/adaptive learning, computational thinking and critical thinking. (Pellegrino & Hilton, 2012; Voogt et al., 2013; Binkley et al., 2012).

Curricula for 21st century learning: What should be taught and learned in school

One of the key issues in many countries around the world is about how to prepare ourselves for future societal challenges and the role of education in providing the skills and competences needed. Social transformations are rapid, while educational processes including curriculum development is slow. This tension of timescale for change is a major challenge since the needs for new skills and competencies are already excisting in society, while the youngsters entering the school system now will be leaving this system and entering the labor market in 10-15 years. So how can we design for learning that is adjusted to the needs of societies in the 21st century? This question led to various initiatives to develop frameworks, which aimed to guide curriculum development for the 21st century. In many of these frameworks the concept of 'skills', as in 21st century skills (Griffin, McGaw & Care, 2012), and 'competences', as in 'key competences' (EU Commission, 2006) or life long learning competences (OECD, 2005), are being used predominantely and interchangeably. The following working definition for skills and competences will be used in this chapter: 'context-specific cognitive dispositions that are acquired by learning and needed to successfully cope with certain situations or tasks in specific domains' (Klieme, Hartig & Rauch, 2008, p. 9). Thus, the notion of competencies encompasses cognitive but also motivational, ethical, social, and behavioral components. It combines stable traits, learning outcomes (e.g., knowledge and skills), belief-value systems, habits, and other psychological features. (Rychen & Salganik, 2001, p. 8). Conceptually, however, the field is unclear, because frameworks describing 21st century competences use the same concepts in different ways, and sometimes use different concepts for the same phenomena.

The conceptual discussions about what skills are needed in the 21st century, and why, point back to OECD's work with DeSeCo (the Definition and Selection of Competencies) during the end of the 1990s and the beginning of the 2000s, which has become important for curriculum development including the role of technology during the last decade. DeSeCo's work was linked to the PISA study by the OECD in 1997. The strategy was that the PISA study would test and compare students' knowledges and skills within defined subject

domains in schools across different countries, while DeSeCo would address a broader set of competences related to; "What competencies do we need for a successful life and a well-functioning society?" (OECD, 2005, p.3), and "knowledge and skills related to outcomes of education in a broad sense" (Salganik, Rychen, Moser & Konstant, 1999, p. 13).

These questions are further elaborated in key curriculum documents during the 2000s. Based on search in the international databases ERIC and Google Scholar we have identified four internationally published meta-reviews as relevant for our discussion in this article. These meta-reviews are: Dede, 2010; Binkley et al., 2012; Voogt & Roblin, 2012; and Kereluik, Mishra, Fahnoe & Terry, 2013. Together these meta-reviews provide a systematic overview of the key concepts and international initiatives within this field. All together they cover 28 different frameworks from different parts of the world, about future competence needs and curriculum changes and numerous research articles. We will give a short presentation of each meta-review.

i) Dede (2010): Comparing Frameworks for 21st Century Skills (Bellanca & Brandt, 2010)
This meta-review was initiated by the American organization 'Partnership for 21st century skills' (P21). The aim of this meta-review was to discuss the concept '21st century skills' and explore differences and similarities between different frameworks. This meta-review is based on eight frameworks, where four of them explicitly deal with 21st century skills, while the four others deal more with information- and communication technologies specifically. The framework developed by the 'Partnership for 21st century skills' is defined as the most detailed and broadest in scope. Dede emphasizes collaboration, increasingly done through digital media, and the ability to rapidly filter huge amounts of incoming data, extracting information valuable for decision making, as a "contextual" capability, to be important aspects of 21st century skills. Based on his review Dede defines five key competence areas. These are: Core subjects; 21st century content; Learning and thinking skills; ICT literacy; and Life skills. In comparison to other frameworks Dede emphasizes that core subjects and knowledge orientation is very important, particularly in relation to the need for deep learning.

Dede discusses several important issues and challenges in the way major frameworks for 21st century skills around 2010 were addressed. One important challenge is that the lack of professional development is a reason why 21st century skills are underemphasized in contemporary schooling, which is still relevant. Another matter he points out is the

overcrowded curriculum and that a major political challenge is to articulate what to deemphasize in order to make room for students to deeply master core 21st century skills. As a way of summary Dede mentions that the 21st century skills frameworks are generally consistent with each other in terms of what should be added to the curriculum. He discussed this as: "The stress on what may be underemphasized, because those skills are inconsistent with current classroom culture, highlights a substantial challenge to infusing these 21st century skills frameworks into educational practice and policy. At this point in history, the primary barriers to altering curricular, pedagogical, and assessment practices are not conceptual, technical or economic, but instead psychological, political, and cultural. We now have all the means necessary to move beyond teaching 20th century knowledge in order to prepare all students for a future quite different from the immediate past. Whether society has the professional commitment and public will to actualize such a vision remains to be seen." (Dede, 2010, p. 68) Dede makes an important contribution in his meta-review that has been followed up in later meta-studies and frameworks.

ii) Binkley, Erstad, Herman, Raizen, Ripley, Miller-Ricci & Rumble (2012): Defining Twenty-First Century Skills (Griffin, McGaw & Care, 2012)

The background for this meta-review is the international project 'Assessment and Teaching of 21st century skills' (ATC21S). Twelve different frameworks, both international and national, on 21st century skills are presented and discussed. As a frame of reference the text outlines some tensions in the transformations our societies are going through, especially the impact of new technologies. This relates partly to changes in working life, with increased automatisation and robotics, and partly to changes in the everyday lives of young people growing up in a rapidly changing media culture. They write: "No longer can students look forward to middle class success in the conduct of manual labor or use of routine skills – work that can be accomplished by machines. Rather, whether a technician or a professional person, success lies in being able to communicate, share, and use information to solve complex problems, in being able to adapt and innovate in response to new demands and changing circumstances, in being able to marshal and expand the power of technology to create new knowledge, and in expanding human capacity and productivity." (Binkely et al., 2012, p.17) The important input from this meta-review is the definition of key concepts and the operationalization of what each implies for pedagogical practice. They group and define the key concepts as:

Ways of Thinking: 1. Creativity and innovation; 2. Critical thinking, problem solving, decision making; 3. Learning to learn, metacognition;

Ways of Working: 4. Communication; 5. Collaboration (teamwork);

Tools for Working: 6. Information literacy; 7. ICT literacy;

Living in the World: 8. Citizenship – local and global; 9. Life and career; 10. Personal and social responsibility – including cultural awareness and competence.

Each of these concepts are then linked to specific knowledge, skills, attitudes, values, and ethics, in what has been defined as the KSAVE-model. Since each of the competences are specified and operationalized they provide a good foundation for measuring and evaluation of these competence areas related to both research and practice. Based on this model the authors argue that: "New conceptions of educational standards and assessment … are a key strategy for accomplishing the necessary transformation. Such standards and assessment can both focus attention on necessary capacities and provide data to leverage and evaluate system change. Technology too serves as both a driver and lever for the transformation." (Binkley et al., 2012, p.18) And the assessment system as a key part of the curriculum, is defined as the most important element in making the transformations needed.

iii) Voogt & Pareja Roblin (2010, 2012): A comparative analysis of international frameworks for 21st century competences: Implications for national curriculum policies, 'Journal of Curriculum Studies.'

This meta-review of conceptual frameworks about 21st century skills compared underlying rationales and goals, definitions of 21st century competences, and the recommended strategies for the implementation and assessment of these skills in educational practice. Voogt and Pareja Roblin included five frameworks, namely: Partnership for 21st century skills (P21), En Gauge, Assessment and Teaching of 21st Century Skills (ATC21S), National Educational Technology Standards (NETS/ISTE), and the National Assessment of Educational Progress (NAEP). In addition three international studies were examined to analyse how supranational organisations (Key Competences - EU, DeSeCo - OECD) and UNESCO) deal with 21st century competences.

In the review 32 documents were analyzed, mainly working papers, international standards for ICT competences and reports from international studies. The results of the analysis were discussed in an expert meeting with the purpose of identifying key issues across frameworks, and come up with strategies and recommendations on how to support the implementation of 21st century skills (Voogt & Pareja Roblin, 2010). Travers and Westbury's framework (1989) of the intended, implemented and attained curriculum was used to identify differences between frameworks (horizontal consistency) and alignment between intentions and realizations (vertical concisistency). The findings indicate a large extent of alignment between the frameworks about what 21st century competences are and why they are important (horizontal consistency), but intentions and practice seemed still far apart, indicating lack of vertical consistency. The study led to several recommendations to support the implementation of 21st century competences curricula:

- To be able to design learning trajectories that support the acquisition of 21st century competences operational definitions – in terms of knowledge, skills, attitudes and values - of 21st century skills are needed as well as indications of what can and should be attained by students of different ages and across educational levels.

- Opportunities for learning 21st century competencies in core subjects need to be indentified. In addition interdisciplinary themes, to be addressed within and across subjects, may help to make the connections between the 21st century competencies stronger. Because the interdisciplinary themes are dynamic and in continuous change, they may reflect contemporary societal issues and can foster learning that is adjusted to the needs of the current society.

- To assure learning about and learning with information and communication technologies digital literacy competencies should be embedded in the curriculum.

- 21st century competences are not only learned in schools, but also at the workplace and in informal learning settings ourside the school. To support the learning of 21st century competences strategies to closely link what is learned in and outside the school should be developed.

- Simultaneously with the development of curricula that include 21st century competences strategies need to be defined that facilitate the implmentationa and assessment of 21st century competences.

iv) Kereluik, Mishra, Fahnoe & Terry (2013): What Knowledge Is of Most Worth: Teacher

Knowledge for 21st Century Learning, 'Journal of Digital Learning in Teacher Education'

The main objective of this meta-review is to identify important areas and recommendations across different 21st century learning frameworks that can say something about types of knowledge that are emphasized. The authors go through 15 reports, books and articles and look at methods used in the different frameworks. In comparison to other meta-reviews this article offers a more critical review of the literature on 21st century knowledge frameworks, with a particular focus on what this means for teachers and teacher educators.

The title of the article alludes to the classical curriculum question of what knowledge is of greatest worth at a time of flux and change. The authors argue that seemingly disparate frameworks converge on three types of knowledge, as necessary for the 21st century: foundational, meta, and humanistic. Although 21st century frameworks are thought to advocate new types of knowledge, little has actually changed in the new century with respect to the overall goals of education. Despite this sense of continuity, significant changes related to how technologies change all three types of knowledge need to be conveyed.

As a summary they argue that: "Our analysis indicates that this seeming paradox of "nothing has changed" *and* "everything has changed" provides us a way forward. It suggests that, though the 21st century is different from previous times, it does not mean that teachers' core roles (to know, to act, and to value) have changed. So, in that sense, there is no disjuncture between what teachers have been doing as educators in the past and what we do today (and in the future). That being said, it also indicates, even as we hold onto these core ideas, that we have to continually shift and come up with newer ways of instantiating them. So, though the manner in which we represent knowledge and act upon it may change, the core idea of what we do as educators has not." (Kereluik et al., 2013, p. 133).

Looking across these four meta-reviews it is interesting that all emphasize three main categories of competences: foundational, meta and life. Digital competence, as we will discuss in more detail below, is defined as key for all competencies as well as an important competence area in itself. The main competencies across different frameworks are: collaboration, communication, ICT literacy, and social and/or cultural competencies including citizenship, as well as creativity, critical thinking and problem solving. The differences across frameworks are mainly about ways of categorizing these competencies,

and about the relationship between the more generic and transversal competencies and foundational knowledge and the core subjects.

A basic tension is the relation between 21st century competences with core knowledge domains, often related to the discussion whether "know-how" is nowadays more important than "know-what". The argument put forward is that most knowledge learned at school—as contained in the curriculum—is likely to become outdated very quickly in today's world (Williamson, 2013). Young (2008) opposes to this argument and advocates the necessity to 'bring knowledge back in' schools. He introduced the concept of powerful knowledge emphasizing the importance of disciplinary knowledge in the curriculum as opposed to everyday knowledge. He argues that powerful knowledge is needed to foster deep learning. Ar first sight these two positions seem incompatible, but McEneaney (2015) while showing how the Internet can be used for learning, offers a more subtle view when she argues that " in recognition of the existence, elaboration and wide accessibility of the Internet, curricula need to differentiate between comprehension and familiarity, with teacher-led support for querying and expert curation of virtual spaces as the surest connection to specialist communities and powerful knowledge for the next generation of learners " (p. 817).

New technologies in the curriculum

Moving from these broader meta-reviews of 21st century skills we now turn to more explicit issues of the role of new technologies in these recent curriculum developments. What is interesting is to look at the role of technology in the curriculum as learning with, through and about new technologies. Technology is considered key for realizing 21st century curricula.

First, technology as a social factor is embedded in the preconditions and arguments for new curriculum developments, as mentioned earlier in this article, since our societies are becoming more and more digital in all facets of social life.

Second, technology is defined as a tool that can support the acquisition and assessment of 21st century skills (Voogt & Pareja Roblin, 2010). What is important across the frameworks, referred to in the meta-studies above, is that technologies are not only linked to specific skills, but relate to all of them as an important skill in a technology-saturated society. For example, technological developments increase the need for skills in self-regulated learning

(Kereleuik et al., 2013). Also, this draws on research and development work on how different technologies can support knowledge work in different domains and strengthen different skills among students (e.g. Eseryel, Law, Ifenthaler, Ge, X. & Miller, 2014; Lee, Linn, Varma, Liu, 2010). In the 'Assessment and teaching of 21st skills' initiative (Griffin, McGaw & Care, 2012) one of the main focus areas was about how technologies are linked to assessment of such skills. The argument was that technology holds the potential of changing educational assessment, especially towards formative assessment methods, and thereby supporting development of important skills for the 21st century. More recently there has been a movements in many countries towards including issues of 'coding' and 'computational thinking' as part of curricula for schools (see also Yadav, Sands, Good and Lishinki in this Handbook).

Third, a factor of growing importance for curriculum development is the growth of a new skills area presented as 'digital literacy', 'ICT literacy' or 'digital competence'. In all the reviews referred to above this has become part of curricula in different countries. As a skill it has moved from the periphery of the curriculum, as part of media education programs and skills in programming software for computers, to the core of the skills agenda addressing 21st century challenges (Erstad, 2013). There are different definitions of such literacies or competencies, but most of them cover abilities to handle information in critical ways, to communicate/collaborate, and to create, as shown in this definition: "To be digitally literate is to have access to a broad range of practices and cultural resources that you are able to apply to digital tools. It is the ability to make and share meaning in different modes and formats; to create, collaborate and communicate effectively and to understand how and when digital technologies can best be used to support these processes." (Hague & Payton, 2010, p.1). Efforts have also been made to develop tests that could measure this skill and how it progresses among students, on both national and international levels, like the ICILS study (see also Ainley in this Handbook). In addition, digital citizenship, or what some countries term as 'digital bildung' (Erstad, 2013), has become increasingly important linked to democratic participation in social and cultural practices of importance for oneself and others, as well as ethical aspects of technology use (see also Law, Chow and Fu in this Handbook).

In a meta-study of digital competence initiatives (Ferrari, 2013; Ferrari, Brecko & Punie, 2014), covering fifteen frameworks, the common elements of digital competences were

defined as: "the set of knowledge, skills, attitudes (thus including abilities, strategies, values and awareness) that are required when using ICT and digital media to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socialising, consuming, and empowerment." (Ferrari, Brecko & Punie, 2014, p. 2). This study shows that the majority of frameworks on digital competence are based on skills development and on the ability to use a specific set of tools and/or applications. However, the recommendation is that the ability to use specific tools or applications is just one of the several competence areas that need to be developed by users in order to function in a digital environment. Further, this study concludes that: "It should, however, be said that the identification and description of competence areas is a first step towards the development of learning objectives. As the analysis in this report shows, different frameworks do not necessarily translate the same competence area into the same learning outcomes. As a matter of fact, a huge difference can be seen between cognitive approaches and application-oriented frameworks. Several frameworks of the latter type tend to apply operational skills to each area. We therefore suggest that, apart from the competence area "technical operations", competences should not be centred on a tooloriented perspective only." (ibid., p. 13)

Fourth, in order to better serve the diversity of students, technology can also be used to tailor the curriculum to individual learners' personal learning trajectories. A tailor-made curriculum may refer to different aspects of curriculum such as place, pace, level, and goals of learning. Technology is seen as indipensable to realize such personal learning trajectories. Bray and McKlaskey (2013) distinguish between three different forms of a tailor -made curriculum. Individualized learning trajectories refer to a curriculum in which learners can learn in their own pace using adaptive technology applications. Differentiated learning trajectories point to matching instruction to pupils' learning needs. With technology it is easy to provide students with scaffolds that support the way students learn (e.g. Devolder, van Braak & Tondeur, 2012). Personalized learning trajectories relate to a curriculum that is tailored to students preferences and interests. The virtual high school (Roblyer, 2008) is an example as it offers students opportunities to choose their own curriculum components on top or instead of regular education. However, far-reaching forms of individualization of the curriculum the may be contrary to another important function of curriculum, viz. the need to prepare all

students for living and contributing to a democratic and coherent society (Law et al. in this Handbook).

Implementation issues and change forces

Only a few frameworks explicitly deal with more practical issues related to its implementation and assessment. Those frameworks that do address such issues refer to three critical factors in the implementation of 21st century skills: 1. the integration in the curriculum, 2. the need for professional development, and 3. the involvement of stakeholders from various sectors. In addition, the adoption of new assessment models in line with the cross curricular and complex nature of 21st century skills is regarded as crucial to ensure the implementation of these skills.

A critical factor is how curricula get implemented within education systems and the implications they have on educational practices. Kereluik et al. (2013) state that: "The introduction of digital technologies has changed the methods and techniques of acquiring, representing, and manipulating knowledge in almost all disciplines, from mathematics to music, astronomy, and archeology." (2013, p. 132). In their meta-review Voogt & Roblin (2012) emphasize that "most frameworks recommend integrating 21st century competences across the curriculum due to its complex and cross-disciplinary nature" (2012, p. 310) The point is that all frameworks demand changes in the curriculum, both in ways of restructuring the curriculum, new teaching methods to provide for the growth of such skills and assessment procedures.

Law (2009) found, in data from the international Second Information Technology in Education Study, that although many teachers reported to have curriculum goals that were in favour of 21st century competences, they did not apply them in classroom practice. This finding aligns with findings of Voogt and Pelgrum (2005) who studied international case studies of innovative pedagogogical practices using technology in schools and found that only a minority of schools had adopted a curriculum that facilitated students' acquisition of 21st century competences. These schools had restructured their school to realize the curriculum. Using technology was essential in the new structure and had become a routine for teachers and students. As we know from research on innovative practices using technologies in schools there are challenges in most countries of scaling up from single schools and classes to whole education systems (Kozma, 2003; Dede, Honan & Peters, 2005). The introduction

of frameworks on 21st century skills and key competences might help to facilitate scaling of 21st century learning in schools. Curricula that are developed now are more specific in the way technologies are embedded both in general ways as pre-conditions and levers for change and as new conditions for knowledge work among students and teachers. The challenges of implementing new frameworks and curricula in educational practices include;

- Access to and availability of different technologies in schools, which is still lacking in many countries.
- Way to prevent curriculum overload to be able to give more space to the learning of 21st century competencies (Voogt, Nieveen & Klöpping, 2017).
- Ways in which the new frameworks are presented as new sets of skills , while many of them are also known from former curricula, but redefined in the context of 21st century challenges (Dede, 2010; Kereluik et al., 2013).

The second issue concerns the role of teachers and their professional development. The key role of teachers in the implementation of curriculum is widely documented in research (Fullan, 2007; Liebermann & Pointer Mace, 2008). In many ways the 21st century competences pose pedagogical challenges for teachers – in their own abilities in these skills, in using various methods with students, understandings of subject content and interdisciplinary content orientation, develop technology-enhanced learning environments and ways of using a variety of assessment tools. There are similar challenges for teacher education institutions in developing professionalism around such skills and competences for pre-service teachers (Voogt & Pareja Roblin, 2012).

The third issue is related to the involvement of stakeholders in the decision making process of curricula for our current societies. This points to the complexity of the curriculum design process, or as Karseth and Sivesind (2010) state "curriculum is about meaning-making and negotiation among different actors in different positions" (p. 114). Stakeholders from the public, educational and private sectors want to have a say about the curriculum and exert their influence on what is being taught in schools. In order to monitor the process of meaning making and negotiation , Eickelmann & Zaka (2013) advocate an ecological approach to guide change processes, including curriculum, in educational systems in which actors in- and outside the system are recognized and co-design. Increasingly technology plays its role in the process of meaning making and negotiation about new curricula. Either planned, with the intention to share, be transparent and offer ample opportunities for active involvement

(Nieveen, Fisser, Muller & Voogt, 2014) or unplanned in which proponents and opponents of change actively discuss and influence the decision making process through applications such as Twitter (Supovitz, Daly & Del Fresno, 2015).

Several studies have shown that assessment is still one of the weakest points in many country's efforts to integrate 21st century competences in the school curricula (Ananiadou & Claro, 2009; Gordon et al., 2009)- Gordon et al. (2009) identified four different approaches to the assessment of key competences across 27 Member States from the European Union: (a) assessment of cross-curricular competences explicitly, (b) assessment of cross-curricular competences implicitly, (c) assessment of subject-specific competences, and (d) assessment of knowledge rather than competence. While the first two approaches show some progress in the assessment of 21st century competences, the other two were more common across most countries participating in the study, revealing that the need to assess these competences is not yet fully acknowledged in many countries. (Voogt & Roblin, 2012, p. 315)

Towards 21st century curricula: Perspectives

In a recent project the implementation of the European eight key competences were studied. The 'Key Competence Network on School Education' (KeyCoNet, 2012 – 2014)[i], organized by European Schoolnet, was a European policy network focusing on identifying and analyzing initiatives on the implementation of key competences in primary and secondary school education. It was a network of more than 100 members from 30 countries gathering together Ministries of Education/related agencies, universities/research institutes, European organizations, and practice related partners. The aim was "to analyse and map emergent strategies in implementing key competences in education across Europe, and to develop recommendations to strengthen policy and practice in different country contexts." (Looney & Michel, 2014, p. 4). This was done by different excersises such as case studies from different countries, transversal analysis of the keyconet case studies, mapping of initiatives, several literature reviews, country overviews and peer learning visit reports.

The conclusions from this project indicate that on the policy level "no country has made a complete shift toward competence-based education" (ibid., p. 14, but that many countries had made significant progress. The strategies used were on different levels and targeting different factors for change such as; legal frameworks for key competences, elaborating and

operationalizing competence-based curricular frameworks, new and innovative partnerships, dedicated funding, capacity building, and monitoring and evaluation of new initiatives. (Looney & Michel, 2014, p. 6) Further, the principles for effective school implementation and practice that emerged from the KeyCoNet case studies included; a central focus on teaching, learning and assessment, effective communication with stakeholders, engagement with the broader community, school plans that incorporate key competences and evaluation of progress. The theme of collaboration and engagement runs throughout these principles.

There are large differences between countries concerning the implementation of new frameworks within 21st century curricula and practices in schools. Concerning digital competencies specifically, there are a few countries where this has been addressed explicitly in national curricula. For example, in 2006, Norway was among the first countries in the world to define digital skills/competencies as one of five key competences travering all subjects and levels of compulsory schooling (the other four being, reading, writing, numeracy and oral skills/competencies). This has been implemented in all schools through strategies and plans following up on the curriculum. In 2016 this was followed up with national strategies on the future of Norwegian schools emphasizing deep learning and a few competencies following different international frameworks on 21st century skills and key competencies. Similar developments have recently been implemented in Finland, where the European framework of key competencies has been the foundation of a new national curriculum. Of special interest for our discussion in this article is the emphasis on multiliteracies and coding as traversal skills/competencies that all Finnish students have to engage with, as related to technological developments and what is defined as new competences emphasized in the national curriculum.

Currently the OECD2030 Future of Education and Skills study is working on a follow up of DeSeCo's work (see http://www.oecd.org/edu/school/education-2030.htm) together with more than 20 countries. The Learning Compass that is being developed has as its core mission that learners need to; " Being able to navigate in time and social space, to manage their lives in meaningful and responsible ways by influencing their living and working conditions" (see link above). In addition data are collected with the aim to analyze how countries cope in their curricula with the challenges of 21st century societies. The results of the analysis are expected by the end of 2018.

As a way of concluding about the perspectives on new curricula on 21st century skills and competencies the few studies that have been done show that many countries are in the process of changing their curricula to adapt to 21st century challenges. However, countries are nevertheless at very different stages in terms of integrating key competences and skills in curricula, engaging stakeholders, and in investing in teacher and school capacity.

The future of the curriculum in the digital age

In this chapter we have presented some perspectives on the curriculum in times of rapid change addressing 21st century challenges. On a fundamental level such evolving perspectives on education and the curriculum in the 21st century raise questions about the models we have been using and if they are suited to deal with the societal changes we are experiencing. In order to explore this further we need to deal with questions and issues like;

- ➢ How the integration of 21st century skills/competences in the curriculum changes the what and the how of what is being taught at schools?
- ➢ What the implementation of 21st century skills demands from teachers, students, administrators and educational leaders?
- ➢ How different educational contexts -beyond the formal education system-, support the acquisition of 21st century skills?
- ➢ How ICT can contribute to bridge formal and informal educational contexts?
- ➢ What specific types of support teachers and schools need to facilitate the acquisition of 21st century skills?
- ➢ To what extent are teachers and students prepared to adopt the new forms of assessments demanded by 21st century skills?
- ➢ We propose that these questions should be addressed in a public debate about the implementation of 21st century skills.

It is important to remember that the novelty of the set of 21st century competences is questionable. Competences such as problem-solving and critical thinking always have been associated with academic achievement and a characteristic of a desirable education. (Voogt & Roblin, 2012: 316) This point might actually help in working with teachers and teacher education institutions in convincing that this is not a matter of replacing the old with something completely new. Teachers have for a long time been dealing with several of the

key competencies mentioned in recent frameworks. What is new is the way they are contextualized and emphasized. For example, by stating that the way curricula have developed in most countries they have become overcrowded with content in all subject areas. Ways of deemphasizing and taking out content from the curriculum is a major political challenge. The same goes for changes in the assessment system that has to be done in order to assess these competences and skills that are not measurable by high-stakes tests the same way as regular cognitive skills of memorization and reproduction of content knowledge are. These aspects to the education system are important to reevaluate in order to make room for students to deeply master core 21st century understandings and performances. The demands are also related to the professional development of teachers to provide for the development of such competences in technology enhanced learning environments.

Still, there are important issues and challenges in these developments that pressure us to reflect on more fundamental transformations in moving from the 20th to the 21st century, especially when exploring the role of technological developments. As Chris Dede (2010) has pointed to, "current approaches to using technology in schooling largely reflect applying information and communication technologies as a means of increasing the effectiveness of traditional, 20th century instructional approaches." (2010, p. 8-9). The disruptive innovations that have happened in different sectors of society (see: http://www.claytonchristensen.com/key-concepts/) has not manifested itself within the regular school systems, as manifested in the disruptive expectations with MOOCs on higher education. This is still a major challenge in the ways ICT is implemented and used in most schools around the world.

Several of the recommendations stated in existing frameworks on 21st century competences express some of the descisions that need to be done, like; "defining goals and standards in national documents regulating the curriculum, embracing a powerful vision, encouraging collaboration between different sectors, building on already existing work and focusing on what is 'do-able', ensuring equitable access to education in present and future society, stimulating teacher collaboration, creating learning environments that enhance competence development, and aligning assessment methods and goals." (Voogt & Roblin, 2012, p. 312).

Further, related to curriculum development we might need to develop new metaphors to guide us in moving towards school systems framed by 21st century competencies. In his

writing on this, Williamson has developed what he terms 'centrifugal schooling' (2013, p. 7). By this he means:

> Centrifugal schooling expresses a vision of the future of education and learning that is decentered, distributed, and dispersed rather than narrowly centered, channeled, and canalized…. Recast as a response to these technological changes, the kind of prototypical curriculum of the future associated with centrifugal models of schooling may be imagined as a more "open source" process rather than a fixed product, as embodied in the "wiki" format of open authorship, collective editing, and collaborative production. Crudely caricatured, the traditional centered curriculum was a curriculum based on a standardized mass-production model of "reading" that positioned teachers as broadcasters and learners as receivers, as embodied by school textbooks. In comparison, the decentered curriculum is a post-standardized, mass-customizable "read-and-write" curriculum that repositions teachers and learners as peer-to-peer producers, participative authors, and active creators of curriculum content, processes, and outcomes in a distributed meshwork of joined-up learning. (2013, p. 7-8)

These methaphors of the curriculum as more open, network-based and process-oriented are interesting as a way of creating new models directly adjusted to the needs of learning in the 21st century.

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