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LEARNING IN THE DIGITAL AGE

Report of the seminar of the European Network of Education Councils,

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INTRODUCTION

EUNEC is the **European Network of Education Councils**. Its members advise the governments of their countries on education and training. EUNEC aims to discuss the findings and recommendations of all European projects in education and training, to determine standpoints and to formulate statements on these issues. EUNEC wants to disseminate these statements pro-actively towards the European Commission, relevant DGs and other actors at European level, and to promote action by EUNEC's members and participants at national level. EUNEC also has the objective that the councils should put internationalization and mobility high on the national agenda, that they should recommend and support a European policy in education and training towards all relevant stakeholders: ministry of education (and employment), sectoral and branch organizations, providers and other actors.

CENTRAL QUESTION

Do digital natives learn in a different way and what are the limitations of (informal) digital learning ?

Children and teenagers are flooded by information and communication technology. It has become an essential and common part of their daily life. They don't question the pro's and con's; they don't read the manuals; they use the technology. Social media are an extension of their social life and a platform to meet one another. It's how they acknowledge each other. They are submerged with information. Information and communication technology offers a broad scope of sources for informal and non-formal learning. It is part of their life style and identity. They use ICT to meet, to play, to date, to connect, to explore the world and to construct (multiple) identities. We consider them as digital natives. It is a common understanding that these developments challenge the traditional content and nature of learning at school. ICT is considered to influence deeply the way how children learn. Learning gets a different meaning for youngsters who grew up with an amount of information within reach.

On the other hand it is obvious that an overflow of information does not necessarily result in a broad and critical understanding of the reality or in a professional attitude. Yet learners working with digital media are tempted to focus more on concrete snapshots that can be of use (a form of "bricolage") rather than to evaluate the reliability of information, to see broad connections and developments and to develop scientific or professional frameworks of reference. Another relevant distinction to make is the one between knowing what (cognition/facts) and knowing how (skills and attitudes). The enculturation and mastery of a scientific or professional practice (becoming a physician, a crafts man, a scientist) requires a socially constructed

understanding that emerges from active collaboration, dialogue and interaction. Students need to absorb the social and practical aspects of a profession (its practices) and gain tremendously from their proximity to practitioners, especially when they can watch, listen, and participate. Enculturation and personal interaction is crucial to such learning, since relatively little of the complex web of practice is difficult to transfer.

Implications for the content and nature of learning

During the seminar EUNEC members reflect on the consequences of these developments for schools.

- What is the meaning of these changing information and technology patterns for the learning and development of children (learning theory/learning psychology)? Is there a difference between young children, teenagers, learners in VET and students in higher education/adult education? To what extent does ICT change the "Bildungsconcept" of education? Is ICT questioning the humanistic content of 'Bildung'? Is ICT part of a new concept of literacy such as the ability to communicate and express oneself with images, sound, and other media? Beyond this, information navigation is perhaps the key component of literacy in the digital age. Digital students have developed their own vernacular, a screen language for their digital culture.
- Does ICT change the nature of learning? Does the spread of digital learning implies a shift from an authority-based lecture model to discovery-based and constructivist learning model? Web based learning also "confuses" learning and entertainment, creating infotainment. What are the consequences of these developments for teachers' roles changing from knowledge deliverers to developers of content and to co-constructors/coachers of the self-centred learning of pupils? What is the added value of open educational learning environments?

Stimulating an innovative approach of the use of ICT in education

During the seminar EUNEC addresses the critical conditions needed for mainstreaming of digital learning. EUNEC discusses needs in the field of didactic and school infrastructure, development of content and how to finance these innovations.

Providing resources

ICT technology is of course more than the availability of hardware (which is increasing). It has also to do with connectivity, mobile devices, cloud applications, software and evidence based digital learning environments. The level and speed of connectivity are other preconditions for integrating ICT in

education. Digital technologies evolve very fast and they require constant efforts to be updated in order to respond to increasing demands.

ICT infrastructure and tools are unevenly available in different schools, regions and countries.

Providing such facilities requires huge investments from education and training institutions and public authorities. This "financial gap" strengthens existing inequalities and increases the gap between teaching practices and ICT in society. How to deal with scale effects needed to finance adequately up-to-date development of educational content and infrastructure, certainly in a policy climate of restricted budgets?

Even though the key for success depends foremost on an innovative climate in schools and on incentives from Member States, the EU also has also a role to play. What is the added value of a European digital agenda to this regard? The EU promotes best practices and supports exchanges across Member States. It can deliver benefits from cooperation and support the deployment and availability of digital technology and content through financial support and stimulate public-private partnerships at a European scale.

Digital contents

How and under which conditions can the development of educational digital content be boosted? There are important disparities across languages, subjects and needs. There are also unclear legal framework conditions for producing, using, re-using and sharing educational contents (copyright, barriers to develop and implement innovative teaching and learning practices, re-use and sharing of contents).

Assessment and evaluation in open learning environments

As described before, the traditional curriculum based approaches of knowledge and skills acquired in a school context have shown to be too narrow. If the focus has changed from schooling to learning both in formal and non-formal context it is necessary to reconsider the techniques and the organization for assessment. Developing outcome based approaches and setting standards for validation of competences is needed.

Teachers' competences to develop innovative learning environments

Teachers are the main actors in turning on new technologies to rich and innovative learning environments. They have to rethink their evaluation and assessment practices to informal learning. They have to redefine their roles from deliverers of knowledge to co-creators and developers of competences. Teacher training and in-service professional development institutions often lack the vision and/or capacities to promote innovative teaching methods and an extensive and integrated use of technologies.

SOURCES TO PREPARE THE DISCUSSION

European Commission

Communication from the Commission[1] on 'Opening up education' and staff working document[2] with state of play in the EU, good practices, challenges, results of the consultation.

Survey of schools: ICT in Education[3]. Benchmarking access, use and attitudes to technology in Europe's schools. A study prepared for the European Commission by European Schoolnet in collaboration with the university of Liège.

OECD

What are characteristics of new learning environments ?

The 'Innovative learning environments'[4] project is focused on innovative ways of organizing the learning of young people. The project changes the spotlight of the well-known programme schooling for tomorrow from 'schooling' to 'learning'. Another change of paradigm is to start the analysis at the micro level (learning of the pupil) instead of at macro level (innovative policy). It consists of three strands: learning research, innovative cases and implementation and change.

[1] 'Opening up Education: Innovative teaching and learning for all through new Technologies and Open Educational Resources' (http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1389115469384&uri=CELEX:52013DC0654)
[2] Staff working document (http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1389115521455&uri=CELEX:52013SC0341)
[3] Survey of schools: ICT in education (http://ec.europa.eu/digital-agenda/en/news/survey-schools-ict-education)
[4] http://oecdeducationtoday.blogspot.fr/2013/09/designing-21st-century-learning.html

PROGRAMME

Monday 5 May 2014

Chaired by Adrie van der Rest, president EUNEC

09.30 – 10.00 **Opening session**

Adrie Van der Rest, president EUNEC

Professor Sokratis Katsikas, President of the Greek National Council of Education

10.00 – 11.15 **Innovative Learning Environments**

Marco Kools, OECD Analyst, Innovation and Measuring Progress Division, Directorate for Education and Skills

Questions and answers

11.15 – 11.45 **Coffee break**

11.45 - 12.45 **Digital Systems for Opening Up Education**

Professor Demetrios G. Sampson, Department of Digital Systems, University of Piraeus, Greece

Questions and answers

12.45 – 14.00 **Lunch**

Chaired by Mia Douterlungne, general secretary EUNEC

14.00 – 14.45 **European Commission Communication 'Opening Up Education'**

Videoconference with the participation of Ricardo Ferreira and Konstantin Scheller, European Commission, DG Education and Culture

Questions and answers

14.45 – 15.30 **Presentation of the report 'Mapping and Analysing Prospective Technologies for Learning. Results from a consultation with European stakeholders and roadmaps for policy action'**

Spiros Borotis, MENON network[5]

[5] http://ftp.jrc.es/EURdoc/JRC88469.pdf

15.30 – 16.00	**Coffee break**
16.00 – 17.30	**Interactive debate leading to conclusions**

Tuesday 6 May 2014

09.00 – 11.30	**School visit at the 1st Experimental Junior High School of Athens**[6]
11.30 – 14.00	**Cultural programme: visit of the Acropolis Museum**
14.00 – 15.00	**Closing lunch**

[6] http://1gym-peir-athin.att.sch.gr

Opening Session

Adrie van der Rest

Adrie van der Rest is president of EUNEC and secretary director of the Dutch Education Council

The theme of this seminar is 'learning in the digital age'. Why are we discussing this issue?

In the past 20 years, the use of ICT has increased dramatically in all areas of life. There is a well-known YouTube movie where in the late nineties people were asked whether they would use a mobile phone. Many of them thought it unnecessary. At that time, there was no way of knowing how pervasive the use of mobiles would be ten years later. We can't go anywhere without our mobiles now. Similar developments have been seen with the emergence of social media and tablet computers. ICT plays a fundamental role in almost all professions. New inventions and applications follow in rapid succession.

Digital technology is fully integrated in the way people keep in contact with each other, work together and do business together; yet technology is not being fully utilised in training and education. More than 60% of nine-year olds in the European Union go to a school that does not have extensive digital facilities (suitable infrastructure, fast broadband and high connectivity). Only 25% of pupils are taught by teachers that are self-confident with ICT and offer support. 50% to 80% of teachers in the EU never use digital text books, exercise software, broadcast/podcast materials, simulations or educational games.

In the Netherlands, the march of ICT in education is slow, but gradual. In 2007, 20% of primary school teachers stated that they used a computer for at least ten hours a week during classroom time. Five years later - in 2012 - this number had risen to 50%. Computers are mostly used to search for information, but digital text books and exercise books - supplementary to the main programme - are also popular. 78% of teachers state that they use

these on a weekly basis. In secondary education, the figures are lower. Electronic pupil tracking systems are also becoming more common.

What is interesting in the Dutch statistics is the way in which technology is used. It is largely complementary to paper-based programmes, exercises, searches and administrative support. This can be called 'conservative use', conservative in the sense that existing methods remain unchanged. ICT makes existing methods easier to use and may make them more interesting for pupils. In areas where ICT opportunities could mean more fundamental changes in working methods, use of ICT is more or less absent. Here, I am referring to digital tests and use of simulators during classroom time or serious gaming.

In summary, we could say that societies across Europe are steeped in digital technology and that use of technology in education is lagging behind. And that current use is primarily aimed at supplementing and supporting existing methods in teaching and that there are considerable differences in the use of technology between countries. According to the Communication from the Commission (Opening up Education), there is a real threat of a digital gap emerging in the EU between those who have access to innovative, tech-based education and those that do not.

Reason enough for the cooperating education councils in Europe to consider this topic. However, this immediately gives rise to numerous questions, such as: Will ICT change how we learn? Will we move from an authority-based lecture model to a discovery-based and constructivist learning model? To what extent does ICT change the 'Bildung' concept of education? And what are the critical conditions needed for mainstreaming of digital learning?

Education councils are expected to feed the democratic decision-making process with robust recommendations. In preparing their recommendations, education councils make use of scientific knowledge and experiences from the teaching profession. All the information is deliberated and considered, and at the end of this process the recommendations are formulated. The structure of this seminar is largely the same.

First, we will consider what science has to say about this topic and we will zoom in a little bit on the situation in Greece. In the afternoon, the focus will turn to Europe: what is EU policy in this field? The MENON network will present the report 'Mapping and analysing prospective technologies for learning'. At the end of the day participants will link all this information up and find out what conclusions can be drawn in relation to the current policy and how, where needed, that policy can be pushed in the right direction.

Sokratis Katsikas

Sokratis Katsikas is the president of the Greek National Council for Education

Professor Katsikas welcomes members of EUNEC, who gather in Athens for the first time. Professor Katsikas acknowledges the importance of EU-wide cooperation in the field of education and training, even though education policy is let at the level of the Member States.

The seminar of EUNEC on 'Learning in the digital age' is closely connected to the priorities of the Greek Presidency of the EU, where ICT is high on the agenda.

Insights from international work on Innovative Learning Environments

Marco Kools

Marco Kools is an analyst for CERI's project on Innovative Learning Environments and has also supported the development of the recently released Education Today 2013.

Prior to joining the OECD, Marco served as an education specialist with UNICEF in the Solomon Islands where he in 2011 also for several months served as the interim manager of the UNICEF Field Office. He further worked with UNICEF in Laos and at the UNICEF Innocenti Research Centre in Italy between 2005 and 2009.

Prior to joining UNICEF Marco worked in the field of education and training in the Netherlands, first with the Union for Catholic Education (Vereniging Katholiek Onderwijs) and later at a consultancy firm. Marco started his career in 1999 as a teacher at a junior secondary school in Rotterdam, where he taught history and geography.

Marco holds several degrees including an MBA, a Post-graduate Diploma in Policy Analysis and Evaluation and a Bsc in Educational Sciences.

Why learning? Why innovation?

Learning is at the heart of the 21st century knowledge societies and economies. Even on conventional measures (for instance PISA), far too many are not achieving well enough. In some countries, the group of not well performing is even growing.

At the same time, we are now increasingly demanding for students. We expect 21st century skills, deep learning, lifelong learning.

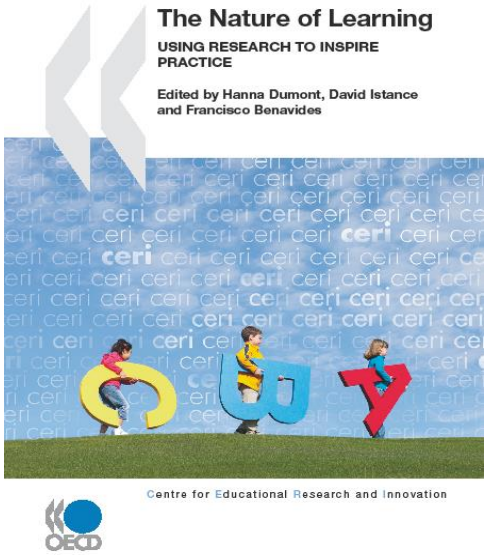
In order to meet these demanding objectives, innovation is essential in a world of change, in a rapidly changing knowledge society.

The presentation is structured along three strands:

- The nature of learning, research on learning
- Innovative learning environments
- Growing and sustaining innovative learning environments, implementation and change

The nature of learning: learning research

'The Nature of Learning: Using Research to Inspire Practice'[7] is a OECD publication from 2010. It offers an overview of existing literature and explores how education can learn from these findings.



An overview of learning literature shows important implications for the design of education:

1. Analysing and designing learning environments for the 21st century
2. Historical developments in the understanding of learning
3. The cognitive perspective on learning
4. The crucial role of emotions and motivation in learning
5. Developmental and bilogical basis of learning
6. Formative assessment
7. Technology and learning
8. Cooperative learning and group work
9. Inquiry-based learning
10. The community and academic servie learning
11. The effects of family on learning
12. Implementing innovation: from visions to everyday practice
13. Future directions

[7] The nature of Learning: Using Research to Inspire Practice', OECD Publications, September 2010 (338 pp).

This implies that learning environments should

- Make learning central, encourage engagement, and be where learners come to understand themselves as learners ('self-regulation');
- Ensure that learning is social and often collaborative;
- Be highly attuned to learners' motivations and the importance of emotions;
- Be acutely sensitive to individual differences including in prior knowledge;
- Be demanding for each learner but without excessive overload;
- Use assessments consistent with its aims, with strong emphasis on formative feedback;
- Promote horizontal connectedness across activities and subjects, in- and out-of-school.

In learning environments, all these 'principles of learning' have to be present, not just one or two.

What are innovative learning environments? The ILE Framework, analyzing innovative cases.

Innovative Learning Environments is a 2013 OECD publication.

The publication is based on the detailed analysis of 40 in-depth case studies of powerful 21st century learing environments from 20 countries that have taken the innovative journey. It presents a new framework for understanding

these learning environments. In the cases, the learners were between 3 and 19 years, although a lot of the learners were also the parents.

It develops and presents the ILE framework for designing powerful learning environments. The term 'learning environments' is used, because the autors sought alternative concepts for the 'school' and 'classroom'. These are institutional units, not about learning per se. So much learning takes place outside schools, and, even within schools, outside classrooms. But, of course, schools are and remain very important locations for learning. As a consequence, one of the key aims of the publication is to help educators and leaders to make schools, or other places where learning takes place, more learning focused.

The publication contains extended extracts, where innovations are described 'in their own words'; concepts and principles of learning are brought to life.

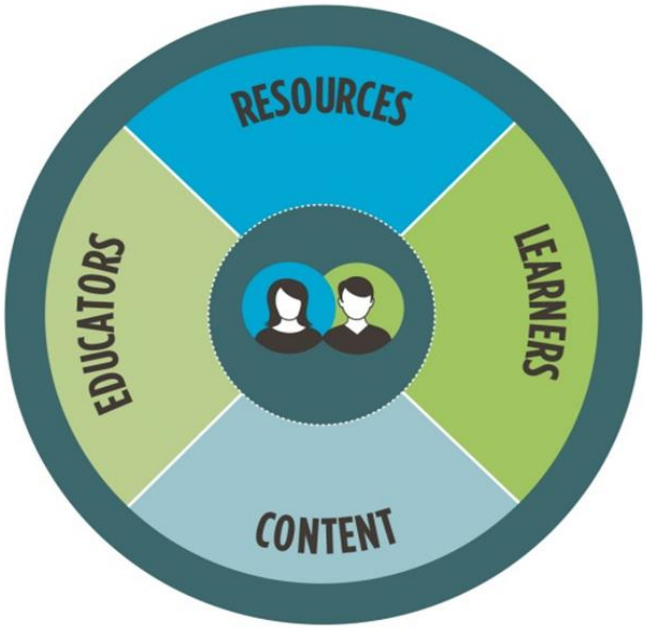
Analysis of the cases: strands of innovation

Innovating the basic elements of the pedagogical core

The analysis of the case studies shows that rethinking the basic elements of the pedagogical core is fundamental to the innovation of any school or learning environment.

These are those basic elements, with the learner in the center:

- The resources
- The learners
- The content
- The educators



In the four fields, the innovation takes place:

- The resources: Innovation can take place through the kind of resources used and how they are used. Innovation includes use of digital resources, use of learning space;
- The learners: Selection or outreach can alter learner profiles. Innovations include distant learners, parents as learners;
- The content: Knowledge, competences & values. Innovations include 21st century competences, languages, culture, sustainability, interdisciplinarity;
- The educators: the profile of 'teachers' may be innovated by adding volunteers, learning professionals, experts, distant teachers, peer teaching. In a lot of innovative cases the word 'teacher' is deliberately not used, but replaced by other words such as educator, coach, tutor, learning facilitator, ..).

Innovating the organization and dynamics of the pedagogical core

Innovating the pedagogical core's elements requires rethinking of the organizational patterns that deeply structure schools: the single teacher, the segmented classroom with that teacher, the familiar timetable structure and bureaucratic classroom units, and traditional approaches to teaching and classroom organization.

Innovation takes place:

- The learners: Rethinking how learners are grouped. Variation in size and profile of the learner groups. Mixed age groups and smaller groups within larger groups.
- The educators: Evolution towards flexible and collaborative teaching. Team teaching is introduced to expand the pedagogical possibilities and to target specific learners.
- Innovating pedagogical options, including inquiry-based methods, tech-rich possibilities, strong formative feedback and remixing pedagogies.
- Rethinking of the learning time, with flexibility in the timetabling, personalized timetabling, learning time in and out of school, in order to permit deep and collaborative learning.

Learning leadership and formative learning environment

The analysis of the case studies also shows how learning environments can become 'formative organizations' through strong design strategies with corresponding learning leadership, evaluation and feedback.

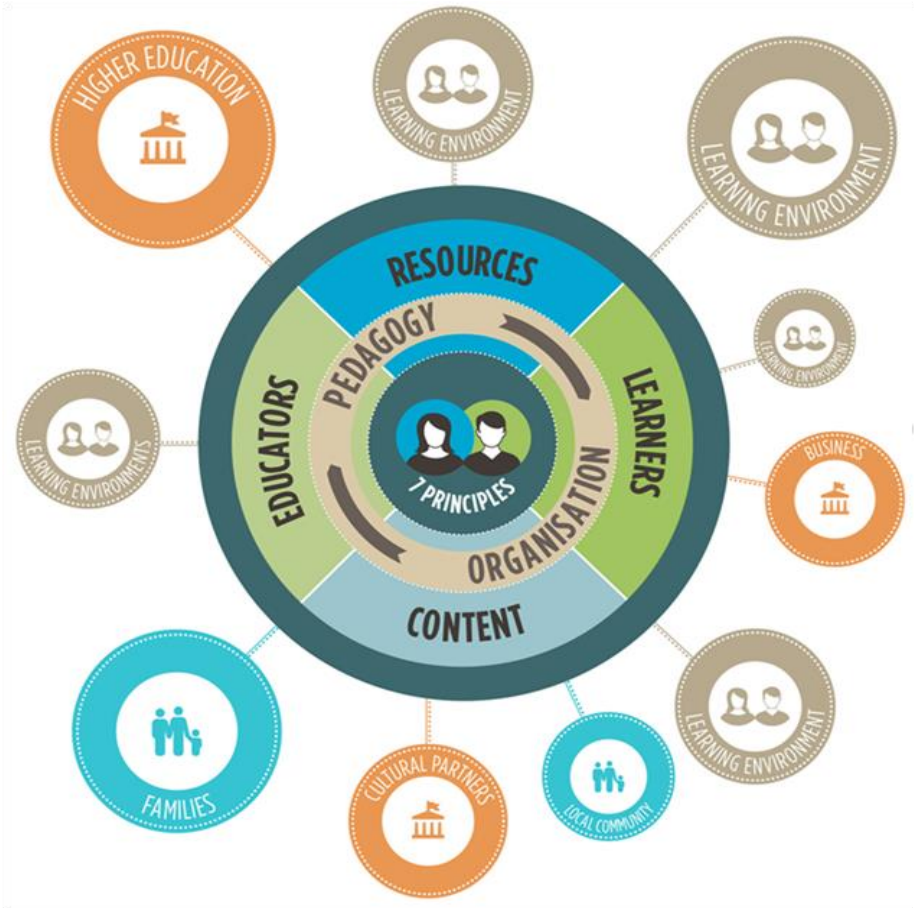
Innovation often starts with a very specific vision on what has to be achieved. The following questions are crucial:

- Who is leading decisions about teaching and learning?
- How is the learning evidence used formatively?
- What are the learners learning? What does the evidence show?
- How is evidence of learning made usable and accessible?

These questions are particularly important given the fact that schools are less stable now, with more critical parents and more demanding society.

Partnerships enrich the pedagogic core, learning leadership and extend boundaries and capacity

The analysis of the case studies also shows how opening up to partnerships helps grow social and professional capital, and allows for sustaining renewal and dynamism.



All the partnerships are permeated by and designed to the principles of learning (cf. supra):

- Learning and learner engagement central;
- Learning is social and often collaborative;
- Highly attuned to learners' motivations & emotions;
- Acutely sensitive to individual differences;
- Demanding for each learner, without overload;
- Assessment coherent with learning aims & emphasis on formative feedback;
- 'Horizontal connectedness' across activities & subjects, in- & out-of-school.

Where does ICT come in?

21st century learning environments should

- Integrate and apply the ILE principles;
- Innovate the pedagogical core;
- Engage the 'design/redesign' formative cycle;
- Extend capacity through partnerships.

In order to realize this, ICT could come in everywhere. ICT and digital learning could enter the learning environment in numerous ways, at different levels. But there is no single technology effect or means through which it might reshape the nature of learning environments.

The presented ILE framework offers a frame to address the multiple roles and opportunities for ICT to innovate learning environments and enhance learning.

Technology redefining the elements of the pedagogical core

Technology may recast all elements of the pedagogical core (learners, educators, content en resources)

- By bringing in excluded learners;
- By bringing in online tutors or experts;
- ICT is extending materials well beyond textbooks;
- Digital resources as well as learning space.

The case of the Instituto Excuela Jacint Verdaguer, Catalonia, Spain is innovative in the field of the basic elements of the pedagogical core. This is an integrated pre-primary, primary and secondary school, with emphasis on learner autonomy, inquiry-based and co-operative learning. Using textbooks is avoided outside certain subjects where learning tends to be linear. The teachers (facilitators of learning) design and prepare any materials used, mainly by means of the Moodle platform. The teachers also look for the best

available resources: software, web pages, educational games, videos, simulations.

Another case is the Escola Móvel, Portugal. The school aims to give permanent access to a virtual, national-curriculum learning environment for secondary-age students who would otherwise be excluded. The content is delivered through online, synchronous classes and includes both individual subjects and cross-curricular areas, personalized through an individual tutor. The virtual learning environment is complemented by four face-to-face weeks a year for each learner.

Technology innovating the organization and dynamics of the pedagogical core

Technology may also innovate the core dynamics. Contemporary learning environments use time more flexibly which goes hand in hand with individualized learning plans. Virtual settings break down the notion that learning has to take place in a fixed place and at a fixed time. The aimed mix of pedagogies can be enriched through digital learning.

The case of Mevo`ot HaNegev, Israel is innovative in the field of the dynamics and organization of the pedagogical core. This school caters for 13-18 year old students, and has introduced a shorter school week (5 days) and longer lessons (60 minutes). The emphasis is on project based learning. The 'virtual campus' school system enables every teacher to develop a course website. 500 virtual learning environments are used to store learning products available any place, any time, and provide an ongoing communication between teachers and learners on the various courses and classes. The teachers invest a lot of time and know-how in developing the course sites, using a wide variety of information sources, communication with peers and colleagues, and most importantly feedback and a direct connection to the teacher.

Technology supporting leadership, design and redesign, formative learning environment

A formative learning environment needs to be highly informed about learning that takes place within it. Learning evidence can be provided through ICT e.g. data management systems, online portfolio's, online feedback by teachers etc.

Distributed leadership may also depend on ICT for communication and collaboration.

The John Monash Science School, Australia, is innovative in this field. School online databases enable teachers to access students' performance data to which staff add online feedback and collected artefacts of student learning.

> *"We are learning to work with the amount of data we generate here. We already have a great deal before the students start, but given the*

way we work, we are continually amassing more and more. And, we are developing a very big picture of each student, so that we can counsel them in how to work more effectively, like whether they should try to get a bit more balance between study and leisure" (teacher)

The Science and Mathematics School, South Australia (grades 10 to 12, on the campus of the Flinders University) is another example. Students work with an individual learning plan and an electronic portfolio. Students and parents can access a virtual learning environment that students use for group work and storing of materials.

Technology opening up wider partnerships

Creating wider partnerships is a defining feature of innovative learning environments through forging of alliances, partnerships and networks, while extending the environments boundaries, learning spaces and resources.

Technology is often integral part of and supports such widening of partnerships.

Technology in the learning principles

Technology has not been singled out as defining a separate principle. Learning research does not suggest that ICT needs to be exploited as a condition for learning to be effective.

But, technology is greatly important. Its creative and informed application can be seen to enhance all of the principles, far from reducing technology's centrality, the principles reinforce the argument for more and better use of ICT in contemporary education.

Examples:

- Technology has repeatedly shown its value in engaging young learners, hence reinforcing the principle of learner centeredness;
- Technology can facilitate collaboration and joint learning, including through use of social media, hence underpinning the social nature of learning principle;
- Individual differentiation can be greatly facilitated through, for example, more systematic tracking of individual learning paths and performances, hence underpinning the principle of sensitivity to individual differences;
- Similarly, technology can support formative assessment and feedback, hence reinforcing the principle of use of assessment strategies consistent with expectations.

Conclusions

We live in a digital age – technology is not an option. However, learning should not be 'technology centred', but instead 'learner centred', and if desired ICT-enabled. ICT is necessary, but it is not the starting point. The important thing is to start with a vision. If there is no continuous professional development, investing in ICT is a waste of money, computers and devices will be collecting dust.

Implementation and change: growing and sustaining innovative learning environments

The strand 'implementation and change' is ongoing work; final reports are to be published by the end of 2014. OECD wants to learn from implementation processes and look for signs of success.

The central question is

> *"How can innovative learning environments be developed, brought to scale and sustained?"*

It includes data collection and analysis of promising strategies and initiatives for spreading and sustaining innovative learning environments. The analysis is operated through time so that there is evidence of implementation. The initiatives and strategies can be large scale reforms as well as other approaches, traditional top down reforms as well as digital platforms.

About 26 'systems' are involved in the implementation and change strand. 'Systems' can be governments, districts, institutions. There are 17 in-depth case studies.

On the next page, there is an overview of the selection of systems engaged in the implementation and change strand:

'Systems' (country, state or organisation)	Reform/stategy/initiative
South Australia (Australia)	Department for Education and Child Development
Victoria (Australia)	School Improvement at Scale
Austria	New Secondary School
Fédération Wallonie-Bruxelles (Belgique)	Décolâge
Alberta (Canada)	Inspiring Hearts and Minds
British Columbia (Canada)	Networks of Innovation and Inquiry, Centre for Innovative Educational Leadership
Chile	Multiple initiatives
Finland	**Finnish National Board of Education**
France	Respire
Israel	Experiments and Entrepreneurship Division, MoE
Korea	Center for Multi-Cultural Education, Along with Hanul Club, Rainbow Chorus
Lego Education (Peru)	Lego Education Program in Peru
CONAFE (Mexico)	Intinerant Pedagogical Advisor
Union of Businessmen for Technology in Education (Mexico)	UNETE 2.0
New Zealand	Learning and Change Network
Norway	The Advisory Team
MIET/Zwazulu Natal (South Africa)	ICT in Education project
Spain	Curricular Integration of Key Competences Project
Sweden	Mother Tongue Theme Site
Ticino (Zwitserland)	School Improvement Advisor/Researcher
UNICEF (Former Yugoslav Republic of Macedonia)	Teacher Education Programme on Early Numeracy and Literacy

Preliminary findings show the importance of

- policy leadership to create favourable climates, conditions & capacities for learning leadership to flourish throughout the system;
- culture change. Sometimes, the school culture is against change. The challenge is to break up the culture. People first of all have to believe that innovative learning environments is the way forward;
- capacity building & collaboration;
- communication technologies & platforms;
- change agents.

Selection of findings from other OECD work

'Innovation in a Knowledge Economy' (OECD, 2004) defines four sources or 'pumps' of innovation for organizations in different sectors of the economy, including education:

- Modular reorganization and specialization;
- Engaging in and exploiting research and development;
- Networking and sharing knowledge;
- Technologies and technological advance.

An analysis of educational patents over the last 20 years shows there has been a clear rise in the production of innovative educational technologies. But the evidence shows this emerging industry targets non-formal and tertiary education, rather than primary and secondary (Foray and Raffo, 2012).

Many of those considered 'digital natives' are not sufficiently 'digitally literate' yet (PISA).

'Connected Minds' (OECD, 2012): Young people's expectations as learners in relation to technology use in formal education seem not to be changing dramatically and they are not always comfortable with innovative educational uses of technology despite the social media and digital practices they otherwise engage in as young people.

This is not to say that they want no change as they do expect technology to be a:

- source of engagement to make learning more interesting and relevant;
- means to make school work more convenient; and
- means to make it more educationally productive.

The 'New Millennium Learners' project shows a need for more systematic knowledge about technology in education, with an evolving framework for sustaining both top-down and bottom-up technology based innovations and appropriate capacity building, and well organized, easily accessible and up to date knowledge base.

Digital Technologies for Opening up Education

Demetrios G. Sampson

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Outlines of the presentation

Digital systems and services for technology-supported learning and education, referring to innovative methods, tools/systems and technology-supported services are recognized as the key drivers to transform the way that individuals, groups and organizations learn and the way to assess learning in 21st Century.

These transformations influence:

- Objectives - moving from acquiring new 'knowledge' to developing new and relevant 'competences';
- Methods – moving from classroom-based teaching to context-aware personalized learning;
- Assessment – moving from life-long degrees and certifications to on-demand and in-context accreditation of qualifications.

Within this context, promoting open access to personalized learning experiences for all, is currently a key issue in the public discourse and the global dialogue on education, especially with the increased interest on 'Massive Online Open Courses' (MOOCs).

The presentation is built up in four chapters:

- the fundamental issues related with the deployment of digital technologies in learning and education (when – why – how – which);
- the key educational innovations that are shaped with the support of digital technologies, namely, opening up education to facilitate personalized learning and connect learning inside/outside the physical classrooms through the digital cloud;
- case examples of major initiatives in Europe and around the world that aim to address the societal demand for large-scale implementation of technology-enhanced learning and schooling innovations and national (Greek) initiatives within this field;
- current technical, pedagogical and organizational challenges when moving learning from the physical classrooms to the digital cloud.

1. Digital technologies for learning and education: fundamental issues

When?

Digital technologies for learning and education are used as an enabler for transformations, to provide learning experiences that would not be possible without digital technologies. The fundamental challenge is **to use digital technologies to enhance the learners' experience,** not only to replace or

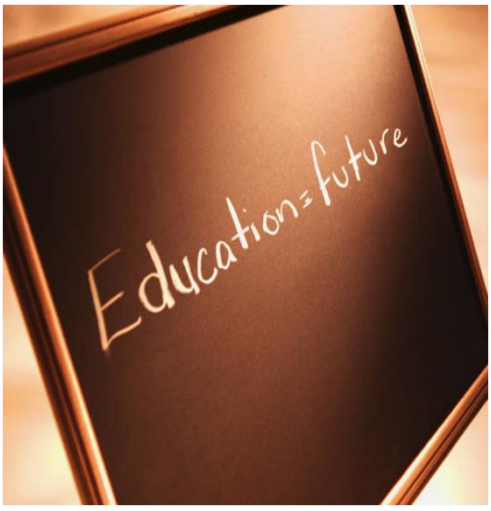
duplicate the experiences they can have in a physical space or in a face-to-face communication.

One of the key challenges is that people are claiming personalized learning. One size does not fit all, and 'one size' is exactly what has been presented in traditional schools, expecting that it will more or less fit to all.

According to the National Academy of Engineering, for instance, building systems for advanced personalized learning is one of the grand challenges for engineering. Founded in 1964, the National Academy of Engineering (NAE) is a private, independent, non-profit institution that provides engineering leadership in service to the nation. The mission of the National Academy of Engineering is to advance the well-being of the nation by promoting a vibrant engineering profession and by marshalling the expertise and insights of eminent engineers to provide independent advice to the federal government on matters involving engineering and technology. The Academy states that instruction can be individualized based on learning styles, speeds and interests to make learning more reliable.

What kind of personalization are we expecting? Many people think that personalized learning is just about creating personalized content. But we expect much more: the aim is to have a complete learning experience adapted to the individual student, including teaching, scaffolding and feedback. The risk is now to move from a teacher-centred approach to a technology-centred approach. It is important to keep in mind that education has to remain learner-centred.

Why?



Why are we trying to use digital technologies for learning and education? Why do we bother? Because there are so many changes in the way we learn and in the way we assess that we can simply not afford to ignore the new technologies. **Digital technologies are an enabler for incremental and disruptive transformations** to the way that individuals, groups and organizations learn and the way to assess learning in the 21st century.

Changes are taking place in three fields, which are equally important:

- Objectives

From acquiring knowledge to develop new and relevant competences.

- Methods

From classroom-based teaching to context-aware personalized learning. Children spend about 8 hours per day in a school environment; this is only one environment, with only limited capacity to have learning experiences. Learning can take place in other environments, outside the classroom. This is also the case for continuous professional development for teachers: teachers learn often more by discussing over coffee than in a formal seminar.

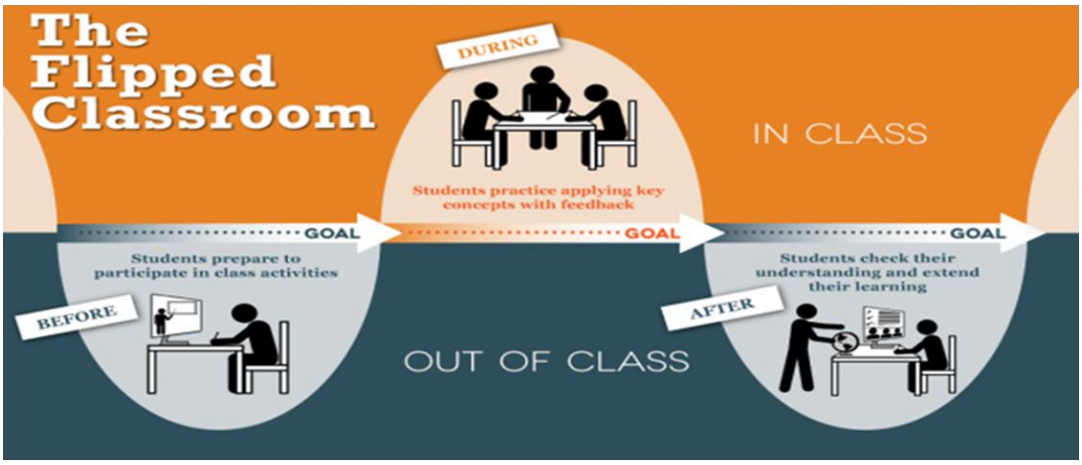
- Assessment

From life-long degrees and certifications to on-demand and in-context accreditation of qualifications. Degrees that are acquired at the age of 22 don't last for life anymore. It is more important to be able to assess the capacity of people to do things.

How?

The flipped classroom is an interesting experiment that is now widely used in the USA, in Canada and in Australia. Flipped classroom is a form of blended learning in which students learn new content online by watching video lectures, usually at home, and what used to be homework (assigned problems) is now done in class with teachers offering more personalized guidance and interaction with students, instead of lecturing.

The idea is to use more effectively the time of the teachers as a resource, **to use the time of the teachers to offer scaffolding and support** in the interaction they have with the students in the classroom.



Out of class students prepare to participate in class activities. In the classroom, students practice applying key concepts with feedback. After that, out of class, students check their understanding and extend their learning.

An example: students are asked to create a small ebook, as a material that will be used in the afternoon by their students to study. Then they collect the data, and they build the next morning activity on the difficulties faced by the

students in the afternoon. The advantage is the easy access and the transparency: we can see how students perform, what went wrong.

It appears that this flipped classroom is not only effective for those pupils who score high on self-regulation. The experience is opposite: the average student tends to be more engaged. Even poor students improved their performance significantly, because of motivation and engagement. They actually see that they benefit from their efforts the next morning.

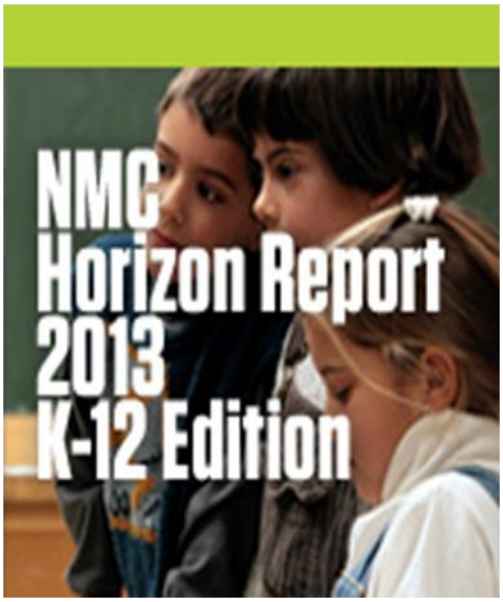
In the US, 'clickers' are being used: every 20 minutes a question is raised with a hidden answer. Each student submits an answer to the question using a handheld transmitter (a 'clicker') that beams a radio-frequency signal to a receiver attached to the teacher's computer. Software on the teacher's computer collects the students' answers and produces a bar chart showing how many students chose each of the answer choices.

The teacher makes 'on the fly instructional choices in response to the bar chart by, for example, leading students in a discussion on the merits of each answer choice or asking students to discuss the question in small groups.

This raises the interest of the students in the topic that is being discussed, better than a 3 hours lecture without any interaction or any discussion. This is a good example of the use of simple technologies. In education, as in other fields, complicated technologies often don't work.

Which?

This issue is examined in the fifth edition in the annual K-12 series of the NMC Horizon Project[8]. The NMC (New Media Consortium) is an international community of experts in educational technology. The study examines emerging technologies for their potential impact on and use in teaching, learning, and creative inquiry within the environment of pre-college education. Six emerging technologies are identified across three adoption horizons over the next one to five years, as well as key trends and challenges expected to continue over the same period, giving educators, school administrators, and practitioners a valuable guide for strategic technology planning.



[8] The NMC Horizon Report > 2013 K-12 Edition (http://www.nmc.org/news/its-here-horizon-report-2013-k-12-edition)

Some highlights of the study: Open access to digital resources and practices, digital tools and digital courses and classrooms is high on the agenda. This access is realized via multiple devices: smartphones, tablets, laptops, game engins and supported by cloud technologies and cloud infrastructure.

One of the interesting questions raised is how to embed educational content in the game engins, and how to dialogue with the industry of games. The industry has invested a lot of money in the development of the games. It is worth exploring how to re-use these engins for educational purposes without having to create everything from the beginning.

2. Key educational innovations shaped with the support of digital technologies, namely, opening up education to facilitate personalized learning and connect learning inside/outside the physical classrooms through the digital cloud.

Opening up education

The Open Educational Resources movement is high on the agenda everywhere. Web-based systems organize, classify, store and share OERs (Open Educational Resources) or LOs (Learning Objects) and their associated metadata.

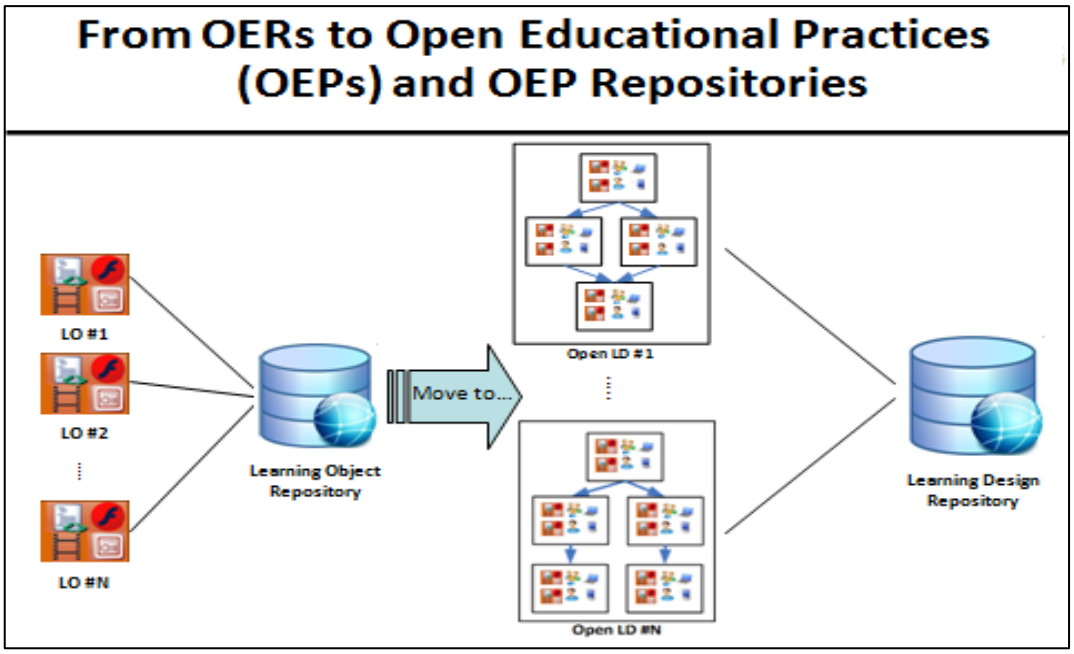
OPEN EDUCATIONAL RESOURCES

Some examples of OER repositories:

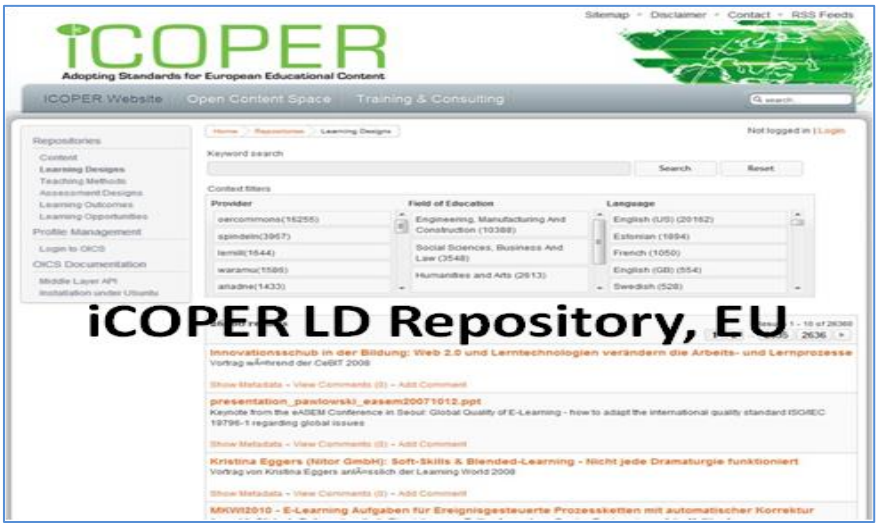
Professor Sampson has some concerns here. Of course, a lot of systems provide access to interesting resources. But, the problem with these systems is that they **include limited explicit information about the learning and educational context of use of their hosted OER**; we see a resource, but we don't really know how is was used, who were the students, what was the effect.

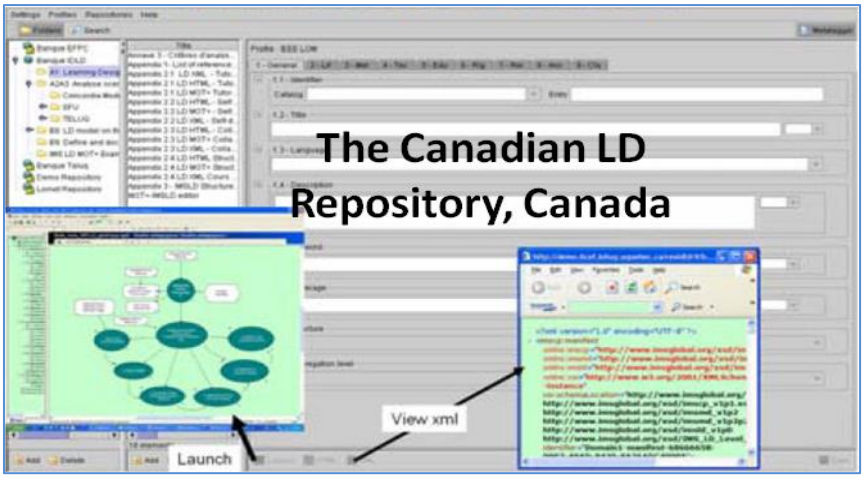
Europe has invested too much in making available resources where people can upload files, simulations, video's, but without any contextual information on the environment of use. Education is not about consuming a specific material, but about doing things, about processes.

Our solution is **to move from OERs to Open Educational Practices (OEPs) and OEPs repositories.** Basically, we want to be able to show the workflow with certain tools. Open Educational Practices don't only share the resources, they also show the context, what has actually been done with the resource.

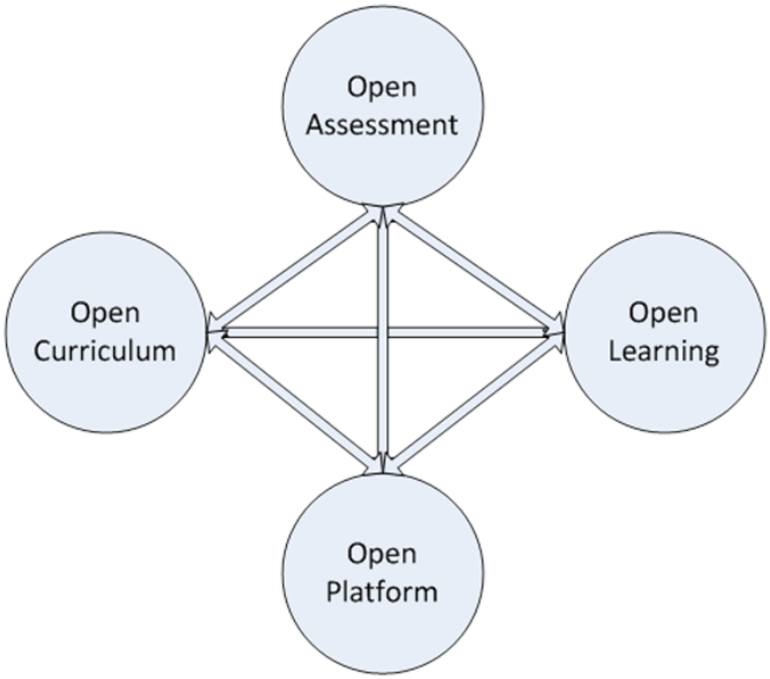


Some examples of OEP repositories:





The European Commission Communication on opening up education in fact recognizes these **different aspects of openness** going far beyond open educational resources, moving to open curriculum, to open learning, to open assessment and to open platform.



- **Open Curriculum:** learners can mix educational resources, learning activities, and/or educational courses for different disciplines to meet their needs. This places learners in charge of their own learning and ensures that they will learn what they need to meet their personal desires and requirements.
- **Open Learning:** teachers, experts and/or peers can share new ideas and new understanding during the learning process. This provides learners with opportunities for self-determined and independent learning.
- **Open Assessment:** instead of formal evaluation of learning results, previously led by accredited education providers, assessment of what learners have learned can be carried out by their teachers, others and peers during the learning process via peer to peer or crowd-sourced assessment with on-demand accreditation for learners.
- **Open Platform:** cloud–based provision and the use of open standards make it easier for different platforms and services to exchange information and data.

Connect learning inside/outside the physical classrooms through the digital cloud

In the preparing documents for the conference, the text refers to the threat of a new digital gap, between the rich and the poor, between pupils in isolated rural areas and pupils in big city schools. Moving the infrastructure from the local to the cloud can be part of the solution.

There are a lot of examples of how we move from the physical school classroom to the digital cloud.

A lot of activities are taking place outside the classroom, within and outside the school. How to connect learning inside and outside the physical classrooms through the digital cloud? How to orchestrate meaningfully in order to serve education? That is a real challenge. In order to do that, **we need to be able to share.**

We need to be able to share

- **People.** The model that the teacher is serving only the community of his classroom is maybe an old fashioned approach. If a pupil can learn better with another teacher, why should he stick with the first teacher, who has been assigned to him perhaps because of his place in the alphabet? Why should a pupil not learn from a teacher on the web, to whom he is not assigned because he lives in a different region?
- **Resources, practices, tools, services**
- **Interaction data.** Education is lacking data, not data that is collected after education has happened, data on output and results, but data on what is happening. That is why it is difficult to tell, for instance, if a pupil is doing well on a PISA test, this performance is thanks to the school or thanks to the private tutor.

Another major challenge is to move from teacher competence profiles to school competence profiles, where schools can benchmark their solutions to educational problems. This can be a competitive advantage, not for the school profit but for better serving society.

<u>School Portal/CMS</u>

On school premises, schools use their own technology infrastructure for hosting their portals/CMSs. School portals/CMSs are based on open source solutions or custom-based solutions, possibly with an extra cost.

On digital cloud, cloud infrastructures offer hosting power and computing power. Each school can easily create its own portal/CMS – Software as a Service (Saas). There is no need for programming skills and cost for technology infrastructure procurement and maintenance.

Teachers' communities

On school premises, teachers' communities are not easily organized. Best practices cannot be easily communicated among their members. Collective knowledge is not easily stored and maintained. There is only local coverage, and there are limited opportunities for professional development.

Web-based teachers' communities share and reuse educational practices and educational resources. There are online collaboration tools such as Forums, Chats, Wikis, Virtual Worlds for retaining and advancing communities' knowledge. Participation is wider, beyond local restrictions. There are more opportunities for professional development.

Physical laboratories

On school premises, physical laboratories are subject to space and time constraints. Only a limited type of experiments is possible. There are accessibility and safety issues, and costs of equipment and procurement are high. Science education thus requires a lot of investments.

Online laboratories (remote laboratories, virtual laboratories) are available beyond time and space constraints. Access to state-of-art experiments is possible (high energy physics, remote telescopes). Provisions for people with physical disabilities are easy. There is no cost for equipment. Experiments can be repeated without constraints.

3. Large-scale implementation of technology-supported educational innovations: initiatives in progress.

Implementing technology-supported educational innovations is another challenge. Policy makers tend to think about changes in terms of "how can this be implemented?"; policy makers think about incremental changes that can be implemented at large scale in the next few years. We need to think out of the box now, and think about truly transformative innovation from which we can learn.

The problem is not the technology itself. This is the less important challenge. Technology is available, a lot of materials are free, there is even no need for investments. The real challenge is how to implement changes that go beyond the preconceived ideas shared by many people involved in education: teachers, parents, students.. They are reluctant to change involving technology; they are uncomfortable when they are out of their comfort zone. They feel more comfortable if they can learn in a traditional setting. Any changes of the rules create confusion. But, bringing people out of their comfort zone is very important in education. This discussion is going on all over the world.

In Europe

ODS Project (Open Discovery Space) (http://www.opendiscoveryspace.eu).

Open Discovery Space is about a socially-powered and multilingual open learning infrastructure to boost the adoption of e-Learning resources. The objective is to support mainstreaming by orchestrating open access to more than 1.5M OERs/OEPs from 75 active existing active LORs/LDRs in Europe. The project started in April 2012 and involves a 15.3M euro investment (public and private).

Possible activities:

- Search/Share OERs/OEPs on the cloud with a wide network of teachers and practitioners;
- Create/participate to teachers' communities (national, thematic) – Access to a number of online collaboration tools;
- Develop my own School Portal on the cloud and share my school resources (OERs/OEPs).

Inspiring Science Education (ISE) Project (http://inspiring-science-education.org)

The projects presents large scale experimentation scenarios to mainstream e-Learning in Science, Mathematics and Technology in primary and secondary schools. Large-scale pilots are set up to stimulate innovative use of cloud-based tools and resources for STEM.

The project started in April 2013 and involves a 9,8M euro investment (public and private). Target users are 5000 primary and secondary schools in 15 European Countries.

Possible activities:

- Design lessons/scenarios by using existing resources and tools (such as online labs) and store them on the cloud;
- Deliver lessons/scenarios to students;
- Collect educational data for student assessement.

Elsewhere in the world

China

The Ministry of Education launched a national programme on the application of e-Learning in the social computing environments: e-Textbook and e-Schoolbag initiatives. China is an interesting case, because in this country, the biggest investments are taking place related to technology and education.

However, professor Sampson is not optimistic about the results, given the fact that this programme has only been centrally designed.

Arab League

ALECSO (Arab League Educational, Cultural and Scientific Organization) provides cloud computing services in education and Arab Open Educational Resources.

4. Technical, pedagogical, organizational challenges

Different levels of technology-supported educational innovations can be distinguished:

- Level 1: Infrastructure

Simple technological shift from local hosting to the cloud. This level offers a practical added value, but not a transformative change.

- Level 2: Resources and teacher competences

Enhance classroom based activities with access to a wider range of resources and tools. What happens in the classroom becomes richer, but it still happens in the classroom. This level deals with incremental school based innovation. Most governments in Europe have taken action related to this level. Governments feel comfortable, because they invested in infrastructure and in teacher training. However, as long as innovation only deals with incremental steps (replace the book by the computer), there will be no real impact. Magical things don't happen here, schooling is not really changed.

- Level 3: Transformative innovation

Orchestrate personalized learning experiences inside the classroom and many personalized learning experiences outside the classroom. This kind of innovation can make the difference. If we are aiming for a real impact we need to think in a transformative way, we need to have the appetite to transform.

What is really missing at the moment is the **smart integration of physical learning spaces (inside and outside the classroom) and the digital cloud.** Move the school into the cloud is not the solution. It is important to **orchestrate educational activities** (teaching, collaborating, scaffolding, feedback, assessment), to **collect and analyze educationally meaningful data** from all these activities in **a smart learning environment which integrates physical learning spaces and the digital cloud.**

European Commission Communication 'Opening Up Education'

Videoconference with the participation of Ricardo Ferreira and Konstantin Scheller, European Commission, DG Education and Culture

The full title of the European Commission Communication is 'Opening up education. Innovative teaching and learning through new technologies and open educational resources.'[9]

During this presentation, the European Commission wants to pass out two main messages:

- The importance of the comprehensiveness of the interventions. In the Communication, the Commission addresses three areas: learning environments, content and infrastructure. It is completely useless to address just one strand, the approach has to be comprehensive. The policy will not work unless it addresses all three areas. It is not enough, for instance, to introduce technology if the teacher is not taught how to use the technology.
- The importance of the comprehensiveness in terms of the actors that need to be engaged. It is not just about the policy side (EU, national, regional, local), but stakeholders at all levels have to be involved. This cannot be a bottom-up approach, neither can it be just a top-down approach.

Opening up education is about the fact that **all individuals can learn anytime, anywhere, with any device, with the help of anyone.** This looked like a nice dream, like science fiction about ten years ago. Today, technology allows us to move towards this direction.

Why?

Why do policy makers need to intervene? Why do policy makers need to consider these changes? Why can't we simply allow these changes to be embedded in the education system? The five following items are different parts of the full picture.

[9] 'Opening up education. Innovative teaching and learning through new technologies and open educational resources.', Communication from the European Commission, 25 September 2013.

The digital revolution

Technology changes the way we deliver education. Ten years ago, we were discussing technology in the classroom. We were discussing about more computers in the classroom, about the use of smartphones, we were discussing technology IN the classroom. Now, we see that often learning is taking place OUT of the classroom, **out of the educational institutions**. A real change is taking place, **learning is becoming mobile**. This allows **massification.** Change is happening now, and policy makers at all levels must grasp the opportunity.

The number of European MOOCs is now already about 500, in six months this number has grown with more than 60 %. In the worldwide offer of MOOCs the offer in Europe is already around one fourth.

More demand for education

Attainment in higher education is about to reach the Europe 2020 target of 40%. That alone means an important increase in the demand for education. If we look beyond Europe, according to UNESCO statistics, there will be more than 414 million students in higher education by 2030. To cope with that number in the traditional education system, we would need to produce one new university (for about 30.000 students) per week. This is a huge challenge, we need to consider radically new solutions.

Skills deficit

20% of the adults is low skilled, whilst 90% of the jobs will require digital skills. We must allow the openness of the educational system to adapt itself to the skills required by the labour market.

Changes in the supply

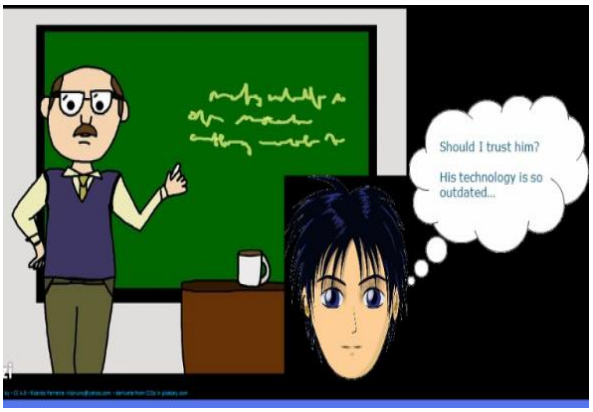
We are not calling for these changes, nor rejecting it; it is simply happening. In the global race for talent, and with the appearance of new providers in education, citizens are exploring new solutions to acquire the knowledge and competences they need. This is a challenge for the existing educational institutions. How will they adapt their educational and business models to cope with this increased competition? The European Commission is not preaching that every institution should be highly digital; but it is necessary that every institution questions itself.

Cost pressure

Whenever the European Commission addresses educational policies, the Commission stated that expenditure in education is an investment. Member States have been encouraged to invest in education. Nevertheless, the economic crisis lead several Member States to decrease public expenditure in education. As a consequence, the costs of education for individuals are rising, there is a huge pressure on families. It does not sound reasonable that individuals don't have access to education, whilst the European Commission is preaching for more access to education for all. Therefore, it is necessary that policy makers overcome some tabous. Using the words 'more cost-effective solutions in education' should not be a tabou. We have to use the potential of technology to allow more cost-effective solutions in order to ensure access to education for all citizens, not just youth.

The learner in the driving seat

In many classrooms today, we see that the teacher is not confident, even a bit scared. Individual pupils question him, and he is scared, because he is not taught how to teach with digital technologies. The increased demand for education does not question the teacher: there is the need for personalized learning, with guidance and support. But above all we need to find solutions, that are not necessarily the same everywhere, to allow the learner to be in the driving seat, to permit a really personalized learning. We now have the technological solutions to permit to every individual to have access to the resources according to his specific needs.



Open learning environments, open educational resources and connectivity and innovation

The European Commission Communication is based on three pillars. For each pillar, a number of actions are foreseen, at the level of the Commission, of the Member States and of educational institutions.

Pillar 1: Open Learning Environments: opportunities to innovate for organizations, teachers and learners

This area is probably the most complex one. The Communication distinguishes opportunities to innovate for organizations, for teachers and for learners.

- For organizations: Education and training institutions need to review their organizational strategies to stimulate innovative learning practices. Schools have to become 'innovation hubs', places fostering challenging new solutions and the implementation of these solutions. In many cases a too rigid system is preventing this from happening. In many schools, teachers receive the message not to take risks.
- For teachers: Teachers should be able to acquire high digital competences, to connect through strong learning communities of practice and be rewarded for new teaching methods. This fails in most Member States. It is not important to teach teachers about computers, but to teach them how to teach with computers.
- For learners: Learners can expect to acquire digital skills and have their digitally-acquired skills certificated and recognized for further learning and work.

The most important **EU-Actions** in this field relate to

- Support review of business and educational models of institutions;
- Support teachers development through online courses;
- Expand EU platforms for communities of practices.

Pillar 2: Open Educational Resources: opportunities to use open knowledge for better quality and access.

This area is related to the content of education. The key message is about the complementarity of open content and traditional content. It is necessary to assess how we can best explore the potentials of open educational resources. These OER offer two immediate and clear advantages:

- They are more cost-effective, because they are easy to adapt, easy to contextualize. They don't get out of date.
- They are being produced often bottom-up, by educators. This element of sharing, of co-creating is promoting peer learning.

The most important **EU-Actions** in this field relate to

- Open access requirement in Erasmus +. This means that every beneficiary of an Erasmus+ grant must make publicly available the educational materials produced. This is a clear policy message: the European Commission wants to maximize the impact of materials produced with public money.
- OpenEducationEuropa.eu. Open Educational Resources are available, but they are not found, they are not used enough. The resources will be more easily accessible through this OpenEducationEurope portal.
- Multi-stakeholder dialogue on transparency of copyrights. At this moment, it is not always clear which content can be introduced in a syllabus that is being prepared for open access. There is need for more transparency here.

Pillar 3: Connectivity and innovation: partnerships for infrastructures, new products and services, and interoperability

This third pillar has to do with infrastructure. It is necessary to upgrade ICT infrastructure and connectivity where needed. The European Commission pleads for open interoperability standards and stimulates a European market for digital content.

The most important **EU-Actions** in this field relate to

- Develop open frameworks and standards for interoperability
- Coordination of joint specifications for public procurement

A concerted effort to seize the opportunities of the digital revolution

The European Commission can

- bring policy guidance under the Open Method of Coordination, through the Commission Communication on 'Opening up Education' and other Communications;
- fund projects under the Erasmus+ programme, the Horizon programme, the structural and investment fund;
- promote overarching tools.

The European Commission is not capable of deciding what works in which context. The Commission can fund projects for exploring these issues, and for stimulating peer learning and interaction. The European Commission does not take a prescriptive position, but stimulates research on effectiveness and impact of open educational resources.

At the same time of the adoption of the Communication on opening up education, the Commission adopted Erasmus+. One of the important changes

compared to the former Lifelong Learning Programme is the fact that different types of beneficiaries and different types of partnerships are possible, including the private sector. This is a clear call for businesses to engage in the education system.

Mapping and Analyzing Prospective Technologies for Learning

Results from a consultation with European stakeholders and roadmaps for policy action

Spiros Borotis, research manager, MENON network

The authors of the report are Stefania Aceto, Spiros Borotis, Jim Divine & Thomas Fischer (MENON Network). The editors of the report are Panagiotis Kampylis and Yves Punie (IPTS). The report is available at: http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=6979.

IPTS, the Joint Research Centre Institute for Prospecetive Technological Studies, operates research on 'educational transformation in a digital world', in support of (mainly) DG Education and Culture.

These are the research strand of IPTS:

- Open Education and OER (OEREU; OpenEdu, Science 2.0);
- Key Competences and 21st century skills (ICEAC; COMPASS; DIGCOMP);
- Innovating Learning and Teaching (LEARNCOM, Learning 2.0; 1:1 Learning; TeLLNet, SCALE CCR);
- Future of Learning (FutLearn; eLFut; **MATEL**; The Horizon Report Europe).

The MENON network is a non-profit organization established in Brussels in 1999, following a successful ESPRIT project. Its mission is to facilitate the evolution of the knowledge society in Europe and in other parts of the world, making learning a priority issue in policy agendas around economic, social and cultural development at both national and international level.

The MENON network has four members:

- CEPCEP – Universidade Catolica Portuguesa, Portugal;
- Hellenic Association for Education, Greece;
- Sophia R&I, Italy;
- Tavistock Institute, UK.

The MENON network works together with seven partners:

- Budapest University for Technology and Economics, Hungary;

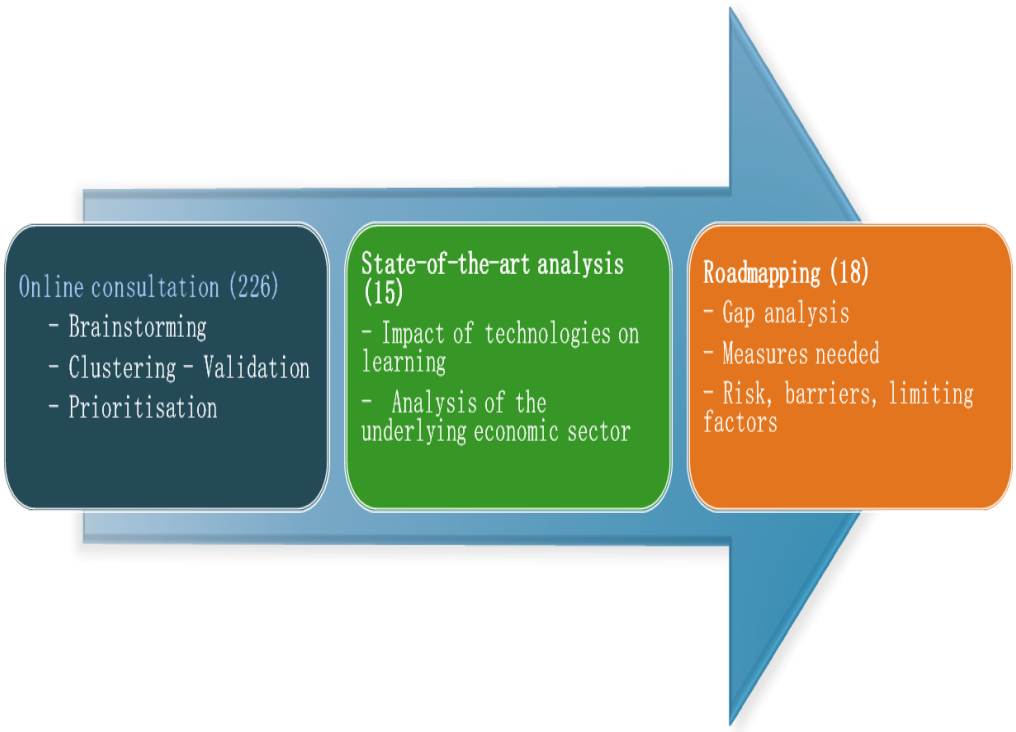
- New Technologies for Learning (NTL), Germany;
- UAM – Universidad Autonoma Metropolitana, Mexico;
- UNIBE - Universidad Iberoamericana, Dominican Republic;
- Universidad Internacional de la Rioja (UNIR), Spain;
- University of Nicosia, Cyprus;
- USP - Universidade de Sao Paulo, Brazil.

The study 'Mapping and analyzing prospective technologies for learning' (MATEL) involved more than 200 stakeholders in a joint reflection on the role of technologies for innovation in learning and change of learning systems. It offers a European perspective on technologies for learning across formal education and training, workplace and work-related learning, and re-skilling and up-skilling strategies for workers, and informal learning.

The study ran over 14 months, from January 2012 until February 2013.

The methodology consisted of three consecutive phases:

- an online consultation;
- an analysis of the state of the art;
- a roadmapping with an analysis of the gap, an overview of the measures needed, and an overview of the risk barriers and limiting factors.



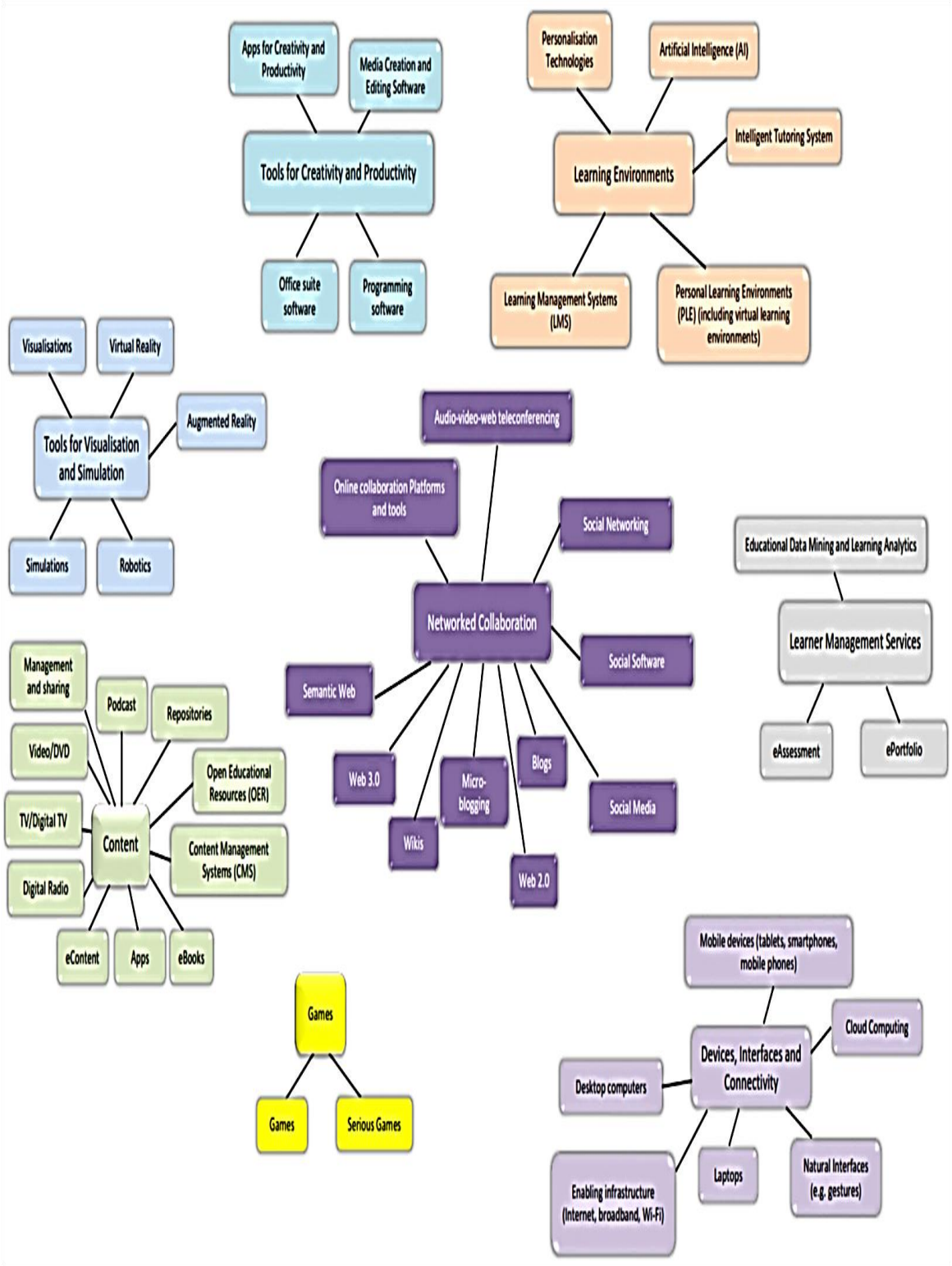
Clusters of technologies

The presentation by Mr. Borotis focuses on the first phase, the online consultation.

Eight main clusters of technologies have been identified:

- Cluster 1: **Tools for productivity and creativity**: Apps for Creativity and Productivity; Media Creation and Editing Software; Office Suite Software; Programming Software.
- Cluster 2: **Networked collaboration**: Audio-Video-Web Teleconferencing; Social Networking; Social Software; Social Media; Blogs and Micro-Blogging; Online Collaboration Platform and Tools; Web 2.0; Wikis; Web 3.0; Semantic Web.
- Cluster 3: **Content:** Video/DVD; Digital radio; TV/Digital TV; Podcasts; Repositories; Open Educational Resources (OER); Content Management Systems (CMS); eBooks; Apps for Content Creation; Management and Sharing; eContent.
- Cluster 4: **Games:** Games; Serious Games.
- Cluster 5: **Tools for visualisation and simulation:** Visualisations; Augmented Reality; Virtual Reality; Simulations; Robotics.
- Cluster 6: **Learner management services:** Educational Data Mining and Learning Analytics; eAssessment; ePortfolio.
- Cluster 7: **Learning environments:** Personalisation Technologies; Intelligent Tutoring Systems; Learning Management Systems (LMS); Personal Learning Environments (PLE); Artificial intelligence (AI).
- Cluster 8: **Devices, interfaces and connectivity:** Cloud Computing; Mobile Devices (tablets, smartphones, mobile phones); Desktop Computers; Laptops; Enabling Infrastructure (Internet, broadband, Wi-Fi); Natural Interfaces (e.g., gestures).

This is graphically represented in the MATEL cluster map:

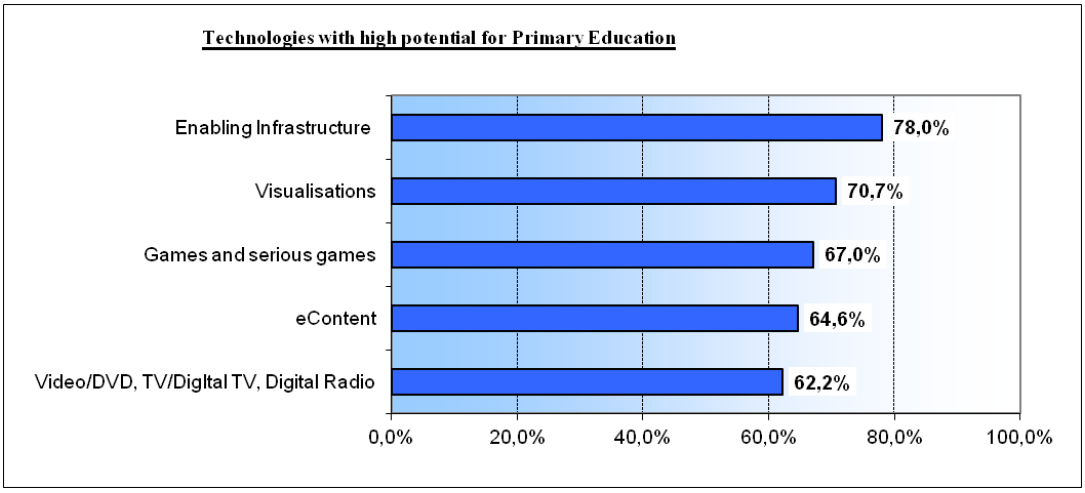


Once the technology clusters and the descriptors were defined, the on-line consultation focused on the identification of the key technologies for educational change across learning sectors and domains, taking into account also the clusters they belonged to. An overview of the results is presented below.

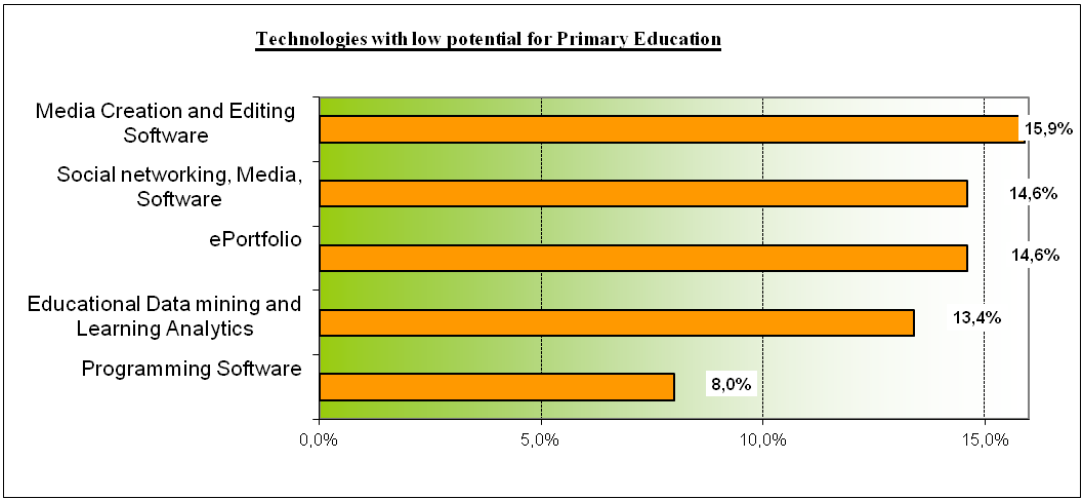
Cluster	Top Technologies	Learning Sectors /domains
Devices, interfaces and connectivity	• Enabling Infrastructure • Mobile devices • Cloud Computing	• Primary Education, Secondary Education, Vocational Education and Training , Higher Education • Workplace learning • Re-skilling and up-skilling strategies • Informal learning
Tools for visualization and simulation	• Visualisations • Simulations • Virtual Reality	• Primary Education, Secondary Education, Vocational Education and Training , Higher Education • Workplace learning • Re-skilling and up-skilling strategies
Content	• eContent • OER • Content Management Systems • Video/DVD, D- Radio, TV/D- TV	• Primary Education, Higher Education • Workplace Learning
Learning environments	• Personal learning environments • Learning Management Systems • Intelligent tutoring systems	• Vocational Education and Training • Re-skilling and up-skilling strategies
Learner management services	• ePortfolio • eAssessment	• Vocational Education and Training • Re-skilling and up-skilling strategies
Networked collaboration	• Online Collaboration platforms and tools • Web 2.0 • Social networking / sw / media • Blogs and micro-blogging	• Higher Education • Workplace learning • Informal learning
Games and serious games	• Games and Serious Games	• Primary Education, Secondary Education • Informal learning
Tools for creativity and productivity		

Primary education

The top-ranked technologies for primary education are: *Enabling Infrastructure, Visualizations, Games and Serious Games, eContent* and *Video/DVD, TV/Digital TV and Digital Radio*.

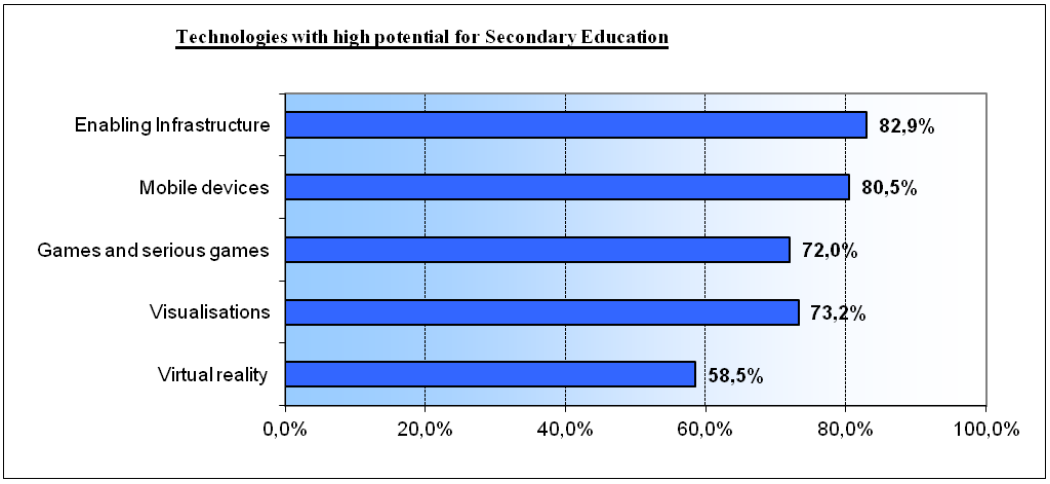


Educational data mining and learning analytics together with *Social Networking, Media and Software* are among the least voted technologies, together with *Media Creation and Editing Software*, *Programming Software* and *ePortfolio.*

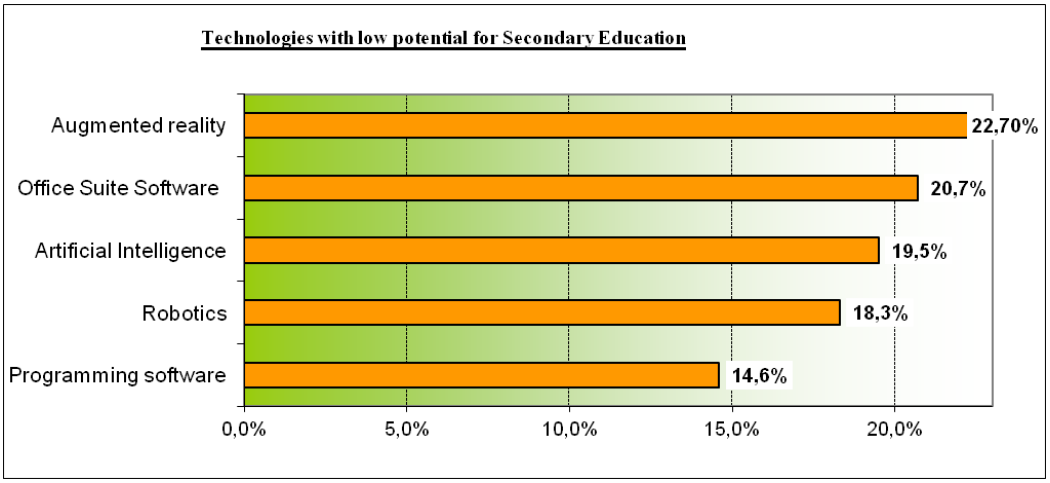


Secondary education

As in the case of primary education, *Enabling Infrastructure*, *Games and Serious Games* and *Visualizations* emerge as top technologies to support educational change in secondary education in the short-medium term. *Mobile Devices* and *Virtual Reality* also belong to the list of technologies with high potential in this sector of formal education and training.

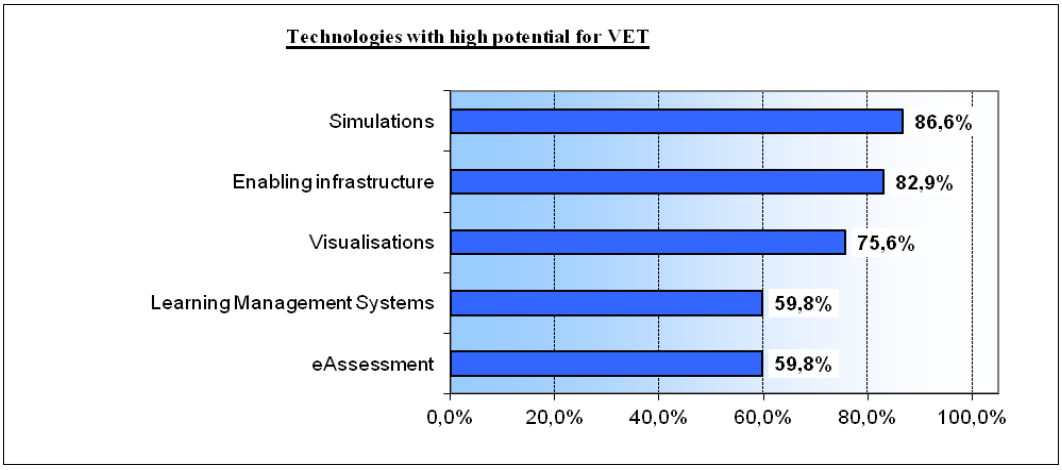


Least voted technologies are *Programming Software*, *Robotics, Artificial Intelligence, Office Suite Software* and *Augmented Reality.*

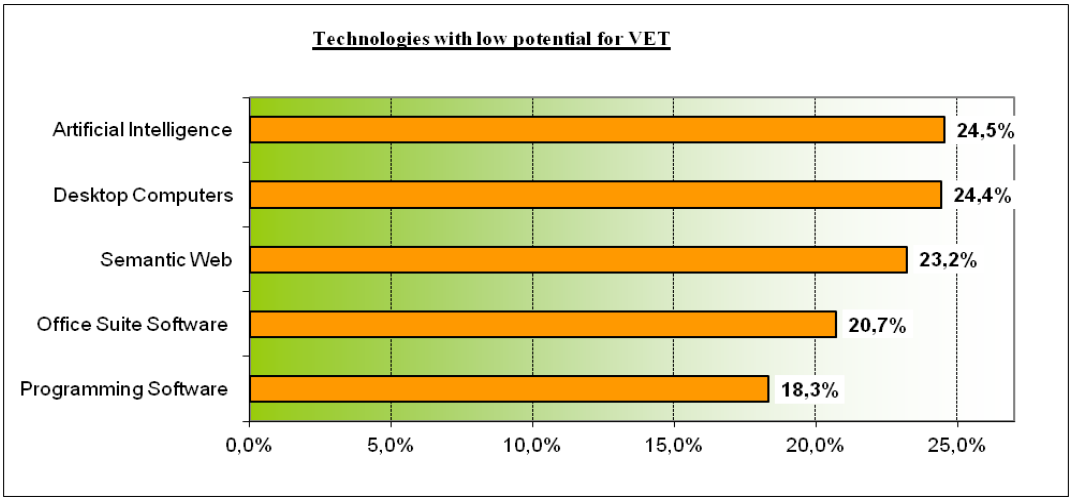


Vocational Education and Training

Simulations, Enabling Infrastructure and *Visualisations* emerge as key to support educational change in VET, together with *Learning Management Systems* and *eAssessment.*

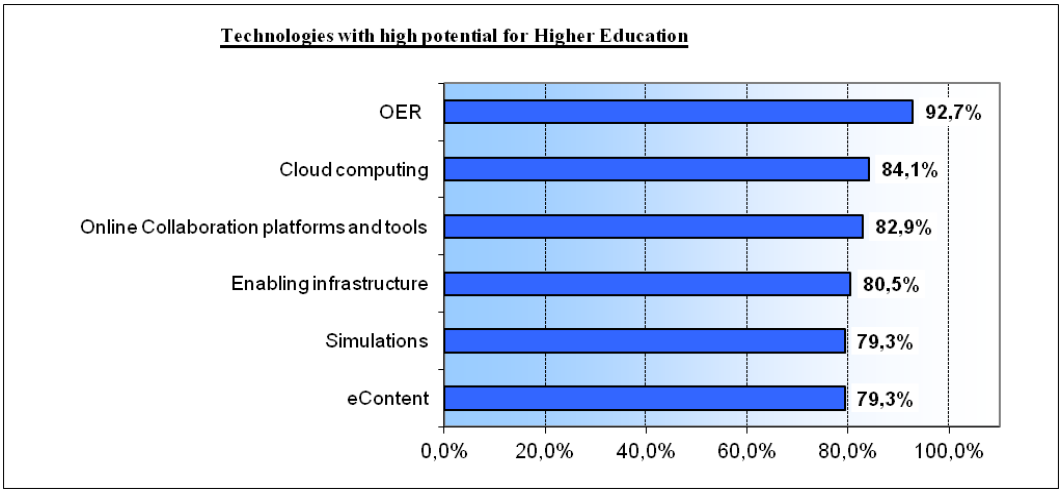


Similarly to primary and secondary education, the least voted technologies are *Programming Software* and *Office Suite Software*. *Semantic Web, Desktop computers* and *Artificial Intelligence* also appear to have low potential for the support of educational change in this sector.

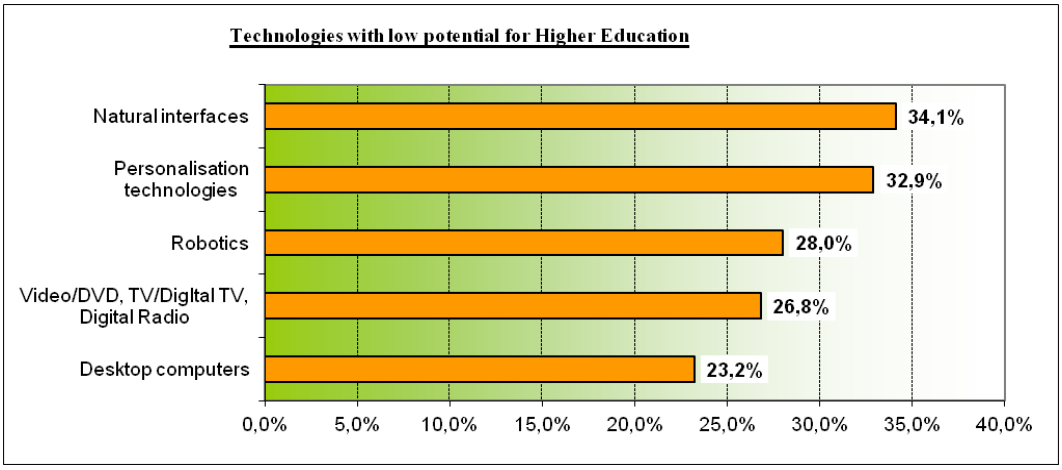


Higher education

Higher education is the sector where technologies as a whole are likely to have the strongest impact on educational change in the short and medium term. If compared to other sectors of formal education and training and to other domains, we can see that even the low ranked technologies have quite a considerable percentage of votes. The technologies that emerge as 'top' are: *OER, Cloud Computing, Online Collaboration Platforms and Tools, Enabling Infrastructure, Simulations* and *eContent.*



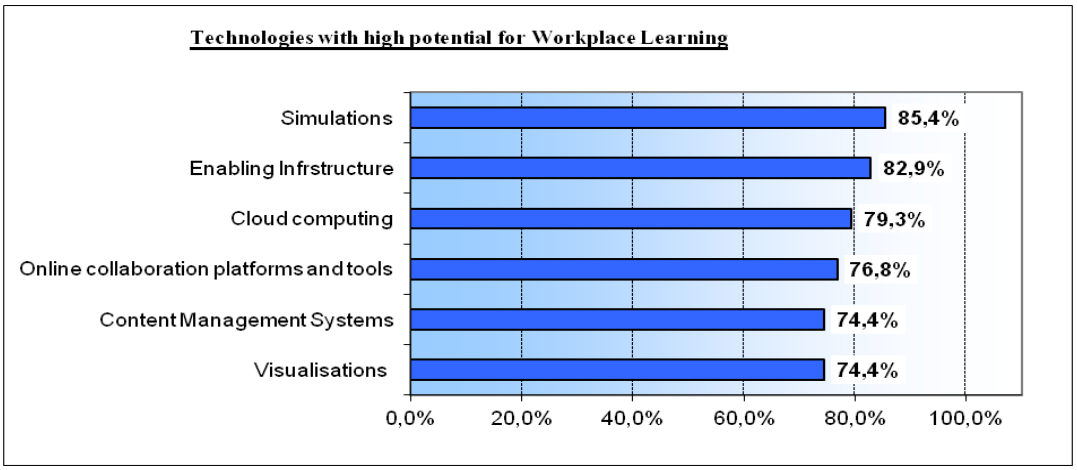
On the opposite side, the technologies expected to have the minor impact are: *Desktop computers, Robotics, Video/DVD, TV/Digital TV and Digital Radio together with Natural Interfaces* and *Personalization Technologies*.



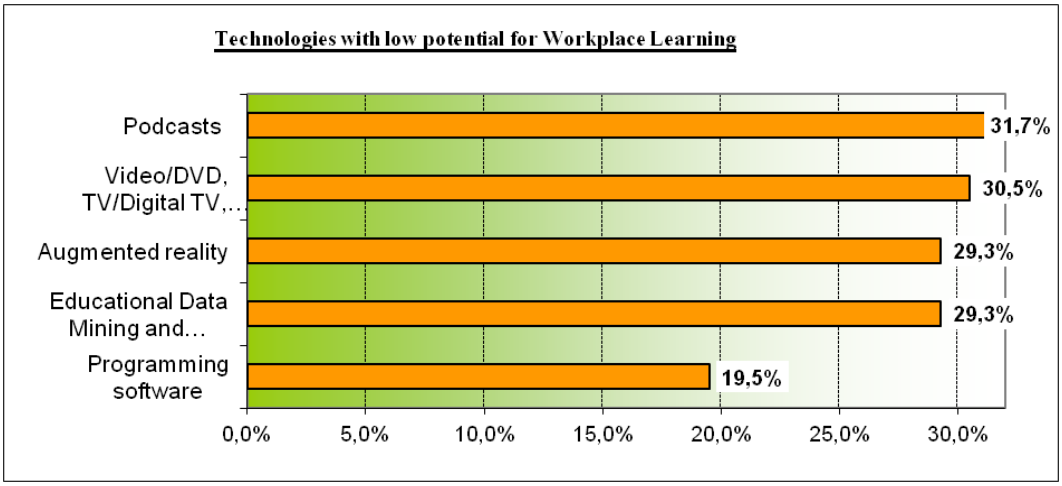
The following scheme is an overview of the key technologies identified in the **four sectors of formal education and training.**

Workplace and work-related learning

Simulations, Visualizations and *Enabling Infrastructure* are likely to play a key role in the transformation of workplace and work-related learning. The same is true for *Cloud Computing, On-Line Collaboration Platforms* and *Tools and Content Management Systems.*

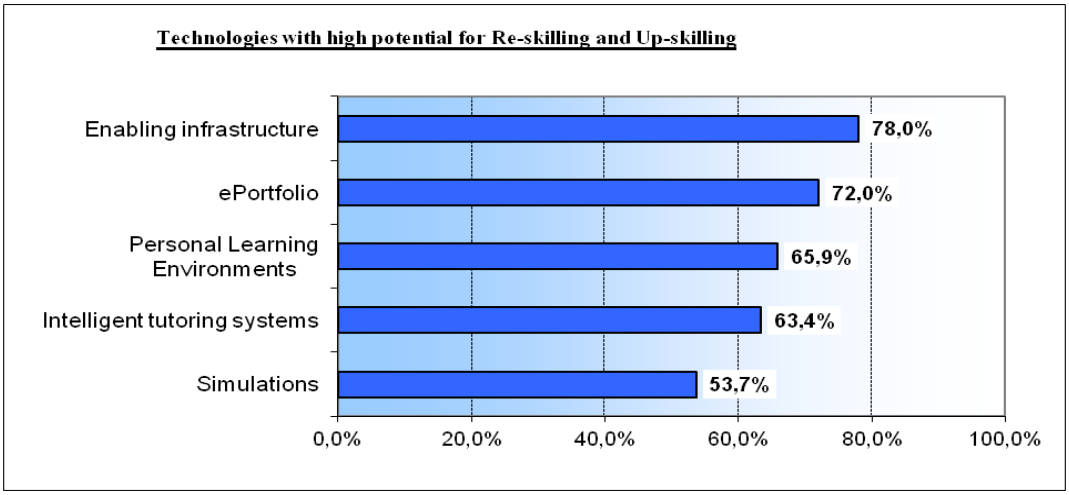


As in the case of formal education and training, *Programming Software* is among the least voted technologies, followed by *Educational Data Mining and Learning Analytics, Augmented Reality, Video/DVD, TV/Digital TV,* and *Digital Radio and Podcasts.*

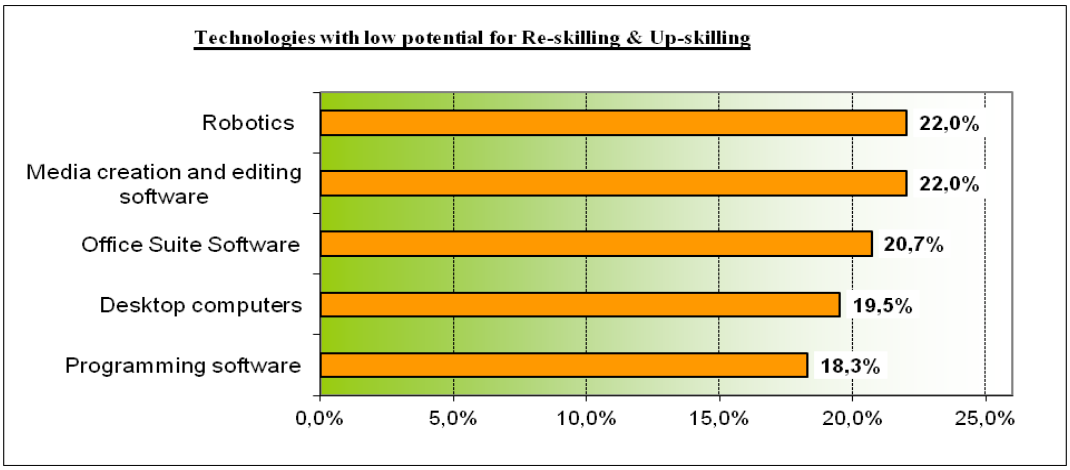


Re-skilling and up-skilling strategies

The technologies that have the potential to influence re-skilling and up-skilling strategies are: *Enabling Infrastructure, ePortfolio, Personal Learning Environments, Intelligent Tutoring Systems*, and *Simulations.*

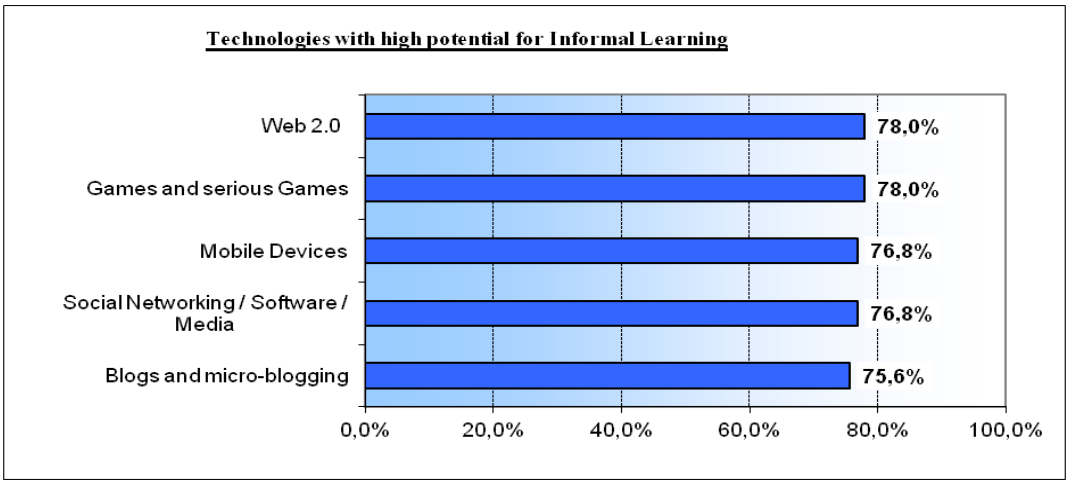


Programming Software, Office Suite Software, Media Creation and *Editing Software* are the least voted, together with *Robotics* and *Desktop Computers.*

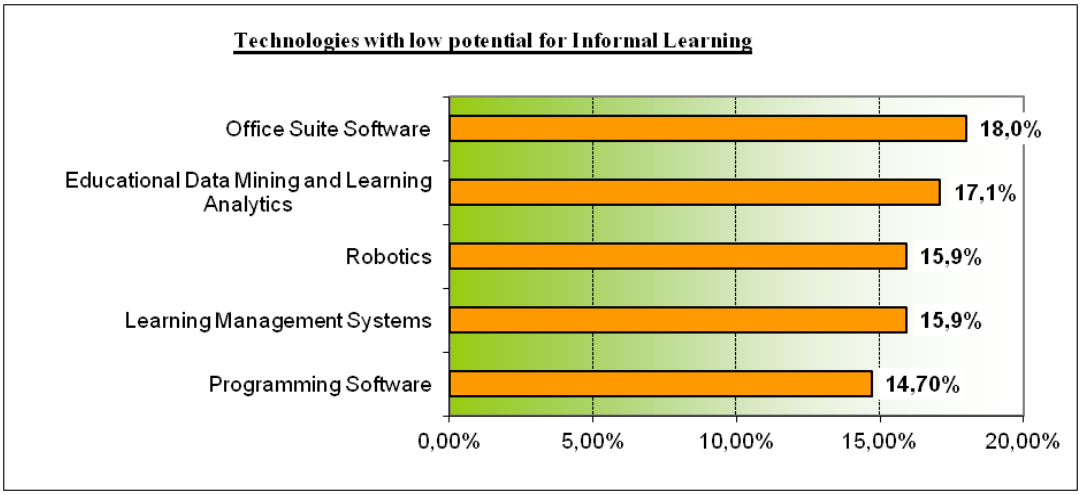


Informal learning

Informal learning will (continue) to be mostly supported by networking technologies, namely *Web 2.0, Social Networking, Media and Software and Blogs* and *micro blogging. Games and Serious Games* will also have a key role, together with *Mobile Devices.*



Educational Data Mining and Learning Analytics as well as *Learning Management Systems* belong to the least voted technologies together with *Office Suite Software, Programming Software and Robotics*.



Strategies suggested by the roadmaps

The objective of the study is to identify bottlenecks and barriers to the deployment and implementation of the identified key technologies for educational change and suggest actions and strategies to ensure that the potential of technologies in facilitating effective, efficient, inclusive and high-quality lifelong learning opportunities is optimally developed.

MATEL presents three Roadmaps (one per learning domain).

- A roadmap for change in primary and secondary education;
- A roadmap for change in work-based and work-related learning;
- A roadmap for change in re-skilling and up-skilling strategies.

In these roadmaps, long term goals and specific objectives for educational change are highlighted. The specific technologies that support these changes are then discussed, leading to the immediate strategies and actions to be undertaken by policy and decision makers. These sectors were assessed by experts as those with the highest need for policy focus.

The following table summarizes the **strategies suggested** by the MATEL roadmaps across the three learning domains.

Primary and Secondary Education

- Increase awareness of the individual behaviour patterns in learning and in the use of technologies in everyday life.
- Connect with the health sector to assess the risks associated to the intensive use of technologies in learning.
- Invest heavily on reinforcing enabling infrastructure.
- Increase piloting in the use of mobile devices in the classroom.
- Focus on equity of access to the above mentioned technologies.
- Establish rules of conduct for the responsible use of technologies in schools.

Workplace and work-related learning

- Update policy strategies at a European level: Adult learning needs to serve new objectives.
- Promote the 'Learning Identity card/passport' for individuals and companies (to show competencies and skills and to enhance motivation to learn).
- Set reward schemes and benchmarking criteria for the valorisation of outcomes developed through Communities of Practice across companies.
- Fund competence development.

Re-skilling and up-skilling strategies

- Keep on investing in new Europass CV incorporating skills acquired informally and non-formally.
- Assess the feasibility for the establishment of a European Skills' Bank.
- Establish local learning centres for the enhancement of critical skills and make sure their offer takes into account local (for instance local labour market needs) as well as individual needs (for instance their age).

Statements

EUNEC formulated critical remarks and statements on the issue of learning in the digital age. EUNEC wants to disseminate these statements pro-actively to the European Commission, the European Parliament and relevant DG's. EUNEC also wants to promote action by its members at national/regional level. These statements can contribute to the national advisory opinions of education councils. They should lead to reflection and action by relevant stakeholders in the field of education and training, such as providers of education, teacher trade unions, social partners, students, parents and experts in the field of education and training.

1 Central questions

The seminar focused on three main questions:

- What is the impact of the digital revolution on the **profile of learners and on the nature of learning**? How to balance new opportunities and traditional concepts of teaching and development of youngsters?
- What use could and should education make of the **opportunities offered by the digital revolution**? Should education change radically its content and approaches and choose for digitalisation at all levels? How can education construct bridges between traditional subjects and pedagogical methods and the new technologies?
- What **provisions and requirements** are needed at the level of content and curriculum development, at the level of professionalism of staff members, at the level of school infrastructure?

2 Recent evolutions with impact on education and training

The context for learning has changed rapidly, both from the perspective of the learner as an individual and from the perspective of society. Digital technology has become an essential part of social life and of economy and business.

Yet digital technology is not fully utilised in education and training.

More than 60% of nine-year olds in the European Union go to schools without qualitative and up-to-date digital facilities (hardware infrastructure, software, high speed broadband and high connectivity). Only 25% of pupils are taught by teachers that are self-confident with ICT. 50% to 80% of teachers in the EU never use digital text books, exercise software, broadcast/podcast materials, simulations or educational games. [10]

[10] See the Communication 'Opening up Education' and the accompanying Staff Working Document for all data.

This could create a digital gap emerging between pupils with access to innovative, technology-based education and those who do not have these opportunities.

2.1 Shift in the profile of young learners

The profile of learners and their learning opportunities have drastically changed. Children and teenagers have easily access to an amount of information, using a.o. communication technology. It has become an essential and common part of their daily life. They use the technology as daily instruments without questioning, as an extension of their social life. It is part of their life style and identity. They use ICT to meet, to play, to date, to connect, to explore the world and to construct (multiple) identities. We consider them as digital natives.
Therefore ICT is considered to influence deeply the way children learn. ICT allows individuals to learn anytime, anywhere with any device. The traditional authority-based delivery model of schooling is turning into a discovery-based and social constructivist learning model.

- Learning is no longer a monopoly of the school as an institution. Learning **anywhere** at **any time** is a reality. Integration between formal learning environments and informal and non-formal settings needs to become a reality. In so doing, this process will question the traditional organization of a classroom and of a school.
- Learning tools have different appearances and have evolved far beyond traditional textbooks. Pupils use **different types of devices** to learn and to gather new information. The learning content becomes a social construction and becomes more mobile.
- New learning devices may also have an impact on learning attitudes and learning psychology, as demonstrated by Marco Kools. Youngsters are more and more aware of the fact that **learning is a social activity**. Discovering new insights is no longer the result of scholarship in the loneliness of a study room, far away from the real life. New and creative insights are a social construction, the result of a dialogue between peer learners and experts on the basis of information provided by the internet. Therefore learning becomes more and more learning in a concrete context (mobilizing information needed to resolve a concrete problem). The readiness to learn abstract, theoretical clusters of knowledge defined on the basis of the logic of 'expertise' is weakening.
- The internet also changed the traditional interaction between teacher and learner from classroom-based teaching to context-aware personalized learning and to social learning. From a classical, traditional point of view the teacher is the expert who 'owns' the knowledge, who corrects the pupils, rewards positive behaviour (classroom management) and who is responsible for the evaluation and assessment of the pupils development. ICT offers the opportunity

to **enhance the responsibility of all learners, including teachers as learners.**

- ICT enhances the opportunities for **personalized learning,** learning experiences adapted to individual development stages of students.
- The gaming industry as well as social media are based on another system of motivation and interaction. They use **appraisal by peers** and by the social group one wants to identify himself with as tools for learning and socialisation. The 'likes' on a facebook page are a symbol of that development. Gaming industries put the spotlights on learning and development by **positive appraisal** of a well-defined sets of skills.

In this deep shift the central debate on learning goes far beyond the mastery of a specific software problem. These evolutions are changing the nature of learning. They are increasingly demanding for students: 21st century skills, deep learning and lifelong learning are required.

2.2 Economic and societal changes

This evolution in the functioning and sensibility of youngsters is a reflection of the **deep, radical and intrusive changes** in the economy and society evolving towards a knowledge based economy and a learning society. Creation, circulation, sharing and application of knowledge have become a fifth pillar of the economy besides the agriculture, the industry, trade and services. Responsive economies anno 2014 are economies based on learning to do things better (Stiglitz, 2014). Learning is at the heart of 21st century knowledge societies and the motor of economic development. We witness a global race between economies to attract the most talented workers. The level of competences needed goes beyond an ephemeral and superficial knowledge.

This is in a sharp contrast with the fact that 20 % of European adult citizens are low skilled while 90 % of the jobs require digital skills.

2.3 Increased educational needs

ICT and new technology can be an answer to the need for cost-effective and high-quality education systems.

The need for high level qualified citizens is behind the urge for stimulating more and more learners to attain higher education qualifications, or to prevent early school leaving, a.o. through the development of a sound vocational education and training system. The European Union translated both ambitions in the benchmarks related to the Europe 2020 strategy:

- by 2020, the share of early leavers from education and training should be less than 10%;
- by 2020, the share of 30-34 year olds with tertiary educational attainment should be at least 40%.

These ambitions have also counterparts: the massification of higher and vocational education and training. Massification could endanger individual coaching and enhance standardised learning approaches. It is difficult to find highly qualified staff to organize the learning trajectories.

Secondly, more students in higher education and in VET call for higher investments in the education system. In 2030, 414 million students are expected to attend higher education.

The cost for education for the individual is rising. Given these facts it is reasonable to search for more cost-effectiveness in learning trajectories.

Open courses provided by information technology open new perspectives to bridge budgetary restraints and specialised expertise. Thanks to the internet students can follow colleges of the most outstanding experts. New providers of learning are emerging besides the education system. Universities and institutions for higher education and lifelong learning should strengthen the integration of distance learning, open courses and blended learning.

3 Policy levers for a responsive education and training system

These developments question the main characteristics of the education and training systems. A **new learning concept** is emerging, and the technological and communication revolution is one of the key factors. Other important factors are a better understanding of learning psychology and the cognitive development of the learner, the crucial role of emotions and motivation, the biological bases of learning and the functioning of the human brain, social and cooperative learning and the impact of family characteristics. This research-based concept of learning should become more known and shared within the world of education policy and education practice. Therefore EUNEC prefers the term 'innovative learning environments' and 'innovative learning' as a better and more research-based terminology for the integration of ICT into the classrooms, labs and auditoria.

This would be consistent with the importance of any organization – school or national institute – seeking to integrate ICT, to answer the question why and how to integrate ICT into the teaching and learning processes. Such a process of discussion rests on teachers as professionals understanding and embracing the concept of reflective practice – of thinking about the rational of a particular initiative or idea before implementing it.

The OECD Innovative Learning Project described the following main characteristics of adequate learning that should all be integrated in the learning environment and not just some of them.

- make learning central, encourage engagement and stimulate learner to understand themselves as learners (self-regulation);
- ensure that learning is social and collaborative;
- be highly attuned to learners motivations and emotions;
- be sensitive to individual differences in learning pace and prior learning.
- be demanding for each learner without excessive overload;
- use assessment consistent with its aims with a strong emphasis on formative feedback;
- promote horizontal connectedness across activities in the school and out-of-school learning.

The nature of learning and the implementation of innovative learning environments should be the starting point of curriculum reform and pedagogic renewal. Translating the consequences of the changing nature of learning into education policies is a central issue for education councils in the years to come.

4 Challenges for the education and training system

These developments challenge the traditional content and nature of learning in the formal education system. Technology functions also as an enabler for transformations and provides learning experiences that would not be possible without the digital technologies. But innovation of the learning concepts demands a rethinking of the organizational patterns that deeply structure schools: the single teacher in the segmented classroom, the traditional time management and time table, class groups based on the age of children, …

Innovative learning demands for an integrated innovative approach at the **curriculum** level (content), at **organizational level**, at **teachers** level and at the **resources** level.

4.1 Content and curriculum

Pupils learn inside and outside the school. Information and communication technology offers a broad scope of learning opportunities in both formal and non-formal learning.

On the other hand it is obvious that all new information flows do not necessarily result in a broad and critical understanding of the reality or in professional attitudes and judgments. For this reason, recent curriculum reforms in different countries are focused on stimulating 'deep learning'. Deep

learning is an approach and an attitude to learning, where the learner uses higher order cognitive skills such as the ability to analyze, synthesize, solve problems, and thinks meta-cognitively in order to construct long-term understanding. It involves the critical analysis of new ideas, linking them to already known concepts and principles so that this understanding can be used for problem solving in new, unfamiliar contexts. Deep learning entails a sustained, substantial, and positive influence on the way students act, think, or feel. Deep learning promotes understanding and application for life. Deep learners reflect on the personal significance of what they are learning. They are more autonomous. But they are also collaborative learners, with high meta-cognitive and learning skills. Deep learning is also about the development of the person (self-regulation and responsibility, perseverance, empathy, self-confidence, personal health and well-being, career and life skills), citizenship (global knowledge, sensitivity to and respect for other cultures, active involvement in addressing issues of human and environmental sustainability), communication and collaboration (communicate effectively orally, in writing and with a variety of digital tools; listening skills, work and learn in teams, social networking skills), creativity and imagination (economic and social entrepreneurialism, considering and pursuing novel ideas, and leadership for action). So this kind of learning is in essence interdisciplinary and inquiry-based. Technology-rich learning environments offer opportunities.

Curriculum construction should become more open allowing learners to mix educational resources, learning activities, and/or educational courses for different disciplines to meet their needs. This places learners in charge of their own learning and ensures that they will learn what they need to meet their personal desires and requirements.

From a traditional point of view a qualification was seen as lifelong guarantee of competences needed for sustainable integration on the labour market and social life. New learning paradigms redefine the perspective not only to a lifelong development but also to on-demand and in-context accreditation of qualifications, acquired in formal education and training but also in informal or non-formal contexts.

New methods could be developed integrating more than before self-assessment and peer or crowd-sourced assessment into the formal evaluation processes.

4.2 Innovative school organizations

The need for innovative learning environments with a full integration of ICT calls for rethinking the concept of school and classroom. The emphasis should be on learning units, not so much on institutional units. On the other hand schools remain very important places for learning, for meeting friends. They remain places par excellence in the social life of children. Indeed, the emphasis in the literature on the concept of communities of practice for reflective practice and lifelong learning for teachers further supports the

importance of schools as one physical manifestation of such a community. Therefore the challenge for education policy in the years to come is to make schools more learning focused. Learners could be grouped in varying and more profiled, better mixed learner groups. The groups could vary according the specific needs of the course and subject.

4.3 Infrastructure and resources

ICT is of course more than the availability of hardware (which is increasing). It has also to do with connectivity, mobile devices, cloud applications, software and evidence based digital learning environments. The level and speed of connectivity are other preconditions for integrating ICT in education. Digital technologies evolve very fast and they require constant efforts to be updated in order to respond to increasing demands. The education system needs open access to digital resources/practices, digital tools, digital courses/classrooms via multiple devices, supported by cloud technologies and cloud infrastructure.

Providing such facilities requires huge investments from education and training institutions and public authorities. ICT infrastructure and tools are unevenly available in different schools, regions and countries. There are important disparities across languages, subjects and needs. This financial gap strengthens existing inequalities and increases the gap between teaching practices and ICT in society.

Even though the key for success depends foremost on an innovative climate in schools and on incentives from Member States, the EU also has also a role to play. What is the added value of a European digital agenda to this regard? The EU promotes best practices and supports exchanges across Member States. It can deliver benefits from cooperation and support the deployment and availability of digital technology and content through financial support and stimulate public-private partnerships at a European scale.

Stimuli for different partners responsible to develop content are essential. This could create an open European market for digital content. These stimuli encompass

- a legal framework for producing, using, re-using and sharing educational contents (copyright, barriers to develop and implement innovative teaching and learning practices, re-use and sharing of contents);
- common standards supporting interoperability;
- public financial support by the EU for the development of content in different languages and in less popular subjects.

4.4 Teachers' competences to develop innovative learning environments

Teachers are the main actors in turning new technologies to rich and innovative learning environments. They need to reflect upon their evaluation and assessment practices related to informal learning. They need to lead the discourse on the redefinition of their roles from deliverers of knowledge to co-creators and developers of competences and leaders of learning. Teacher education and in-service professional development institutions need to work more closely together to promote innovative teaching methods and an extensive and integrated use of technologies in the overall context of a continuum of teaching and learning.

The integration of ICT in the learning process calls for a higher level of didactical and pedagogical competences of teachers. This impacts on the different aspects of the whole learning process: modelling and targeting the learning process to the developmental needs of the pupils, assessing the competences.

Flexible and collaborative approaches are gaining more attention. More team work amongst teachers offers opportunities for role differentiation (expert in development of courses, coach, managing learning processes, …) and for more effective differentiated teaching of children and young people with a variety of needs. New learning practices such as distant teachers, peer teaching, flipped classrooms should be stimulated.

Annex :

Opening up Education:

Innovative teaching and learning for all through new technologies and open educational resources.

Communication from the European Commission.

Technology and Open Educational Resources as opportunities to reshape EU education

This Communication sets out a European agenda for stimulating high-quality, innovative ways of learning and teaching through new technologies and digital content. 'Opening up education' proposes actions towards more open learning environments to deliver education of higher quality and efficacy and thus contributing to the Europe 2020 goals of boosting EU competitiveness and growth through better skilled workforce and more employment. It contributes to the EU headline targets for reducing early school leaving and increasing tertiary or equivalent attainment[11] and builds on the recent initiatives 'Rethinking Education'[12], 'European Higher Education in the World'[13] as well as the flagship initiative Digital Agenda[14].

It proposes actions at EU and national levels, notably:

- helping learning institutions, teachers and learners to acquire digital skills and learning methods
- supporting development and availability of open educational resources
- connecting classrooms and deploying digital devices and content
- mobilizing all stakeholders (teachers, learners, families, economic and social partners) to change the role of digital technologies at education institutions

Even though the key for success depends foremost on Member States, the EU also has a role to play. It can promote best practices and support exchanges

[11] 2012/C 70/05
[12] COM(2012)669
[13] COM(2013)499
[14] COM(2010)245

across Member States. It can deliver benefits from economies of scale and interoperability, thus avoiding fragmentation. It can support the deployment and availability of digital technology and content through financial support, public-private partnerships and recommendations.

EU education is failing to keep pace with the digital society and economy…

Digital technologies are fully embedded in the way people interact, work and trade; yet they are not being fully exploited in education and training systems across Europe. A recent study[15] on the state of digital provision in schools in the Union revealed that 63% of nine year olds do not study at a 'highly digitally-equipped school' (with appropriate equipment, fast broadband and high 'connectivity'). While 70% of teachers in the EU recognize the importance of training in digital-supported ways of teaching and learning, only 20-25% of students are taught by digitally confident and supportive teachers. Most teachers use Information and Communication Technologies (ICT) mainly to prepare their teaching, rather than to work with students during lessons[16].

Today's learners expect more personalization, collaboration and better links between formal and informal learning much of it being possible through digital-supported learning. However, between 50% and 80% of students in the EU never use digital textbooks, exercise software, broadcasts/podcasts, simulations or learning games. The EU lacks a critical mass of good quality educational content and applications in specific subjects and multiple languages as well as connected devices for all students and teachers. A new digital divide in the EU, between those who have access to innovative, technology-based education and those who do not, is on the rise as a consequence of this fragmentation of approaches and of markets.

The EU also risks lagging behind other regions of the world. The USA and some Asian countries are investing in ICT-based strategies to reshape education and training. They are transforming, modernizing and internationalising education systems with tangible effects in schools and universities on access to and cost of education, on teaching practices and their worldwide reputation or branding. A case in point is that much of the supply of digital content comes from players outside Europe, including from educational institutions offering their courses globally through Massive Open Online Courses (MOOCs).

…and yet technology provides the opportunity to increase efficiency and equity in education.

[15] See http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=1800

[16] See accompanying Staff Working Document for all data and evidence used in this Communication

The potential benefits of the digital revolution in education are multiple: individuals can easily seek and acquire knowledge from sources other than their teachers[17] and institutions, often for free; new groups of learners can be reached because learning is no longer confined to specific classroom timetables or methods and can be personalised; new education providers emerge; teachers may easily share and create content with colleagues and learners from different countries; and a much wider range of educational resources can be accessed. Open technologies allow *All individuals to learn, Anywhere, Anytime, through Any device, with the support of Anyone*.

Most importantly, education and knowledge are able to travel far more easily across borders greatly increasing the value of and potential for international cooperation. Thanks to Open Educational Resources (OER)[18], and namely MOOCs, teachers and education institutions can now reach thousands of learners from all five continents simultaneously, showcasing that language is not always a barrier. Cooperation is enhanced by allowing learners, educators, researchers and institutions to create, share and discuss content with peers from all over the world.

In addition to broadening access to education, wider use of new technology and open educational resources can contribute to alleviating costs for educational institutions and for students, especially among disadvantaged groups. This equity impact requires, however, sustained investment in educational infrastructures and human resources.

Open technologies provide the opportunity for Europe to attract new talent, equip citizens with relevant skills, promote science and research and fuel innovation, productivity, employment and growth. Europe should act now providing the right policy framework and a stimulus to introduce innovative learning and teaching practices in schools, universities, vocational education and training (VET) and adult learning institutions. The EU policy framework (the Open Method of Coordination in Education and Training 2020) and EU programmes (particularly Erasmus+, Horizon 2020 and the Structural and Investment Funds) can provide incentives and create framework conditions for this to happen. This can help all Member States and regions, particularly those less developed, to also benefit from quality education, and improve their growth potential, thus maintaining economic and social convergence.

The actions proposed in this document will be supported by the EU as mentioned above and reflect the results of consultation with a broad range of stakeholders which took place since summer 2012. The results and detailed evidence base are also presented in a Staff Working Document (SWD) that provides an analysis of the current situation in Member States with significant

[17] The word teachers is used as meaning 'teachers, trainers, professors and other educators from all educational levels and sectors'

[18] OER are learning resources that are usable, adaptable to specific learning needs, and shareable freely.

differences among them, highlights best practices, and analyses the main obstacles at EU level impeding the introduction of innovation in education through digital content and technologies. What is at stake obviously varies between different learning sectors (i.e. compulsory education, higher education, vocational education and training and adult education) and non-formal and informal learning.

1. Open Learning Environments: opportunities to innovate for organisations, teachers and learners

1.1 Innovative organisations

Education and training institutions need to review their organisational strategies…

All educational institutions need to improve their capacity to adapt, promote innovation and exploit the potential of technologies and digital content. In effect, however, institutional strategies tend to oppose openness to education that ICT provides. In school education and VET, restrictive regulations on curricula and assessment practices impede the full exploitation of technology-enabled approaches to teaching and learning. In higher education other factors such as inflexible funding and governance structures, compounded by restrictions on budgetary resources, inhibit change. In adult learning too, ICT offers huge potential for structural change: a survey carried out in Finland[19] shows that only 41% of respondent organisations in Finnish industry had used online learning in their 2012 staff training. Yet using ICT in training can reduce costs and increase flexibility in terms of time and space.

Only if educational institutions change the framework conditions in which they operate will they grasp the opportunities that ICT provides. Open learning environments require the leaders of educational institutions to play an active role by: providing a strategic vision; transforming siloed institutions into connected learning communities and rewarding professionals for innovative teaching approaches. Leadership has to be accompanied by organisational change and institutional development plans. Educational institutions should consider assessing how fit and ready they are to use ICT and reviewing their organisational and business models if necessary. This implies, for example assessing what efficiency gains can be made by digitising back-offices, whether ICT is safely integrated as can be done via the eSafety label for schools[20] or, whether learning and teaching are digitally supported. It may also require a review of whether it is the institution's vocation to transmit knowledge and/or to certify its acquisition.

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19 http://www.ek.fi/ek/fi/tutkimukset_julkaisut/2013/4_huhti/henko_tiedustelu2013.pdf

20 http://www.esafetylabel.eu/ - the eSafety label is an initiative developed by some Ministries of Education of the European Schoolnet network

The appearance of disruptive innovation like MOOCs has the potential to transform higher education and create new competition and centres of excellence among universities worldwide. Even though the first Open Courseware project began in Germany, the biggest shifts are taking place in the USA. While the three main MOOC providers in the USA offer around 400 courses, with three million users worldwide, few European universities are providing MOOCs. A recent survey[21] shows that one third of the 200 European universities consulted were not even aware of what a MOOC is, and only one third were considering any MOOC-related initiative.

Exploiting this potential can best be achieved through strategic partnerships. One positive example is the recent launch of the European MOOC Initiative by the European Association of Distance Teaching Universities[22]. Such an initiative proves that working across borders provides the necessary scale to generate new education solutions which would otherwise be out of reach if designed by each institution on its own.

… to stimulate innovative learning practices.

A stronger use of learning experiences, combining face-to-face and online (blended learning), can increase student's motivation and the efficacy of learning. In apprenticeship-type training, for example, technologies can be used to simulate real-life situations where learners improve their technical skills and their problem-solving abilities. Technology also allows for new ways of learning and assessing, focussing more on what the learner is capable of doing rather than on the mere acquisition of information or on what the learner is capable of repeating.

Technology makes it possible to develop new solutions for better personalised learning, by allowing teachers to have a more accurate and up-to-date follow up of each learner. Through learning analytics[23], new and more learner-centred teaching methods can emerge since the evolution of learners who use ICT regularly can be closely monitored: teachers may know the exact learning outcomes of each individual and identify needs for additional support depending on each individual's learning style.

1.2 Innovative teachers

Teachers should be able to acquire high digital competences…

Teachers have been, over the years, constant promoters of innovation in our educational institutions. However, when considering the integration of ICT,

[21] http://www.eua.be/news/13-0225/Massive_Open_Online_Courses_MOOCs_EUA_to_look_at_development_of_MOOCs_and_trends_in_innovative_learning.aspx

[22] http://www.openuped.eu

[23] Learning analytics are defined as the measurement, collection, analysis and reporting of data about learners and their contexts. See http://www.solaresearch.org/

many do not possess the necessary competences for the pedagogic use of ICT. Only seven countries[24] have 30 to 50% of students at grade 4 and/or grade 8 taught by digitally confident and supportive teachers, with high access to ICT and who face low obstacles to their use at school. Studies also show that 70% of teachers in the EU would like to have professional development on ICT skills.

Initial teacher education should place a strong emphasis on digital-supported teaching methods (digital pedagogies). A joint EC-OECD survey shows that six teachers out of ten have not received any training on how to use ICT in the classroom. An urgent emphasis on digital pedagogic competences is also needed during continuing professional development to keep teachers updated. Addressing this challenge is at the heart of interests of several stakeholders who, in the context of the Grand Coalition for Digital Jobs, have already pledged to develop European MOOCs to train teachers in specific skills so as to contribute to boost their digital skills. Among others, the Commission will build further on the *European Schoolnet*[25] Academy to develop and deliver large scale online professional development courses for teachers in specific areas such as maths, science and technology as well as will support a network of organisations involved in pre- and in-service training for teachers.

… to connect through strong communities of practice…

The use of educational content and OER is constrained by the difficulty in finding adequate resources for each user's specific needs: teachers tend to mainly use resources that have been recommended by other colleagues. Communities of practitioners at EU level have proven to be solid solutions for exchanging good practices and for peer support, as shown by the massive engagement of teachers in the *e-Twinning*[26] platform, with more than 200.000 registered users, in *SCIENTIX*, the community for science education in Europe[27], and in *Open Discovery Space*[28]. In order to ensure that large communities of practice benefit from professional development through online resources and peer learning, the Commission will explore ways to leverage the existing networks and create new ones including the future *EPALE* (Electronic Platform for Adult Learning in Europe). Attention will also be devoted to explore the potential of collaborative work in teaching and learning in higher education, currently less developed than in research.

… and be rewarded for new teaching methods.

[24] BG, EE, IE, PT, SK, SI, SE

[25] Network of 30 European Ministries of Education dedicated to the innovative use of educational technology

[26] http://www.etwinning.net/

[27] http://www.scientix.eu

[28] Open Discovery Space (www.opendiscoveryspace.eu) provides communities of practice round use of OER

Teachers are influenced by the way their performance is evaluated. While performance measurement differs between countries and educational sectors, it rarely includes parameters associated with open pedagogical practices. Member States, regional authorities and education and training institutions need to revisit performance evaluation schemes to create the right stimulus for teachers to introduce and embed innovative teaching.

1.3 Innovation for learners

Learners expect to acquire the digital skills for the 21st century…

Individuals must acquire new skills for a digital world[29]. Although digital competences are essential for employment, today's young people lack the ability to use them creatively and critically. Being born in a digital era is not a sufficient condition for being digitally competent. Studies show that, on average, only 30% of students in the EU can be considered as digitally competent; and still 28% of students in the EU have practically no access to ICT, neither at school or at home. Only around half of initial VET students in Europe attend classes where teachers use ICT in more than 25% of the lessons. Furthermore, the low or non-existent digital skills of many adults hinder their productivity and innovation capacity at the workplace and limit their participation in society[30].

Through the *Grand Coalition for Digital Jobs,* the Commission is already working in partnership with industry to promote the necessary skills for ICT practitioners. However, more individuals need to acquire better digital skills and become accustomed to actively using technology to increase their job prospects. It is essential to reinforce digital skills through informal and non-formal learning and through new school curricula, where coding for example is becoming commonly used. Special attention is also needed to disadvantaged groups such as learners at risk of low achievement in e.g. science & technology or with learning difficulties.

…and have their digitally-acquired skills easily certified and recognised for further learning or work.

Learners expect their skills to be recognised by potential employers or for further learning and seek out education and training providers who can award relevant qualifications.

Assessing and certifying learners' achievements are challenges facing those who provide online education: it implies integrating online learning practices into formal curricula and finding ways to validate technology-supported learning in non-formal and informal settings. Some providers have started to offer 'open badges' certifying that a learner has completed a given course or

[29] Digital competence is one of the 8 key competences for lifelong learning (Recommendation 2006/962/EC)

[30] 48% of Europeans aged 16-74 have low or no ICT skills.

acquired a certain skill. However, these are not yet recognised by qualifications authorities and are often unknown in the labour market.

Validation and recognition instruments used in formal education must adapt to the emergence of a much more diversified educational offer, including new education providers and the new forms of learning made possible by technology. In parallel, new tools may need to be created both to ensure that technology-supported learning taking place outside formal education is validated and to encourage learners to become more engaged in open practices. These new tools should respect the principles set out in the Council Recommendation for the Validation of Non-formal and Informal Learning[31] in synergy with established validation and recognition tools and contribute to the creation of a European Area for Skills and Qualifications[32], the latter aiming to address the diversity of practices across Member States and promote an effective recognition across borders.

Key Transformative Actions in this Area

Through the new programmes Erasmus+ and Horizon 2020, the Commission will:

- Support educational institutions in developing new business and educational models and launch large-scale research and policy experimentations to test innovative pedagogical approaches, curriculum development and skills assessment;
- Support teachers' professional development through open online courses, following pledges made under the Grand Coalition for Digital Jobs[33,] and by creating new and scaling up existing European platforms for teachers' communities of practice (e.g.: eTwinning, EPALE) to establish collaborative peer-based teaching practices across the EU;
- Explore and test, in cooperation with stakeholders and Member States, digital competence frameworks and self-assessment tools for learners, teachers and organisations;
- Explore how established and emerging tools for the validation and recognition of skills, such as 'open badges', can be tailored to the needs of learners.
- Coordinate, facilitate exchange of experiences and results achieved in national programmes between MS and provide targeted policy guidance to clusters of MS to help them to identify successful measures for meeting their challenges in view of the country specific recommendations (CSRs) under the European Semester /Europe 2020

[31] Council Recommendation (2012/C 398/01)
[32] COM (2012)669
[33] http://ec.europa.eu/digital-agenda/en/grand-coalition-digital-jobs-0

Member States and education institutions should:

- Support innovative teaching and learning environments, including through the use of structural and investment funds (ESIFs);
- Ensure that transparency and recognition instruments for formal education are adapted to new forms of learning including validation of skills acquired online, in line with national tools in the context of the Council Recommendation for Validation of non-Formal and Informal Learning,
- Support teachers in acquiring a high level of digital competences and adopt innovative teaching practices through flexible training, incentive schemes, revised curricula for teachers' initial education and new professional evaluation mechanisms;
- Reinforce digital skills in education and training institutions, including among disadvantaged groups, and revisit learners assessments in order to ensure that all skills acquired through digital learning can be recognised.

2. Open Educational Resources: opportunities to use open knowledge for better quality and access

Knowledge is open when it is provided through tools accessible to all citizens. OERs are important for stimulating innovative learning environments where content can be adapted by users according to their needs. Stimulating supply and demand for high-quality European OERs is essential for modernising education. Combined with traditional educational resources, OERs allow for blended forms of face-to-face and online learning. They also have the potential to reduce the costs of educational materials for students and their families as well as for public budgets when these cover the costs of educational materials.

High-quality European OER must become more visible and accessible to all citizens…

In the past decade, the supply of OERs in the world has grown exponentially. However, while there is an increasing variety of subjects, OERs are generally produced in a limited number of languages (mostly English), and used by specific education sectors (especially higher education) and specific disciplines (e.g. ICT). The use of OERs in Europe is still too fragmented and not sustained[34].

Efforts need to be stepped up to ensure that European content is visible and widely accessible as well as that users, learners and teachers are capable of

[34] See outcomes public consultation in the accompanying Staff Working Document

finding resources and are assured of their high quality. For many teachers the lack of cataloguing, selection and availability of adequate quality resources is an important obstacle to the wider use of OER.

Based on the initial experience of the *e-Learning Portal* and building on the strong involvement of stakeholders, the Commission will launch, with Erasmus+ funding, a single gateway for OERs produced in Europe, federating existing platforms with advanced browsing and search features to help users find the appropriate content. In terms of quality assessment of content, the potential of peer and crowd assessment[35] will be explored next to other approaches to increase the visibility of high-quality OERs, and to develop quality frameworks for OER and mapping with curricula.

European education and training institutions, teachers and learners should also be encouraged to share their own educational materials freely with peers through the use of open licenses[36]. In line with the Paris Declaration of the United Nations Educational Scientific and Cultural Organization (UNESCO)[37], a common European approach should allow publicly funded educational materials to be freely available for all those wishing to use them for learning or teaching. Furthermore, technical tools such as Open Quality Standards should help OER producers to raise the visibility of the quality of the creation process and the resource itself. Moreover, currently the value added tax (VAT) rate applied to digital (educational) textbooks is, in most countries, higher than the VAT rate applied to physical (educational) textbooks. A range of stakeholders urge to address this difference in rates in order to enhance the uptake of digital resources. The Commission has an on-going process and will come before the end of 2013 with the follow-up to the VAT action plan. Moreover, the 2013 European Semester recommendations also highlight that the inefficiency that is built into the design of some national tax systems (for example some reduced rates and other tax exemptions) needs to be tackled.

Finally, stakeholders involved in the provision of 'traditional' educational materials can also help to make high-quality digital content more available: textbook authors, publishers and booksellers can contribute to joint collaborative efforts to find new innovative technical solutions ensuring that high-quality resources are available to all. The complementarity of traditionally published resources and OERs, as well as freedom of choice for teachers and educators, should remain key guiding principles.

…and the rights and obligations of users of educational materials under copyright should be more transparent across borders.

[35] Crowd rating refers to ratings being attributed to available resources by their users (crowd).

[36] As defined by OECD: "Open licensing provides a way of controlled sharing with some rights reserved to the author. Open licenses have the benefit of introducing certainty and clarity into the process of obtaining permission to use the work of others". http://www.oecd.org/edu/ceri/37351085.pdf

[37] http://www.unesco.org/new/en/communication-and-information/access-to-knowledge/open-educational-resources/what-is-the-paris-oer-declaration/

The absence of clear information on authorised uses for a specific online learning material (e.g. text, images and videos) deters users[38]. Similarly, it is difficult for authors of new content to define the usage rights and/or limitations they wish to associate with a certain resource. Promoting open licences among both communities of teachers and policy makers, as well as developing of technical tools to integrate metadata[39] in each resource available on the web, will increase transparency.

The EU copyright framework[40] includes exceptions for the use of material for teaching purposes. The implementation of these exceptions varies across Member States. Given the cross-border potential of innovative practices in using educational content, it is important to assess whether the current legal framework ensures in practice sufficient transparency and legal certainty for users. The Commission is currently carrying out a review of the EU copyright framework as announced in its Communication of 18 December 2012 on Content in the Digital Single Market.

Key Transformative Actions in this Area

The Commission will:

- Ensure that all educational materials supported by Erasmus+ are available to the public under open licenses and promote similar practices under EU programmes;
- Use the new programmes Erasmus+ and Horizon 2020 to encourage partnerships between creators of educational content (e.g. teachers, publishers, ICT companies), to increase the supply of quality OER and other digital educational materials in different languages, to develop new business models and to develop technical solutions which provide transparent information on copyrights and open licenses to users of digital educational resources;
- Launch with this Communication the *Open Education Europa* portal linking it to existing OER repositories in different languages and bringing learners, teachers and researchers together, so to improve the attractiveness and visibility of quality OERs produced in the EU.

Member States and education institutions should:

- Stimulate open access policies for publicly-funded educational materials;

[38] See public consultation: 84 % of respondents indicate the lack of a clear legal framework in this respect.

[39] Specific data on each resource allowing for automated classification of its content or its characteristics.

[40] Directive 2001/29/EC of the European Parliament and of the Council of 22 May 2001 on the harmonization of certain aspects of copyright and related rights in the information society.

- Encourage formal education and training institutions to include digital content, including OERs, among the recommended educational materials for learners at all educational levels and encourage the production, including through public procurement, of high-quality educational materials whose copyrights would belong to public authorities.

3. Connectivity and Innovation: partnerships for infrastructures, new products and services, and interoperability

The lack of hardware devices or the low penetration of broadband impedes the optimal use of technology, impairs the potential to use OER and educational software and compromises the '*Bring Your Own Device*' principle[41]. In many places broadband exists at institutional level but not at classroom or device level, and different devices with different technical specifications (e.g. different software or brands) are currently not providing equal access to educational resources.

Enhancing local ICT infrastructure (broadband, content, tools) is still needed in some parts of Europe…

The level of infrastructures should no longer be a factor impeding innovative ways of teaching and learning. Nor should differences in availability be a cause for inequalities between citizens or different geographical areas. The infrastructure divide not only creates equity problems among learners but also erodes the potential gains from a greater participation by citizens in the economy.

Member States are investing in upgrading their national educational infrastructure (ICT, digital educational resources, broadband) but fragmentation and incoherence among EU Member States persists. On average, 93%[42] of EU students access the internet at home, but only 72% have access to it at a place of education, sometimes not in the classroom. Regional disparities also persist: only 45-46% of students who use the Internet in Greece and Croatia can access it at a place of education, as opposed to more than 90% in Latvia, Lithuania and the Czech Republic[43].

Investment in infrastructures should be fostered in those regions lagging behind the rest of Europe. Structural and Investment funds should be channelled towards education and training[44] to enhance local ICT

[41] According to which learners are expected to use their own computers or mobile devices to access educational materials in the classroom.

[42] Eurostat, 2011 data.

[43] http://epp.eurostat.ec.europa.eu/tgm/mapToolClosed.do?tab=map&init=1&plugin=1&language=en&pcode=tin00081&toolbox=types

[44] http://www.education.ie/en/Press-Events/Conferences/Ireland-s-Presidency-of-the-EU/Conference-21-22-May-2013/Channelling-cohesion-policy-funds-towards-education-and-training.pdf

infrastructures and joint procurement for innovation of different contracting authorities. This would produce economies of scale, lower prices, administrative cost savings and a pooling of different skills and expertise.

… and open interoperability standards are necessary to ensure economies of scale…

Learners using different devices, including different hardware and software configurations, should not be prevented from using the same educational resources. Neither should producers of digital content see their chosen format limit the potential number of users of their resources. Interoperability and portability standards for educational resources have to be defined and ensured across devices, platforms and brands to provide a level playing field for all market players. Standards should also ensure that resources could be used across different platforms thus enhancing their effectiveness. Furthermore, such standards must remain open to avoid market dominance by any single company owning standards and able to shape the market according to its individual goals.

…so that European digital apps and digital contents markets can grow.

While worldwide investment in broadband and entrepreneurship is creating important business opportunities, the business potential for educational software and content in Europe remains largely untapped. Developments in cloud technologies and gaming, personalisation of learning and mobile devices will drive growth in the educational technology market. Encouraging growth and innovation-based entrepreneurship for a new educational ecosystem as well as mechanisms to scale solutions appropriately across education and training sectors is imperative if European companies are to be internationally competitive and create jobs.

Key Transformative Actions in this Area

Through the new programmes Erasmus+ and Horizon 2020, the Commission will:

- Promote the development of open frameworks and standards for interoperability and portability of digital educational content, applications and services, including OER, in cooperation with European standardization organisations and programmes, and develop components for an efficient educational technologies market place including the coordination of joint specifications for public procurement of innovative solutions to help the deployment of affordable devices, software and content;
- Promote research and innovation on adaptive learning technologies, learning analytics and digital games for learning, creating links with innovative entrepreneurs.

Member States and education institutions should:

- Connect every school, ideally including connectivity to individual classrooms, to broadband, upgrade their ICT equipment, and develop accessible, open national digital learning repositories using structural and investment funds by 2020.

4. A concerted effort to seize the opportunities of the digital revolution

We need an integrated approach …

Developments in the use of ICT and digital content have varied in the Member States. Many have recognized the potential impact of technology on education and many e-learning initiatives have been launched. However, initiatives have been fragmented and isolated; investments in infrastructure were often not accompanied by efforts to increase the capacity and motivation of teachers and learners to use it. For this reason, despite the large investments made, projects have rarely succeeded in moving from a pilot phase into mainstreaming.

Past lessons show that merely introducing technology into classrooms is not enough. Only an integrated approach, where access to digital content, ICT infrastructure, the right level of digital skills, and the right organisational strategies are secured, can generate an educational offer able to sustain innovation.

… a concerted effort by all actors …

Triggering large-scale sustainable changes requires shared efforts and focused actions, involving and engaging all stakeholders, learners, teachers, families, school managers, educational policy makers and the local communities.

Large scale demonstrations and experimentations, engaging pupils with exciting learning opportunities inside and outside schools and involving all stakeholders, including regional and local actors, should contribute to building bridges between the education and the workplace, to produce for more flexible and effective mechanisms for integrating working and learning experiences.

Key Transformative Actions in this Area

Through the new programmes Erasmus+ and Horizon 2020, the Commission will:

- Launch a platform open to all stakeholders (teachers, learners, families, digital communities, economic and social partners, etc.) to record and benchmark the digital state of educational institutions;

- Establish a European Hub of Digitally Innovative Education institutions, showcasing and piloting innovative ICT-based pedagogical and organizational practices, complemented by a specific European Award of Digital Excellence.

Member States and education institutions should:

- Promote networks of volunteer teachers, digital communities and ICT experts in launching initiatives (such as coding courses or back-to-school programmes) and establish teachers' awards for the good pedagogical use of ICT for all educational sectors.

…and a better understanding of all opportunities that the digital revolution is yet to unfold.

Member States and other stakeholders are invited to work actively with the Commission to implement, in a systemic way and with vigour, the priorities proposed in this Agenda as part of their national education and training reforms. The Commission will follow the progress made at national level on the key challenges identified in this Communication via the annual Education and Training Monitor.

This Agenda is not an end but a starting point. In the longer term, technological change will radically affect education and research in ways that are difficult as yet to predict. Sustained effort and on-going international cooperation is required to improve our knowledge-base and take full advantage of the impact of technology on education.

By the end of 2013, the Commission will present studies on innovation in Higher Education, on the changing pedagogical landscape in Higher Education due to new modes of teaching and learning, and on the use of ICT and OER in adult learning. Furthermore, it will continue to work and cooperate with national regional and local authorities, social partners, business, students, new educational providers and other international organisations such as UNESCO, the International Council for Open and Distance Education (ICDE) and the OECD, to better understand the implications of technology in the education world while harnessing the potential of these changes it brings.

European Commission support for better knowledge and stronger evidence-based policies

T**he Commission will:**

- Carry out a comprehensive exercise of foresight scenarios for education in Europe 2030, in consultation with relevant actors such as ERT, EADTU, LERU, EUA and European Schoolnet on the basis of the work carried out by JRC-IPTS[45] and in line with the on-going FUTURIUM[46] project. As

[45] http://ipts.jrc.ec.europa.eu/pages/EAP/eLearning.html

regards higher education, the Commission will also pursue work with the High Level Group for Modernisation of Higher Education to establish recommendations on the new modes of learning.

- Develop measuring tools and indicators to monitor more closely the integration of ICT in teaching and training institutions, and support Europe-wide quantitative surveys.
- Launch an impact assessment on the economic and social impact of an EU initiative to stimulate open access to educational materials produced with public funds.
- Exploring ways with rightholders, teaching institutions and other educational stakeholders to understand and assess the current practices and needs of sharing educational materials (including open educational resources), including those resulting from copyright and licensing regimes, multilingualism, quality assurance, etc. both in national and cross-border contexts.

[46] http://ec.europa.eu/digital-agenda/futurium/

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Manuel Miguéns	Secretary general CNE (Portuguese Education Council)
Tomás Ó Ruairc	Director of the Irish Teaching Council
Demetrios G. Sampson	Professor at the Department of Digital Systems, University of Piraeus, Greece
Konstantin Scheller	European Commission, DG Education and Culture
Angela Soufli	Greek National Council of Education
Vilija Targamadzė	President Education Council Lithuania
Alfons ten Brummelhuis	Head of Research Kennisnet, Netherlands
Liis Turu	Estonian Education Forum
Adrie van der Rest	EUNEC president and secretary director of the Onderwijsraad (Dutch Education Council)
Jiri Zajicek	President Unions of Schools' Associations, Czech Republic

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