Knowledge Management & E-Learning: An International Journal
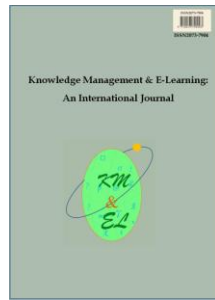
Evolution of the framework for 21st century competencies

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Abstract: This article presents the successive changes and evolution of the frameworks for 21st century competencies, since the appearance of the first conceptual models during the final years of the last century, and also it is a review of the competencies that are needed in the 21st century with a special focus on the Information and Communication Technologies (ICT) competencies. The included frameworks have been elaborated by diverse institutions such as international organizations, private consortia and also governments as a guideline for educational policies in elementary and secondary schools. Later, the frameworks are compared and analyzed according to a classification of the competencies into general categories, in order to visualize some trends and obtain some insights about the direction they are heading. Finally, it provides some suggestions for the conception of future frameworks.

Keywords: 21st century competencies; Framework; Information and communication technologies (ICT)

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1. Introduction

The new technologies are changing the way we work, live and interact. The present century is a period of intense transformation; then, in order to meet the needs of the society, it is essential to face significant new challenges at all levels. Additionally, the most formidable difficulty is not just the change per se, but the fast pace at which these changes are happening in several areas: economic, educational, political, social, scientific, and so forth. These changes require society as a whole to adapt and educate young people to become more knowledgeable, be able to communicate effectively and contribute to a sustainable development (Dunning, 2000; Kozma, 2008; Pigozzi, 2006).

In this regard, young people need to be prepared and internalize the idea of being lifelong learners. This is due in part to the exponential growth of information, where any content becomes obsolete with a few years and continuous updating is the only way to meet the demands of the 21st century (Pedró, 2006). Another critical requirement is to

use technology proficiently (Wang & Chang, 2012); initially, the digital divide was focused on the inequalities of access to information technologies and connectivity (OECD, 2001); but nowadays, the effective use of new technologies is considered a second digital divide (Claro, 2010). In particular, Information and Communication Technologies (ICT) have become critical enablers for innovation in fields such as industry, communications, science, and so on. Also, the introduction of ICT created many expectations about their possible implications for education; but, the key challenge has been their integration that still prevents teachers, schools and educational systems from taking advantage of the technology (Law, Pelgrum, & Plomp, 2008; Servon, 2002).

Moreover, changes in economic and political situation are driving the development of new economic indicators, such as the index of creativity and human potential that aims to measure the level of innovation and competitiveness of individuals, companies and nations (Bacon-Shone & Hui, 2010; Innocentive, 2011) as well as the Index for a Sustainable Society and the Gross National Happiness that aims to measure the well-being and mental health of the population (Van de Kerk & Manuel, 2008; Pennock & Ura, 2011). At the political level, the rise of the Arab Spring has brought to the fore the power of the social networks in the hands of young people, who are no more passive citizens, but rather have started to participate actively in world events (Stepanova, 2011). Today more than ever, education must prepare people to become global and conscious citizens, and also be ready for challenges that do not yet exist (Castells, 2010).

Taking this further, decision makers, teachers and parents are asking what core competencies students need to develop in the 21st century? Then, the focus will be on those capabilities that empower young learners and enable them to cope with the demands of the present century. Therefore, they should be creative, proactive, committed, critical thinkers and collaborative knowledge-builders (Bereiter, 2002). They also have to develop ICT competencies such as locating and selecting relevant information; producing and sharing using different forms of media, in other words becoming a multiliterate person (Borsheim, Merritt, & Reed, 2008; Cope & Kalantzis, 2000; OECD, 2005). However, a globalized world requires people able to interact in diverse socio-cultural contexts to create a harmonious society. Indeed, teachers should also reflect these capabilities and become role models for this young generation (UNESCO, 2011).

2. Frameworks for twenty-first century skills and competencies

First of all, although the term '*21st century skills*' might seem modern and recent, actually as Silva (2009) pointed out, the skills alluded to "are not new, just newly important" (p. 631). Vital capabilities such as critical thinking and problem solving have always been important; however nowadays, because of the emergent demands of knowledge-based economies, those capabilities are more crucial (Rotherham & Willingham, 2009; Sivagnanam, 2010). In relation to those capabilities, other organizations and scholars prefer to use the term *competency* [1] (Ministry of Education-

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[1] Sometimes the terms *competence* and *competency* are used interchangeably. However, Moore, Cheng, and Dainty (2002) have proposed some specific meanings in order to clarify them; *competence* means the ability in an area (what people do), while *competency* means the attitude and behavior supporting an area of work (how people do). Consequently, in this article, the term *competency* will be preferred, because it includes operational elements such as knowledge, skills and attitudes (Klett, 2010). Further, the term *competency* is more widely used in education field and several organizations (IEEE, 2008; OECD, 2005; UNESCO, 2011).

Singapore, 2010a; OECD, 2005; UNESCO, 2012), which makes reference to a complex demand of knowledge, skills and attitudes. In that sense, both terms will be used interchangeably in the present article.

During the last decade, many frameworks have been developed with the support of international organizations, governments, consulting firms, and so forth. These conceptual schemas have provided an approach to what could be considered the fundamental competencies needed in our present society. Although an exhaustive list of frameworks would be preferred, this article includes those frameworks that were elaborated having in mind the aim of developing capabilities in elementary and secondary school settings, from the perspective of the technological advances and their impact in the field of ICT in education.

3.   An initial framework

UNESCO's Delors (1996) Report prepared by the International Commission on Education for the Twenty-First Century could be considered some of the first frameworks that tried to look ahead to what kind of competencies will be needed in the coming century. At that time, four principles were outlined better known as the four pillars of education: a) *Learning to know* that could also mean learning to learn, b) *Learning to do*, this pillar pointed out not only occupational capacities, but also the ability to deal with diverse situations, c) L*earning to live together or learning to live with others* that promotes mutual understanding, acceptance and respect of the plurality of human beings, and d) *Learning to be* that develops autonomy and personal responsibility.

However, at the beginning of the 21st century, emergent economies that were growing faster, especially in Asia, and were moving further towards a knowledge-based economy needed to support the development of new competencies, in order to prepare students for managing the complex tasks inherent in this new world (Asian Development Bank, 2007). Then, the initial framework provided by the UNESCO's Delors Report had to give way to other frameworks that included the dynamic social, technological and economic change that started happening since the last years of the twentieth century.

In the following, the frameworks are presented in chronological order to understand their evolution across the time, and they are outlined in tables to provide a more clear analysis and comparison of their proposals.

3.1. DeSeCo/OECD. 1997-2003

In 1997, the Organization for Economic Cooperation and Development (OECD) set up a four-year program entitled *Definition and Selection of Competencies: Theoretical and conceptual foundations* (DeSeCo) to develop an international consensus on a set of competencies essential for the 21st century. The project was led by Switzerland and involved multidisciplinary experts who worked with stakeholders and policy analysts. The final report was presented by Rychen and Salganik (2003) who pointed out that one of the goals of the DeSeCo project was to establish a common understanding of key competencies. Based on the various lists of competencies from different countries' reports, DeSeCo identified three broad categories: using tools interactively, interacting in heterogeneous groups and acting autonomously; each of the three categories contains a number of competencies that are summarized in Table 1.

Table 1
Key competencies identified by the DeSeCo project/OECD

CATEGORY	COMPETENCIES
Using tools interactively	-Use language, symbols and text interactively -Use knowledge and information interactively -Use technology interactively
Interacting in heterogeneous groups	-Relate well to others -Cooperate -Manage and resolve conflicts
Acting autonomously	-Act within the big picture, which means to understand and consider the wider context of their decisions and actions. -Form and conduct life plans and personal projects -Assert rights, interests, limits and needs

Note. From *The definition and selection of key competencie*s. Executive summary (p. 10-15), by OECD, 2005, Paris, France: OECD.

3.2. National educational technology standards for students (NETS•S/ISTE), 1998-2007

The International Society for Technology in Education (ISTE) (www.iste.org) is an association of educators and leaders in education that developed the National Educational Technology Standards for Students (NETS•S). The standards were released in 1998; then later they were revised in 2007 and finally made available to the educational community at the National Educational Computing Conference (NECC) in 2008. The conceptual schema includes six Performance Indicators that are the guidelines to learn and live in a digital society, as it is shown in Table 2 (ISTE, 2007).

Table 2
National educational technology standards for students (NETS•S/ISTE), 2 edition. 2007

PERFORMANCE INDICATORS	DESCRIPTION
Creativity and innovation	Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.
Communication and collaboration	Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
Research and information fluency	Students apply digital tools to gather, evaluate and use information.
Critical thinking, problem solving and decision making	Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
Digital citizenship	Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
Technology operations and concepts	Students demonstrate a sound understanding of technology concepts, systems, and operations.

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3.3. NCREL and Metiri Group, 2003

Another framework was developed by the North Central Regional Educational Laboratory (NCREL) a federally funded American laboratory that collaborated with the Metiri Group, an American consulting services provider. They published together a research report called *enGauge21st Century Skills: Literacy in the Digital Age* (NCREL & Metiri Group, 2003), where a framework of skills for the 21st century was presented, and it was explained how these skills will contribute to the success of students in the knowledge society. The skills were described in great detail with their essential attributes. In addition, the study identified four levels of progress for each of these attributes: novice, basic, proficient and advanced. The goal was to provide a set of explicit criteria that could be used as indicators of the students' progress. The clusters and their respective skills are shown in the following table (see Table 3).

Table 3
21st century learning by NCREL and Metiri Group

CLUSTERS	SKILLS
Digital-Literacy	-Technical literacy, -Multicultural literacy -Global awareness
Inventive Thinking	-Adaptability, managing complexity and self-direction -Creativity, curiosity and risk taking -Higher-order thinking and sound reasoning
Effective Communication	-Collaboration, teaming and interpersonal skills -Personal, social and civic responsibility -Interactive communication
High Productivity	-Prioritizing, planning and managing for results -Effective use of real-world tools -Ability to produce relevant, high-quality products

Note. From *enGauge 21st century skills: Literacy in the digital age.* (p. 12), by NCREL & Metiri Group, 2003, Chicago, IL: NCREL.

3.4. Key competencies in Europe - European Community, 2006

The Council and the European Parliament after five years of work by experts and government representatives developed a framework that included some competencies for lifelong learning (European Community, 2006) and provided a recommendation of eight key competencies shown in Table 4.

Table 4
Elements framework of key competencies for lifelong learning

COMPETENCY	DESCRIPTION
Communication in the mother tongue	Ability related to the acquisition of the mother tongue.

Communication in foreign languages	Knowledge of vocabulary, grammar, social conventions of a foreign language and culture.
Mathematical competency and basic competencies in science and technology	Sound knowledge of numbers, measures, basic operations, as well as understanding some mathematical terms and concepts. For science and technology, it is essential to know the basic principles of the natural world, scientific principles and methods, technological products and processes.
Digital competency	Understanding and knowledge of ICT in everyday contexts, digital communication and awareness of the validity and reliability of information available on the internet, as well as the ability to search, collect, process and use information in a critical and systematic way.
Learning to learn	To know their own preferred learning strategies, as well as the strengths and weaknesses of their skills and qualifications.
Social and civic competencies	Understanding of how to ensure optimum physical and mental health, including their family and community. Civic competency is based on knowledge of the concepts of democracy, justice, equality, citizenship, and civil rights.
Sense of initiative and entrepreneurship	Ability to identify available opportunities for personal, professional and business activities, understanding of the workings of the economy; also, the opportunities and challenges faced by an employer or organization.
Cultural awareness and expression	Awareness of the local, national and European cultural heritage and their place in the world.

Note. From "Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning" by European Community, 2006, *Official Journal of the European Union,* L394, p.13-18.

3.5. Partnership for 21st century skills, 2007

This American organization founded in 2002 (http://www.p21.org), composed of business leaders, consultants and educators, has proposed a particular framework that has three elements as follows: a) *Learning and innovation skills* whose competencies are: Creativity and innovation, Critical thinking and problem solving, Communication and collaboration; b) *Information, media and technology skills* that includes the following competencies: Information literacy, Media literacy, ICT (Information, Communication and Technology) literacy; and c) *Life and career skills* has competencies such as: Flexibility and adaptability, Initiative and self-direction, Social and cross-cultural skills, Productivity and accountability, Leadership and responsibility. Also, this framework includes two general themes: *Core subjects and 21st century themes*: English, reading or language arts, World languages, Arts, Mathematics, Economics, Science, Geography,

History, Government and Civics; and *21ˢᵗ century interdisciplinary themes*: Global awareness, Civic literacy, Health literacy, Environmental literacy, Financial, economic, business and entrepreneurial literacy (Partnership for 21st Century Skills, 2009).

The proposal has been developed since 2007 and had many successive improvements until its last schema. It does not just include skills, but also has a support system that embodies standards, assessment, curriculum, instruction, professional development and learning environments, which provide a better consistency to the whole framework.

3.6. Framework based on the organization for economic cooperation and development countries, 2009

Another framework was developed by Ananiadou and Claro (2009) who have produced a document that discusses the importance and relevance of 21st century skills and competencies for the new millennium learners. In that document, after analyzing the teaching and assessment practices of OECD countries, they conceptualized and developed a framework based on the competencies and skills found in those countries regarding the role of ICT in education. Table 5 presents a summary of this framework organized by dimensions and sub-dimensions.

Table 5
21st century skills and competencies for new millennium learners in OECD countries

DIMENSION	SUB-DIMENSIONS
Information dimension	-Information as source: searching, selecting, evaluating and organizing information -Information as product: the restructuring and modeling of information and the development of own ideas(knowledge)
Communication dimension	-Effective communication -Collaboration and virtual interaction
Ethics and social impact dimension	-Social responsibility -Social impact

Note. From *21st century skills and competences for new millennium learners in OECD countries.* OECD Education Working Papers, No. 41, (pp. 8-11), by K. Ananiadou & M. Claro, 2009, OECD Publishing.

3.7. Summarized framework by Trilling and Fadel, 2009

The framework build by Trilling and Fadel (2009) is based on the Partnership for 21st Century Skills' schema. They condensed the eleven competencies into three skill sets and 12 components (see Table 6). The set of Learning and innovation skills includes the more common skills. The set of Life and career skills is related to the socio-economic context. Finally, the set of Digital literacies includes three main components: information, media and technology literacy.

Just for clarification, it will be particularly interesting to review the definitions of the components of the Digital literacies set, for example, *Information literacy* has been defined by the American Library Association (1989) as the ability "to recognize when information is needed and have the ability to locate, evaluate, and use effectively the

needed information". *Media literacy* is the ability to "access, analyze, evaluate, and produce both print and electronic media" (Aufderheide, 1993). *Technology literacy* might be defined as "using digital technology, communication tools, and/or networks to access, manage, integrate, evaluate, and create information" (International ICT Literacy Panel, 2002).

Table 6
Capabilities for each set of 21st century skills

3 skill sets	Learning and innovation	Digital literacies	Life and career skills
12 components	-Critical thinking and problem solving -Communication -Collaboration -Creativity and innovation	-Information literacy -Media literacy -Technology literacy	-Flexibility and adaptability -Imitative and self-direction -Social and cross-cultural interaction -Productivity and accountability -Leadership and responsibility

Note. From *21st century skills: learning for life in our times.* (p.176), by B. Trilling & C. Fadel, 2009, San Francisco, CA: Jossey-Bass.

3.8. Assessment and teaching of 21st century skills (ATCS), 2010

The Assessment and Teaching of 21st Century Skills (ATCS) is an international research effort headquartered at the University of Melbourne and sponsored by Cisco, Intel and Microsoft (http://www.atc21s.org). It encourages the adoption of 21st century skills and also has proposed different ways of assessing them. The researchers belonging to this organization have developed a framework composed of four categories and ten competencies which is shown in Table 7. It also includes a core curriculum (Binkley et al., 2010).

Table 7
21st century skills framework according to the ATCS project

CATEGORIES	TEN COMPETENCIES	CORE CURRICULUM
Ways of thinking	1. Creativity and innovation 2. Critical thinking, problem solving, decision making 3. Learning to learn, metacognition	1. Home language 2.Mathematics
Ways of working	4. Communication 5. Collaboration (teamwork)	3. Science
Tools for working	6. Information literacy 7. ICT literacy	4. History
Living in the world	8. Citizenship – local and global 9. Life and career 10. Personal & social responsibility – including cultural awareness and competence	5. Arts or Humanities

Note. From "Draft White. Paper 1, Defining 21st Century Skills," by M. Binkley et al., 2010, Assessment and Teaching of 21st Century Skills (ATCS), pp. 1-2.

3.9. 21st-century competencies – Hewlett Packard, 2010

Finegold and Notabartolo (2010) have also written a report sponsored by the Hewlett Foundation; they have summarized and listed 15 competencies as components of five broad categories, as shown in Table 8.

Table 8
21st century competencies framework – Hewlett Foundation

CATEGORIES	COMPONENTS
Analytic skills	-Critical thinking -Problem solving -Decision making -Research and inquiry
Interpersonal skills	-Communication -Collaboration -Leadership and responsibility
Ability to execute	-Initiative and self-direction -Productivity
Information processing	-Information literacy -Media literacy -Digital citizenship -ICT operations and concepts
Capacity for change	-Creativity / innovation -Adaptive learning / learning to learn -Flexibility

Note. From "21st century competencies and their impact: An interdisciplinary literature review," by D. Finegold & A. S. Notabartolo, 2010, p.7.
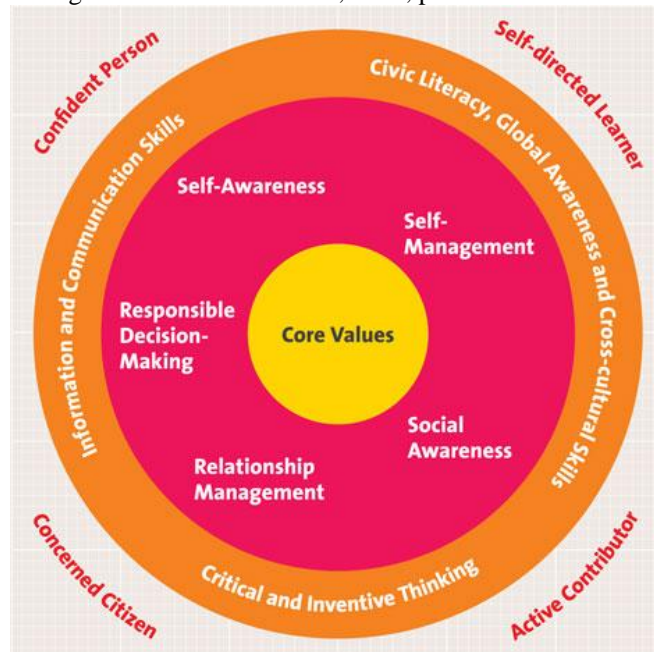

Fig. 1. Framework proposed by the Ministry of Education of Singapore (2010a)

3.10.   21st century competencies – Singapore, 2010

Finally, an interesting alternative framework was developed by the government of Singapore, through its Ministry of Education (2010a). This framework has been implemented in order to enhance Singaporean students' competencies "to thrive in a fast-changing and highly-connected world". Fig. 1 shows the schema proposed that has as a central element the core values that are followed by the social and emotional competencies. Also, Table 9 details the domain and components of the 21st century competencies. Perhaps the most important characteristic of this particular conceptual schema is its holistic approach, and as a whole it provides a well rounded education for young Singaporeans who are growing up in a demanding society.

Table 9
Domains and components of the emerging 21st century competencies – Ministry of Education of Singapore (2010b)

CORE VALUES	SOCIAL AND EMOTIONAL COMPETENCIES	DOMAINS	COMPONENTS
Respect	Self-awareness	**Civic literacy, global awareness and cross-cultural skills**	-Active community life -National and cultural identity -Global awareness -Socio-cultural sensitivity and awareness
Responsibility	Self-management		
Integrity	Social awareness		
Care	Relationship - management	**Critical and inventive thinking**	-Sound reasoning and decision-making -Reflective thinking -Curiosity and creativity -Managing complexities and ambiguities
Resilience			
Harmony	Responsible decision-making		
		Information and communication skills	-Openness -Management of information -Responsible use of information -Communicating effectively

Note. From "Elaboration of the MOE 21st century competencies" (electronic source), by Ministry of Education - Singapore, 2010.

Since one decade and a half ago, starting from the first framework presented by UNESCO's Delors (1996) Report that highlighted the competencies required to develop in the 21st century, several frameworks have arisen providing lists of key competencies and skills that young people should be educated with. Some of them were developed by international organizations in order to provide guidelines for educational policies; but interestingly other frameworks were elaborated by consortiums and private institutions where scholars and researchers provided, although empirically, some useful lists of essential skills. Finally, governments, such as Singapore, have also outlined those competencies that their society needs according to its particular context.

4.   Analysis of frameworks

After having introduced these diverse conceptual schemas, some questions are proposed in order to analyze them and get helpful insights about:

- What 21st century competencies have being included in the different frameworks?

- What are the similarities and differences between the frameworks according to the 21st century competencies included?

- What is the importance of ICT skills in relation to other competencies?

In order to make a comparison, the competencies from all frameworks were checked under common categories as shown in Table 10.

Table 10
Comparison among frameworks according to general categories

General categories Framework	Communication &	Citizenship & social	Information skills &	Digital literacies	Creativity & innovation	Critical thinking	Sociocultural sensitivity	Autonomy & leadership	Learning to learn &	Productivity	Entrepreneurship	Life & career	Math & Science
1. DeSeCo/OECD 1997-2003	✓	✓	✓	✓								✓	
2. NETS•S/ISTE 1998-2007	✓	✓	✓	✓	✓	✓							
3. NCREL & Metiri Group 2003	✓		✓	✓	✓				✓				
4. European Community 2006	✓	✓		✓			✓	✓	✓		✓		✓
5.& 6. P21, 2007 & Trilling and Fadel, 2009	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		
7. OECD countries 2009	✓	✓	✓										
8. ATCS 2010	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	
9. Hewlett Packard 2010	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
10. 21st Century Competencies Singapore, 2010	✓	✓	✓		✓	✓	✓						

The table was elaborated taking into account the competencies highlighted by the different frameworks and considering some general categories in order to classify the competencies inside a particular group. The categories were chosen considering the most common and important competencies even including some competencies such as Math and Science that were explicitly mentioned in one of the frameworks. Also, it should be mentioned that the frameworks corresponding to the Partnership for 21st Century Skills and its summarized version by Trilling and Fadel (2009) were considered as one, because they included the same competencies, although, the summarized version was more comprehensive and well organized in relation to digital literacies.

From the previous comparative table (see Table 10) some insights can be deduced, and at the same time some questions are raised for analysis.

First, the most frequently mentioned competency was communication and collaboration, which was followed closely by citizenship and social responsibility as well as information and research skills; then, with the inclusion of digital literacies all these four competencies compose the group of the competencies that are almost always considered in all the frameworks. A second group was formed by creativity and innovation as well as critical thinking and decision making; plus socio-cultural sensitivity and awareness, and finally autonomy and leadership. These capabilities are included with some frequency in the schemas. Finally, a third group includes learning to learn and metacognition, plus productivity, entrepreneurship, life and career, and last but not least math and science. In fact, a low frequency of appearance does not mean a particular competency is not important, but rather that it was less explicitly reflected.

Second, the evolution and changes of the framework across time show the tendency of moving from core competencies to a broader range where some competencies are mentioned explicitly to highlight more actual needs.

Third, it is interesting to note the widened participation of private consortiums in developing new schemas – although very similar, such as P21, ATCS and Hewlett Packard – when before the leading voice was held by international organizations that provided guidelines for educational policies. It could mean that the private sector is also concerned with the kind of preparation that young people should have in order to develop future careers and overcome the challenges offered by dynamic and ever changing environments.

Fourth, the importance of ICT skills and digital literacies has always been there since the beginning, although its pervasiveness has increased and become merged with other competencies, for example 'digital citizenship'; in other words due to its ubiquity it has become an essential characteristic that is found in the daily activities of the 21st century world.

Fifth, the Singaporean Ministry of Education gives a good example of how a government can develop a framework that fulfils the needs of its society. As in the case of the emergent country of Singapore the emphasis of its framework has been on social and cultural competencies that are particularly important in its present context.

5. Conclusions and suggestions

Although the list of frameworks chosen is not exhaustive, they were representative of the evolution of conceptual schemas in the past few decades, and help to visualize and draw some conclusions useful for subsequent developments and theorizations as well. Previously some researchers have also analyzed the frameworks for the 21st century skills, but from different approaches (Dede, 2010; Voogt & Roblin, 2010). The present article tries to provide some insights into the trends in this topic and increase the understanding of the key competencies that young people should cultivate. It also provides a reference for further work toward integration into technology-based systems that could enhance human development through innovative means.

It would be preferable to elaborate the frameworks based on a strong conceptualization that at the same time is congruent with the context; having in mind, first of all, the goals pursued by the particular institution, organization or country.

In order to build a sustainable framework, it should be done with co-participation of the society, for example in educational systems by including not only educational

authorities, but also parents, teachers as well as students, and all the people to whom the implementation will have an effect or impact. In that way, the framework developed will reflect the real needs and essential competencies required in a particular context.

In conclusion, all the frameworks give a useful guideline; they could be employed if they match the goals pursued by any educational organization or institution. However, the 21st century skills and competencies are quite an endeavour for any educational system. It involves not only a continuous change in decision-making, but also the society as a whole has to care about the future of children, and provide what is necessary to help them to achieve their own personal goals, empowering and nurturing them from their early years as autonomous citizens who will have the self-confidence to create their own future.

Acknowledgements

References

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

American Library Association. (1989). *Presidential committee on information literacy: Final report*. Chicago, IL: American Library Association.

Asian Development Bank. (2007). *Moving toward knowledge-based economies: Asian experiences*. Regional Sustainable Development Department, Asian Development Bank.

Aufderheide, P. (1993). *Media literacy: A report of the national leadership conference on media literacy*. Queenstown, MD: Aspen Institute.

Bacon-Shone, J. H., & Hui, D. (2010). Design and construction of the Hong Kong Creativity Index. In E. Villalba (Ed.), *Measuring Creativity* (pp.91–102). Luxembourg: Publications Office of the European Union.

Bereiter, C. (2002). *Education and mind in the knowledge age*. Mahwah, NJ: Lawrence Erlbaum Associates.

Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., & Rumble, M. (2010). *Draft White. Paper 1: Defining 21stCentury Skills*. Assessment and Teaching of 21st Century Skills (ATCS). Retrieved from http://atc21s.org/wp-content/uploads/2011/11/1-Defining-21st-Century-Skills.pdf.

Borsheim, C., Merritt, K., & Reed, D. (2008). Beyond technology for technology's sake: advancing multiliteracies in the twenty-first century. *The Clearing House, 82*(2), 87–90.

Castells, M. (2010). *The rise of the network society: The information age: Economy, society, and culture* (2nd ed.). Oxford, UK: Wiley-Blackwell.

Claro, M. (2010). *Impacto de las TIC en los aprendizajes de los estudiantes. Estado del arte. (ICT Impact in students' learning. State of Art)*. Comisión Económica para América Latina y el Caribe (CEPAL). United Nations.Santiago de Chile. Retrieved from http://www.eclac.org/publicaciones/xml/7/40947/dp-impacto-tics-aprendizaje.pdf.

Cope, B., & Kalantzis, M. (2000). *Multiliteracies: literacy learning and the design of social futures*. New York: Routledge.

Dede, C. (2010). Comparing frameworks for 21st Century Skills. In J. Bellanca & R. Brandt (Eds.), *21st Century Skills* (pp. 51–75). Bloomington, IN: Solution Tree Press.

Delors, J. (1996). *Learning: The treasure within*. UNESCO. Paris: UNESCO.

Dunning, J. H. (2000). Regions, globalization, and the knowledge economy: Issues stated. In J. H. Dunning (Ed.), *Regions, Globalization, and the Knowledge-Based Economy*. Oxford: Oxford University Press.

European Community. (2006). Recommendation of the European parliament and of the council of 18 December 2006 on key competences for lifelong learning (2006/962/EC). *Official Journal of the European Union, L394*, 10–18.

Finegold, D., & Notabartolo, A. S. (2010). *21st century competencies and their impact: An interdisciplinary literature review*. Retrieved from http://www.hewlett.org/uploads/21st_Century_Competencies_Impact.pdf.

IEEE (2008). *IEEE standard for learning technology—Data model for reusable competency definitions*. IEEE Std 1484.20.1™-2007.

Innocentive. (2011). *Human potential index challenge*. Retrieved from http://www.innocentive.com/for-solvers/winning-solutions/human-potential-index-challenge.

International ICT Literacy Panel. (2002). *Digital transformation: A framework for ICT literacy*. Princeton, NJ: Educational Testing Services.

International Society for Technology in Education (ISTE). (2007). *Iste® nets•s Advancing digital age learning*. Retrieved from http://www.iste.org/docs/pdfs/nets-s-standards.pdf.

Klett, F. (2010). The design of a sustainable competency-based human resources management: A holistic approach. *Knowledge Management & E-Learning, 2*(3), 278–292.

Kozma, R. B. (2008). Comparative analyses of policies for ICT in education. In J. Voogt & G. Knezek (Eds.), *International Handbook of Information Technology in Primary and Secondary Education* (pp. 1083–1096). Berlin: Springer Science.

Law, N., Pelgrum, W. J., & Plomp, T. (2008). *Pedagogy and ICT use in schools around the world findings from the IEA SITES 2006 Study*. Hong Kong, China: Comparative Education Research Centre.

Ministry of Education - Singapore (2010a). *MOE to enhance learning of 21st century competencies and strengthen art, music and physical education*. Press releases. Retrieved from http://www.moe.gov.sg/media/press/2010/03/moe-to-enhance-learning-of-21s.php.

Ministry of Education - Singapore (2010b). *Elaboration of the MOE 21st century competencies*. Retrieved from http://www.moe.gov.sg/media/press/files/2010/03/21st-century-competencies-annex-a-to-c.pdf.

Moore, D. R., Cheng, M., & Dainty, A. R. J. (2002). Competence, competency and competencies: Performance assessment in organisations. *Work Study, 51*(6), 314–319.

NCREL & Metiri Group. (2003). *enGauge 21st century skills: Literacy in the digital age*. Chicago, IL: NCREL. Retrieved from http://pict.sdsu.edu/engauge21st.pdf.

OECD. (2001). *Understanding the digital divide*. Paris: OECD. Retrieved from http://www.oecd-ilibrary.org/content/workingpaper/236405667766.

OECD. (2005). *The definition and selection of key competencies: Executive summary*. Paris, France: OECD. Retrieved from http://www.oecd.org/pisa/35070367.pdf.

Partnership for 21st Century Skills (P21). (2009). *P21 framework definitions*. Retrieved from http://p21.org/storage/documents/P21_Framework_Definitions.pdf.

Pedró, F. (2006) *The new millennium learners: Challenging our views on ICT and*

learning. OECD-CERI. Retrieved from http://www.oecd.org/edu/ceri/38358359.pdf.

Pennock, M., & Ura, K. (2011). Gross national happiness as a framework for health impact assessment. *Environmental Impact Assessment Review, 31*(1), 61–65. doi: 10.1016/j.eiar.2010.04.003

Pigozzi, M. J. (2006). A UNESCO view of global citizenship education. *Educational Review, 58*(1), 1–4.

Rotherham, A., & Willingham, D. (2009). 21st Century skills: The challenges ahead. *Educational Leadership, 67*(1), 16–21.

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

Servon, L. J. (2002). *Bridging the digital divide: Technology, community and public policy*. Oxford, UK: Blackwell.

Stepanova, E. (2011). *The role of information communication technologies in the "Arab Spring": Implications beyond the region*. PONARS Eurasia Policy Memo no. 159. Retrieved from http://www.gwu.edu/~ieresgwu/assets/docs/ponars/pepm_159.pdf.

Silva, E. (2009). Measuring skills for 21st-century learning. *The Phi Delta Kappan, 90*(9), 630–634.

Sivagnanam, L. (2010). Carl Bereiter, 21st century skills and knowledge. Retrieved from http://www.faculty.utoronto.ca/arc/college/Programarchives/Carl_Bereiter__21st_Century_Skills_and_Knowledge.htm.

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

UNESCO. (2011). *UNESCO ICT competency framework for teachers*. Retrieved from http://unesdoc.unesco.org/images/0021/002134/213475e.pdf.

UNESCO. (2012). *Competencies*. Education. Retrieved from http://www.unesco.org/new/en/education/themes/strengthening-education-systems/quality-framework/desired-outcomes/competencies/.

Van de Kerk, G., & Manuel, A. R. (2008). A comprehensive index for a sustainable society: The SSI - The sustainable society index. *Ecological Economics, 66*(2-3), 228–242. doi:10.1016/j.ecolecon.2008.01.029

Voogt, J., & Roblin, N. P. (2010). *21st century skills– Discussion paper.* Enschede, The Netherlands: University of Twente. Retrieved from http://www.internationalsymposiumoneducationalreform.com/storage/21st%20Century%20Skills.pdf.

Wang, M., & Chang, C.-C. (2012). Editorial: Technology in higher education and human performance. *Knowledge Management & E-Learning, 4*(3), 231–235.