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Innovating Learning: Key Elements for Developing Creative Classrooms in Europe

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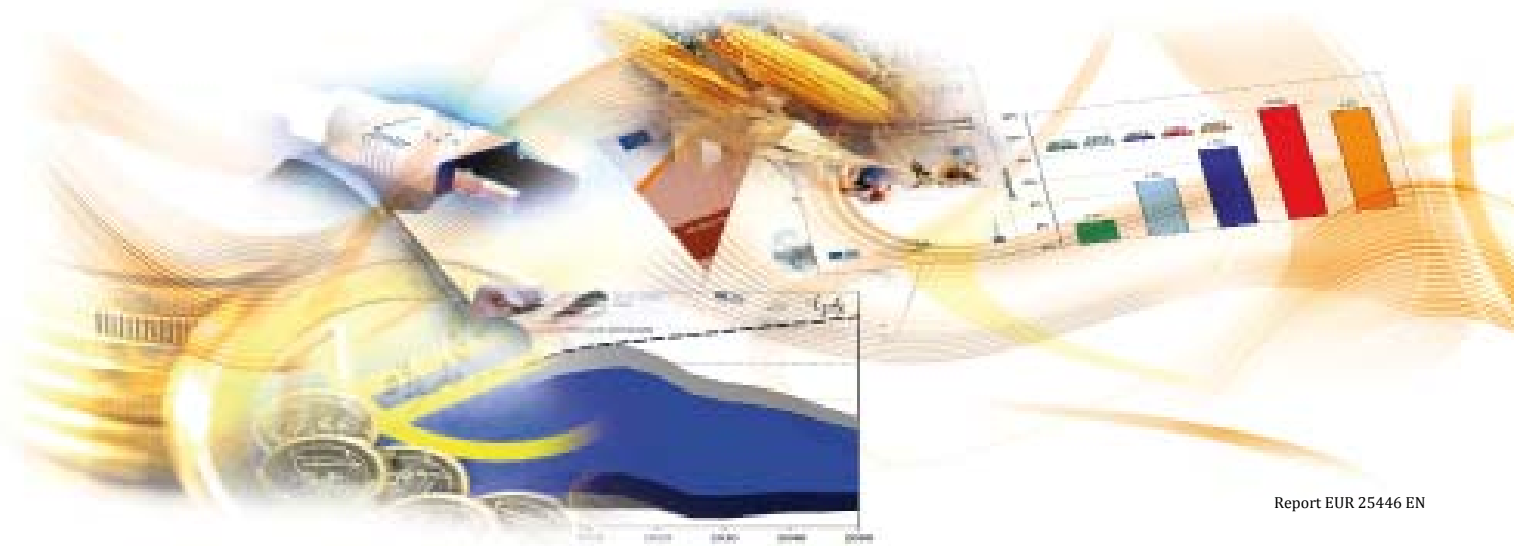

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Preface

The Europe 2020 strategy acknowledges that a fundamental transformation of education and training is needed to address the new skills and competences that will be required if Europe is to remain competitive, overcome the current economic crisis and grasp new opportunities. Innovating in education and training is a key priority in several flagship initiatives of the Europe 2020 strategy, in particular the Agenda for New Skills and Jobs, Youth on the Move, the Digital Agenda, and the Innovation Union Agenda. This priority is directly linked to the Europe 2020 educational headline targets regarding early school leaving and tertiary attainment levels.

Educational stakeholders recognise the contribution of ICT to achieving these targets, and more broadly, the role of ICT as a key enabler of innovation and creativity in Education and Training (E&T) and for learning in general. It is however also highlighted that the full potential of ICT is not being realised in formal education settings and that only a few innovative projects manage to survive beyond the early adopter stage and become fully embedded in educational practice.

This report is part of a larger study on "Up-scaling Creative Classrooms in Europe" (SCALE CCR) launched by the Information Society Unit at JRC-IPTS[1] in December 2011 on behalf of the Directorate-General Education and Culture (DG EAC), to be completed in June 2013. The project aims to further define the concept of 'Creative Classrooms' (CCR) and to provide a better understanding of ICT-enabled innovation in E&T, and in adult education that can be up-scaled in a cost-effective way. A set of policy recommendations for educational policymakers, stakeholders and practitioners for mainstreaming of ICT-enabled innovation for learning through the up-scaling of 'Creative Classrooms' in Europe will also be developed.

This report contributes to the second work package of the project. It aims to define the essential elements of Creative Classrooms and to depict the systemic approach that is needed for the sustainable implementation and progressive up-scaling of innovative and open learning environments using ICT across Europe, both within formal Education and Training and outside formal learning settings.

Progress on this study can be followed on the project website:
http://is.jrc.ec.europa.eu/pages/EAP/SCALECCR.html

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[1] The Institute for Prospective Technological Studies (IPTS) is one of the seven scientific institutes of the European Commission's Joint Research Centre (JRC). IPTS consists of five research units, one of which is the Information Society Unit.

Acknowledgements

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Executive Summary

'Creative Classrooms' (CCR) are conceptualised as innovative learning environments that fully embed the potential of ICT to innovate and modernise learning and teaching practices. The term 'creative' refers to innovative practices, such as collaboration, personalisation, active learning and entrepreneurship, fostering creative learning, while the term 'classrooms' is used in its widest sense as including all types of learning environments, in formal and informal settings.

This report proposes a multi-dimensional concept for CCR, consisting of eight key dimensions and 28 reference parameters (*building blocks*). These are intended to capture the essential elements of Creative Classrooms and to depict the systemic approach that is needed for the sustainable implementation and progressive up-scaling of innovative and open learning environments using ICT across Europe.

The aim of this report is to provide educational policy makers, stakeholders and practitioners with thorough understanding of ICT-enabled innovation for learning, focusing on key elements that need to be addressed in order to innovate and modernise Education and Training (E&T) in Europe.

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1. Objectives of this report

This report aims to provide a well-articulated and overarching conceptualization of 'Creative Classrooms' (CCR), as well as a set of reference parameters that exemplify the enablers of 'Creative Classrooms'. This conceptualization and the reference parameters are intended to provide the key components of ICT-enabled innovative learning environments, considering the vast diversity of educational context in the Member States (Kampylis, Bocconi and Punie, 2012).

As learning is conceived of as a social process in CCR, opening educational practices outside the formal context (Punie, Cabrera, Bogdanowicz, Zinnbauer, & Navajas, 2006), the proposed concept and reference parameters mainly cover formal education settings (e.g. school education, initial VET), and also include informal ways of learning (such as peer-to-peer interaction in online networks).

2. Background

The project "Up-scaling Creative Classrooms in Europe" (SCALE CCR) was launched by the Information Society Unit at IPTS on behalf of the Directorate General Education and Culture (DG EAC) and it will run from December 2011 to June 2013. The project aims to further define the concept of 'Creative Classrooms' (CCR) and to provide a better understanding of ICT-enabled innovation in both Education and Training (E&T) and Adult Education, which can be up-scaled in a cost-effective way. The major focus will be on formal education settings, although informal ways of learning will be considered as well. The project contributes directly to the objectives of three of the Europe 2020 flagships: the Digital Agenda, the Innovation Union Agenda and "Youth on the move".

Within SCALE CCR, up-scaling is not considered as a one-dimensional process, involving solely the expansion of numbers of schools implementing specific ICT-enabled innovation for learning. In other words, up-scaling does not refer to recipes or to 'one-fits-all' approaches. In contrast, in this project, up-scaling CCR is considered as a contextualized process that involves all the challenges of implementing sustainable systemic change characterized by complexity and shifting priorities (Coburn, 2003; Fullan, 2011b; Levin, 2008; OECD/CERI, 2010a; Shapiro, Haahr, Bayer, & Boekholt, 2007).

More specifically, the objectives of SCALE CCR project are:

- To define and classify "ICT-enabled innovation for learning" across a range of settings and participants, including groups of learners and teachers/instructors at system level, both within and outside formal education settings;
- To develop a concept of 'Creative Classrooms' (CCR) and reference parameters for a pilot initiative in up-scaling CCR;
- To identify and analyse the implementation strategies underpinning a number of highly effective ICT-enabled innovations for learning in order to bring to the surface commonalities of purpose, scope and impact;
- To support DG EAC in establishing an extensive dialogue on CCR with multiple key stakeholders; and
- To propose concrete policy recommendations for the further development and mainstreaming of 'Creative Classrooms' (CCR) in Europe.

The 'Creative Classrooms' concept, complemented with an in-depth analysis of implementation strategies of existing ICT-enabled innovation for learning and a definition of policy recommendations for educational policymakers and stakeholders will constitute the main outcomes of the SCALE CCR project.

The concept and reference parameters of CCR provided here are based on previous IPTS studies (e.g. Cachia, Ferrari, Ala-Mutka, & Punie, 2010) and other relevant works on creative learning and innovative pedagogies supported by the use of ICT (e.g. ACOT2, 2008; Kennisnet, 2011; Law, Yuen, & Fox, 2011; OECD, 2012; OECD/CERI, 2010a). The desk research also included existing best practices from experiences of innovations for learning in real educational settings worldwide. Furthermore, consultations with educational policymakers, stakeholders and practitioners (DG EAC A2 Thematic Working Group on ICT in Education, eTwinning teachers) contributed to the further development and validation of the CCR concept and reference parameters.

3. Setting the scene

3.1 What are Creative Classrooms?

'Creative Classrooms' are innovative learning environments that fully embed the potential of ICT to innovate and modernise learning and teaching practices.

In CCR, open education principles (e.g. Iiyoshi & Kumar, 2008) are fully implemented in practice, at all levels. Curriculum and content are open, providing learners with concrete opportunities for developing 21st century skills, such as problem-solving, inquiry, collaboration, and communication. Learning is flexible and engaging, meeting students' individual needs and expectations. Leadership is open and participatory, supporting teachers/educators' innovative practices. (e-)Assessment paradigm now reflects the core competences needed for life in the 21st century.

Though the terms creativity and innovation are often used interchangeably (Kahl, et al., 2009), within SCALE CCR innovation is conceived of as a two-component process, encompassing both the development of creative ideas and the intentional introduction and application of selected creative ideas into teaching and learning practices (Ferrari, et al., 2009a; West, 2002). Hence, the term *'creative'* refers here to the innovation and modernisation of learning and teaching practices through technologies (collaboration, personalisation, active learning, entrepreneurship, etc.).

Likewise, the term *'classrooms'* is used in its widest sense to include all types of learning environments, both informal and non-formal. The focus is not on future classroom scenarios but on what is possible in today's practices, taking advantage of existing and emerging technologies.

3.2 Innovative teaching and creative learning

The CCR concept is based on innovative teaching and creative learning practices (personalised learning, collaborative learning, entrepreneurship, etc.) as documented in the literature (Cachia, et al., 2010; Ferrari, Cachia, & Punie, 2009b; Microsoft, 2011) and existing cases from real life educational settings (Fullan, 2010; Law, et al., 2011).

Innovative teaching is any kind of teaching which addresses creativity and applies it to methods and contents, whereas *creative learning* refers to the possibility for learners to develop their thinking

skills and learn in a new, creative way (Cachia, et al., 2010; Ferrari, et al., 2009a). Innovative teaching includes both the processes of *teaching for creativity* and *teaching creatively* (Ferrari, Cachia, & Punie, 2009b; Jeffrey & Craft, 2004). The former refers to any teaching that tries to develop learners' own creative thinking and performance, whereas the latter refers to the implementation of innovative teaching practices to make learning more interesting and effective. Both innovative teaching and creative learning presuppose an active role for the learner and new roles for the teacher who acts mainly as mentor, orchestrator, and facilitator of the learning process.

3.3 Innovative pedagogies and ICT

ICT play an increasingly central role in learners' lives and have the potential to enable educational change towards innovative learning environments (Ferrari, et al., 2009b).

Innovative forms of pedagogical practice with ICT encourage learner-centred approaches, group work and participative learning and promote inquiry-based learning, learning-by-doing, problem solving and creativity (Law, Pelgrum, & Plomp, 2008; Redecker, Ala-Mutka, Bacigalupo, Ferrari, & Punie, 2009). Existing (e.g. mobiles, wikis, 3D virtual worlds) and emerging technologies (e.g. gesture based, augmented reality, immersive worlds) increasingly allow teachers to create pedagogically effective learning activities (Bottino, 2004; Conole, 2010) that support experimental and experience-based learning, promoting and improving motivation and learner involvement (Johnson, Smith, Willis, Levine, & Haywood, 2011; OECD/CERI, 2010b; Punie, et al., 2006). However, technology is just a means towards pedagogical change.

The innovativeness of different pedagogical practices only emerges when teachers use ICT in their efforts to organize newer forms of open-ended, collaborative, and extended learning activities, rather than simply to enhance traditional pedagogies, such as expository lessons and task-based learning (Law et al, 2011). These innovative practices require a huge individual and collective effort from all the practitioners involved, as well as adequate support and recognition (e.g. teachers' professional development in the pedagogical use of ICT, changing assessment strategies and curricula) at system level (OECD/CERI, 2010a; Ottestad, 2010). Human factors (vision and expertise), as well as learning materials and infrastructures, are decisive success factors for the pedagogical use of ICT and, as such, need to be effectively addressed (Law, et al., 2008).

Accordingly, innovative pedagogies lie at the core of the CCR concept and reference parameters, as highlighted in the following sections.

4. Creative Classrooms: a multi-dimensional concept

4.1 The rationale

The Creative Classrooms (CCR) innovative learning concept puts emphasis on the holistic and systemic nature of these environments, their intended learning outcomes, and their pedagogical, technological, and organisational characteristics that favour innovation.

The proposed ***multi-dimensional concept*** is intended to capture the essential elements of Creative Classrooms that can be seen as live "eco-systems" (Law, et al., 2011). As complex organisms, CCR constantly evolve over the time, mainly depending on the context and the culture to which they

pertain. Hence, the CCR concept is composed of eight encompassing and interconnected key dimensions which capture the essential nature of these learning ecosystems. As depicted in Figure 1, there are eight CCR key dimensions: *Content and Curricula, Assessment, Learning Practices, Teaching Practices, Organization, Leadership and Values, Connectedness* and *Infrastructure*.

It is naïve to assume that addressing one dimension in isolation will make innovation happen; evidence from research (Law, et al., 2011; Microsoft, 2011; OECD/CERI, 2010a, 2012; Punie, et al., 2006) clearly shows that a significant number of these key dimensions -if not all- needs to be tackled by the common efforts of a critical mass of actors (e.g. Fullan, 2010).

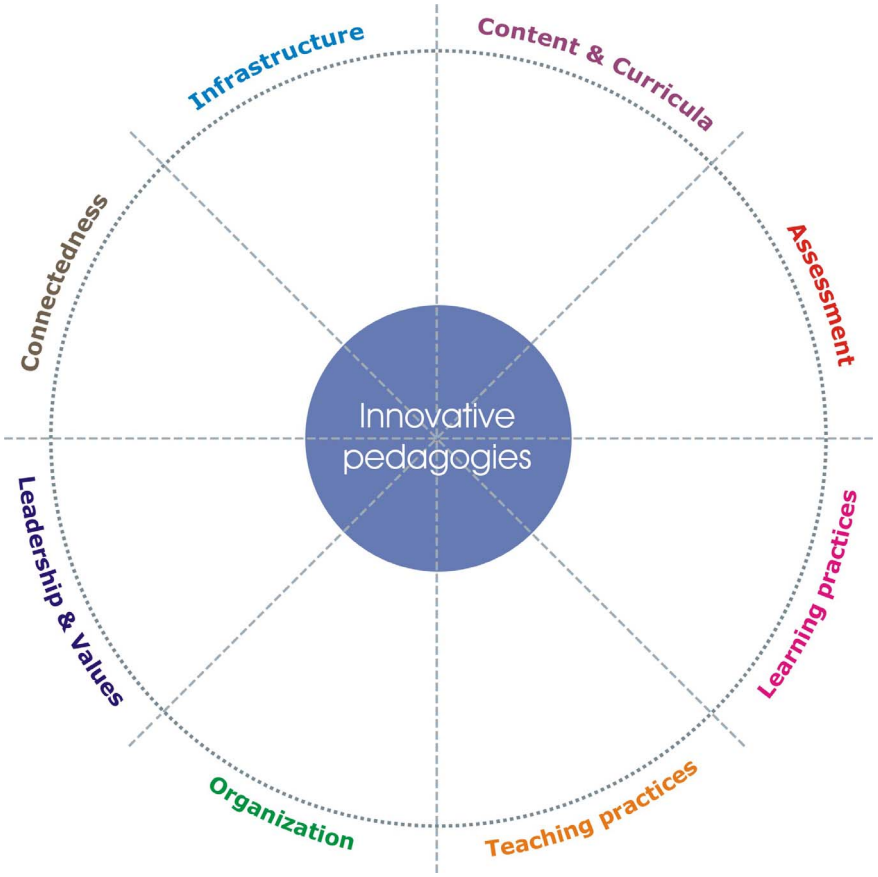

***Figure 1**. Key dimensions of Creative Classrooms*

These proposed dimensions build on the following:

- Previous IPTS research on Creativity and Innovation (Cachia, et al., 2010), Learning 2.0 (Redecker, et al., 2009), and the Future of Learning (Redecker et al., 2011).
- Other relevant studies and existing cases of ICT-enabled innovation for learning also provide the conceptual framework for the proposed CCR dimensions, embedding core principles for designing Innovative Learning Environments (OECD, 2008; OECD/CERI, 2010a, 2012), new and creative ways of implementing applied curriculum and informative assessment for learning in the 21st century (ACOT2, 2008), learning leadership for lifelong learning orientation and connectedness (Law, et al., 2011), and understanding of basic conditions (such as vision, expertise, digital learning materials and ICT infrastructure) for the sustainable use of ICT in education (Kennisnet, 2011).

- Inputs were also collected through ongoing consultations with DG EAC and the Education and Training 2020 Thematic Working Group (TWG) on "ICT and Education", as well as with other key stakeholders (e.g. European Schoolnet, European Foundation for Quality in e-Learning, European Trade Union Committee for Education, eSkills Industry Leadership Board) and practitioners (eTwinning teachers).[2]

Innovation goes hand in hand with all eight dimensions, which are equally necessary and vital within CCR, and significant effort should be made to address them all. To this end, CCR innovative learning environments need to be inspired and supported by innovative policies, ensuring the progressive implementation at system level of all CCR encompassing elements (OECD, 2010).

4.2 The key dimensions of Creative Classrooms

Content and Curricula

This dimension captures the key characteristics that lie beneath contents and curricula within CCR. The term *Curricula* is conceptualized as learning objectives and frameworks for developing activities, while the term *Contents* refers to the resources for innovative teaching and creative learning. Content and curricula within the CCR context should be subject to regular updates, in which education stakeholders and practitioners take an active part. CCR should also take advantage of recent evidence-based research (e.g. Hattie, 2012; Kampylis, 2010; Law, et al., 2008; Law, et al., 2011; OECD, 2008; Vosniadou, 2007), which emphasizes among other things the need to:

- introduce less extensive curricula covering fewer topics in more depth;
- develop and assess not only factual knowledge and hard skills, such as numeracy and literacy, but also the transversal soft skills such as problem-finding, problem-solving, and collaboration;
- take seriously into account the prior knowledge, ideas, interests and skills that learners bring to CCR;
- value both formal and informal learning;
- re-arrange education practicalities (such as timetables, learners' allocation in classrooms, etc.) in order to give more time and opportunities for creative, personalized learning; and
- make better use of already available ICT for innovative teaching and learning.

Assessment

This dimension focuses on the conceptual shift from traditional assessment of knowledge acquisition to innovative ICT-enabled assessment approaches that better capture 21st century skills (Griffin, McGaw, & Care, 2012). Assessment for creative learning and innovative pedagogies should provide valuable insights into individual student's learning (US Department of Education, 2012) and accounts for individuals' progress as creative learners (Ellis, 2009). Both teachers and students actively engage in the assessment process which fosters peer-assessment (Hattie, 2009; Redecker, Punie, & Ferrari, 2012) and incorporating *coherence*, *comprehensiveness* and *continuity* principles (Binkley et al., 2012). Within CCR, eAssessment strategies should transcend the testing paradigm and develop integrated, authentic and holistic assessment formats by designing assessment tasks that replicate real life contexts, and are solved by using common ICT tools, such as the Internet and multimedia resources (Redecker, et al., 2012; Villalba, 2008).

[2] http://conference2012.etwinning.net

Learning practices

This dimension centres on the experience of learning and how learners engage with it (Craft, 2011; OECD/CERI, 2010a). Personalisation, collaboration and informal ways of learning are at the core of creative learning practices (Ott & Pozzi, 2010; Redecker, et al., 2011). In CCR, learners not only have to take responsibility for their own learning progress, but also have to support each other in jointly creating the learning content and context. CCR should support more engaging and playful approaches to learning and should encourage collaboration and peer learning. The learning process should make use of different sensory channels, providing new formats for creative expression and encouraging learners to experiment with different, innovative, ways of articulating their thoughts and ideas (Bocconi & Trentin, 2012; Redecker, et al., 2009). Particular emphasis should also be put on developing students' self-directed (Zimmerman & Schunk, 2011), lifelong-learning abilities and transversal soft-skills.

Teaching practices

CCR require that teachers[3] effectively play new roles as mentors, orchestrators, and facilitators of learning and act as role models of creativity and innovation. Therefore, the skill sets of professional teachers should shift from subject knowledge towards expertise in pedagogy (Hannon, 2009) in order to effectively foster creative learning and innovation attitudes in learners. Besides innovative pedagogies (e.g. networking in real-world contexts with real-world actors for meaningful activities) CCR teachers should also implement creative classroom management strategies (e.g. how to manage a classroom during group work or peer assessment), and make innovative use of ICT for creative learning (Cachia, et al., 2010). Innovative teaching practices should be supported by updated, targeted, and inspiring initial education and in-service training (Kampylis, 2010).

Organization

This dimension captures the organisational practices in CCR, and refers to the macro, meso and micro levels, implying a progressive breadth and depth of action to meet local circumstances and needs (OECD, 2012). At all levels, CCR should adopt a holistic approach to innovation for learning, where all the elements of a learning organisation are brought into the picture and considered 'vital' (Law, et al., 2011; Levin, 2008). Continuous monitoring mechanisms should be in place to evaluate progress and effectively refocus organisational practices in order to raise the levels of eMaturity in learning organisations (Durando, Blamire, Balanskat, & Joyce, 2007; Vanderlinde & Braak, 2010). Organisational practices should be co-owned and shared among the multiple actors of the community. This should be an essential practice in CCR to ensure quality in teaching, learning and assessment and to open up learning organisations as cultural and learning centres for the local community.

Leadership and Values

CCR should operate within a context of educational structures and values that strongly influence learning objectives and pedagogies, promote equity and guarantee access to quality education for all (Alexander, 2008; OECD, 2012). It is well documented that school leaders exert power and influence in the school community and create a culture that supports or hinders innovation (Law, et al., 2011). In CCR, school leadership should play a crucial role in orchestrating innovations by initiating and monitoring changes, providing required resources and infrastructure, challenging misconceptions about ICT-enabled innovations for learning by supporting staff professional development and taking

[3] In this report, we use the term *teacher* for anyone who orchestrates and facilitates learning in both formal and informal settings.

advantage of creative partnerships. In general, effective school leadership, which values innovative teaching and creative learning, is key to large-scale, sustainable implementation of CCR (e.g. Fullan, 2010).

Connectedness

This dimension concerns the *social* and *emotional factors* that profoundly affect the relationships among members of a learning institution and that have a significant impact on their level of engagement and motivation (ACOT2, 2008; OECD/CERI, 2010a). CCR should allow new possibilities for students to connect with multiple actors (e.g. other students, parents, external experts and practitioners, wider community), *opening up* alternative channels for gaining knowledge and broadening their horizons, *embracing diversity* thus anchoring their learning experiences in a rich world of diverse cultures, traditions, languages and opinions. A participatory culture of this kind should be pervasive in CCR (Craft, 2011), encompassing different levels of connectedness (Law, et al., 2011).

Infrastructure

CCR need a dynamic ICT infrastructure of adequate performance and reach that can facilitate, communicate and disseminate innovative teaching and creative learning. Effective support structures are also needed to implement smoothly all the necessary technologies. Moreover, ICT infrastructure should be used to extend the boundaries of the learning space across time (access to resources 24/7) and space (virtual learning spaces). Last but not least, the physical learning space should be designed and (re)arranged (taking advantage of colours, lights, sounds etc) in order to facilitate and inspire innovative teaching and creative learning (Burke, 2007).

5. Reference parameters for Creative Classrooms

5.1 The purpose and nature of reference parameters

The aim of the reference parameters is twofold: (i) to unravel the most innovative elements of the multi-dimensional CCR concept and (ii) to depict the systemic approach needed for the sustainable implementation and progressive up-scaling of Creative Classrooms across Europe.

The proposed set of reference parameters described in the following sections thus captures significant changes in *what* we learn, *how* we learn, *where* we learn and *when* we learn in order to achieve educational transformation for a digital world (Redecker, et al., 2011). In other words, these parameters constitute an encompassing list of fundamental *building blocks of the CCR*: their multiple possible combinations allow us to configure a wide variety of CCR according to given needs and contexts. As constituents of the "CCR ecosystems", the reference parameters are also dynamic by nature, flexible and evolve over time.

The ultimate scope is to provide educational policy makers, stakeholders and practitioners with an encompassing perspective of ICT-enabled innovation for learning, including key elements that need to be addressed in order to take more strategic decisions within the context of Education and Training in Europe.

5.2 CCR reference parameters (building blocks)

The current set is composed of 28 reference parameters/building blocks derived from literature in the field (e.g. Cachia, et al., 2010; Craft, 2011; Redecker, et al., 2011) and existing cases of ICT-enabled innovation for learning (e.g. Law, et al., 2011; OECD/CERI, 2012); some of them are already well-established in real life practice, whereas others are more at the forefront. Figure 2 shows an overview of the proposed set.

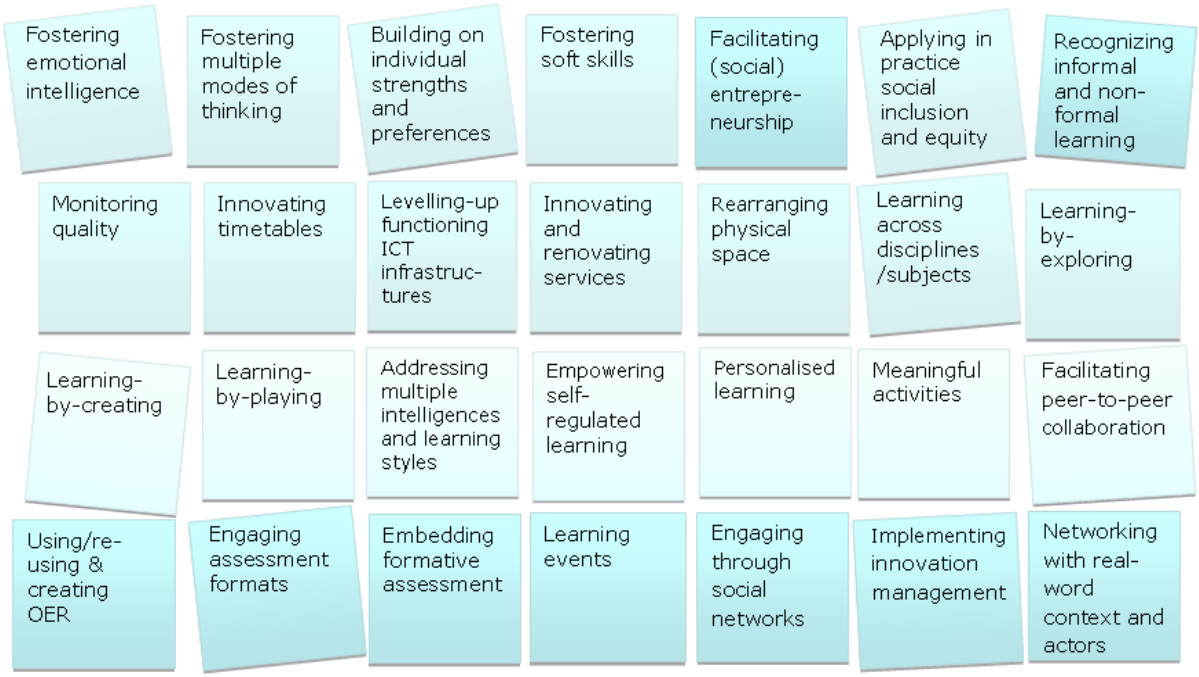

Figure 2. *Overview of the proposed set of reference parameters (building blocks) of Creative Classrooms*

As a strong interrelation exists among the eight key dimensions of the CCR concept (described in Section 4.2), the same applies to the reference parameters that are also complementary and cross different CCR key dimensions.

Table 1 summarises the CCR reference parameters and their interrelations. Blue cells represent the main connection of each reference parameter with a corresponding CCR key dimension; grey cells depict a second level of interconnections with other CCR dimensions. For instance, the reference parameter “(1) Fostering emotional intelligence” is mainly connected with the dimension “Content & Curricula” (blue cell), but it also has implications on “Learning practices” and on "Leadership and values" (grey cells).

	Content & Curricula	Assessment	Learning Practices	Teaching Practices	Organization	Leadership & Values	Connectedness	Infrastructure
1. Fostering emotional intelligence	■		■			■		
2. Fostering multiple modes of thinking			■	■			■	
3. Building on individual strengths and preferences		■		■		■		
4. Fostering soft skills	■		■	■				
5. Facilitating (social) entrepreneurship			■			■	■	
6. Applying in practice social inclusion and equity	■					■	■	
7. Recognizing informal and non-formal learning		■		■	■			
8. Monitoring quality					■	■	■	
9. Innovating timetables	■			■	■			
10. Levelling-up and functioning ICT infrastructure					■	■		■
11. Innovating and renovating services					■		■	■
12. Rearranging physical space			■			■		■
13. Learning across disciplines /subjects	■		■	■				
14. Learning-by-exploring	■		■	■				
15. Learning-by-creating	■		■	■				
16. Learning-by-playing	■		■	■				
17. Addressing multiple intelligences and learning styles	■			■				■
18. Empowering self-regulated learning		■	■	■				
19. Personalised learning			■	■				■
20. Meaningful activities	■			■			■	
21. Facilitating peer-to-peer collaboration			■			■	■	
22. Using/re-using & creating Open Educational Resources (OER)	■			■		■		
23. Engaging assessment formats		■	■	■				
24. Embedding formative assessment		■		■	■			
25. Learning events				■	■		■	
26. Engaging through social networks				■	■		■	
27. Implementing innovation management					■	■	■	
28. Networking with real-word context and actors					■	■	■	

Table 1. *Interrelation matrix of CCR concept dimensions and reference parameters*

The following information is given for each reference parameter:

- *Title and short description*: this provides a short and general description of the reference parameter.
- *ICT specificity*: here the focus is on the potential contribution of ICT for real life implementation of CCR
- *Example(s)*: one (or more) concrete example related to the given parameter are provided.
- *CCR key dimensions*: this identifies the CCR key dimensions (described in Section 4.2) that are covered by the specific reference parameter.

FOSTERING EMOTIONAL INTELLIGENCE: Emotional intelligence should be valued in CCR as it is a key factor for creative learning. It can be fostered through a variety of activities that aim to help learners recognise and manage emotions, form positive relationships, and successfully handle the demands of growing up in a complex and constantly changing world.

- ***ICT specificity*:** ICT enable the online delivery of multimedia learning materials and events. Regardless of the type (synchronous or asynchronous) and duration (short or long term) of the online learning event, the actual presence and ability of the participants to demonstrate socio-emotional competences, such as awareness and control of self, along with empathy for others, is essential.
- ***Examples*:** Research reveals (Domitrovich, Cortes, & Greenberg, 2007) that after exposure to the Promoting Alternative Thinking Strategies curriculum - PATHS (http://www.pathstraining.com/pages/curriculum.html) for nine months, young learners had higher emotional knowledge skills and were rated by parents and teachers as more socially competent compared to peers from a control group. Another case of successful promotion of socio-emotional competences through PATHS is reported in the OECD's Innovative Learning Environment Project (http://www.oecd.org/dataoecd/39/27/49772416.pdf).
- ***CCR key dimensions*:** Content and Curricula | Learning practices | Leadership and Values

FOSTERING MULTIPLE MODES OF THINKING: CCR teachers should distinguish clearly between disciplinary products and trans-disciplinary thinking processes and encourage learners to develop their talents and creative potential to the fullest extent in all possible areas of human endeavour, both artistic and scientific (notion of *polymathy*).

- ***ICT specificity*:** ICT applications - such as virtual labs, audio, video and image editing software and apps - offer unprecedented opportunities for exploratory learning and creative expression.
- ***Example*:** Several researchers argue that creative *polymathy* is actually fairly common and polymaths are most likely to become innovators (Kaufman, Beghetto, Baer, & Ivcevic, 2010; Root-Bernstein, 2003). For instance, members of the *Media Lab* at the Massachusetts Institute of Technology (http://www.media.mit.edu/about/mission-history) "continue to check traditional disciplines at the door" and the majority are engaged in cross-disciplinary projects in a wide range of domains such as behavioural economics, nanotechnology, data visualization, and music.
- ***CCR key dimensions*:** Teaching practices | Learning practices | Connectedness

BUILDING ON INDIVIDUAL STRENGTHS AND PREFERENCES: CCR teachers should build on learners' strengths, potentials and preferences (by taking into account their backgrounds, cultures, interests, goals, skills and prior knowledge) as crucial resources and drivers for motivation for creative learning.

- ***ICT specificity*:** ICT offer ways of expressing learners' interests and preferences (e.g. through social networks) and can facilitate the development of their creative potential in many ways.
- ***Example*:** The Enrichment Programme implemented in a Slovenian school (http://www.oecd.org/dataoecd/40/45/49768501.pdf) aims to increase learners' inner motivation for learning by respecting their "initiatives/interests/proposals/ideas".
- ***CCR key dimensions*:** Teaching practices |Assessment | Leadership and Values

FOSTERING SOFT SKILLS: In CCR, a great variety of activities should address transversal soft skills, such as problem-solving, collaboration and cultural awareness, in order to facilitate the learning of the -equally important and complementary- hard, subject-specific skills.

- ***ICT specificity*:** ICT provide means for fostering transversal soft skills such as online collaboration, problem-solving and cultural awareness.
- ***Example*:** *Fab labs* (http://fab.cba.mit.edu/about/faq/), an initiative of MIT's *Center for Bits and Atoms*, provide widespread access to modern means for invention and have spread all over the world, from USA to India, and from South Africa to North Europe. Projects being developed and produced in Fab labs follow mainly a five steps Design Process (Investigate, Design, Make, Evaluate and Communicate) to provide opportunities for authentic learning and soft skills development (Beyers, 2010; NESTA, 2007).
- ***CCR key dimensions*:** Teaching practices | Learning practices | Content and Curricula

FACILITATING (SOCIAL) ENTREPRENEURSHIP: CCR should provide learners with more opportunities to initiate, design, and implement real-life projects with emphasis on innovative products or services for the school community in order to create a culture that values sensible risk taking, initiative, entrepreneurship, and innovation (European Parliament and the Council, 2006; Hannon, 2009; Leadbeater & Wong, 2010).

- ***ICT specificity*:** ICT offer opportunities for both real and/or virtual entrepreneurship. For instance, virtual world Second Life is used for entrepreneurship studies in the framework of the Hyvä Yritys project funded by the Finnish Board of Education (http://www.oecd.org/dataoecd/32/23/49750510.pdf).
- ***Example*:** In Cyprus, a new programme has been introduced in some schools, called 'simulation sample enterprises'. During a whole year, students divide into groups to work on a specific area of entrepreneurship, building their own understanding of what an enterprise is. (cf. Eurydice p. 26 http://eacea.ec.europa.eu/education/eurydice/documents/thematic_reports/135EN.pdf).
- **CCR key dimensions:** Leadership and Values | Learning practices | Connectedness

APPLYING IN PRACTICE SOCIAL INCLUSION AND EQUITY: Within CCR, all learners (gifted students, migrants, drop-outs, etc.) should be provided with equal opportunities and the appropriate means for quality learning, in order to mitigate social disadvantage, promote active citizenship and multicultural integration and reduce schools failures.

- ***ICT specificity*:** Evidence shows that ICT-enabled approaches can mitigate existing inequalities by offering tailored learning opportunities (and contents) inside and outside of E&T institutions (Redecker, et al., 2011).
- ***Examples*:** In Ireland, the CONNECT Project is part of a broader local social-economic redevelopment initiative in schools in Ireland North and South. This initiative is comprised of various interventions which involve collaboration between a number of local interest groups and government agencies. These interventions are grounded in a pro-social philosophy which seeks to target the causes of anti-social behaviour and community disengagement by means of an innovative, technology-centred approach which has *pedagogical, information, strategic, transactional and transformative benefits* (Galvin, et al., 2010). Reducing school failure pays off for both society and individuals, contributing to economic growth and social development. Indeed the highest performing education systems across OECD countries are those that combine quality with equity (OECD, 2012).

- ***CCR key dimensions*:** Leadership and Values | Content and Curricula | Connectedness

RECOGNIZING INFORMAL AND NON-FORMAL LEARNING: Informal and non-formal learning that takes place outside formal settings should be appreciated. It constitutes the basis for real-life, context-based, and learner-centred activities inside CCR for creating innovative solutions to local needs.

- ***ICT specificity*:** ICT have the potential to facilitate ubiquitous learning through open educational resources (online videos on demand, podcasting etc) when and where they are needed.
- ***Example*:** *Flipped classrooms* follow a reversed teaching and learning model: learners watch lectures (usually pre-recorded by their instructors) and study supplemental online materials at home and then do the "homework" in the classroom having the opportunity to interact with peers and teachers (e.g. http://www.techsmith.com/flipped-classroom.html, http://edudemic.com/2011/12/15-flipped-classrooms).
- ***CCR key dimensions*:** Assessment | Teaching practices | Organization

MONITORING QUALITY: CCR should develop and communicate a clear framework for quality, transparent to all members of the wider school community, and aimed at monitoring and enhancing quality with all its implications for teaching, learning and assessment.

- ***ICT specificity*:** Research evidence indicates that ICT offers a broad variety of versatile tools which can support incremental approaches and systematically review quality implementation strategies.
- ***Example*:** The *Qualities of Quality* project at Harvard's Project Zero explores the qualities of good K-12 arts programs and concludes they go beyond "best practices" to include consideration of the goals of arts education, such as aesthetic awareness and personal growth. Thus, achieving quality involves an ongoing examination of programmatic as well as personal purposes and values, along with a continual examination of what is actually happening "in the room" (Seidel, Tishman, Winner, Hetland, & Palmer, 2009).
- ***CCR key dimensions*:** Organisation | Leadership and Values | Connectedness

INNOVATING TIMETABLES: Innovative, flexible (Csikszentmihalyi, 1996), and tailored-made timetables should be used for providing teachers and learners with more opportunities and time to engage in creative learning in CCR.

- ***ICT specificity*:** ICT offer new tools (such as online shared calendars) for developing and sharing tailored-made timetables, which facilitate time management and offer the possibility of just-in-time learning.
- ***Examples*:** *Vittra* free schools timetable subjects into three-hour blocks to allow for multi-stage lessons and absorption in topics through case- and problem-based learning. (http://www.rosanbosch.com/en/projects, http://vittra.se/english/VittraEnglish.aspx). A pre-primary and primary state school in Seville, Spain, with the vast majority of learners being mainly from gypsy community and at risk of exclusion, has adopted an innovative timetable: lesson time is divided in periods of 15-20 minutes with subgroups dynamics coordinated by teachers, volunteers from families, and collaborating associations (http://www.oecd.org/dataoecd/0/61/49930737.pdf).
- ***CCR key dimensions*:** Organization | Content and curricula | Teaching practices

LEVELING-UP AND FUNCTIONING ICT INFRASTRUCTURE: ICT infrastructure of adequate performance, reach and interoperability should be used in order to provide learners and staff with access to multimedia-rich contents and online services for innovative teaching and creative learning in CCR.

- ***ICT specificity*:** Recent research (e.g. Johnson, et al., 2011; Redecker & Punie, 2010) shows that ICT-based infrastructures such as broadband networks, cloud computing, web applications, smartphones and tablets offer great opportunities for innovating learning and teaching practices (e.g., online learning).
- ***Example*:** Recently, numerous large-scale 1-to-1 computing initiatives have been launched in Europe (e.g. http://resources.eun.org/insight/Netbooks_on_the_rise.pdf) and in other world regions (e.g. South-Korea Ministry of Education Science and Technology, 2011) representing a qualitative move toward a ubiquitous access to online resources through a personal device (netbooks, tablets etc) for all the learners.
- ***CCR key dimensions*:** Infrastructure | Leadership and values | Organization

INNOVATING AND RENOVATING SERVICES: CCR should make use of ICT infrastructure in order to modernize existing services and/or offer totally new services both for formal and informal creative learning.

- ***ICT specificity*:** ICT offer powerful tools for updating existing services (e.g. the school library could offer e-books and audio books) or introducing innovative services (e.g. online courses for ill or excluded students) for ubiquitous learning (24/7).
- ***Examples*:** *NotSchool.Net* is a well established and officially endorsed online platform which aims to re-engage UK teenagers, otherwise excluded from the formal education system, with learning and the pursuit of qualifications (OECD/CERI, 2010a, p. 29). Another example is the project "World of stars" (El mundo de las estrellas) that through its portal (http://www.mundodeestrellas.es/opencms/index.html) offers an attractive learning environment for children who have to stay in a hospital for a long time and tools (e.g. chat and video-conferencing) for communicating with peers who are also hospitalised, friends, school, and family.
- ***CCR key dimensions*:** Organization | Infrastructure | Connectedness

REARRANGING PHYSICAL SPACE: The physical CCR space should take advantage of colours, lights, sounds, materials, etc in order to provide a flexible, aesthetically appealing and inspiring environment for innovative teaching and creative learning (Burke, 2007). Moreover, the physical CCR space should cover as much as possible learners' special needs (e.g. full access to impaired individuals).

- ***ICT specificity*:** ICT tools, such as video projectors, can be used for creating an inspiring and easily adaptable physical space.
- ***Examples*:** *Vittra* free schools have adopted a new pedagogical approach, without any classes or traditional classrooms. The challenging custom design and pedagogical zones have created a space for differentiated learning and digitalised didactic where the students' laptops are their most important learning tool (http://www.rosanbosch.com/en/projects, http://vittra.se/english/VittraEnglish.aspx). Another example of innovative physical space arrangements for learning is the *ateliers* in the Reggio Emilia education approach (http://www.innovativeteacherproject.org/reggio/values.php).
- ***CCR key dimensions*:** Infrastructure | Leadership and Values | Learning practices

LEARNING ACROSS DISCIPLINES / SUBJECTS: In CCR, a great variety of teaching and learning materials should be organized thematically to foster "horizontal connectedness" (OECD, 2008; OECD/CERI, 2010a) across different areas of knowledge and enable learners to utilize multiple perspectives for looking at, analyzing and understanding things (Cachia, et al., 2010).

- ***ICT specificity*:** ICT offer innovative and cost-effective ways to retrieve and process information from different domains/disciplines and to create multimodal rich content within the context of cross-curricular learning activities.
- ***Example*:** The International Primary Curriculum - IPC (http://www.internationalprimarycurriculum.com/pages/curriculum) is a privately developed curriculum (which was introduced in 2000 and today has been adopted by over 1000 schools in 65 countries worldwide) providing a cross-curricular, thematic teaching structure designed to engage learners of all abilities in today's world.
- ***CCR key dimensions*:** Content and Curricula | Teaching practices | Learning practices

LEARNING-BY-EXPLORING: CCR should enable learners to explore complex concepts and manipulate ideas in order to enhance their critical thinking and ability to make connections about seemingly unrelated concepts.

- ***ICT specificity*:** ICT offer new tools for exploratory learning such as online access to remote laboratories (e.g. iLabs http://ilabcentral.org/about.php).
- ***Example*:** Online laboratories (https://wikis.mit.edu/confluence/display/ILAB2/iLabs) are experimental facilities that can be accessed through the Internet from anywhere and at any time, allowing learners and teachers to carry out experiments with advanced equipments.
- ***CCR key dimensions*:** Learning practices | Teaching practices | Content and curricula

LEARNING-BY-CREATING: CCR should actively engage learners in producing and generating their own contents (artefacts) in order to nurture creative imagination, innovation attitude and authentic learning.

- ***ICT specificity***: ICT offer the means for designing, (re)creating, and communicating learner-generated content worldwide, in new and cost-effective ways, from blogs, to wikis, to video making and sharing.
- ***Example***: Stop-motion animation is among the techniques used in many schools worldwide for learning-by-creating. For instance, Australian students working in small groups created their own movies by using clay animation and flip video cameras (e.g. https://fuse.education.vic.gov.au/pages/View.aspx?pin=7C8E6E). Another example comes from Canada, where recently two teens demonstrated their creative imagination and innovation attitude by sending a homemade balloon, carrying a toy as a passenger and four cameras, approximately 24 kilometres above sea level (http://www.thestar.com/news/article/1120808--toronto-teens-send-lego-man-on-a-balloon-odyssey-24-kilometres-high).
- ***CCR key dimensions*:** Learning practices | Teaching practices | Content and Curricula

LEARNING-BY-PLAYING: CCR should extensively embed playfulness (both physical and mental) in order to fully engage students in the learning process.

- ***ICT specificity*:** ICT offer great opportunities for playful learning through a great variety of digital games and simulations.

- ***Examples*****:** *Lego Mindstorms for Schools* (based on a partnership between *Lego* and the *MIT Media Laboratory*) contains software and hardware to create small, customizable and programmable robots. It has been used by many schools worldwide for engaging students in creative learning-by-playing. Digital games, such as *Winterfest:* (http://is.jrc.ec.europa.eu/pages/EAP/eInclusion/games/documents/Buchem_CASE_Winterest_short.pdf) have also effectively been used for improving adults' hard-skill (numeracy and literacy) and soft-skills (e.g. communication skills).
- ***CCR key dimensions*****:** Learning practices | Teaching practices | Content and Curricula

ADDRESSING MULTIPLE INTELLIGENCES AND LEARNING STYLES: CCR should give value and provide the means (in terms of plurality of tasks, educational contents, etc.) of addressing multiple learning styles (e.g. Dunn & Dunn, 2008) and intelligences of learners (e.g. Gardner, 1999), hence helping them to effectively reach their personal learning objectives.

- ***ICT specificity*****:** Evidence shows that ICT applications have great potential to support the fostering of multiple learning styles and intelligences (e.g. e-diaries and journals / intrapersonal intelligence, social networks / interpersonal intelligence, motion-controlled video games / body-kinesthetic intelligence and so on).
- ***Example*****:** Within the framework of the Comenius project *EduComics* (http://www.educomics.org), the creation of online comics is used to facilitate multiple learning styles, engage and motivate students, and utilize technology in a practical and effective way.
- ***CCR key dimensions*****:** Teaching practices | Content and Curricula | Infrastructure

EMPOWERING SELF-REGULATED LEARNING: CCR should empower learners with self-regulation skills in order to help them take control of their learning process, promoting self-directed learning skills and supporting reflection and meta-cognition (e.g. Hattie, 2009).

- ***ICT specificity***: Evidence indicates that ICT provide attractive, encouraging and engaging environments that foster social skills and self-directed learning, thus helping learners to cope with the challenges of lifelong learning.
- ***Examples*****:** Exhaustive international research project in the field provides a comprehensive overview (from 28 different institutions, in 13 countries) of learning technologies used to foster students' self-regulated learning, offering rich and compound pictures of the state of the art on Self Regulated Learning in Technology Enhanced Learning Environments and the several directions in which the field is developing (e.g. Dettori & Persico, 2011). Evidence from international research is also offered on how fostering the use of metacognition on a wider front can help students to improve their outcomes and understanding in several subjects, and also how providing them with a wider variety of metacognition facets can give rise to a more composite and effective *metacognition competence generalized across domains* (Azevedo & Aleven, 2012).
- ***CCR key dimensions*****:** Learning practices | Teaching practices | Assessment

PERSONALISED LEARNING: In CCR, learners should be at the centre of any learning process. Accordingly, curricula and methods are continuously sensitively adjusted to respond to individual learners' needs in order to foster their intrinsic motivation and allow for self–expression (Redecker, et al., 2011).

- ***ICT specificity*:** The ubiquity of ICT increases opportunities for personalized learning, both in formal and informal settings. ICT for personalised learning could include providing access to learning activities through the school intranet, maintaining accurate, detailed and accessible data on learners' academic progress and using open educational repositories and portals for tailor-made learning activities (e.g. http://schoolofeverything.com/).
- ***Example*:** In the Innovative Learning Environment project E-Classrooms at Škofja Loka-Mesto *Elementary* School, a virtual learning environment is used in order to personalize student learning, foster creativity and innovation, and improve students' digital literacy (http://www.oecd.org/dataoecd/1/38/49930715.pdf).
- ***CCR key dimensions*:** Learning practices | Teaching practices | Infrastructure

MEANINGFUL ACTIVITIES: CCR activities should be carried out in an authentic context, encouraging learners to apply their prior knowledge, inquiry and independent thinking in order to enhance both soft and hard skills.

- ***ICT specificity*:** Evidence shows that ICT play an increasingly central role in learners' lives and offer unprecedented opportunities for engaging them in meaningful, authentic learning (e.g. virtual tours in museums, geotagging activities and so on).
- ***Example*:** *Fiskars elementary school* (http://www.oecd.org/dataoecd/32/28/49750430.pdf) provides students with active learning in authentic "real life" contexts through an innovative partnership with local artists and handicrafts.
- ***CCR key dimensions*:** Content and Curricula | Teaching practices | Connectedness

FACILITATING PEER-TO-PEER COLLABORATION: As learning is a social rather than individual process, CCR should constantly encourage peer collaboration. This fosters learners' ability to think both independently and with others, and enables learners to consider a plurality of points of view that helps creative thinking.

- ***ICT specificity*:** Online synchronous and/or asynchronous peer collaborations across networks, communities of practice and interest-driven websites transcend previous limitations of space and time and are likely to increase creative learning, both in formal and informal settings.
- ***Example*:** eTwinning projects offer teachers from around Europe the opportunity to collaborate with their counterparts in designing and implementing innovative pedagogies (http://www.etwinning.net/en/pub/news/press_corner/statistics.cfm).
- ***CCR key dimensions*:** Learning practices | Connectedness | Leadership and values

USING/RE-USING AND CREATING OPEN EDUCATIONAL RESOURCES (OER): CCR should make consistent use /reuse of existing OER to broaden and update the curriculum, as well as to achieve the desired/expected learning outcomes (e.g. Iiyoshi & Kumar, 2008).

- ***ICT specificity*:** ICT increase opportunities for sharing, reuse, adaptation and exchange of resources, promoting social mechanisms (e.g. recommending system, ratings) and learning communities around OER which contribute to increasing the motivation amongst stakeholders to create, share and evaluate useful content.
- ***Examples***: There are already initiatives across Europe in which teachers use an open repository and collaborative authoring platform to exchange and reuse learning resources (e.g. http://lemill.net; http://www.openeducationweek.org/). Overall, the use of digital resources to support teaching and learning in higher education is becoming more and more

widespread. Particularly, developing effective techniques for finding, evaluating and using digital resources should be seen as a key digital literacy for both staff and students (http://www.jisc.ac.uk/media/documents/programmes/elearning/oer/OERTheValueOfReuseInHigherEducation.pdf).

- ***CCR key dimensions***: Content and Curricula | Teaching practices | Leadership and values

ENGAGING ASSESSMENT FORMATS: In CCR, assessment should incorporate creative tasks in order to engage and motivate learners while assessing complex skills, such as collaboration and problem solving developed inside and outside school, which cannot be measured with conventional assessment tools.

- ***ICT specificity*:** ICT tools and applications have the potential for recording, retrieving, keeping track, processing, and communicating the learning progress of each individual in totally new ways (e.g. e-portfolios).
- ***Example*:** Evidence-based research reveals that it is possible to assess creative learning in order to promote it (e.g. Ellis, 2009). One of the most promising methods for assessing creative learning would involve the review of learners' portfolios of creative works. For example, the Danish Innovative Learning Environment project *Pedagogical Platform* (http://www.oecd.org/dataoecd/32/55/49749695.pdf) utilizes three different portfolios (the working, the selection, and the presentational ones) for facilitating four 'life competencies' in the learners: competences of knowledge, of self-assessment, of conduct, and of 'being'.
- ***CCR key dimensions*:** Assessment | Teaching practices | Learning practices

EMBEDDING FORMATIVE ASSESSMENT: CCR should embed a plurality of methods and tools for formative self- and peer-assessment (e.g. OECD/CERI, 2010a). These methods and tools should provide a record of learners' thinking and reasoning - assessing competences rather than factual knowledge - in a form that is accessible to the teachers for monitoring and feedback purposes.

- ***ICT specificity*:** Open ICT tools, such as online forms (http://www.google.com/google-d-s/forms), audience response services (http://www.polleverywhere.com) and flash cards and study games creators (http://www.quizlet.com), can be used in ways that provide immediate feedback to students and meaningful data to teachers for formative assessment.
- ***Example*:** Concept cartoons, together with other diagnostic and scaffolding tools, have been used in Singaporean schools for formative assessment, to stimulate reasoning among students in small groups, as part of self- and peer-assessment (Fullan, 2011a).
- ***CCR key dimensions*:** Assessment | Teaching practices | Organization

LEARNING EVENTS: The CCR community should actively and systematically participate in learning events and also organise them (f2f, online and blended).

- ***ICT specificity*:** ICT have the potential to deliver open educational courses worldwide and offer innovative ways for online lifelong learning.
- ***Examples*:** Massive Open Online Courses (MOOC) are good examples of the potential of current ICT to offer innovative and cost-effective solutions for lifelong learning and training. For instance, *MITx*, a new initiative of the Massachusetts Institute of Technology, offers to anyone (and from anywhere) highly effective online learning tools for attending open online courses (http://mitx.mit.edu/). The eTwinning Group *Creative Classroom* (http://groups.etwinning.net/web/creative-classroom/welcome) also utilizes ICT for

delivering good practices and online open learning events (such as webinars with invited experts) on topics related to fostering creativity in formal education context.

- ***CCR key dimensions*:** Connectedness | Teaching practices | Organization

ENGAGING THROUGH SOCIAL NETWORKS: in CCR, social networks should be used in order to increase interaction opportunities within the school community, opening up and modernising internal processes (Ala-Mutka, 2010).

- ***ICT specificity*:** Evidence shows that social computing (blogs, Twitter, LinkedIn, etc.) supports the interaction and collaboration among learners, as well among teachers, enabling collaboration across borders, cultures, language barriers, and institutional walls (Selwyn, 2011).
- ***Examples*:** Learning institutions (both in higher education and in the school system) relate to their audiences through an intensive use of mediating technologies by their organisational bodies. These new forms of relationship point to the intensive use of the potential of social media and of devices that facilitate ubiquity in order to expand capacities, to generate exchanges and to create and share new knowledge (http://www.emergingedtech.com/2011/03/facebook-in-the-classroom-seriously). Social computing is also used to facilitate intercultural dialogue in formal and informal learning settings (e.g. http://www.absolutely-intercultural.com).
- **CCR key dimensions:** Connectedness | Teaching practices | Organization

IMPLEMENTING INNOVATION MANAGEMENT: Innovation and creativity comes from the people, while organizations should provide the necessary structures and incentives for their realization and management. CCR should implement a systemic approach to learning, defining and adopting a strategic and feasible development plan for all its constituent parts and thus create a school culture that favours sustainable innovation and makes effective use of human resources.

- ***ICT specificity*:** Social computing helps educational organisations become more dynamic, flexible and open, also enabling them to intensify their collaboration with other organisations, across borders, language barriers, and sectors.
- ***Example*:** The case in Ontario shows how effective leadership should be fostered throughout the learning system —from teacher leaders and school administrators, to district leaders, to state-level leaders. To change the culture of the learning organization, leaders have to understand, embrace, and participate deeply in implementation processes by putting in place a set of fundamental whole-system-reform strategies (Levin, 2008).
- ***CCR key dimensions*:** Leadership and values | Organization | Connectedness

NETWORKING WITH REAL-WORD CONTEXT AND ACTORS: CCR effectively interact and cooperate with a plurality of actors (e.g. industries, agencies, museums, etc.), on a regular basis in order to engage and experiment with social values and multiple cultures, and to support and foster learners' motivation.

- ***ICT specificity*:** ICT offer innovative, powerful and cost-effective ways for online networking, interaction, and collaboration across the boundaries of time and space.
- ***Example*:** In the Finnish *Model Vihti*, schools interact and cooperate with local municipalities, parents, NGOs, local farms and experts to learn by doing and by experience how to create sustainable learning environments outdoors (http://www.oecd.org/dataoecd/32/21/49750537.pdf).

- ***CCR key dimensions*:** Connectedness | Leadership and values | Organization

6. Applying the CCR multi-dimensional concept: an example

A preliminary application of the proposed CCR multi-dimensional concept has been carried out in order to show how the CCR key dimensions and reference parameters are combined and implemented in existing cases of ICT-enabled innovation for learning in Europe (see also Bocconi, Kampylis and Punie, in press; Kampylis, Bocconi and Punie, in press). The Notschool.net initiative has been selected as it covers different CCR key dimensions and reference parameters.

Notschool.net (http://www.notschool.net/notschool.html) is a virtual learning community that provides learning opportunities for young people who, for a variety of reasons such as pregnancy, illness or phobia, are excluded from mainstream education. It is primarily aimed at the 14-16 age range, although both younger and older teenagers also use its services. Notschool.net, which started as a research project in 2000 and currently is led by the not-for-profit education charity *Inclusion Trust,* has supported over 8,000 individual students (called 'researchers') in its life time and has helped over 98% back into lifelong learning and employment. Students can join Notschool.net at any time during the year and they tend to stay about 18 months on average. According to GHK Consulting (2008), the Notschool.net initiative has proven to be very cost-effective as the cost per capita[4] is comparable to the cost of education in a normal school.

As shown in Figure 3, Notschool.net adopts innovative practices that cover 6 out of the 8 key dimensions for Creative Classrooms (CCR) and 16 out of 28 reference parameters (building blocks). The majority of building blocks are related to learning practices and content and curricula: Notschool.net facilitates active and engaging ways of *self-regulated* and *personalized learning* supported by a team of personal mentors, subject experts and virtual buddies who variously direct, assist, assess and encourage them; it allows *peer-to-peer collaboration* (e.g. with ex-researchers called 'buddies'). Moreover, students can gain a range of qualifications that recognise their progress (*recognition of informal and non-formal learning*).

[4] The cost of participation in the project is covered by state funding through the local education authorities.

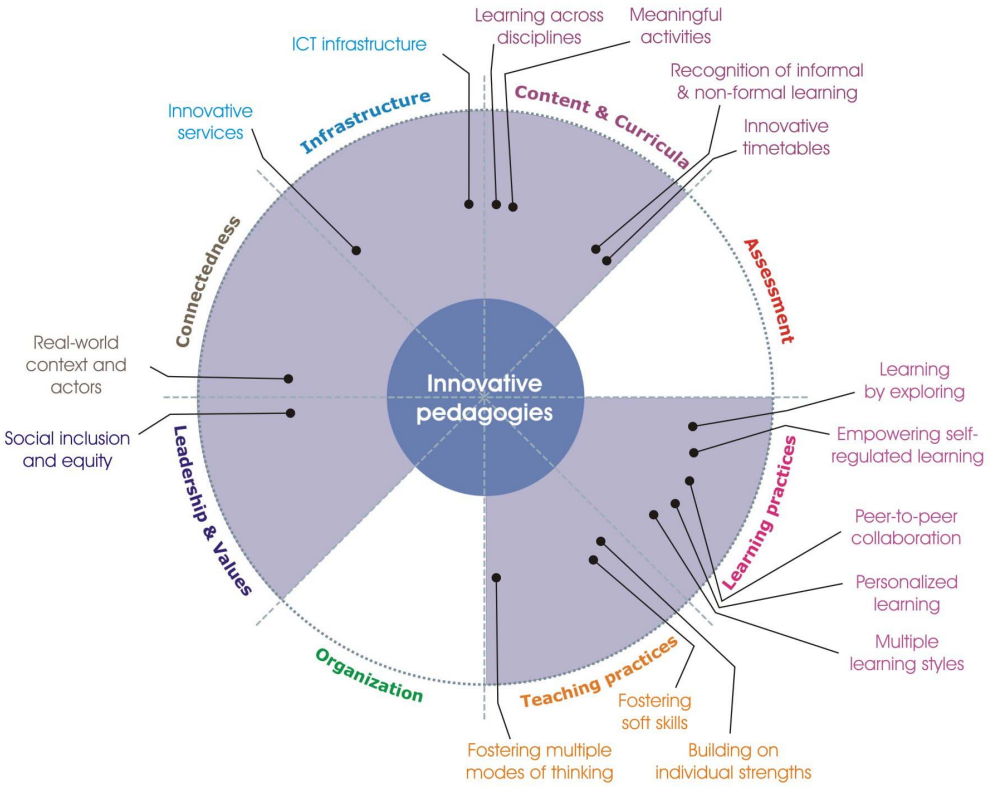

Figure3. *CCR key dimensions and building blocks covered by Notschool.net*

Through the *ICT infrastructure* (each student is given a computer, broadband connection at home, a printer and, where necessary, additional ICT tools) Notschool.net empowers the development of learner's *soft skills*, such as problem solving and communication with *real-world context and actors,* and the fostering of *multiple modes of thinking* through a variety of learning materials. Moreover, the individual learning plans developed by Notschool.net mentors help students to become more self-aware about their *individual strengths* and potential. These plans also provide students with a broader and longer-term perspective on their future professional development (*social inclusion and equity*).

Thus, Notschool.net innovative approach impacts not only on learning practices, but also on content and curricula, connectedness, leadership and values, teaching practices, and infrastructure. However, as this preliminary application of the proposed CCR multi-dimensional concept is based on desk research (Duckworth, 2005; GHK Consulting, 2008; OECD, 2008), an in-depth analysis is needed to make it more accurate and evidence-based.

7. Conclusions

'Creative Classrooms' (CCR) are conceptualised as innovative learning environments (in formal and informal settings) that fully embed the potential of ICT to innovate and modernise learning and teaching practices.

Elaborating on current literature and existing cases, a multi-dimensional concept of Creative Classrooms was proposed which depicts the systemic approach that is needed for the sustainable implementation and progressive up-scaling of innovative and open learning environments using ICT across Europe.

The proposed conceptualisation will be used to identify, select and analyse the implementation strategies of a number of highly effective ICT-enabled innovation for learning at system level across Europe.

It will also help to provide educational policy makers, stakeholders and practitioners with thorough understanding of key elements that need to be addressed in order to innovate and modernise Education and Training (E&T) in Europe.

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Abstract
'Creative Classrooms' (CCR) are conceptualised as innovative learning environments that fully embed the potential of ICT to innovate learning and teaching practices. This report proposes a multi-dimensional concept for CCR intended to depict the systemic approach that is needed for the sustainable implementation of innovative and open learning environments using ICT across Europe. The aim is to provide educational policy makers, stakeholders and practitioners with a thorough understanding of ICT-enabled innovation for learning, focusing on key elements that need to be addressed in order to innovate and modernise Education and Training (E&T) in Europe.

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