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COMMISSION STAFF WORKING DOCUMENT

Analysis and mapping of innovative teaching and learning for all through new Technologies and Open Educational Resources in Europe

Accompanying the document

Communication

'Opening Up Education'

{COM(2013) 654 final}

Contents

EXECUTIVE SUMMARY

This Staff Working Document accompanies the new European initiative on 'Opening up Education'. It outlines the scope, size and complexity of the challenges that lie ahead, in order to modernize and open up education through new technologies and Open Educational Resources (OER). The document provides the necessary evidence and background analysis on the use of new technologies and OER in education and training across Europe. It is based on in-depth country analysis for all EU Member States, expert reports and an extensive literature review on the state of play for new technologies and open educational resources in education and training.

What is the state of play in Europe? New technologies and OER can have an extraordinary effect on improving the efficiency, accessibility and equity of education, training and learning. Learning and teaching can become more focused on the learner supporting the individual learning pathways, enhancing collaboration online and blending formal and informal education. Personalisation, collaboration and links between formal and informal learning enhanced by technologies will be at the core of future learning and push educational institutions towards opening education and institutional transformation.

However, literature and practices show that education is one of the last societal sectors in Europe, which has not yet embedded the potential of new technologies, failing to provide European citizens with the skills necessary for the future. Europe is not fully reaping the potential offered by new technologies and the upsurge across the globe of digital content, including OER, to improve the efficiency, accessibility and equity of its education, training and learning systems. 63% of nine year olds do not study at a highly digital equipped school and only 20 to 25% of students are taught by digital confident and supportive teachers.

In a digital world, this has serious consequences for citizens who do not possess the skills necessary for social and economic well-being. In the last years the lack of systemic uptake of new technologies in education has been a concern for many EU countries but with scattered efforts. Despite the investments, a full uptake of new technologies and OER requires more than dispersed action. Evidence indicates that the EU-wide experiences on innovative learning need to be scaled up into all classrooms, reach all learners and teachers/trainers at all levels of education and training.

What are the underlying problem drivers of this implementation gap?

- Teaching and learning environments: lack of teachers' skills for a real digital pedagogy; organisational barriers for developing innovative and personalised pedagogies and assessment practices; and lack of validation and recognition mechanisms for online-acquired skills.
- Digital contents: insufficient supply of quality digital contents across languages subjects and needs; uncertain legal framework conditions for producing, using, re-using and sharing educational contents; and difficult access to relevant, quality digital resources, in particular OER.
- ICT infrastructure and equipment: uneven availability of ICT infrastructures and tools, including connectivity, across Member States, and absence of open interoperability standards.

What are the consequences for the EU? Without adequate action in the EU, the current problems of uneven availability of infrastructures, difficult discoverability of quality digital resources, difficult validation of skills acquired online, etc. will continue to be reproduced. This has negative implications related to digital skills, digital divide and access to knowledge, inefficient use of resources and Europe's leadership.

Education and training systems do not provide the digital competences needed in the 21st century economy and society. Europe will not provide similar opportunities to all its citizens to acquire digital skills for employability as well as active citizenship. The European economy would keep on facing digital skills gaps.

There is a risk of increasing the digital divid**e** between digital competent people and those who do not have such ICT skills. This is particularly relevant in terms of access to knowledge. The current gaps between countries may increase even more. Some countries would continue to make efforts for exploiting the potential of digital technologies for learning, while others would reduce or even stop them. This is likely to increase the negative impacts in terms of social cohesion, competitiveness and efficiency of resources.

The efficiency potential of new technologies, evident in all economic sectors, is not reaped off in education and training, which lead to an inefficient use of educational resources. Europe will not be able to catch up with the emerging digital phenomena in education and training across the world and be able to modernise its education systems in terms of equity, quality and efficiency.

Europe will be lagging behind in terms of supply of OER and emerging digital markets compared to the US and Asia. Third countries will lead the emerging digital phenomena in the education and training field (e.g. MOOC) and better exploit the potential of new technologies and of the investments already done. The EU would be just a follower, losing opportunities and increasing its dependency on educational technologies designed and produced abroad.

What are possible ways forward? Education and training systems must be lined up with the expectations and requirements of the digital society. New technologies and the increasing attention for open educational resources can enable a paradigm shift and transform education if it takes account simultaneously of pedagogical, organisational and technological innovation. Education will only reap the full benefits of embedding new technologies and open educational resources when it opens up simultaneously the learning environments, the content and knowledge and the underlying infrastructures. The focus has to be on the learner and improvement of learning, instead of focusing on technology only.

The new ways of looking to learning through OER (and MOOCS) require a rethinking of the educational landscape in terms of access, quality and efficiency. Past experiences have shown that any initiative to overcome the implementation gap of using new technologies in education requires a 360 degree approach or (eco) system-wide, and not a piecemeal approach. A full uptake of new technologies and OER requires more than boosting experimentations across Europe.

Over the past years several large scale pilots have been implemented across Europe, crossing national countries and some even of European dimension. Various practices in Europe are being looked into such as: One-to-one learning initiatives providing every child or teacher with a personal device; eTwinning, a European-wide community of schools; large scale experimentations providing real-life laboratories of scale to develop and test scenario's for mainstreaming innovative use of new technologies in education; Open Courseware; MOOCs changing the European higher education landscape and large-scale platforms for open education.

Based on the evidence base and best practices provided in this Staff Working Document the underlying conditions and some ways forward for successful uptake and use of new technologies and OER in education are analysed.

1. Introduction

Highlights

New technologies and open educational resources (OER) can have an extraordinary effect on improving the efficiency, accessibility and equity of education, training and learning. Learning and teaching can become more focused on the learner supporting the individual learning pathways, enhancing collaboration online and blending formal and informal education. Personalisation, collaboration and links between formal and informal learning enhanced by technologies will be at the core of future learning and push educational institutions towards opening education and institutional transformation.

However, literature and practices show that education is one of the last societal sectors in Europe, which has not yet embedded the potential of new technologies, failing to provide European citizens with the skills necessary for the future. In the last years the lack of systemic uptake of new technologies in education has been a concern for many EU countries but with scattered efforts. Despite the investments, a full uptake of new technologies and OER requires more than dispersed action. Evidence indicates that the EU-wide experiences on innovative learning need to be scaled up into all classrooms, reach all learners and teachers/trainers at all levels of education and training.

Education and training systems must be lined up with the expectations and requirements of the digital society. New technologies and the increasing attention for OER can enable a paradigm shift and transform education if it takes account simultaneously of pedagogical, organisational and technological innovation. Education will only reap the full benefits of embedding new technologies and OER when it opens up simultaneously the learning environments, the content and knowledge and the underlying infrastructures. The focus has to be on the learner and improvement of learning, instead of focusing on technology only.

We are living a paradox: digital technologies are fully embedded in our economies and societies – they have, for example, changed the way people may access financial services or read the news – but they have not yet changed the way learning and teaching occurs in European schools, training institutions or universities.

The European education and training systems have not yet fully tapped into the potential offered by digital technologies and content, including open educational resources (OER)[1], losing the opportunity to innovate the teaching and learning practices, to increase the efficiency and equity of the education and training provision and to raise the digital skills of learners necessary for a more competitive and knowledge-based economy.

Integration of digital technologies and digital content in education and training systems does not simply mean more electronic devices or more broadband connections. Supporting learning with technologies allows for the combination of innovative pedagogies with an effective use of digital tools and content which in turn can boost the quality of teaching and learning processes.

[1] Open Educational Resources (OERs) are any type of educational materials that are in the public domain or introduced with an open license. The nature of these open materials means that anyone can legally and freely copy, use, adapt and re-share them. OERs range from textbooks to curricula, syllabi, lecture notes, assignments, tests, projects, audio, video and animation. (UNESCO 2012)

1.1. Future trends opening up education: personalisation, collaboration, blended learning

Digital competences are considered core skills for employability and societal inclusion due to both fast advances in technology and structural changes of European labour markets related to demographic change, globalisation and immigration. These *transversal skills gain importance*[2] as they empower lifelong learners who respond to changes flexibly, develop competences pro-actively and thrive in collaborative learning and working environments.

Box 1: A few ideas about the future

Constants amongst the change[3]

1. *The world of work is increasingly global and increasingly collaborative.*
2. *People expect to work, learn, socialise, and play whenever and wherever they want to.*
3. *The Internet is becoming a global mobile network — and already is at its edges.*
4. *The technologies we use are increasingly cloud-based and delivered over utility networks, facilitating the rapid growth of online videos and rich media.*
5. *Openness — concepts like open content, open data, and open resources, along with notions of transparency and easy access to data and information — is moving from a trend to a value for much of the world.*
6. *Legal notions of ownership and privacy lag behind the practices common in society.*
7. *Real challenges of access, efficiency, and scale are redefining what we mean by quality and success.*
8. *The Internet is constantly challenging us to rethink learning and education, while refining our notion of literacy.*
9. *There is a rise in informal learning as individual needs are redefining schools, universities, and training.*
10. *Business models across the education ecosystem are changing.*

Ten future technological trends[4]

1. *e-Books: dynamic formats, and innovative uses*
2. *Publisher-led short courses: offering self-directed, CPD learning opportunities;*
3. *Assessment for Learning: changing the focus of assessment from assessment of learning outcomes towards assessment for feedback to enhance the learning;*
4. *Badges: awarding 'non-formal learning' through a widely-recognised honour or badge system;*
5. *MOOCs: massive open online courses bring open-access education to the masses;*
6. *Changing nature of academic publishing: the continued development of open-access scholarly publishing initiatives;*
7. *Seamless Learning: learning across multiple locations, platforms, formats in a continued way;*
8. *Learning Analytics: emphasis on obtaining data to learn more about the learner and their contexts in an effort to improve learning opportunities;*
9. *Personal Inquiry Learning: focus on the learner as an active, exploratory learning agent involved in discovery and inquiry learning processes;*
10. *Rhizomatic Learning: learning occurring through multi-facets/avenues of inquiry, taking contexts and previous knowledge and experiences into consideration, using social and personal sources of learning to foster a personal learning network.*

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2 Cedefop 2010: Skills supply and demand in Europe - Medium-term forecast up to 2020; *http://www.cedefop.europa.eu/en/Files/3052_en.pdf*

3 The Future of Education: The 2013 NMC Horizon Project Summit Communiqué. *http://www.nmc.org/pdf/2013-Horizon-Project-Summit-Communique.pdf*

4 Sharples 2012: UK Open University's Innovating Pedagogy 2012 Report *http://www.open.ac.uk/personalpages/mike.sharples/Reports/Innovating_Pedagogy_report_July_2012.pdf*

Recent forward-looking surveys on ICT and education (Horizon Report 2013[5]; IPTS 2011[6]; Sharples 2012[7]; Matel Project 2013[8]) all identify an **increasing opening up in education of practices, resources and infrastructures**. They underline the core trends:

- **Personalisation** both in terms of equity among all learners[9] as well as in terms of individual learning plans and tailor-made learning activities. A mix of different technologies can support personalisation, by allowing for a diversity of learning activities, tools and materials; providing tools which support continuous monitoring and assessment strategies; making educational resources openly available; allowing for the implementation of collaborative projects; offering learning opportunities that are motivating, engaging and even playful; and supporting multilingual environments.

- **Collaboration**: Collaboration with the community at large, and with people from other social, cultural or age groups, will become increasingly important. Virtual study exchange programmes, internet based intercultural exchange projects, online massive multiplayer games, simulations creating and sharing open educational resources with peers and other internet-based services can serve educational institutions in allowing learners to experience, understand and reflect upon societal developments in a safe and protected environment.

- **Blending formal and informal learning**: abundant learning opportunities that assist people in converting professional experiences and personal skills into competences that are relevant for (new) job profiles. However, not all of these training opportunities will lead to formally recognised qualifications. Similarly, professional experiences acquired in previous jobs will give rise to a number of diverse competences that are seldom officially acknowledged or recognised. Thus, in view of increasing labour market dynamics, informally acquired skills need to become better recognised and/or integrated with formal qualifications and mechanisms will have to be put in place that allow people to obtain formal recognition for their experiences and skills.

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5 New Media Consortium 2013: Horizon Report, Higher Education & K-12 *http://www.nmc.org/pdf/2013-horizon-report-HE.pdf*, The NMC Horizon Report: 2013 K-12 Edition, *http://www.nmc.org/pdf/2013-horizon-report-k12.pdf*

The New Media Consortium is an international community of educational experts that collaborated with EDUCASE Learning Initiative in early 2013 to publish the annual Horizon Report. The Report describes trends and predicts which ones will be adopted in the short (< 1 year), medium (2-3 years) or long (4-5 years) term.

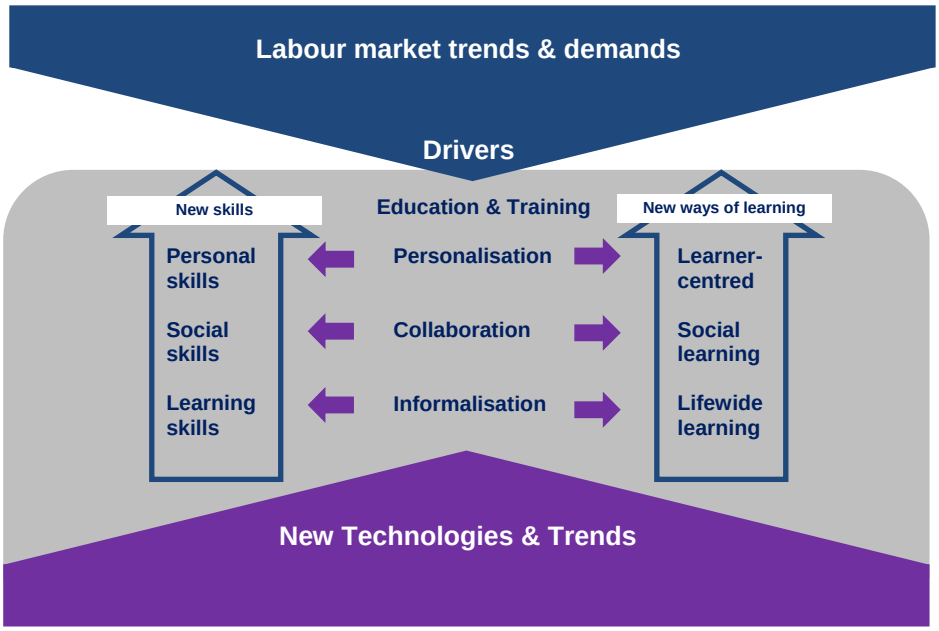
6 IPTS 2011 The Future of Learning: Preparing for Change. JRC Scientific and Technical Report, EUR 24960 EN. *http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=4719*

7 Sharples 2012: UK Open University's Innovating Pedagogy 2012 Report *http://www.open.ac.uk/personalpages/mike.sharples/Reports/Innovating_Pedagogy_report_July_2012.pdf*

8 IPTS 2013 Mapping and Analysing Prospective Technologies for Learning. Results from a consultation with European stakeholders and roadmaps for policy action. JRC Scientific and Policy Reports, in collaboration with Menon network. EUR: JRC81935. *http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=6360.*

9 Special needs, remote learners, early school leavers, migrant children, adult learners, unemployed, etc.

Figure 1: Conceptual map of the future of learning[10]



Personalisation, collaboration and links between formal and informal learning will be at the core of future learning and push educational institutions towards opening education and institutional transformation[11]. They will be the central guiding principles for organising education in the future. Together with scalable and flexible infrastructure (e.g. cloud-based) and proliferation of (personal) mobile devices **access to learning** becomes practically unlimited.

1.2. New technologies and OER can enable a paradigm shift

All forecast surveys note a also fundamental paradigm shift on the role of new technologies supporting educational change: while some years ago the term "e-learning" dominated the educational discourse, the "e" has nowadays disappeared. It is all about the core business of education: learning. The focus is no longer on ICT tools and infrastructures but on open and flexible learning and teaching with the **learner (and the educator) at the centre,** enhanced through new technologies. This indicates that the step from an early adoption of ICT use in education towards mainstreaming has been started.

Transforming education requires pedagogical, organisational and technological innovation[12]. Learning takes place in a **learning environment** which is increasingly **open and flexible** to embed a diversity of learning and teaching practices and respond to the personalised needs of each learner. Such a learning environment can be a local classroom or college setting or based anywhere remotely between peer learners and educators. In order to acquire knowledge and thus to learn, content is provided through digital **educational resources** (openly available or not) and offered through courses in a learning environment guided by a teacher or tutor. One of the basic conditions enabling learning practices are the available **ICT infrastructures**, tools and networks.

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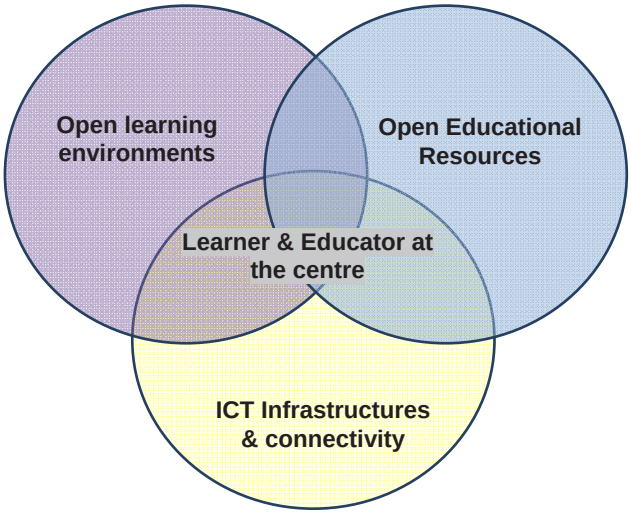
[10] Based on IPTS 2011, p. 43
[11] IPTS 2011
[12] European Commission 2008: Staff Working Document on ICT and Education

Figure 2: An integrated vision and approach



a. Learning and teaching in Open Learning Environments: New technologies are encouraging teaching and learning based on personalisation and collaboration, changing and redefining the roles of teachers and learners. The increasing use of social media makes learning environments more dynamic, flexible and open, taking into account that learning also takes place outside formal learning environments, i.e. at home, in the community, at work, for leisure, in informal ways. Learning and teaching in the 21st century are increasingly taking place through learning networks and communities of practices, connected and collaborating, even if geographically dispersed, through open technologies. Learning networks promote collaboration across borders, language barriers and institutional walls. For teachers and educators, specifically communities of practice are an ideal platform for collaborative peer learning, exchanging good practices and even developing joint teaching activities between educational institutions (e.g. via eTwinning[13]).

b. Acquiring knowledge through Open Educational Resources: Digitised materials offered freely and openly for educators, students and self-learners are not only driving change in the access to content for everyone but also widening its diversity and changing the educational practices. Re-use and sharing of open educational resources (OER) increase the quality, reduce the costs and the time lag between production and use of resources. Learning becomes more personalised, interactive and collaborative. Access to educational content and services anytime, anywhere and how the learner wishes opens opportunities for a diversity of learners, from those more exigent and ready to choose their education paths to those more difficult-to-reach such as those outside the traditional educational landscape and early school leavers.

c. Educational services enabled by ICT Infrastructures and connectivity: An open learning infrastructure will enable more effective and efficient ways to make use of that abundance. An open learning infrastructure relies on open standards that enable the interconnection between different infrastructures or the development of an integrated infrastructure from heterogeneous independently developed building blocks. Different services offering for example integration, visualisation and analytics can be built on these infrastructures allowing teachers and learners to leverage the abundance of learning content in much more flexible ways when these resources are integrated in more subtle ways in their existing workflows.[14]

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

[14] Duval et al. 2011. Towards an Open Learning Infrastructure for Open Educational Resources: Abundance as a Platform for Innovation. In C.S. Calude, G. Rozenberg, A. Salomaa (Eds.): Maurer Festschrift, LNCS 6570, pp. 144–156,

This paradigm shift also indicates the importance of integrating all of these elements simultaneously and in a holistic way. Only then will education reach full uptake and reap the full benefits of embedding new technologies and OER in its practices.

1.3. The objectives of the Staff Working Document

In the last years the lack of systemic uptake of ICT in education has been a concern for many EU countries. Member States are looking into the scalability and sustainability of their pilots in order to increase the uptake of ICT and OER in education. The focus is on the learner and improvement of learning, instead of focusing on technology only.

This Commission Staff Working Document aims at analysing and mapping the use of new technologies and Open Educational Resources in EU education and training. The Staff Working Document ***is based on*** i) ***in-depth country analyses of all EU Member States***[15]***;*** ii) ***extensive literature review*** on the state-of-the-art of ICT and OER in education and training; and iii) ***expert reports*** provided by DG JRC-IPTS[16].

The in-depth ***country analyses*** describe how the EU Member States have provided digital resources and integrated the use of ICT in education and their strategies, policies and initiatives. The evidence and the literature review highlight the importance of collection of data for evidence-based policy making both at EU and national level, particularly given the rapid changes in the supply, demand and distribution of educational content through digital technologies.

The country analyses draw on the experiences of the individual Member States and its publication[17] is one of the core outcomes from the Open Method of Coordination (OMC) Thematic Working Group on 'ICT and education' under the Education and Training 2020 Work Programme. It reflects on developments achieved by the Lifelong Learning (LLP) and FP7 programmes from 2006 until today – a period when the EU Member States invested heavily in the use of ICT for education and training.

The Commission also undertook a comprehensive ***consultation of external stakeholders,*** including a public consultation carried out between August and November 2012[18]. It was targeted to both individuals and public authorities and organisations involved in education and training (e.g. schools, universities, trade unions, industry and consumers associations). The aim was to assess i) to what extend stakeholders agreed with a possible initiative, its rationale and scope; ii) possible actions and; iii) the need for a policy intervention at EU level.

Further to the public consultation, four ***other initiatives*** were undertaken to collect the views of external stakeholders:

- The views of Member States have been discussed and analysed through the Thematic Working Group on 'ICT and Education'. This group is composed mainly by representatives of ministries of Education and the European Trade Union Committee for Education.
- The views of external experts and other stakeholders have been discussed and analysed through a High Level Experts Group. Participants were experts from international organisations; researchers involved in education, training and innovation; members of EU

Springer-Verlag Berlin Heidelberg. *https://lirias.kuleuven.be/bitstream/123456789/323814/1/rainbow.pdf*

15 European Commission 2013: Report on the Provision of Digital Resources and ICT in Education in the Member States

16 JRC-IPTS *http://is.jrc.ec.europa.eu/pages/EAP/eLearning.html*

17 See Website DG EAC

18 *http://ec.europa.eu/dgs/education_culture/consult/open_en.htm*

networks, representatives of industry and open universities, as well as developers of open educational resources.

- The Commission also met relevant stakeholders concerned by the initiative, both at ad hoc roundtables (i.e. European publishers; Digital Europe) and bilaterally, included ICT and publishing industry, representatives of education and training organisations, NGOs and public authorities.
- A Ministerial Conference entitled 'Opening up education through technologies' was organised on 9-11 December 2012 under the Cypriot Presidency (in collaboration with Norwegian authorities)[19]. Ministers discussed the scope and actions of the Opening up Education initiative and forwarded the outcome of their debate through Presidency Conclusions that highlighted the innovative potential of ICT in fundamentally transforming education and training. The Cypriot Presidency focused on the importance of up-scaling pilot programmes, the necessity to explore further how to enhance the use and sharing of OER, the need for accreditation and quality assurance mechanisms, the vital role of teachers and communities of practice, and the potential for transnational cooperation and peer learning in these areas.

[19] *http://ministerialconference2012.linkevent.no/index.htm*

2. The State of Play in the EU: a major implementation Gap and Barriers for uptake

Highlights

The European Commission undertook a comprehensive consultation of external stakeholders, including a public consultation carried out between August and November 2012[20]. Responses were very positive towards a possible initiative by the EU creating synergies and complementing existing or future actions by Member States. 84% of respondents found that ensuring a wider availability and use of ICT and OER in education should be a top priority for the EU and its Member States. The most important actions to be implemented were ensuring open access for educational resources developed with public funding; support for teacher education and professional development on ICT didactics and use of open educational resources; increased access to communities of practice; and adaptation of the funding and quality frameworks to incentivise engagement in open education.

Literature and practices show that Europe is not fully reaping the potential offered by new technologies and the upsurge across the globe of digital content, including OER, to improve the efficiency, accessibility and equity of its education, training and learning systems. 63% of nine year olds do not study at a highly digital equipped school and only 20 to 25% of students are taught by digital confident and supportive teachers.

In a digital world, this has serious consequences for citizens who do not possess the skills necessary for social and economic well-being. In the last years the lack of systemic uptake of new technologies in education has been a concern for many EU countries but with scattered efforts.

The following underlying problem drivers have been identified causing this implementation gap:

- ***Teaching and learning environments: lack of teachers' skills for a real digital pedagogy; organisational barriers for developing innovative and personalised pedagogies and assessment practices; and lack of validation and recognition mechanisms for online-acquired skills.***
- ***Digital contents: insufficient supply of quality digital contents across languages subjects and needs; uncertain legal framework conditions for producing, using, re-using and sharing educational contents; and difficult access to relevant, quality digital resources, in particular OER.***
- ***ICT infrastructure and equipment: uneven availability of ICT infrastructures and tools, including connectivity, across Member States, and absence of open interoperability standards.***

Despite the investments, a full uptake of new technologies and OER requires more than dispersed action. Evidence indicates that the EU-wide experiences on innovative learning need to be scaled up into all classrooms, reach all learners and teachers/trainers at all levels of education and training. Past experiences have shown that any initiative to overcome the implementation gap of using ICT in education requires a 360 degree approach or (eco) system-wide, and not a piecemeal approach. A full uptake of ICT and OER requires more than boosting experimentations across Europe.

[20] *http://ec.europa.eu/dgs/education_culture/consult/open_en.htm*

This chapter will describe the current gap in Europe between the embedded use of digital technologies in almost all aspects of our lives and their poor integration in education and training.

As a starting point one can describe the core problem as follows:

Europe is not fully reaping the potential offered by new technologies and the upsurge across the globe of digital content, including open educational resources, to improve the efficiency, accessibility and equity of its education, training and learning systems.

Based on the description of the implementation gap in Europe, Chapter 2 will analyse the underlying reasons for this implementation gap and the obstacles to overcome it. These obstacles are manifold and will be discussed each in detail.

2.1. The opinion of stakeholders: results of the public consultation

A total number of 222 responses were received, 80 of which representing organisations[21]. Responses were very positive towards all three above mentioned aspects. The main findings were:

- 84% of respondents found that ensuring a wider availability and use of ICT and OER in education should be a top priority for the EU and its Member States.
- Both organisations and individuals foresaw strong positive effects for almost all education and training sectors.
- A very strong agreement of stakeholders with the problems to be addressed: a deeper exploitation of OER would increase access to education (93%); the use of ICT and OER in education in Europe is still too fragmented (92%); pedagogical approaches for using ICT and OER are not sufficiently available to teachers, particularly during initial teacher training (87%).
- A strong support for EU intervention: 86% of respondents defended that an EU initiative would create synergies and complement existing or future actions by Member States; 81% disagreed that it would be appropriate to leave the initiative exclusively to Member States; 86% stated that jointly agreed actions are needed to maximise the effects.
- Among other problems to be addressed, the need for quality certification systems and standards was the most emphasised (24% of organisations and 18% of individuals have indicated so in an open question), followed by support to teachers and need to change mentalities (22% of individuals and 12% of organisations, also in an open question).
- The most important actions to be implemented were ensuring open access for educational resources developed with public funding; support for teacher education and professional development on ICT didactics and use of OER; increased access to communities of practice; and adaptation of the funding and quality frameworks to incentivise engagement in open education.
- Support for a future EU initiative.

Interesting to highlight are the underlying reasons for this implementation gap or obstacles identified in the public consultation (in order of importance):

- The use of OER and ICT in education in Europe is still too fragmented (92%);
- Deeper exploitation of OER would increase access to education (93%);
- A clear legal framework applicable in the EU, addressing IPR, copyrights, licensing and publishing rights is lacking (76%);

[21] More in detail, the main types of organisations that responded to the consultation where: Universities (13), Organisations promoting ICT in education (12), Organisations promoting Open Educational Resources (8), NGOs (8), ICT industry (5)

- The variety of resources makes is complicated to find and select right resources for specific needs (76%);
- Development of quality standards and quality assurance tools for OER would have a positive effect (84%);
- It is yet not clear how different actors can adapt their strategies and business models (73%);
- Stronger uptake of OER would generate higher levels of innovation in education and training institutions (90%);
- Wider use of ICT in education would contribute to reduce early school leaving (70%);
- The availability of free digitised school books could lead to a significant reduction in costs of education (72%);
- Availability of high quality European OER would increase attractiveness of European education and training systems (80%);
- ICT didactics are not sufficiently available to teachers, particularly during initial teacher training (87%);
- A stronger cooperation between traditional and open universities could contribute to better use and uptake of OER (86%);
- There is an insufficient availability of hardware and ICT infrastructures in many learning environments, creating imbalances in learner's access to education (75%).

In addition to the questionnaires, the European Commission (EC) received 25 position papers, mainly from publishers and their associations, but also from university consortia and public authorities (at regional level). The position papers recommended support for appropriate ICT infrastructure, including open technical interoperability standards and European cloud infrastructure; support for European businesses in digital learning aiming at global leadership; new methodologies for assessing learning outcomes; development of European quality standards specifically for OER; creation of a multi-stakeholders platform to facilitate partnerships between ICT industry, publishers and the public sector; and alignment of the VAT rates of digital and printed resources and materials.

2.2. Major implementation gap in education

As indicated in the previous chapter, technological advancements make it possible for individuals to learn anywhere, at any time, following very flexible and individualised pathways and often for free. However, educational institutions are not yet fully exploiting the potential benefits of new technologies as an enabler to innovate and modernise learning and teaching practices[22]. When technology is not used in education, learners are also not developing digital competences to become confident, critical users of new technologies[23].

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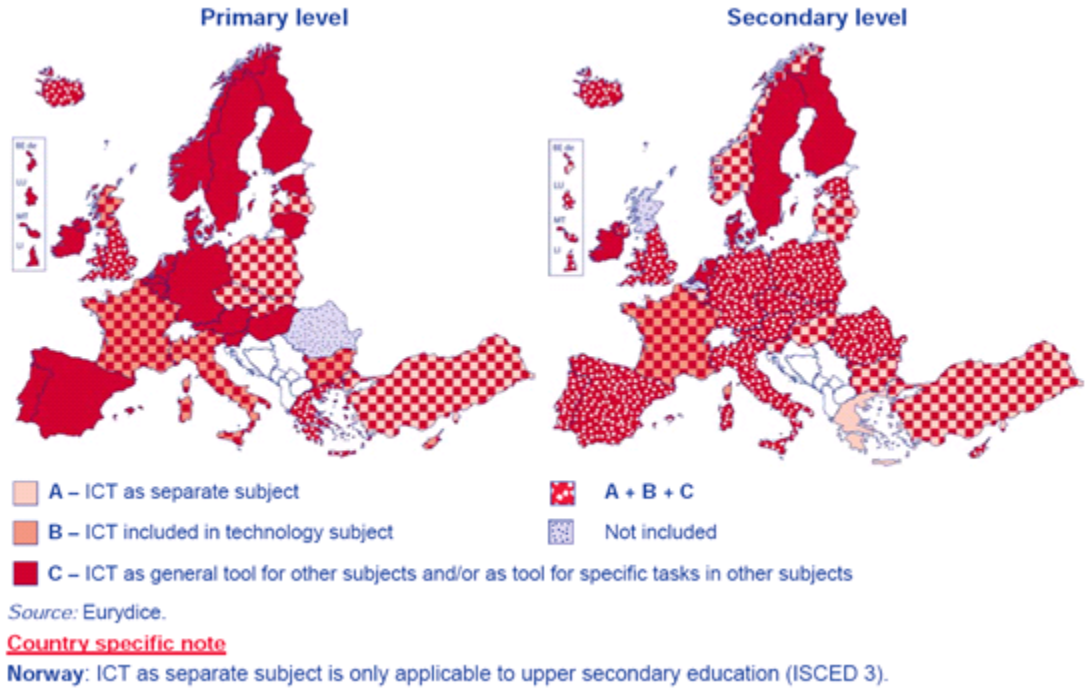
[22] Research shows systematic and massive uptake of new technologies in education and training has not yet happened: European Journal of Education, March 2013, Issue 1 on ICT and Education: Taking stock of progress and looking at the future. *http://onlinelibrary.wiley.com/doi/10.1111/ejed.2013.48.issue-1/issuetoc*
Eurydice 2011: Key Data on Learning and Innovation through ICT at School in Europe
http://eacea.ec.europa.eu/education/eurydice/documents/key_data_series/129en.pdf
Balanskat 2009: Study of the impact of technology in primary schools (STEPS)
http://insight.eun.org/ww/en/pub/insight/school_innovation/best_practice/steps.htm
European Schoolnet and University of Liège 2013: *Survey of Schools: ICT in Education*, Final report based on over 190,000 responses from students, teachers and head teachers in 27 countries collected and analysed during the school year 2011-12. The *Survey of Schools: ICT in Education* provides detailed, up-to-date and reliable benchmarking ICT in school level education (primary, secondary and initial VET) across Europe. The survey was commissioned in 2011 by the European Commission to benchmark access, use and attitudes to ICT in schools in 31 countries (EU27, Croatia, Iceland, Norway and Turkey) *https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/KK-31-13-401-EN-N.pdf.*

[23] OECD 2011: PISA 2009 Results: Students On Line: Digital Technologies and Performance (Volume VI)
http://www.oecd.org/pisa/pisaproducts/pisa2009/48270093.pdf

Education is one of the last sectors which have not yet embedded the potential of ICT. Numerous international surveys describe the seriousness of this implementation gap, its negative implication on learning outcomes and the need for education to take immediate action[24].

It is noted that national policies for ICT education exist in all European countries[25]. These aim to provide the necessary basic ICT skills to learners and ICT training for teachers. In most countries, ICT education is subject-specific; some also foresee cross-curricula strategies[26]. These countries also plead for using ICT as an innovative tool for learning and teaching. Policy and strategy development rests mainly with the central administrative level while implementation involves more local administrations and schools.

Figure 3: Delivery of ICT learning objectives as recommended by central steering documents of MS in primary and general secondary education (ISCED 1, 2 and 3), 2009/10[27]



Example 1 - Spain

In 2012, Spain replaced its former national programme Escuela 2.0 through a new ICT programme named TIC 2012. The general objective of this new programme is to develop an electronic learning platform that improves the management of content and promotes the use of virtual learning environments that facilitate classroom instruction and individualised learning according to the needs of students. For this purpose, the budget allocated for the new programme is 41.5 million euros, a

Kozma 2009: Assessing and teaching 21st century skills: A call to action. In F. Schueremann & J. Bjornsson (eds.), The transition to computer-based assessment: New approaches to skills assessment and implications for large scale assessment (pp. 13-23)

IPTS 2013: ICT-enabled innovation for learning in Europe and Asia - Exploring conditions for sustainability, scalability and impact at system level, by Kampylis, Law & Punie, JRC Scientific and Policy Reports, in collaboration with Centre for Information Technology in Education (CITE), University of Hong Kong: EUR: JRC83503. *http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=6362*

24 OECD 2011 ; Eurydice 2011; European Schoolnet & University of Liège 2013

25 Eurydice 2011, European Schoolnet & University of Liège 2013

26 See GHK report on key competences

27 Eurydice 2011

figure considerably lower than the 91 million euros for Escuela 2.0 in 2011. In this scenario co-funding models (public-private) and the participation and educational priorities of the regional communities will have an even more prominent role in continuing the incorporation of ICT and digital educational materials in the education system.

However, large implementation gaps remain. 92% of respondents of the public consultation confirm that the use of ICT and OER in education and training is still too fragmented. Past and recent surveys[28] show that teachers have not yet adopted ICT for learning across all subjects. In science, it is used for looking up information but rarely for conducting experiments or simulations of natural phenomena. In mathematics, it is also rather limited and sometimes used for skills practice. ICT use in language of instruction and foreign languages is more the exception than the rule[29].

It is crucial that educational institutions and all educational stakeholders involved have an integrated vision on how ICT can add-value to learning and teaching. *Developing integrated strategies and implementation plans with full engagement of all educational stakeholders is essential for any larger uptake and full implementation of ICT and OER use in education.*

Integrated ICT-policies in teaching and learning combined with concrete support measures at school level affect the frequency of students' ICT based activities for learning in the classroom. Students, as well as teachers, have the highest frequency of ICT use and ICT-based learning activities during lessons, in schools which have general policies on ICT-integration in teaching and learning as well as in subject learning, incentives to reward teachers using ICT, concrete support measures including teacher professional development and the provision of ICT-coordinators. Schools belonging to these two groups, i.e. having policies and/or concrete support measures, are defined as *digitally supportive schools*[30].

Example 2 - Greece

The Operational Programme 'Education and Lifelong Learning 2007-2013' is a large scale, nationwide funding programme, co-funded by the European Social Fund (ESF) and the Greek State. It is the main funding scheme for upgrading the quality of learning at all levels of the educational system, involving the use of Internet technologies. As part of the programme, the "Digital School Initiative" created an official repository that gives free online access to digital textbooks on all levels of education.

Having formalised school policies on teaching and learning is key towards an e-mature or digitally-supportive school[31]. On average, at EU level and across all grades, around 50% of students are in schools where such policies exist – in writing.[32] However, only 20% of students are in schools where they have actually been adopted. Around 35% of students are in schools where there are plans and measures to support collaboration between teachers and there is time scheduled for them to share, evaluate or develop approaches and instructional material.

Differences between countries are large: at least 50% of students are in digitally supportive schools having policies and support measures in Czech Republic, Denmark, Norway, Slovenia (at several grades, see figure 4), as well as in Bulgaria, Estonia, Ireland and Spain (at grade 4), while less than

[28] TIMMS 2007, PISA 2009, European Schoolnet & University of Liège 2013
[29] Eurydice 2011; PISA 2009
[30] European Schoolnet & University of Liège 2013
[31] e-Maturity is the level of integration of ICT in the teaching and learning process. An e-mature school can also be referred to as a digital competent and supportive school.
[32] European Schoolnet & University of Liège 2013

10% of students are in such schools in Croatia (at grade 8), France (at grade 4) and Greece (at grade 8 and 11, see figure 5).

Figure 4: Percentages digitally supportive schools in Slovenia

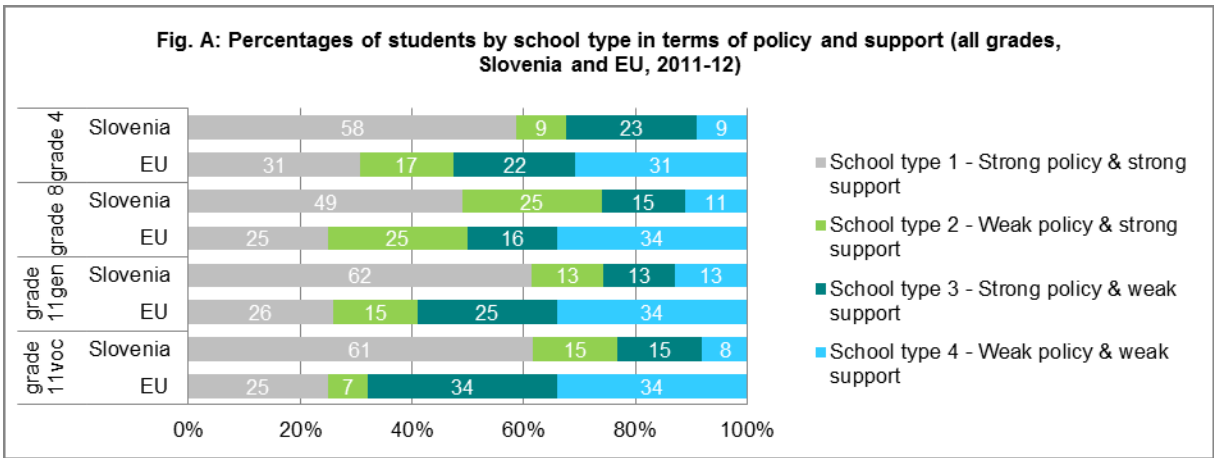
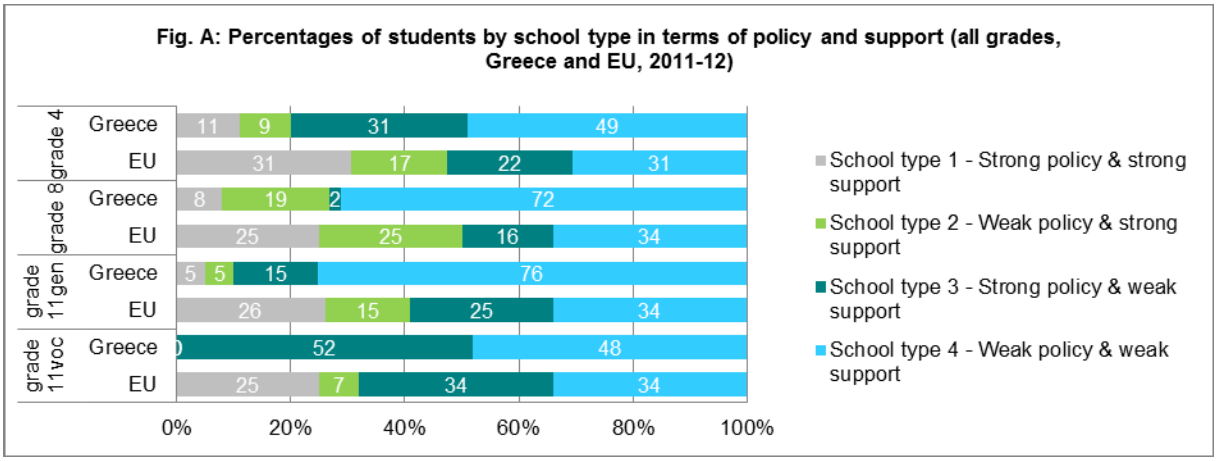


Figure 5: Percentages digitally supportive schools in Greece



2.3. The underlying problem drivers

Learning sectors are differentiated not only by their needs but also by their development stages. What is at stake obviously varies between different learning sectors. Each problem affects with different intensity each form of education and training (formal, non-formal and informal) and education sector (i.e. compulsory education, higher education, vocational education and training (VET), non-formal and informal youth and adult learning).

This section of the Staff Working Document will discuss the various barriers in Europe to move the use of ICT and OER from its early adopters' stage towards full uptake stage. These problems are being mapped and discussed following the three axes identified in the first chapter: (1) Open learning environments; (2) Open educational resources and (3) ICT infrastructures and tools. The relevance by sectors of education and training is mentioned for each barrier. The best practice examples identified are based on a detailed analysis of the use of ICT and OER in each country[33].

[33] European Commission 2013: Report on the Provision of Digital Resources and ICT in Education in the Member States

2.3.1. Open and innovative learning environments

The problems related to the first axe are:

1. Low use of ICT for innovative learning and lack of incentives to develop innovative teaching practices
2. Today's learners may be digital natives but not necessarily digitally competent
3. Insufficient teacher's digital competences
4. Teacher professional development lacks attention to innovative teaching through ICT
5. Evaluation mechanisms rewarding innovative practices for teachers
6. Assessment, recognition, validation and certification of online acquired learning is an open issue
7. Assessment supported by ICT in school education
8. National policy initiatives are fragmented with a large implementation gap

2.3.1.1. Low use of ICT for innovative learning and lack of incentives to develop innovative teaching practices

While infrastructure barriers to the use of ICT in education have been reduced over the last 5 years[34], the percentage of *school and initial VET* teachers using ICT in more than 25% of lessons has remained fairly stable[35]. Most teachers have been familiar with ICT for teaching and learning for some years but still use it first and foremost to prepare their teaching[36]. Only a few (15%) use it – and still to a limited extent – to work with students during lessons, and even less frequently to communicate with parents or to adjust the balance of students' work between school and home in new ways. The overall frequency of use of different types of ICT-based activities in class reported by teachers is around several times a month on average at EU level. But students report lower frequencies. Digital resources such as exercise software, online tests and quizzes, data-logging tools, computer simulations, etc. are still very rarely used by students during lessons.

The following figure demonstrates also the huge diversity between the EU Member States:

[34] Comparison between the 2013 European Schoolnet & University of Liège survey and a similar survey carried out in 2006

[35] EC DigitalAgenda Scoreboard: *http://ec.europa.eu/digital-agenda/en/scoreboard*

[36] European Schoolnet and University of Liège 2013

Figure 6: % of Grade 8 pupils attending classes where teachers' use of ICT in more than 25% of lessons[37]

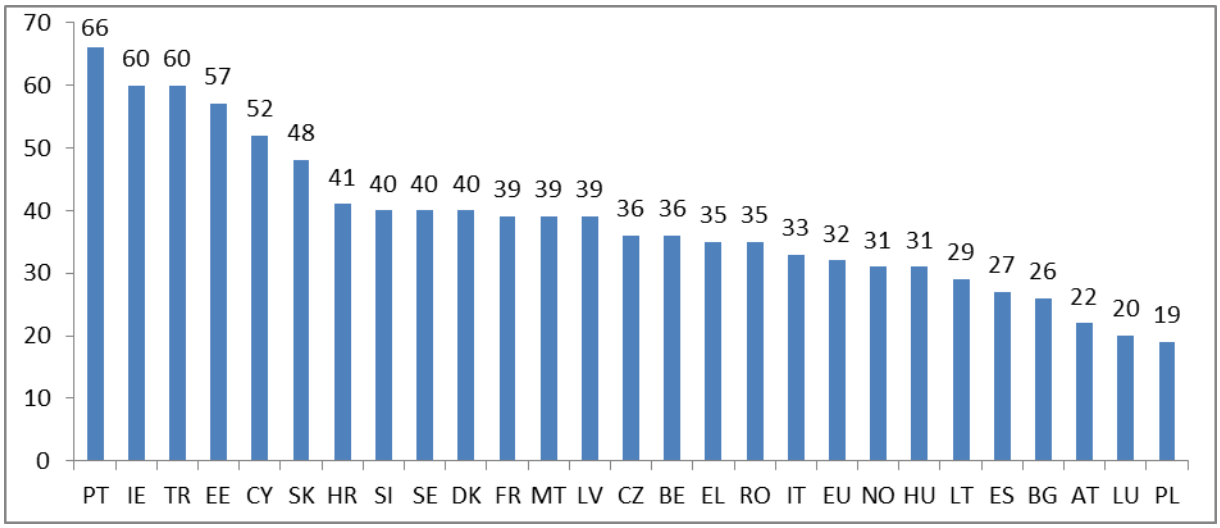


Figure 7: Teachers use of ICT in Cyprus

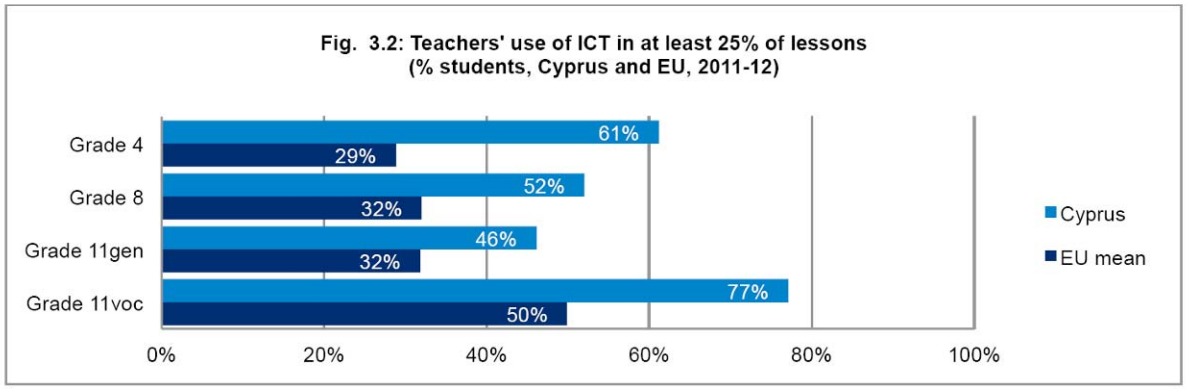
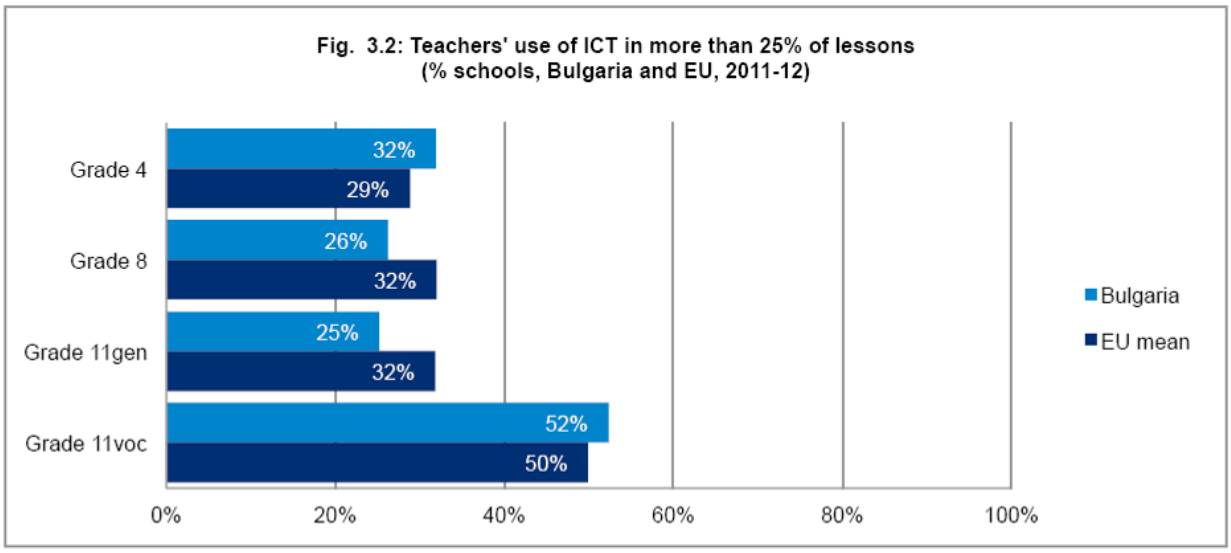


Figure 8: Teacher's use of ICT in Bulgaria



[37] European Schoolnet & University of Liège 2013

But despite the low use of ICT for learning during lessons, a very large majority of school heads and teachers agree about the relevance of ICT use in different learning activities, as well as concerning the positive impact of ICT use on students' motivation and achievement, and on transversal skills. They are also close to unanimity about the fact that ICT use is essential to prepare students to live and work in the 21st century. An overwhelming majority of students is also positive about the impact of ICT on the classroom atmosphere and on different learning processes.

2.3.1.2. Today's learners may be digital natives but not necessarily digitally competent

School education and initial VET

Longitudinal profiling of the evolving digital lives of teenagers and adults demonstrates the pace of change[38]. In Europe, data shows that going online is a part of children's activities from a very young age (7 to 9); 15-16 year olds spend an average of 118 minutes per day on the Internet, compared to 58 minutes per day for 9-10 year olds; 33% go online using a mobile device; 87% use the Internet at home compared to 63% at school; 75% use social networking sites and 56% display a sophisticated level of use, including playing games with others online, downloading films and music and sharing content peer-to-peer (e.g., via a webcam or message boards).[39]

Contrary to the popular image of 'digital natives' navigating effortlessly in web-based settings, many students cannot in reality operate so effectively. PISA results show that even when guidance on navigation is explicit, significant numbers of students still cannot locate crucial information. Today's 'digital natives' are not 'born digitally competent' as has sometimes been claimed[40]. Digital literacy is still an issue. OECD countries still have significant numbers of students who perform poorly in digital reading[41]. These results show also that one must make a clear difference between having access and using ICT effectively.

Also, PISA 2009 data show that the OECD average for 15-year-olds reporting using computers at home is 93%, compared with only 71% using them in school, with a stronger correlation between educational performance and computer use at home than with its use in school[42]. This discrepancy has also repeatedly been reported by European Schoolnet in the first European-wide surveys on ICT use in education (2006) and again in 2013. Students' ICT use during lessons still lags far behind their use of ICT out of school: Students' ICT-based activities related to learning at home are more frequent compared to ICT activities at school. Reasons for this are manifold, but one of them can generally be identified as lack of general strategy on integrating ICT for learning purposes at schools

Across the EU Member States, students have more confidence in their digital competences when they have high access to/use of ICT at home and at school compared to students (see figure below). Such higher confidence applies to students' operational ICT skills, social media skills, their ability to use the internet responsibly, and, to a slightly less extent, their ability to use the internet safely. These students are not just confident in their digital competences, but also positive about the impact of using

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38 Zickuhr, Rainie & Purcell 2012: Younger American's Library Habits. Pew Research Center's Internet and American Life Project, *http://libraries.pewinternet.org/files/2013/06/PIP_Younger_Americans_and_libraries.pdf*

39 Livingstone et al. 2011: Risks and safety on the internet. The perspective of European children: Full findings and policy implications from the EU Kids Online survey of 9-16 year-olds and their parents in 25 countries, EU Kids Online Network, *http://www2.cnrs.fr/sites/en/fichier/rapport_english.pdf*

See also on digital games for inclusion and empowerment: IPTS 2013 The Industry and Policy Context for Digital Games for Empowerment and Inclusion: Market Analysis, Future Prospects and Key Challenges in Videogames, Serious Games and Gamification, JRC Scientific and Policy Reports, EUR 25910. *http://ftp.jrc.es/EURdoc/JRC77656.pdf*

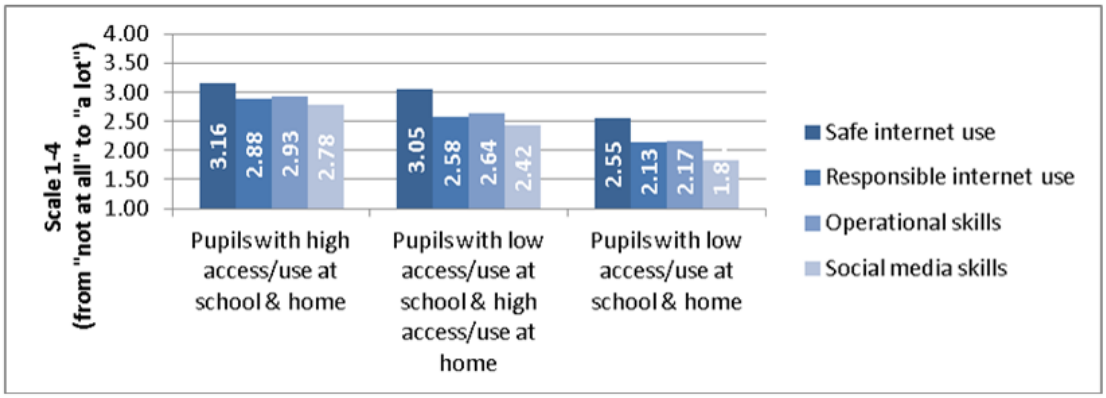
40 OECD 2011, p. 19

41 IPTS 2012: ICT and Learning - results from PISA 2009, pp. 28–42 by Biagi & Loi, JRC Scientific and Policy Reports, EUR: 25581, *http://ftp.jrc.es/EURdoc/JRC76061.pdf*

42 OECD 2011

ICT in teaching and learning. Students, having high access to and use of ICT at home and at school, are defined as digitally confident and supportive students[43].

Figure 9: Average pupil confidence (scale 1-4) in using ICT skills, by type of skills and pupils' use/access to ICT. Grade 8[44]



These findings underline how important it is to effectively develop ICT use during lessons at school for students to become more digitally competent, regardless of the many opportunities some have for using ICT out of school, and even more fundamentally for those still lacking access to it at home. Across the EU countries, on average between 30-35% of students are digitally confident and supportive students, i.e. have high access to ICT at home *and* at school; the highest percentage of digitally confident and supportive students is systematically found in Denmark at all grades and Norway at grade 11. Across all EU countries, the highest percentage of digitally confident and supportive students is observed at grade 11 in general education, suggesting a particular focus of policies at that education level. Nevertheless, around 50% of students at grade 8 and 11 in vocational education still have high access/use at home, but low access/use at school; it decreases to 35% at grade 11 in general education. Even more alarming is that between 18-28% of students, depending on the grade, have low access to/use of ICT at home as well as at school.

These results show clearly that as the digital divide defined by technology access, at home or in schools, has tended to fade, a second one – based on digital competence – more stubbornly remains: between those who have the necessary competences and skills to benefit from computer use, and those who do not.

The report revealed a positive link between confidence in ICT skills and the use of ICT at home and at school. Students with high access/use both at home and schools are more confident in their ICT skills than those that only report high access/use at home and not at school. The confidence in ICT skills is lowest amongst pupils with low access/use both at home and at school.

A recent analysis by the Eurydice network[45] *captures what might be referred to as the culmination of the first the large scale phase of digital development, 'computers in schools' and 'computers at home', reporting widespread but quite diverse activity throughout the European member states. On the positive side, key competences for lifelong learning are widely referenced in curricula and the integral role of ICT is promoted. A wide range of innovative pedagogical approaches are reported at both primary and secondary school levels, and these frequently integrate the use of ICT.*

However, there continues to be a strong emphasis on the separate teaching of ICT and on linking

43 European Schoolnet & University of Liège 2013
44 European Schoolnet & University of Liège 2013
45 Eurydice 2011

outcomes to very specific skills programmes such as the European Computer Driving License (ECDL)[46]. Wider integration of digital media in the curriculum, where it occurs, it often more in support of the teacher than in support of the individual student and the adoption by and large remains within the traditional schooling frameworks and teaching and learning paradigms. The report confirms that, at home, students are more likely to use an Internet-connected computer for entertainment than for learning. The OECD PISA 'Reading Online' survey[47] presents a generally positive perspective on the reading abilities of 15-year olds in a digital environment. However, relative to the scope of digital activities of teenagers, reported in a general way in other studies, PISA examines, albeit in detail, a very specific and small subset of such activities.

The New Millennium Learners report[48] arrived at the conclusion that there was little evidence that significant investment in ICT in compulsory education over many years had made any measurable difference at a macro level, (at least in respect of what was actually measured), while acknowledging that innovation was visible at the micro level. In this sense a systemic implementation gap remains.

Higher Education

Many higher education institutions have by now made significant investments in ICT for teaching and learning, for example in Learner Management Systems (LMS, e.g. Moodle or commercially available platforms such as Blackboard, offering extensive synchronous and asynchronous functionality to support course design, teaching, learning, collaboration, assessment and analytics) and by providing 24/7 electronic access to library resources. Campus facilities have been upgraded to offer WIFI access and digital projection/electronic whiteboard facilities are widely available in auditoria and classrooms. There is no doubt that the wide adoption these technologies has been of benefit to traditional cohorts of students, who now have access to a far wider range of resources and the flexibility of working online 24/7 in a 'blended learning' mode. Students at distance teaching universities have also benefited from the adoption of the same technologies, and convergence is evident between the fully distance/online mode of delivery and on-campus delivery

However, particularly in respect of LMS, it is difficult to gauge the extent to which their deployment has been fully embedded within faculties or disciplines, or the extent to which their deployment has resulted in a transformation of existing practices.

The arrival of MOOCs and the growth of open and online education are increasingly shifting the *focus to learners as the primary target group*. This group consists not only of students enrolled at education institutions but also "self-learners", everyone from pupils to professionals to retirees who, for their own reasons, want to learn without enrolling in a mainstream programme or needing/wanting a diploma or academic degree at the end. Personal development and employability are important motives for engaging in open education; for example, there are employees who use open education for continual professional development, or for retraining or refresher training.

This shift offers new opportunities for education, especially since the new target groups for higher education (HE), for example, are located around the world, massively extending the reach of open and online education. The demand for open education especially in higher education is enormous, as evidenced by the unprecedented popularity of MOOCs.

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[46] SWD (2012) 371 Assessment of key competences in initial education and training, *http://ec.europa.eu/education/news/rethinking/sw371_en.pdf* and COM (2012) 669 Rethinking Education: Investing in skills for better socio-economic outcome, h*ttp://ec.europa.eu/education/news/rethinking/com669_en.pdf*

[47] OECD 2011

[48] OECD & CERI 2010: Are the New Millennium Learners Making the Grade? Technology Use and Educational Performance in PISA 2006, *http://www.oecd-ilibrary.org/education/are-the-new-millennium-learners-making-the-grade_9789264076044-en*

Adult learning

Despite developments in ICT infrastructures and new web services, only 53% of the available labour force report that they are confident that they have sufficient digital skills if they were to look for a job or change jobs within the next year. Countries such as Sweden, UK, and the Netherlands report at the higher end with more than 80% expressing confidence in their skills, whereas countries such as Cyprus, Romania, Greece, and Lithuania report at the lower end of the benchmarking exercise with confidence levels not exceeding 40%[49]. These data and declared level of confidence are framed further by findings from IPTS who have conducted research on informal learning communities[50]. Moreover, digital competences among the adult population are unevenly divided, with older people and those with lower qualification levels having lower digital competences than the population in general. It appears that even where digital competence seems to increase over time, a clear socio-economic divide remains in the labour force according to country of location, formal level of qualification and age[51].

There is little data on the extent of ICT equipment available in adult learning institutions or on the extent to which it is being used in learning and teaching of adults. However, it is likely that ICT enabled learning is not at wide spread in this field as it is in the more formal education fields. Even within companies, the use of ICT enabled learning has not reached its full potential as evidenced by a Finnish survey, which shows that only 41% of respondent companies had used ICT enabled learning in their staff training in 2012[52].

2.3.1.3. Insufficient teacher's and educators digital and didactic competences and confidence

While teachers are quite motivated to use ICT for innovation in their teaching practices, they often lack the necessary digital competences and *even more the didactic competences* and confidence to use ICT in their teaching.

At EU level[53], 75% of teachers have been using computers and the internet at school for four years or more, but more for preparing lessons than teaching [54]. However, experience of using ICT does not necessarily imply a high level of expertise. Especially in the areas of social media, teachers demonstrate consistently lower levels of expertise than in operating ICT equipment more generally. This is also reflected in the teachers' frequency and areas of use. One in five grade 8 students in the EU are in schools where teachers never or almost never use a computer. More precisely, one in four students is in a school where the teacher uses ICT in *less* than one in 20 lessons.

The limitations of teacher expertise of using ICT for pedagogical reasons in the classroom become even clearer when looking at the areas for which teachers use ICT devices. The most frequent ICT based activities of teachers at EU level are related to the preparation of teaching activities (30-45% of students) are taught by teachers declaring they do some form of lesson preparation at least once a week.

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49 EC 2012: Digital Competences in the Digital Agenda, Digital Agenda Scoreboard 2012, *https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/scoreboard_digital_skills.pdf*

50 IPTS 2010: Learning in Informal Online Networks and Communities, by Ala Mutka, JRC-IPTS Scientific and Technical Reports, EUR 24149, *http://ftp.jrc.es/EURdoc/JRC56310.pdf*

51 OECD & CERI 2010: Are the New Millennium Learners Making the Grade? Technology Use and Educational Performance in PISA 2006, *http://www.oecd-ilibrary.org/education/are-the-new-millennium-learners-making-the-grade_9789264076044-en*

52 Confederation of Finnish Industries 2013

53 European Schoolnet & University of Liège 2013

54 European Schoolnet & University of Liège 2013

In contrast, only 20% - 30% of students have teachers who create digital resources and use the school website or virtual learning environment at least once a week. Similarly, around 30% of students at all grades are taught by teachers claiming they have participated in online communities to exchange professionally with other teachers. And between 60% and 85% of students are taught by teachers declaring they never or almost never communicate online with parents, post homework online for their students, assess students using ICT, or evaluate digital resources[55]. These Europe-wide results suggest that *while teachers are familiar with using ICT, the full potential of using ICT as a pedagogical tool in the classroom is not yet realised for a majority of students.*

2.3.1.4. Teacher professional development lacks attention to innovative teaching through ICT

Teacher education and professional development have positive impact on the take-up of new technologies[56]. International surveys indicate that teacher professional development ranging from initial teacher education, in-service training and other types of professional development schemes is the most important condition to ensure efficient and effective uptake of using ICT in education.

In 18 EU countries or regions, curricula for *initial teacher education* include some provision of digital skills[57]. However, according to a joint EC–OECD study of 2010, 58% of teachers surveyed said they had not received any training on how to use ICT in the classroom. ICT didactics are not sufficiently available to teachers, particularly during initial teacher training. The mostly frequently indicated action teachers would like to receive was "*to support teacher education and professional development on ICT didactics and use of OER, and increase access to communities of practice*".

Example 3 - Slovenia

*The Slovenian government is currently implementing an e-education initiative which consists of a range of projects on textbooks, competences and infrastructures. One part is designed to improve teachers' e-competences. It has defined an **'e- competence standard'** which all teachers and principals should reach. Teachers are trained online and onsite to reach the standard. By November 2012 there were about 32,000 participants in these seminars. The most popular seminars were on Virtual Learning Environments (moodle) and interactive whiteboards.*

Statistics presented with the individual country analyses show the different situations in EU Member States[58]. The EU-wide schools survey[59] provides more in-depth insight in what are the issues at stake. On average, only around 25% of students in Europe who are taught by teachers for whom ICT education and training is compulsory**.** In Lithuania around 70% and in Romania around 65% of students at all grades are taught by teachers for whom it is compulsory to participate in ICT training, while 13% or less of students are taught by such teachers in Luxembourg, Austria and Italy.

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55 European Schoolnet & University of Liège 2013

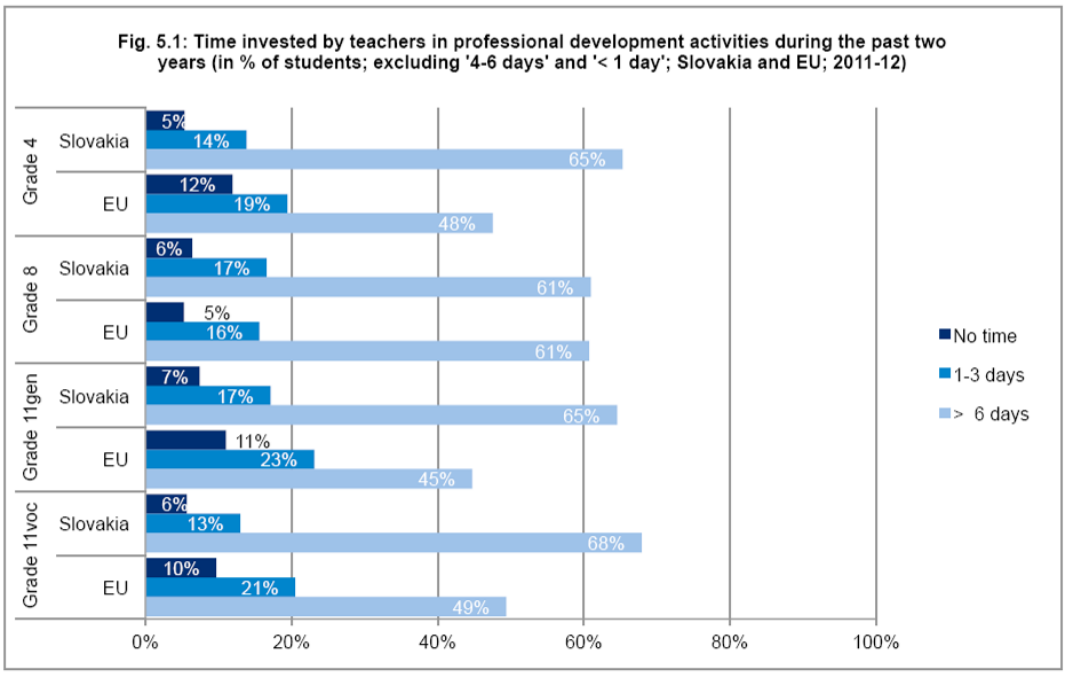
56 Scheerens 2010: Teachers' professional development. Europe in International Comparison. A secondary analysis based on TALIS dataset, OPOCE, Luxembourg
http://ec.europa.eu/education/school-education/doc/talis/report_en.pdf

57 Eurydice 2011
C 398/1 Council Recommendation of 20.12.2012 on the validation of non-formal and informal learning,
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2012:398:0001:0005:EN:PDF

58 For example in Austria's primary schools only 24% of students are taught by teachers who feel confident in using ICT, compared to 51% at EU level.

59 European Schoolnet & University of Liège 2013

Figure 10: Time invested by teachers in professional development activities during the past two years, Slovakia compared to EU average, 2011-12, in % of students



Example 4 - Austria

'Onlinecampus Virtuelle PH' (*http://www.virtuelle-ph.at****)***   *'Onlinecampus Virtuelle PH' is a service centre maintained by the Ministry for Education targeted at all Austrian teachers and all Universities of Teacher Education (Pädagogische Hochschulen). It offers online seminars and e-Lectures for teachers' professional development. There are also a number of resources for self-study. Virtuelle PH also provides know how and expertise in the field of technology assist teaching and learning to teacher educators.*[60]

To compensate the lack of focus on digital skills in initial teacher education, a large proportion of teachers develop their ICT skills privately. At EU level, around 70% of students at all grades are taught by teachers who have engaged in personal learning about ICT in their own time. Other ways of teachers engaging in ICT professional development include ICT training provided by school staff (50%).

Boosting teacher's confidence using ICT for teaching is a condition for an effective and efficient use. The EU schools' survey shows indeed that students have the highest frequency of ICT use during lessons when they are taught by teachers with high confidence in their own ICT operational, having positive opinions about ICT use for teaching, as well as having high access to ICT infrastructure at school. Such teachers are defined in the survey as *digitally confident and supportive teachers*.

On average across the EU countries, between 20-25% of students are taught by digitally confident and supportive teachers having high access to ICT. Here again differences between countries are very large. Between 30-50% of students at grade 4 and/or grade 8 are taught by such teachers in Bulgaria, Estonia, Ireland, Portugal, Slovakia, Slovenia and Sweden; conversely, less than 10% of students at the same grades are taught by such teachers in Austria, Belgium, Cyprus, France, Finland, Greece and

[60] European Commission 2013: Report on the Provision of Digital Resources and ICT in Education in the Member States (Austria)

Luxembourg. In secondary general education, more than 45% of students are taught by such teachers in Denmark, Luxembourg, Norway and Portugal; conversely, less than 10% of students are in this situation in Greece, Romania and Turkey.

One of the most efficient approaches in continuous professional development of teachers is through *communities of practices* allowing teachers to participate in a professional community that supports the new ideas and practices at the same time as they challenge existing ones[61]. Teachers not only need to rethink what they teach, but also why. However, in order to thrive, communities of practice require time for collaborative learning to emerge. Findings suggest that if teacher collaboration is genuinely bottom-up driven and derived from practice-based experimentation, then communities will gradually grow and be reinforced[62].

2.3.1.5. Evaluation mechanisms rewarding innovative practices for teachers

As any other professionals in any sector, teachers (including professors and all other educators), are influenced by the way their performance is assessed and their career opportunities influenced. Being careers involving many individuals, public authorities are highly pressured to define very clear and objective performance evaluation schemes. For such, these are generally focused on a relatively small number of criteria, which are easily measurable and clearly comparable. Teachers are generally evaluated by criteria directly related with their input to the students to whom they have been allocated (like the time spent in class), their involvement in the institution administration, and/or their involvement in research (like the number of research papers published). Very seldom are any variables associated with innovation in education or the openness of education considered in performance evaluation schemes.

Many experiences and projects are achieving very positive results all over Europe. However, frequently teachers are developing them beyond their normal working hours or their contractual obligations. Most teachers are not incentivised to introduce new technologies or open practices in education. They are actually de-incentivised by the need to convince leaderships on the appropriateness of their projects.

To have full involvement of the high number of teachers with a potential commitment to improve education through open practices it would be essential to have these practices considered in the framework of teachers' performance evaluation schemes.

2.3.1.6. Certification, validation and recognition of online acquired learning is an open issue

The recent EC recommendation on the validation of non-formal and informal learning[63] already referred to the importance of recognition of skills and competences acquired through online learning and open educational resources when discussing the value of online learning.

When students learn within the context of their formal education, it is an obvious step for the educational institution to recognise the knowledge acquired, for example by noting it in their

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61 European Schoolnet & University of Liège 2013

62 Shear Linda, Gorges Torie et al SRI International Research (2010) The Innovative Schools Program Year 2 Evaluation Report Microsoft partners *http://www.itlresearch.com/images/stories/reports/isp_year_2_eval_full_report%20final.pdf*

63 C 398/1 Council Recommendation of 20.12.2012 on the validation of non-formal and informal learning *http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2012:398:0001:0005:EN:PDF*

portfolio[64]. This is evident in higher education which has an accreditation system for guaranteeing quality and standards. It also applies to learners when the labour market demands formal evidence of competence, knowledge, or skills.

Up to now it has been virtually impossible to acquire formal recognition for learning achieved by OER. This has to do with the authenticity and validity of students' performance outside a controlled environment and fraud prevention. There is therefore an enormous need to develop a method for evaluating and certifying open learning in an effective, efficient, and confidence-inspiring manner.

Example 5 - France, Germany

VAE system – France *(http://www.francevae.fr/francevae/)*

The VAE system (Validation des Acquis de l'Experience) is used to deliver whole or partial qualifications. Each Ministry awarding qualifications has developed its own rules for the context-specific implementation of the principles outlined in the legislation. Generally evaluations are made on the basis of a portfolio where the applicant describes his/her experience. Further written evidence of the experience is also frequently requested. This declaration must include details of skills and competences used in their activities. Further evaluation methods include observations of real or simulated working activities, interviews and presentations. Certificates awarded by the private sector can be recognised after an accreditation process. A similar system is in place in Luxembourg[65].

ProfilPASS – Germany *(http://www.profilpass-online.de/)*

In Germany, different validation methods are in place. The ProfilPASS is a system of formative validation for both adults and young people, while the external students' examination leads to the award of a full qualification in a recognised apprenticeship trade. Access to a higher education course can be granted through the 'access for qualified workers' route. Knowledge and skills can be recognised up to a maximum of 50% if their content and level are equal to the equivalent formal qualifications[66].

An increasing number of universities providing online programmes (or parts of programmes) also offer methods of guaranteed and alternative certification (for example by means of “badges”). Examinations for MOOCs can be taken at Pearson test centres in a controlled environment[67]. For a few of its open courses, Saylor.org offers assessment for credits[68]. However, these are payable services. Accreditation organisations such as the Council for Higher Education Accreditation[69] and the American Council on Education[70] have now expressed the intention of accrediting MOOCs, thus making their quality apparent. If this development continues, they can become important alternative learning pathways – virtually free of charge – not only for lifelong learning but also for basic degrees and qualifications. Even though the business models behind them are still to be developed, their proliferation will force higher education institutions to think hard about their actual business models.

64 *http://grial.usal.es/agora/trailerproject/about*
65 European Commission 2013: Report on the Provision of Digital Resources and ICT in Education in the Member States (France, Luxembourg)
66 European Commission 2013: Report on the Provision of Digital Resources and ICT in Education in the Member States (Germany)
67 *www.pearsonvue.com*
68 *www.saylor.org*
69 *www.chea.org*
70 *www.acenet.edu*

Another emerging trend for recognition is to award "badges". A badge is a (digital) insignia awarded to a person who has achieved a particular level of performance[71]. Various different names are applied. The OpenStudy platform, for example, uses "medals" and "SmartScores", leading to "certificates". Codecademy works with "points" and "streaks" as well as badges. At Coursera, participants who have completed all the components of a course can acquire a "certificate of participation". It is, however, difficult to organise formal recognition for this system. The primary function of the badges is to act as a signal for participants in determining who plays an important role or knows a lot. To increase the value of badges, it is important to get some level of European-wide agreement on which kind of badges and the criteria are recognised for validating learners' performance.

OpenStudy Certificates *involve cooperation between OpenStudy and the worldwide OpenCourseWare Consortium (OpenStudy, n.d.). Participants taking an OpenCourseWare course supported by OpenStudy can sign up for a (worldwide) study group, which has a forum where they can ask and answer questions. Activities within the course are tracked, as is progress in the course and in the community. By answering questions put by fellow participants, the learner can demonstrate his/her understanding of the material, thus gaining medals. A participant can gain a certificate if he/she has been active within the system for at least four weeks, with questions posted and answered for at least 70% of the course topics. If the participant complies with the requirements and his/her SmartScore has increased by 20 points, he/she receives a certificate of participation for a "self-directed learner": "You have demonstrated engagement, teamwork, problem solving as you participated in this open online course and created an online portfolio of your activity."*

With ***Mozilla Open Badge Infrastructure*** *(Mozilla Open Badges, n.d.) learners can increase their competencies via a number of different channels, earning badges that are allocated to them by individuals or organisations. The learner can collect, manage, group, and share his/her badges on the website. He/ she can then decide which badges to make visible (via a personal website, a blog, a social network profile, or a jobs website). Usage of this system can also be good for the reputation and profile of those who allocate the badges.*

In recognition process partnerships between institutions are important. The institution that recognises learning must have confidence in the quality of the education offered, and must be able to assess it for itself. The recognition of credits in Erasmus student exchanges provides a good example[72]: recognition is institutionalised on the basis of the relationship of trust between the participating institutions and can therefore be successfully incorporated into accreditation procedures. In the case of education acquired by the OER, that relationship of trust does not yet exist and should be forged.

The possibilities for formalising recognition are increasing now that the providers of MOOCs are actively making secure supervised examinations possible. Udacity and EdX have signed a contract with Pearson VUE, an independent commercial provider of examination services. Pearson has testing centres worldwide where the identity of learners can be verified and exams can be taken under controlled conditions[73]. The question is whether, given these trends, the business model of traditional

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71 Casilli, C., Lee, S. and McAvoy, C. 2012: Mozilla Open Badges: into the great wide open. Open Education Conference, *https://www.surfspace.nl/artikel/937-blog-open-education-2012-conference-dag-2-17-oktober-2012*,in: OER Special Interest Group 2013: Trend Report: Open Educational Resources 2013, *http://www.surf.nl/en/publicaties/Documents/Trend%20Report%20OER%202013_EN_DEF%2007032013%20%28LR%29.pdf*

72 Camilleri & Tannhäusser 2012: Open Learning Recognition: taking Open Educational Resources a step further. *http://cdn.efquel.org/wp-content/uploads/2012/12/Open-Learning-Recognition.pdf?a6409c*, in: OER Special Interest Group 2013: Trend Report: Open Educational Resources 2013, *http://www.surf.nl/en/publicaties/Documents/Trend%20Report%20OER%202013_EN_DEF%2007032013%20%28LR%29.pdf*

73 Gaber 2012: edX announces option of proctored exam testing through

higher education institutions is still tenable (see further). Also, the spirit of free OER based education is undermined when the examinations that accredit learning become payable.

2.3.1.7. Assessment supported by ICT in school education

One of the key challenges for education systems in many European Member States is the assessment of key competences[74]. ICT offers many opportunities for the provision of assessment formats which comprehensively capture all key competences even the more transversal and complex ones such as critical thinking or creativity. These transversal competences are often acquired across subjects and even outside school, informally and non-formally. It is therefore important to investigate how ICT supported assessment and recognition of competences is considered in school education.

There is a general awareness among school educators that ICT can help students to self-assess as part of their learning-to-learn. In a number of European countries, ICT tools are already being used to support self-assessment. Liechtenstein already uses them in secondary education; Bulgaria, Lithuania and Iceland have pilot projects, while France, Malta and Slovenia are planning to use self-assessment[75].

Overall, the potential of ICT in the comprehensive assessment of competences in school education, including less tangible and generic skills, remains largely untapped and take-up in school education is still low.[76] To seize the opportunities offered by ICT, targeted measures are needed to encourage the development. ICT-based assessment provides a gateway for more formative assessment, measuring actual learning, appreciated by teachers and students, and a potential shift away from summative high-stakes assessments at the end of the school year or term, criticised for measuring the ability to recall information at a given time.

Currently, two conceptually different approaches to assessing competences can be distinguished. On the one hand, there is Computer-Based Testing using multiple choice, quizzes, simple games and audio-visual representations for testing knowledge, skills and attitudes, as well as ePortfolios. Many Member States are using CBT for more effective and efficient testing. Computer-Based Assessment (CBA) approaches on the other hand, offer a promising avenue for embedded assessment of the more complex and behavioural dimensions of competences, based on different technologies analysing student performance like Learning Analytics. Many of the currently available technology-enhanced learning environments, tools and systems recreate authentic learning situations which require complex thinking, problem-solving and collaboration strategies and thus allow for the development of both transversal skills in addition of core subject knowledge. Some of these environments allow learners and teachers to assess performance, understand mistakes and learn from them. Even though many of these programmes and environments are still experimental in scope and have not been mainstreamed in education and training, commercial products start to emerge (eg. Knewton[77])[78].

ePortfolios *are ideally suited to the assessment of collections of work produced by students and are thus particularly powerful tools for communication in the mother tongue, communication in foreign*

collaboration with Pearson VUE, *http://www.pearsonvue.com/about/release/12_09_06_edx.asp* in: OER Special Interest Group 2013: Trend Report: Open Educational Resources 2013, *http://www.surf.nl/en/publicaties/Documents/Trend%20Report%20OER%202013_EN_DEF%2007032013%20%28LR%29.pdf*

74 European Commission 2012: Assessment of key competences in the initial education and training, SWD (2012) 371, *http://ec.europa.eu/education/news/rethinking/sw371_en.pdf*

75 Eurydice 2011a: How do countries respond to changing skills demands? Some challenges and policy issues in the implementation of key competences

76 IPTS 2013: The use of ICT for the Assessment of Key Competences, JRC Scientific and Policy Reports, EUR 25891. *http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=5719*; EC COM Rethinking education, 2012

77 http://www.knewton.com/

78 IPTS 2013: The Use of ICT for the Assessment of Key Competences, ibid.

languages and cultural awareness and expression. ePortfolios are already widely used in European schools as a means of supporting the formative and summative assessment of students' creative productions.

E-Portfolios have been implemented in school education in Belgium, Austria, Portugal, Romania, UK and Turkey; while Bulgaria, Germany, France and Iceland are in the pilot phase and eight countries in the planning. In Portugal and the United Kingdom e-Portfolios are available to students throughout their entire educational career and are assessed by awarding bodies in England, Wales and Northern Ireland. In contrast, Poland and Liechtenstein are focusing more on providing teachers with ICT tools to monitor pupil progress[79]*.*

However, more innovative formats of cultural and artistic expression, such as blogs, wikis, tweets, audio and video recordings, etc., are seldom included. Educators often do not realise that ePortfolios can be powerful tools for encouraging online collaboration, self- and peer assessment, which contribute to and at the same time assess students' learning to learn skills.

2.3.2. Open Educational Resources challenging education

While the rapid increase of OER's and in particular the recent proliferation of MOOCs indicate that the educational world is keen on embracing this phenomenon made possible by the internet and social media, OER are still challenged by many unsolved questions. These problems are:

1. Low use of OER for innovative learning
2. OER supply is currently fragmented
3. OER supply is not quality assessed
4. OER opens up education towards informal learning but educational practices are not in line with the increasing OER supply
5. Lack of appropriate business models for OER
6. OER and publishers: opportunity or threat?

2.3.2.1. Low use of OER for innovative learning

School education and initial VET

Centrally promoted digital resources (openly available or not) are widely available in the EU[80] to support teachers in their use of ICT for innovative teaching and learning in the classroom. The majority of European countries have online platforms, blogs, forums or other social networking sites that facilitate the sharing of experience and exchange of materials between teachers.

Example 6- Denmark

EMU portal – Denmark *(www.emu.dk)*

The main portal for educational content is the EMU. It provides access to a federation of OER repositories which were previously operating separately but since 2012 have been consolidated under the roof of EMU. The concept is liberal in the sense that professionals can publish content or references to content without having to meet any set of pedagogical or technical specifications. Content may be free, partly free or fully commercial, and varies from descriptions and links to books

[79] Eurydice 2011a: How do countries respond to changing skills demands? Some challenges and policy issues in the implementation of key competences

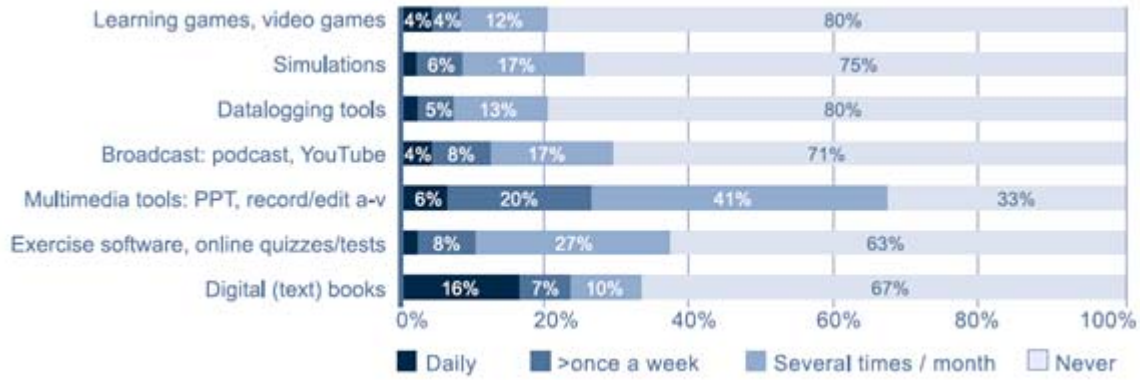
[80] Eurydice 2011: Key Data report on Learning and Innovation through ICT

for educational use or other paid services, through free samples, to fully free content. The EMU is closely connected to the school and high school educational levels; uploading content demands a login for the intranet services offered to these educational levels. EMU also contains the main national repository for school teachers and students 'Materialeplatformen', which provides access and summaries to all online learning resources. It was initiated by the Ministry of Education but is implemented together with publishers who can also publish content on the platform. A screening procedure exists for all materials produced by teachers and uploaded to the platform. This is provided by an organisation administrating ICT-related services to the Ministry of Education. It is used primarily in primary and lower secondary and in general upper secondary education.

However, availability does not mean that these resources are actually used by teachers and learners. With the exception of the EU School survey[81], not many large scale studies explore if and how teachers use OERs. However, there is a general agreement among scholars surveying the OER landscape that usage falls far behind its potential across the sectors.[82] Especially primary and secondary schools have yet to realise the potential.

Between 50% and 80% students (depending on the grade and the specific tool concerned) never or hardly ever use digital resources, openly available or not, such as digital textbooks, exercise software, broadcast/podcast, data logging tools, simulations or learning games/video games[83]. Overall, digital resources and tools are more frequently used at grade 8 than at grade 11 in general education. This low frequency of digital resources is quite alarming, especially as these resources seem to be widely available for use[84].

Figure 11: Use of resources and tools during lessons at grade 11 general education (in % of students, EU level, 2011-12)



Moreover, when OER are used by teachers, a majority are passive consumers simply browsing for resources rather than participating in the creation and sharing of them. Data from the Wikiwijs project show that only 3% of users actively contribute to the pool of resources[85]. These statistics suggest that very few teachers in fact engage in open educational practices, a term used to describe the focus on

81 European Schoolnet & University of Liège 2013
82 McAndrew, Patrick. 2010. Fostering Open Educational Practices in ICT in Teacher Education: Policy, Open Educational Resources and Partnership, Proceedings of International Conference IITE-2010. UNESCO Institute for Information Technologies in Education; Hache, Alexandra. Towards the Sustainability of OER Initiatives.
83 European Schoolnet & University of Liège 2013
84 Eurydice 2011
85 Wikiwijs Program Plan

learning as a process of construction and sharing which is essential for the successful use.[86] The potential of OER as a tool of innovation and collaboration is thereby not achieved.

Higher Education

In higher education, compared to school education and initial VET, OERs are neither used to their full potential even the supply of OER is more available.

59 Higher Education Institutions from nine Member States are member of Open Courseware Consortium, representing 24% of the total members[87].

860 EU organisations run about 1,031 open access repositories[88].

The number of courses, modules or collection available for free counts several thousand: 14,000 courses through the OpenCourseWare Consortium; 20,000 modules through Connexions; 38,000 through OER Commons, etc.

Universities like Stanford, Princeton, EPF Lausanne or Edinburgh, amongst many others, have established partnerships with Coursera, while Harvard and the MIT launched in 2011 their joint venture EdX to offer university-level courses from a wide range of disciplines online to a worldwide audience. Coursera currently have 9, 5 million enrolments.

In order to realise the full potential of OER, barriers for using and sharing OER need to be removed. The primary barrier identified in a large scale study of higher and adult education was the "lack of interest in creating or using OER" amongst teachers, suggesting a lack of incentives to adopt open educational practices[89]. For example, the creation and sharing of OER are not generally taken into account by promotion systems, leaving individuals dedicating time to OER comparatively less well off to their peers who use the time for more recognised pursuits.

2.3.2.2. OER supply is currently fragmented

It is not obvious to accurately estimate the number of OERs available in Europe due to the lack of reliable monitoring studies[90]. However, rough estimates of numbers of OERs to be made available in the EU funded Open Discovery Space project which incorporates a large number of European repositories and focuses on school education lie at 1.5 million[91]. *This shows that there is no real lack of supply of OERs but these are very diverse, difficult to find, through multiple access points, and no comparable approaches.*

As shown by the country analyses, some EU Member States have national strategies to foster the use of OER in education and training. Countries have established platforms and repositories where teachers, trainers and learners can find and share digital educational resources. Some of them target specific groups (e.g. teachers).

Example 7 - Cyprus, Finland

***Schoolnet DIA.S portal – Cyprus** (https://www.dias.ac.cy/en/Pages/intro.aspx)*

The Schoolnet DIA.S portal offers access to online courses and content for primary, secondary and vocational education. It also provides teachers with a tool to organise and create digital interactive

86 OPAL Report. Beyond OER. 2011

87 *http://www.ocwconsortium.org/en/members/members/master; http://opencourseware.eu*

88 *http://www.opendoar.org/countrylist.php?cContinent=Europe*

89 OPAL Report. Beyond OER.

90 IPTS presentation at Open Education 2030: Foresight workshop on School Education, Seville, 28-29 May 2013, See *http://blogs.ec.europa.eu/openeducation2030/b-workshop-on-school-education.*

91 *www.opendiscoveryspace.eu*

activities like experiments, measurements, simulations etc. and the possibility to make them available online.

***Le Mill – Finland** (http://lemill.net/)*

Le Mill is an online community for finding, authoring and sharing OERs. Le Mill has nearly 15,000 teachers contributing from 63 countries and almost 24,000 learning resources in 83 languages. It was designed by the University of Art and Design of Helsinki as part of the Learning Resource Exchange service developed by European Schoolnet.

A recent analysis of OER initiatives in EU Member States by the European Commission (May 2013) identified 24 OER initiatives mainly covering simultaneously school education and VET whilst five of them (in BEfr, FI, HU, IT and NL) have a wider scope also encompassing higher education and adult learning[92]. The majority of the initiatives are publicly funded and primarily target school teachers. In five cases, they explicitly target both teachers and students (in EE[93], FI[94] and SE) or students only (in ES and IT). Only four initiatives (in BEfr, IE, LU and PT) have a wider remit, targeting the whole education community (i.e. teachers, school management and administrative staff, students, parents, inspectors, etc.).

Overall, these initiatives mostly offer education-related information, pedagogical tools/materials (e.g. lesson plans, textbooks (or links to), quizzes, videos, pictures, etc.) to support teachers' work. The language is mostly limited to the country language(s); only the OER initiatives addressing higher education offer English courses. Some of the initiatives may also offer additional functionalities aimed to foster collaborative work (through webinars, forums and exchange of good practice, etc.) among teachers and/or other users (as found in CY, NL and PT) or to allow them to re-mix and re-use content to create their own lessons (as reported in CY, EE and FI[95]). In several cases (BEnl, CY, EE, FI, NL, PL and PT), pedagogical resources are mostly (or even exclusively) generated by teachers.

The *analysis on the actual use and uptake of OER* among these 24 European OER initiatives shows that this information is overall scarce and, where available, often patchy. Most relevant findings – not comparable though - are found in three countries (BEnl, CY and NL).

Example 8 - Belgium and the Netherlands

***Wikiwijs – the Netherlands** (http://www.wikiwijs.nl/task)*

Wikiwijs is a programme intended to promote the use of open educational resources (OER) in the Dutch education sector. It includes an Internet portal where instructors can search for OER adapt them combine them with other educational resources and share them with other instructors. The resources intended for higher education come from the collections of higher education institutions in both the Netherlands and other countries.

Since it's launching in 2008 the Wikiwijs initiative has steadily gained in visibility and attractiveness with a number of uploads and downloads respectively tripled and multiplied by five between 2010 and 2012. A survey focusing on the use of the tool is carried out annually. Notwithstanding these promising figures the latest findings (2012 survey) show that there are still areas for improvement as slightly over 50% of surveyed teachers do not know about the initiative.

***KlasCement – Belgium** (http://www.klascement.be/)*

In the case of the Belgian (BEnl) KlasCement initiative which was launched in 1998 by a teacher and a group of volunteers its value has been progressively acknowledged at both community level (the

[92] European Commission 2013: Report on the Provision of Digital Resources and ICT in Education in the Member States
[93] e-Learning Development Centre's repository initiative.
[94] i.e. Vetamix initiative. *http://edrene.org/results/currentState/finland.html*
[95] i.e. Vetamix initiative: *http://edrene.org/results/currentState/finland.html*

initiative has been under the remit of the Flemish Minister for Education and Training since January 2013) and outside the country. KlasCement has been indeed replicated in the Netherlands into two versions namely 'klascement.nl' (addressed to Dutch teachers) and 'klascement.eu' (for teachers all around the EU).

In spite of these positive examples, the limited use of OER by teachers is linked to the *fragmented distribution of resources and their visibility***.** These portals represent an environment of multiple access points, making it difficult for a teacher with little time to operate[96]. It is of utmost importance that teachers and educators have access to OER through environments which are already close to their teaching environments and preferred teacher platforms and portals, but also provide access to all possible OER available across Europe and even across the globe. Finding OER in the language of their teaching is very important. A federated platform of OER using teachers' preferred platforms and portals to give access to all OER available by linking up to all existing local, regional and European existing platforms, could be seen as the way forward[97].

Interoperability between these repositories is a challenge for technical, semantic and organisational reasons. A number of EU funded projects (e.g. through LLP, eContentPlus, FP5 and FP7) has focused on these issues. Most repositories adopt one of the main three approaches to collect and organise; namely being a content repository; being a link or metadata repository; or a hybrid repository that hosts content and links to external OERs.[98] This creates a variety of issues for the teachers who require multiple user accounts to share their resources, be aware of varying standards for resources and their metadata and have to adapt their resources accordingly. Furthermore, as repositories have to acquire a critical mass of OER in order to attract users, the distributed nature of accessing OER suffers from serious inefficiencies.

The availability of quality digital resources is not sufficient, especially when addressing a specific combination on language/education sector/subject. 92% of respondents of the public consultation confirm that the use of ICT and OER in education and training is still too fragmented. The fragmented nature of OER in Europe is due to linguistic and cultural boundaries and is a serious obstacle for the "learning industries" to be further involved in emerging markets. When digital educational resources are dominated by the English language, Europe is unable to exploit opportunities coming from its multilingualism.

Open Educational Resources' availability in different languages is highly concentrated, mainly in English. For example when considering those provided through the Learning Resource Exchange[99], a service of European Schoolnet that focuses on the reuse of OER at the European level, we observe that of the approximately 235,000 resources available, more than 57% are in English. The second more frequently available language in that platform is Dutch with 12% of resources, followed by Italian with 9% and Catalan 5%. What is most preoccupying is that out of the 32 languages identified in that portal 9 comprise less than 1% of available resources. This clearly illustrates the lack of availability of reusable resources at the European level in many languages.

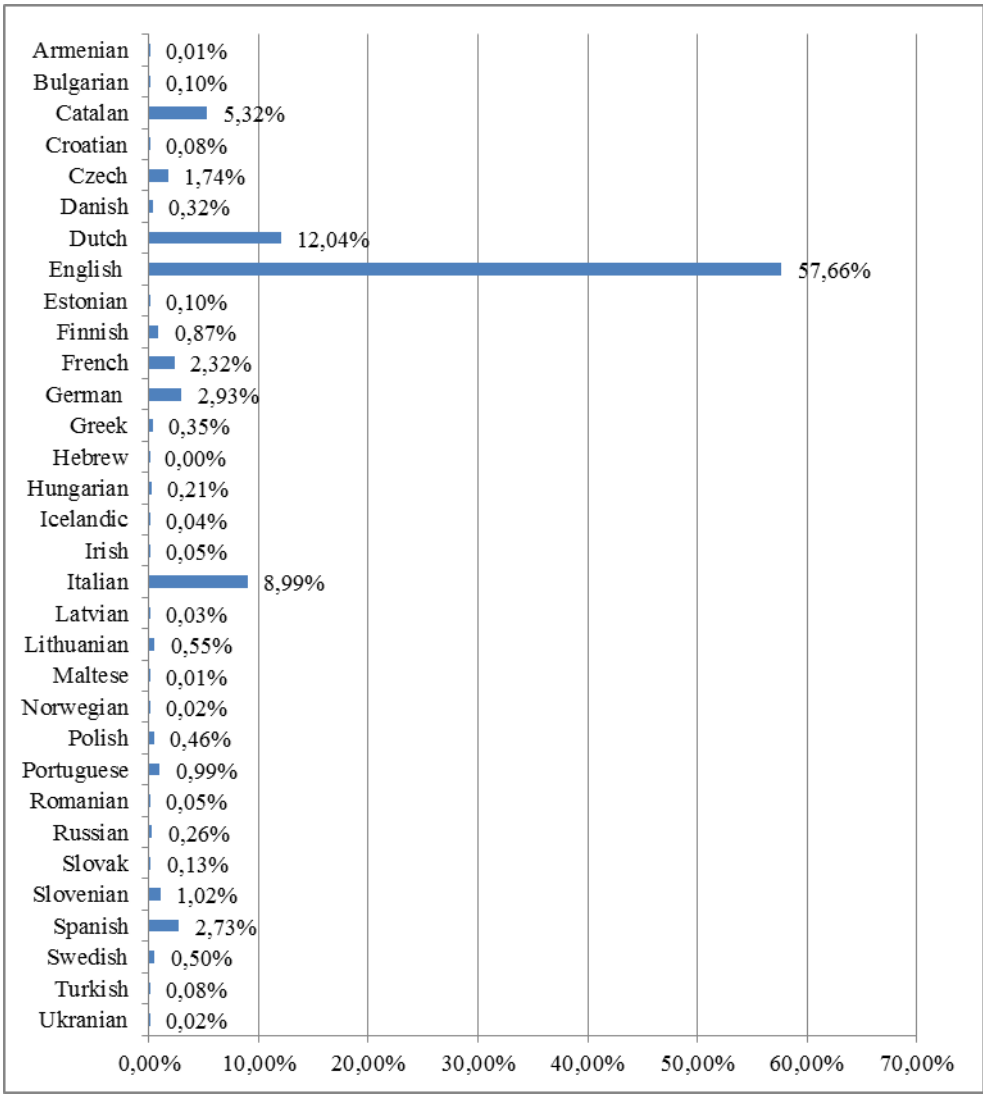
[96] IPTS presentation at Open Education 2030: Foresight workshop on School Education, Seville, 28-29 May 2013, See *http://blogs.ec.europa.eu/openeducation2030/b-workshop-on-school-education.*

[97] E.g. Open Discovery Space (ODS), *www.opendiscoveryspace.eu; ; Learning Resource Exchange (LRE) www.lre.eun.org*

[98] McGreal, Athabasca University: Resource Repositories Analysis *http://academia.edu/2832823/Open_educational_resource_repositories_An_analysis*

[99] *http://lreforschools.eun.org/web/guest/home*

Figure 12: Availability of content in different languages, in %



2.3.2.3. OER supply is currently not quality assessed

Whilst online materials for educational purposes are rising in prominence, it is crucial that the material they use is of quality and is both effectively and regularly quality checked. Quality of OER is another obstacle to extend their use: "lack of time to find suitable OER materials" (56.8%), "lack of OER that are culturally relevant to the user" (50%) or "lack of quality of the OER" (47.8%)[100].

76% of respondents In the public consultation in the context of the 'Opening up Education' initiative, mentioned that finding the right resources for their specific needs is a serious barrier for a wider use of OER. This issue linked with easy access to quality contents in all sectors of education but affects more acutely the quality of learning that takes place in non-formal and informal settings.

The panoply of sources for learning materials oblige to have quality assurance models, as well as technical search solutions so that individuals are supported in the task of assessing the quality and appropriateness of the materials available[101]. Time can be a strong incentive or disincentive to use ICT and online resources for learning and teaching[102].

Nowadays, the proliferation of websites, platforms, blogs makes it difficult for any user to easily find and recognise quality and appropriate contents. This implies an increasing cost for the user in terms of time. Not being able to find it, the user (educator or learner) lacks information. The complete and free information assumption of free markets is not verified, thus generating inefficiency. This is a strong obstacle for a further usage of OER, and Internet-based resources in general.

Mapping of OER quality approaches in the Member States

Quality assurance models used by providers of OERs range from automated checking of the completeness of metadata, using ISO or EFQM standards to certify quality, to working groups of selected teachers assessing and adapting resources[103]. According to recent literature[104] on OER, 'new ways of assuring and assessing quality are increasingly being developed, in co-existence with traditional quality assurance methods and mechanisms. Peer review of OER learning materials based on the country analyses can be combined with user comments and ratings on the web. The quality of OER is primarily ensured via peer review in the case of eleven initiatives delivered in ten MS (BEfr, CY, CZ, EE, IE, IT, NL, PL, PT and UK). Peers are in most cases peer teachers or sometimes subject experts.

In the UK, participating teachers are financially rewarded for their review. In Ireland and in the Netherlands the process jointly associates teachers and experts whilst in Portugal[105], all content submitted by school teachers is reviewed by academic peers who evaluate the quality following the same approach than for the publication of articles in scientific journals.

Apart from peer review, the methods used for ensuring the quality of OER resources may involve individuals who are specifically assigned to act as editors (as in CZ, EE, FI, LT, LU, NL and SE) or moderators (as in EE). In Sweden, 8 editors work for instance 3 hours per week to keep the Länkskafferiet portal up-to-date. Their role notably consists of reviewing and assessing the proposals for new websites to be added to the portal and consider issues such as the structure of the site, its ease of navigation, appropriate use of language whether in Swedish or English and appropriate vocabulary.

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100 This is confirmed by an international survey on the use of OER in Higher Education and Adult learning (OPAL 2011)

101 Quality assurance models are supported by 83.6% of the organisations and 73.2% of individuals who responded to the public consultation

102 Bacsich 2012: The cost- and time-effectiveness of online learning: providing a perspective on Microlearning and the differences between academic & corporate views, *http://www.scribd.com/doc/96397285/Time-Bacsich-Final-Final-PDF*

103 Jim Ayre & David Massart, LearningResource Exchange Network:

104 Hyle et al. 2012: Open Education resources: analysis of responses to the OECD country questionnaire, OECD Education Working Papers, No.76, OECD Publishing.

105 Casa das Ciências initiative.

Reference to more traditional quality assurance methods such as inspection was found in the case of the two French initiatives[106]. Proposed content is firstly identified by each 'académie'[107] which circulate the information to inspectors who are in turn responsible for assessing this content.

Among other ways to ensure the quality of online content, use of quality standards and design and promotion of quality labels are being used in some countries. Quality standards (EE[108], FI[109] or LT) may build on existing standards such as in Lithuania where specially trained staff indexes online content in conformity with the LOM AP standard[110] or in Finland where all content must be in line with the national e-educational resources guidelines 'E-learning materials for teaching and learning'. This may alternatively involve ad hoc guidelines as in the case of the Estonian initiative where 'guidelines for creating a quality e-course' have been specifically designed for the purpose of the initiative. The latter have used the "Quality Manual for E-learning in Higher Education" of the European Association of Distance Teaching Universities as a basis. Designing and promoting quality labels were found in the description of the Estonian initiative that has launched an 'e-course of the year' contest since 2004.

For higher education 27 in-depth countries have been analysed by the LLP project 'Policies for OER Uptake' (POERUP)[111]. A full analysis, comparison and policy recommendations will only be available by mid-2014.

To summarise: quality of OERs is perceived as another key problem for educational professionals and policy makers. While many OER repositories adopt some form of quality assurance model, these remain incomplete. While the latter examples are fairly thorough forms of quality assurance and can be useful for building trust in the standards of a collection of resources, centralised approaches are often seen as less appropriate to more user focussed approaches as the quality of a resource is highly subjective and depends on the context used. Furthermore, centralized approaches are very costly, time consuming and difficult to organise. As most OER providers are not commercial and cost and sustainability are key issues, more common and realistic models rely on communities of teachers who adapt, tag, review, and rate resources[112].

2.3.2.4. Lack of appropriate implementation models for OER

These new ways of looking to learning through OER (and MOOCs) implies that educational institutions rethink their actual implementation and business models independently if they are school, VET, HE and/or adult learning institutions[113]. Currently only higher education is reflecting on how OERs will affect the educational landscape and data is rather scare. The following will therefore focus on higher education but it is expected that the other educational sectors will follow soon.

By providing free online education to large groups of learners, MOOCs (and OER in general) are challenging the traditional business models of universities. Organisations offering MOOCs such as Coursera have seen their user base increase rapidly. Less than a year since its launch, Coursera already

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106 PrimTICE and Edu'Bases. *http://eduscol.education.fr/bd/urtic/ses/*

107 Académies' corresponds to *regional education authorities in France.*

108 e-Learning Development Centre's repository

109 EDU.fi portal initiative

110 ASK-LOMAP v1.0 is an open source web-based application for creating application profiles and manipulating application profile registry.

111 POERUP is a project approved by the Lifelong Learning Programme under Key Activity 3 ICT (*http://poerup.referata.com/wiki/Countries_with_OER_initiatives*). The project Consortium is a group of organisations across Europe and Canada interested in understanding how to foster the uptake of OER by governments (national and regional) and groups of educational institutions. It covers all sectors of education with a core focus on higher education and schools. For the summary see *http://www.poerup.info*

112 Pawlowski & Clements 2011: User-oriented quality for OER: understanding teachers' views on re-use, quality, and trust.

113 Schuwer and Janssen, 2013, Trends in Business Models for Open Educational Resources and Open Education

has close to 2 million users and the number of universities offering free online courses is also rising with unprecedented speed. OER like MOOCs have the potential to substantially increase access to high quality education and create competitive pressures for all universities to improve their teaching and course provision.

Schuwer and Janssen distinguish three perspectives or approaches that a higher education institution can select regarding OER, with three different associated types of sustainability:

1. an OER project so as to gain experience, with a funding model
2. a relatively independent OER activity, intended to generate its own income (revenue model)
3. OER as part of the institution's strategy to provide education for the future

Implementation model 1: The number of institutions that say they will be exploring the value and function of OER is increasing (approach 1); this is an international trend. See, for example, the large number of newcomers at the 2012 OpenEd Conference in Vancouver and the growing number of members of the Open Courseware Consortium[114].

Implementation model 2: The second approach is to apply a "freemium" business model, in which money is earned by customers paying for OER in printed form. Due to the rise of Coursera and Udacity this business model has been slightly adapted[115]. Educational resources are no longer available "for free"; but are now exploited commercially. The resources continue to be "open" to the extent that users can alter and add to them. The intention is to continue to use the "wisdom of crowds", but income is necessary in order to guarantee quality and more complete OER-based courses are also becoming available[116], generally in the form of projects with external or internal funding. It still appears to be very difficult to apply a sustainable OER-based business model after the pilot phase

The xMOOCs provided by Coursera, Udacity, and others indicate the advent of a new business model. The dominant model in commercial distance education is one of education – including testing and certification – on a large scale and at a low price. Revenues are achieved by having a large number of participants. By contrast, the new competitors' model involves providing a complete educational experience, free of charge, created by leading universities such as Stanford, MIT, and Harvard. Parties such as Coursera and Udacity expect to generate their revenues from activities such as testing and certification. A second source of revenues is for third parties to be permitted – on a payment and profit-sharing basis – to make use of copyright-protected materials, with anyone who wishes to take the course having free access. A third source involves the analysis and sale of data that can generate mass participation. A potential fourth flow of revenue is from job placement services, i.e. providing companies with the details of appropriate job candidates from among course participants (in return for payment). See, for example, the details of the contract between the University of Michigan and Coursera[117].

It will need to become clear in the next few years whether this business model is effective, and whether mass participation continues. If that is in fact the case, xMOOCs can become major competitors for open and distance education.

Implementation model 3: The best prospects for higher education institutions when OER could be embedded within their strategy and core activities (approach 3). OER can make a major contribution to the performance and quality of higher education, thus helping tackle a number of challenges.

However, today many higher education institutions have neither an overall strategy nor a policy as regards OER. Making the business model chosen by the educational institutions is a must. The public

[114] OCWC 2012
[115] Howard 2012
[116] OCWC 2012
[117] Young 2012

consultation as input to this Staff Working Document showed that 73% of respondents believed that a lack of new business models is preventing a full exploitation of ICT and OER in education and training.

Providing a range of different business models based on best practice examples would be an asset and would help any HE or even other type of educational institutions to discuss the various options and make an appropriate chose which business model fits best the vision of the institutions and which roadmap could be taken.

2.3.2.5. OER and publishers: opportunity or threat?

For publishers the main challenge is to find appropriate business models while users who generate content perceive the unclear copyright and licensing frameworks as a major obstacle. Educational publishers are seeing how new actors, like digital giants as Apple and Microsoft, provide educational materials, as well as teachers produce and share their own contents for free through new "bottom-up" practices. The public consultation showed that 73% of respondents believed that a lack of new business models is preventing a full exploitation of ICT and OER in education and training. There are also social and political pressures to increase the use of free online resources in order to reduce costs in education and training.

Despite their significant investments in ICT, publishers have *concerns about which new business models could be develope*d. They perceive this implies commercial risks, possible difficulties to make returns of investments and a major risk of losing intellectual property[118]. Some cases of successful business models exist, like the Irish social enterprise ALISON that provides free online learning resources for basic and essential workplace skills, and offer complementary paid-for certificates as a complementary service[119].

Example 9 - Ireland

> *'Advance Learning Interactive Systems Online' (ALISON – www.alison.com) is a social enterprise which provides free online learning resources for basic and essential workplace skills. Certificates or diplomas are sold to learners after the completion of most courses. ALISON offers more than 400 courses to a community of over 1 million learners.*

Online resources and textbooks are currently seen as complementary instruments[120] by European publishers. Complementarity increases quality of teaching and, at the same time, creates incentives to improve quality of commercialised contents due to an increased competition, which may even reduce costs.

The production of textbooks is characterised by high fixed costs, different entities choosing the textbook and buying it, low price-elasticity and thus relatively little competition[121]. In many countries, the school textbooks submarket is strongly financed and/or regulated by the State. Several public authorities delegate "de facto" textbooks production to publishers[122]. Both are “expected” to guarantee quality and appropriateness of contents. The current economic and financial crisis obliges nonetheless to review the efficiency of the system and in some countries, textbooks provision is becoming an issue, both for families and for public budgets. Even if at aggregated level the cost of textbooks represents a small percentage of total public and private education expenditure (around 1%), provision

[118] European Learning Industry Group, 2011
[119] European Commission 2013: Report on the Provision of Digital Resources and ICT in Education in the Member States
[120] Savoir Livre et Syndicat National de l'Edition, 2010
[121] Skidelski, 2011; Levine, 2011; Koch, 2006
[122] Séré et al. 2010: Le manuel scolaire a l'heure du numérique: les premiers usages. Une enquête.

of textbooks by families is becoming a real issue in countries like Ireland, Spain, Italy or Portugal[123]. In this context it should also be recalled that currently the VAT rate applied to digital (educational) textbooks is higher than the VAT rate applied to physical (educational) textbooks. The Commission is working on the reform of the VAT system and is investigating the possibility to make digital books, including digital educational resources, more accessible.

Example 10 - Slovenia

An e-textbooks pilot which is part of the e education initiative encourages and provides support and infrastructure to teachers to produce their own digital textbooks. All textbooks are produced with a Creative Commons license. In 2012, four e-textbooks were produced and 25 are planned for 2013. The process is designed to improve teachers and students' digital competences as well as address the lack of digital textbooks available.

Box 2: Specificities of the school books submarket

National policies concerning school textbooks are variable but with common characteristics. Production of textbooks is generally commercial but public authorities use to play a relevant role to determine or authorise contents. This is a major particularity of the school books sub-sector: it is strongly financed and/or regulated by the State.

For example, public authorities of Austria, France, Germany, Hungary or Poland approve the textbooks that can be used at schools, in some cases after prescribing the content, format, cost or the frequency of updates. At the other extreme, there is not public intervention concerning the contents in Ireland, Sweden, of the UK, while Italy, the Netherlands or Spain are in an intermediary positions (respectively, the State provides guidance on costs and frequency of updates, the Ministry prescribes educational attainment targets, and Autonomous Communities recommend a list of books). Public authorities determine contents and select textbooks in an open competition, co-funded by the European Commission at 75% and the Greek State at 25%.

In most countries, teachers and/or schools decide the educational materials that have to be used by pupils – but within the list or constraints determined by the Ministry of Education.

Member States like Austria, Belgium, Denmark, Finland, France, Germany, Greece, Luxembourg, The Netherlands, Slovenia, Sweden or the UK, textbooks are provided for free, at least in primary education and often in the whole compulsory education. Parents have to pay for them in Hungary, Italy, Ireland, Poland, Portugal or Spain. Due to the current economic crisis, this is creating problems to an increasing number of families who cannot afford for such expenditure.

In addition, according to public consultation, there is *not enough collaboration between the traditional publishing industry and ICT companies,* implying a waste of complementary know-how with consequences on the quality of the educational resources produced. Integrating ICT in mainstream education and training requires the involvement of publishers and the private. Incentives could be created to address the current barriers and stimulate the emergence of new business models among the publishing industry.

2.3.3. ICT infrastructures and equipment stay a recurrent issue to tackle

[123] European Commission 2013: Report on the Provision of Digital Resources and ICT in Education in the Member States

Up-to-date and adequate ICT infrastructure is one of the crucial pre-requisites for integrating digital technologies in education and training systems and for the benefit of citizens at large. Digital technologies evolve very fast and require constant efforts to be updated, but the same is true for all infrastructures. Even though the provision of new digital facilities can demand huge investments from private persons, education and training institutions, and public authorities, many educational authorities are making critical calculations and comparisons on the cost-effectiveness between physical infrastructure and material and digital ones[124].

The following problems have been identified:

1. Uneven availability of ICT infrastructures and tools, including connectivity, across Member States
2. Absence of open interoperability standards

2.3.3.1. Uneven availability of ICT infrastructures and tools, including connectivity across Member States

Uneven availability of crucial digital infrastructure (broadband, devices) leads to inequality and increases the gap between teaching practices and ICT in society.

This issue is particularly relevant in schools and VET. The figure below shows that the availability of the infrastructure in the EU in these sectors has generally improved in recent years, but there are still large disparities between Member States.

Figure 13: ICT infrastructure trends (EU average)[125]

Infrastructure	Grade 4 2011	Grade 4 2006	Grade 8 2011	Grade 8 2006	Grade 11 Gen 2011	Grade 11 Gen 2006	Grade 11 VET 2011	Grade 11 VET 2006
Computers per 100 students	16	10	20	11	24	13	33	16
Computers connected to the internet per 100 students	15	8	19	10	23	12	31	14
% computers in labs	53%	74%	67%	96%	67%	97%	66%	93%
% schools with broadband	92%	65%	95%	71%	96%	75%	94%	75%
% schools with broadband via ADSL	53%	42%	52%	51%	52%	51%	51%	54%
Schools having support or maintenance contract with a service provider	37%	48%	43%	46%	45%	47%	42%	46%
% school with a website	72%	55%	88%	76%	90%	88%	92%	85%
Email for > 50% of teachers	60%	67%	57%	64%	66%	62%	66%	64%
Email for > 50% of students	23%	21%	29%	28%	33%	28%	31%	29%
% schools with a local area network	64%	50%	69%	68%	82%	75%	86%	72%

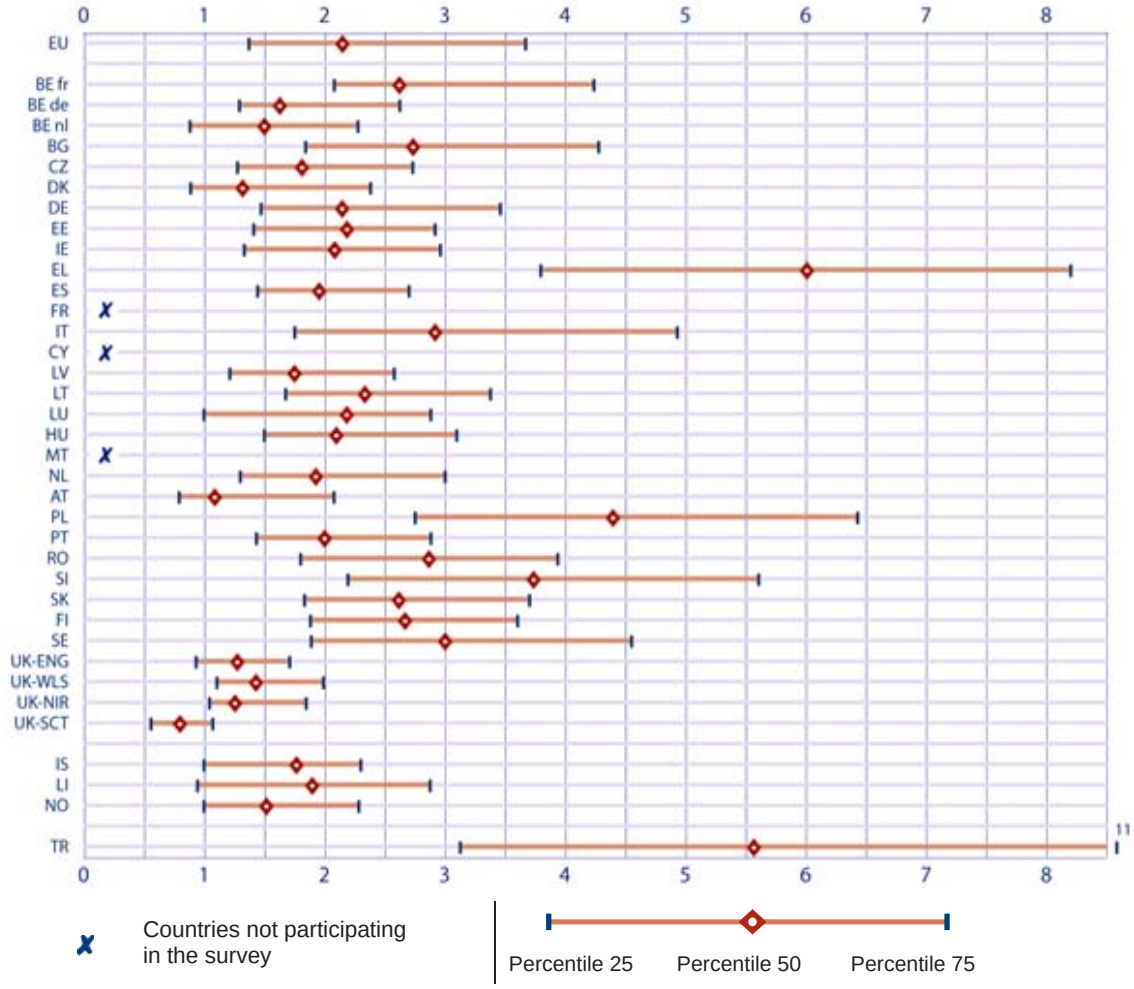
According to OECD's PISA study, the median pupil/computer ratio at EU level in 2009 was 2.15. This was also the case in most EU countries, but in countries like Greece, Italy, Poland and Slovenia and to

[124] Digital Agenda Assembly Workshop 1 report on 18/6/2013 in Dublin; *http://www.bbc.co.uk/news/education-20930195; http://www.independent.co.uk/news/education/education-news/the-school-where-every-teacher-has-an-ipad-and-every-student-has-an-ipod-7578167.html*

[125] European Schoolnet and University of Liège 2013

a lesser extent Belgium (French Community), Bulgaria and Sweden, computer availability is not so large. Even within countries, disparities are sometimes very significant[126].

Figure 14: Distribution of student/computer ratio in schools attended by pupils aged 15, 2009[127]



(P) = Percentile.

(P)	EU	BE fr	BE de	BE nl	BG	CZ	DK	DE	EE	IE	EL	ES	FR	IT	CY	LV	LT	LU
25	1.37	2.08	1.29	0.88	1.84	1.28	0.89	1.47	1.41	1.33	3.79	1.44	✗	1.75	✗	1.21	1.68	1.00
50	2.15	2.62	1.63	1.50	2.73	1.81	1.32	2.15	2.19	2.08	6.00	1.95	✗	2.92	✗	1.75	2.33	2.18
75	3.67	4.23	2.62	2.28	4.27	2.73	2.38	3.46	2.92	2.96	8.19	2.70	✗	4.93	✗	2.58	3.38	2.88

(P)	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK-ENG	UK-WLS	UK-NIR	UK-SCT	IS	LI	NO	TR
25	1.50	✗	1.30	0.79	2.75	1.43	1.80	2.19	1.83	1.88	1.89	0.93	1.11	1.04	0.56	1.00	0.95	1.00	3.13
50	2.10		1.93	1.09	4.39	2.00	2.86	3.73	2.62	2.67	3.00	1.28	1.43	1.26	0.80	1.77	1.90	1.52	5.56
75	3.10	✗	3.00	2.08	6.42	2.88	3.93	5.60	3.70	3.60	4.55	1.71	1.99	1.85	1.07	2.30	2.88	2.28	11.04

In 2011, between 44% (grade 11) and 76% (grade 8) of students in the EU were at a school which had slow or no broadband, made limited use of Internet facilities or had no ubiquitous access to ICT equipment. Only 61% of secondary students and 27% of primary pupils were at school equipped with

[126] Eurydice 2011; OECD 2011
[127] Eurydice, based on OECD, PISA 2009 database

a virtual learning environment (VLE), with national figures going respectively from 12% to 98% and from 6% to 96%[128]. Such uneven access was also perceived by the respondents of the public consultation: 73% of respondents addressed the availability of infrastructures as insufficient.

Cloud computing promises to reduce costs of ICT at schools, as it has done in other economic and societal sectors. Own servers are not necessary as the necessary cloud space can be rented according to the actual need. In addition to learning resources, cloud computing also supports both the academic and administrative services required in education and training systems. The privacy issues can be overcome by careful selection of private, public or hybrid cloud and appropriate security protocols. Cloud-based infrastructure allow students and educators to access the same learning resources from different Internet devices anytime and anywhere, both in and out of school.

Example 11 - Finland[129]

In Finland the National Board of Education is set to establish a new data cloud service offering schools children and parents access to educational resources. The board aims to improve students' ability to bridge the "digital divide". Educational resources would be available via the service for schools and pupils across the country. The goal is to ensure all students start from the same point in using information technology.

For real connectivity each student will need a connected device, which evidently represents a cost, either for the public budget or for families. However, many ways to license or rent these devices exist to suit diverging requirements, and often the cost of the device can be offset by reduced need to acquire other traditional educational material.

In higher education, institutions have realised relevant investments to respond to students' needs like Wi-Fi access everywhere in the campus or a full range of Internet services and tools[130], but students generally follow the "Bring Your Own Device" approach. This trend is also gaining foothold in primary/secondary sector, as effectively students own devices represent an unused resource, more often banned than used for learning. The general concerns of inappropriate use of devices, what is accessed by them and when, can be overcome, on one hand, with clear policies regarding the use and, on the other hand, through filtering of the content by the educational institution itself.

2.3.3.2. Open standards and interoperability are crucial for innovation and adoption new technology in learning[131]

We are all surrounded by digital systems that rely on well-functioning technical standards that have become transparent: we talk about the internet, not TCP/IP; about the world-wide web, not HTML; about mobile phones, not WAP and 3G. What do not work so well (and in many cases do not even exist) are the technical standards specific to learning – and in particular to learning in formal, school environments. In fact, often the problem is not the identification of suitable standards and specifications, but the adoption of these standards and specifications and their application in practice.

Standards for interoperability, so easily just dismissed as "technical matters", are in fact crucial to the future of learning. Appropriate interoperability standards allow software applications to integrate with

[128] European Schoolnet & University of Liège 2013

[129] *http://yle.fi/uutiset/educational_data_cloud_service_planned_for_finland/6714130*

[130] Bacsich 2012a

[131] Supporting Interoperable Learning Technology. Saltis 2009. *http://www.saltis.org/papers/silt.pdf*; Kurilovas E. Intelligent Distributed Computing III. Studies in Computational Intelligence. Volume 237, 2009, pp 121-130 Interoperability, Standards and Metadata for E-Learning; The Future of Interoperability Standards in Education: System and Process by Li Yuan, Scott Wilson, Adam Cooper & Lorna M Campbell *http://wiki.cetis.ac.uk/images/3/38/Fis_whitepaper_final_.pdf*;

third-party tools, creating synergies, extending functionality, and supporting flexible markets. Interoperability standards play a crucial role in systems integration and content sharing in the education sector.

There are many formal standards bodies that have become involved in educational technology standardisation, including IEEE, the International Standards Organisation (ISO) and CEN Information Society Standardization System (CEN/ISSS). There are also other user led bodies who are driving the development of specifications, including the Department of Defence's Advanced Distributed Learning programme (ADL) and the IMS Global Learning Consortium. Those formal public standards (FPS) bodies are committed to achieving educational technology interoperability standards in areas such as metadata, content, administrative (enterprise) systems, and learner information.

However, the development and implementation of specifications and standards is not a simple and straightforward process. The stakeholder's interests may conflict at different stages of the standards development life cycle, and the standardisation process itself may result in conflicting issues. Several issues and barriers which prevent the development and adoption of specifications and standards and hinder technology innovation include complex and inflexible standardisation processes; lack of inclusiveness in the process of developing and adopting specifications and standards; lack of consistent approach to allow multi-stakeholder collaboration and participation; lack of early implementation of specifications; and lack of ability to create derivative works.

Institutionalised specification and standards development can hinder participation, limit quality, impede innovation, restrict agility and lead to unnecessary costs. On the another hand, a huge range of social software tools have been developed, and adopted enthusiastically by users, which do not require support for slow-moving and possibly complex standards, and this suggests an ever increasing challenge to established standards bodies and consortia.

In order to support educational technology innovations there is a need for the development and adoption of specifications and standards that are less formal, less governed and aligned more closely with agile development models. There is a growing demand that the process and production of specifications and standards should be more "open" from developers, users and implementers in the technical community that have grown up with the web. Open markets can stir the innovation needed to create innovative educational technology. The quality of specifications and standards rely on the transparency and openness of their development procedures.

Countries like South Korea for example, early adopters in ICT for education and training and very competitive in the ICT domain, have understood the importance of having formal standards, so that systems can work with each other and quality can be assured[132]*. The e-Textbook standardisation on global scale is a topic of intense debate also in the EU, as evidenced by the eTernity initiative*[133]*.*

The public consultation also underlined the need to provide for interoperability and open technical standards. Pearson, the world's leading learning company, emphasised that the "role for the EU in developing a set of technical standards will be extremely useful for industry. (…) This activity will ensure that no one player concentrates the market by introducing their own set of standards for how open resources are assessed, made available, traded and marketed".

Some standards have been tried in Europe, but remained national, like the Finnish Metadata standard (FinnEduMeta)[134]*, used for some of the resources available on OER portals in that country. In other countries like France, there is no single metadata standard used by all repositories: the French country analysis shows that at least five different ones apply.*

[132] "Digital textbooks open a new chapter" 18 October 2011. *http://www.bbc.co.uk/news/business-15175962*

[133] http://etextbookseurope.eu/

[134] For further references, see European Commission 2013: Report on the Provision of Digital Resources and ICT in Education in the Member States (Finland)

These problems in development and adoption of open standards and interoperability represent a barrier to develop, use, re-use and share resources, and reduces the possibility for the private sector to exploit economies of scale, hampering innovation. The problem of interoperability standards affects all education and training forms and sectors. The Commission cannot solve the issues of standards and interoperability, but it can foster transparency and adoption by providing support to stakeholder collaboration.

3. CONSEQUENCES FOR THE EU

Highlights

Without adequate action in the EU, the current problems of uneven availability of infrastructures, difficult discoverability of quality digital resources, difficult validation of skills acquired online, etc. will continue to be reproduced. This has negative implications related to digital skills, digital divide and access to knowledge, inefficient use of resources and Europe's leadership.

Education and training systems do not provide the digital competences needed in the 21st century economy and society. Europe will not provide similar opportunities to all its citizens to acquire digital skills for employability as well as active citizenship. The European economy would keep on facing digital skills gaps.

There is a risk of increasing the digital divide between digital competent people and those who do not have such ICT skills. This is particularly relevant in terms of access to knowledge. The current gaps between countries may increase even more. Some countries would continue to make efforts for exploiting the potential of digital technologies for learning, while others would reduce or even stop them. This is likely to increase the negative impacts in terms of social cohesion, competitiveness and efficiency of resources.

The efficiency potential of new technologies, evident in all economic sectors, is not reaped off in education and training, which lead to an inefficient use of educational resources. Europe will not be able to catch up with the emerging digital phenomena in education and training across the world and be able to modernise its education systems in terms of equity, quality and efficiency.

Europe will be lagging behind in terms of supply of OER and emerging digital markets compared to the US and Asia. Third countries will lead the emerging digital phenomena in the education and training field (e.g. MOOC) and better exploit the potential of new technologies and of the investments already done. The EU would be just a follower, losing opportunities and increasing its dependency on educational technologies designed and produced abroad.

Due to the many obstacles that have to be tackled and with the current economic and financial crisis, there is a significant risk that Member States are discouraged in moving forward in integrating digital technologies and content, including OER, in their education and training systems. This would reproduce the current problems: uneven availability of infrastructures, difficult discoverability of quality digital resources, un-adapted and fragmented legal frameworks for an innovative use of educational contents, difficult validation of skills acquired online, etc.

3.1. Lack of digital competences for employability

The lack of integration of new technologies in the mainstream teaching and learning practices implies that digital competences necessary for the current economy and society are not being fostered and developed. European industry is facing digital shortages and ICT-skills gaps in different sectors and expects this trend to further increase. According to the Digital Agenda, there will be around 900,000 unfilled vacancies for ICT practitioners in Europe by 2015.

Several actions to reduce the e-skills shortages, mismatches and gaps have been formulated at European level over the last few years under the European e-skills strategy (2007)[135]. Furthermore, a 'Grand Coalition for Digital Jobs' was launched by the European Commission in early March 2013. Some of the actions of the Grand Coalition are explicitly targeted towards increasing the number of ICT graduates and professionals through different activities directly addressed to students, reducing the rate of university drop-outs in ICT and STEM studies and making more intensive use of industry-based training and certification .

Over the past few years the number of ICT graduates has steadily been declining every year, and demand is by far outstripping supply. The numbers of ICT graduates have shown a decline since 2006 while the e-skills demand increased and reach a substantial demand potential and number of vacancies for new ICT jobs until 2015 ranging between 372,000 and 864,000. As a consequence the e-skills gap will widen.

As such, it is projected that by 2015 the number of vacancies for ICT jobs in the EU will have grown to between 372,000 and 864,000 depending upon the scenario. As a consequence the e-skills gap will widen.

Furthermore, the Digital Agenda estimates that by 2015, 90% of jobs will require at least a basic level of digital skills, while in 2012, 49% of the European population had low or no digital skills, according to Eurostat.. Education has thus a crucial role to assure that all learners have the necessary digital skills for employability[136]. Real integration of ICT in education and training institutions will increase the digital skills of the population and contribute to the transformation and digital regeneration of people and society, with positive impacts on competitiveness and growth[137]. Public savings associated with putting these citizens back to work are of great importance.

Digital competences, one of the eight key competences for lifelong learning[138], are more than just functional or operational ICT skills. They refer to the skills, knowledge and attitudes required to use new technologies in a critical, collaborative and creative way. In fact, in a study just published by JRC IPTS, on behalf of the European Commission, 21 specific competences have been described that constitute a framework for digital competence, emplacing critical, collaborative and creative ways of using digital technologies.[139] The concept of "digital natives" and the assumed high level of ICT skills acquired by young people at home are contested by international research (see section 2.1.). This shows the importance of integrating ICT into education.

3.2. Digital divide and access to knowledge

The level of digital competences varies substantially according to age, education levels and gender. Therefore, increased access to digital technology risks also to increase the digital divide if not provided equally, particularly in terms of access to knowledge on digital skills – and learning with them. This "digital divide" - between individuals but also between countries and regions - is increasing in Europe.

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[135] EC 2007: COM(2007) 496 of 7.9.2007 E-skills for the 21st century: Fostering competitiveness, growth and jobs, *http://ec.europa.eu/enterprise/sectors/ict/files/comm_pdf_com_2007_0496_f_en_acte_en.pdf*

[136] See also IPTS 2013 Literature Review on Employability, Inclusion and ICT, Report 2: ICT and Employability, JRC Technical Reports, EUR 25792. *http://ftp.jrc.es/EURdoc/JRC78601.pdf*

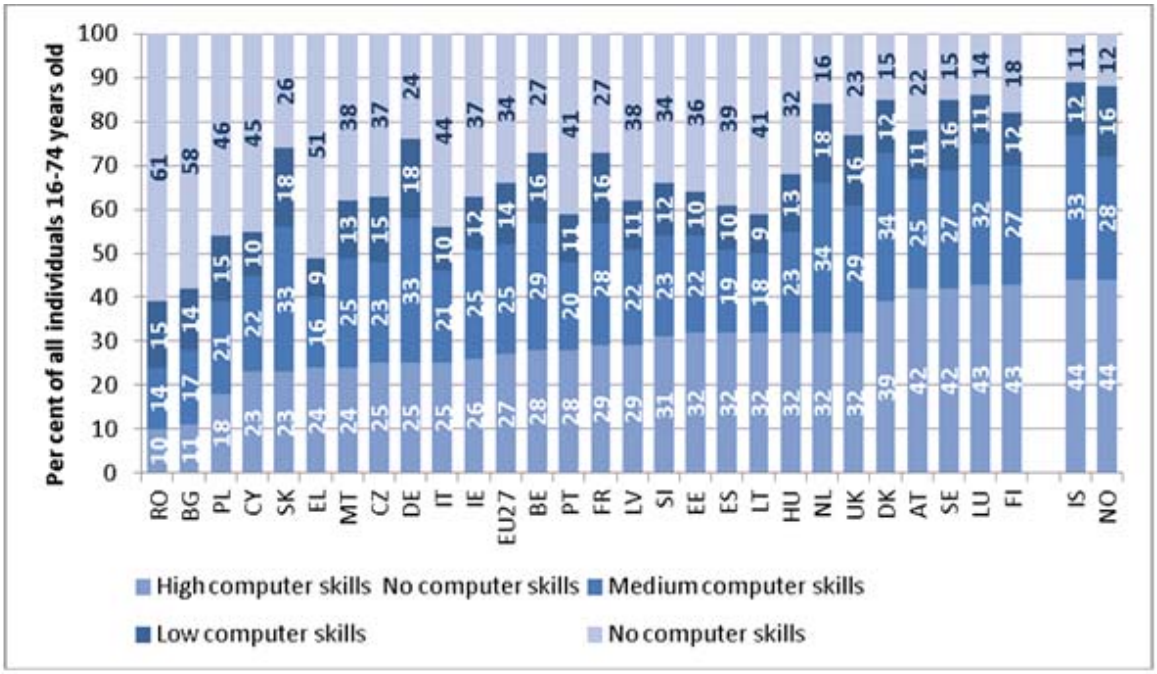
[137] The underlying reasons for such skills gap are complex and not due to a simple lack of digital skills, but general digital competence is a precondition for a professional career in ICT and hence deserves to be developed through digitally – based learning.

[138] Recommendation 2006/962/EC of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning, *http://europa.eu/legislation_summaries/education_training_youth/lifelong_learning/c11090_en.htm*

[139] JRC-IPTS 2013: DIGCOMP: A framework for developing and understanding Digital Competence in Europe. JRC Scientific and Policy Reports. See EUR JRC83167. *http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=6359*.

The digital divide also affects active citizenship, as e-government practices are more and more widespread. Eurostat provides biannual data on self- declared computer skills[140] of 16-74 year-olds in Europe through their Community survey on ICT usage in households and by individuals. In 2011, the "high level" varied between 43% (Finland) and 10% (Romania). In 2011, only 53% of the labour force felt confident in their computer and/or ICT skills if they were to look for or change jobs, yet the figures drop to below 40% in several countries such as Greece, Italy, Cyprus, Lithuania and Romania. The level of digital competences varies substantially according to age, education levels and gender.

Figure 15: Percentage of individuals aged 16-74 with low, medium and high computer skills. 2011[141]



There is a clear generational and educational divide in computer skills. 45% in the age group 16-24 have high computer skills compared with 31% and 10% in the age groups 25-54 and 55-74. Computer skills are positively correlated with educational attainment in all the age-groups, with the difference in skills between lowest and highest education attainment level being most pronounced in the 25-54 age group.

The digital divide has consequences in terms of citizenship and access to knowledge. For example, e-administration practices are more and more widespread. Without access to Internet and a minimum level of digital competences, a citizen can be confronted to administrative difficulties. Moreover, Internet is already the field of political debates, as shown in the US' presidential elections or in the Arab Spring. At a time when knowledge is easily available through the Internet, the impact of the

[140] Computer skills are defined as having ever performed at least one of the following activities: Copying or moving a file or folder; using coping and paste tools to duplicate or move information within a document; using basic arithmetic formulas in a spread sheet; compressing (or zipping files); connecting and installing new devices; writing a computer programme using a specialized programming language. Low computer skills refers to having done one or two of these computer-related activities, medium skills refers to having done three or four of these activities, and high skills five or all of them. Data on digital skills (computer skills) are available for 2012 on the Eurostat website and analysed in this year's Digital Agenda Scoreboard. The questions on confidence have not been updated as they formed part of a special module in 2011. However, it should be noted that these indicators are under review and in general should be interpreted with some caution since surveys face limitations in skills assessment.

[141] Eurostat, Information Society Statistics (data extraction: June 2012). For details about different types of computer activities, see *http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/4-26032012-AP/EN/4-26032012-AP-EN.PDF*. Data on digital skills confidence also from Eurostat.

digital divide goes far beyond the mere use of digital tools. It creates a strong gap between those who are able to increase their knowledge through ICT and those who cannot.

3.3. Inefficient use of resources

National policies on ICT in education and training are fragmented and very often financially unsustainable. The investments of European public authorities (e.g. € 487 million only in the UK between 2009 and 2010[142]) to create infrastructures and provide training to teachers, rarely reached the expected uptake and have not led to radical improvements in education.

Evaluation of EU's educational programmes reported that impacts were positive at micro level (for participants), but they just had moderated strategic effects (at country and European levels). The programme is not always matching the goals of ICT integration and mainstreaming in education systems[143]. EU's financing could be more efficient if based on a strategic approach, and the same conclusion could be extrapolated to several Member States and regions.

In addition, Member States are rarely exploiting the expected potential of OER for reducing public and private costs of education and training, even if in some like Spain, Portugal, Italy or Ireland, the cost of textbooks is becoming a real challenge for families.

In the current economic climate, cost-effectiveness, productivity and the need to do more with less are imperative in nearly every sector. Education and training is not an exception, as financial cuts in several EU Member States shows[144].

The efficiency potential of ICT, evident in all economic sectors, is not reaped off in education and training, which lead to an inefficient use of educational resources both at collective and individual levels. Digital technologies can improve effectiveness of resources through economies of scale, expanding access to a wider number of people at lower costs or allowing teachers to focus on what they do best by automating or offloading more routine tasks. New didactics linked to a stronger usage of ICT may lead to significant gains in educational productivity[145].

Box 3: "Today, Bolton – tomorrow, the world"[146]

Bolton's Essa Academy has undergone a technological revolution envied by schools across Britain and is considered amongst the most technologically advanced state school in the UK. Essa is a 900

[142] Luckin et al., 2012: Decoding learning - The proof promise and potential of digital education. NESTA *http://www.nesta.org.uk/library/documents/DecodingLearningReport_v12.pdf*

[143] Ecotec, 2007: Final Evaluation of the eLearning Programme: Annex to the Joint Report *http://ec.europa.eu/dgs/education_culture/evalreports/training/2007/joint/elearning_en.pdf*

Public Policy and Management Institute, 2011: Interim Evaluation of the Lifelong Learning Programme 2007-2013 *http://ec.europa.eu/dgs/education_culture/evalreports/education/2011/llpreport_en.pdf*

[144] OECD Education at a Glance 2013. *http://www.oecd.org/edu/eag.htm, http://www.oecd.org/newsroom/value-of-education-rises-in-crisis-says-oecd.htm*

[145] SRI International Center for Productivity in Learning 2012: Understanding the Implications of Online Learning for Educational Productivity. US Department of Education, Office of Educational Technology.

http://www.sri.com/sites/default/files/publications/implications-online-learning.pdf

Butler Battaglino et al. 2012: The Costs of Online Learning. In: Creating Sound Policy for Digital Learning. A Working Paper Series from the Thomas B. Fordham Institute. *http://gsehd.gwu.edu/documents/users/juliestella/The-costs-of-online-learning.pdf*

President Obama Speaks on Technology in Schools. June 6, 2013. *http://www.whitehouse.gov/photos-and-video/video/2013/06/06/president-obama-speaks-technology-schools#transcript*

http://yle.fi/uutiset/educational_data_cloud_service_planned_for_finland/6714130

[146] *http://www.essaacademy.org/*, Digital Agenda Assembly Workshop 1 report on 18/6/2013, Dublin, *http://www.bbc.co.uk/news/education-20930195, http://www.independent.co.uk/news/education/education-news/the-school-where-every-teacher-has-an-ipad-and-every-student-has-an-ipod-7578167.html*

pupil 11 to 16 school, taking most of its pupils from disadvantaged communities in the town. Its predecessor was deemed to be a failure by Ofsted, but it is now flourishing, after a remarkable shake up in the way pupils are learning. The new method of learning has acted as a catalyst in improving results: last year every pupil achieved five A to C grade passes at GCSE, compared with 40 per cent previously.*

Technology decisions in Essa have been made with strict concerns of the cost, as they believe that thousands of pounds have been spent in schools and used really unwisely. Every pupil has their own iPod Touch or iPad, and teachers have their own iPads on which they can create mini textbooks for their subjects. The school has no offices, all staff communicates through hand held mobile devices.

The creativity that has been inspired by the use of this technology has been phenomenal. Staff and students are able to have seamless communication that allows learning conversations to develop and feedback to be of a higher quality as well as the delivery of a personalised curriculum.

According to the British Educational Suppliers Association (BESA), ICT spending by UK schools rose to €286 million, an increase of 2.1% compared to 2011. Primary schools spent an average of €17,416 on ICT (plus 2.3%), while secondary schools spent an average of €77,444 on ICT (plus 1.9%)[147]. Such investments may not always give the expected returns in the short-term and their sustainability is at risk in times of economic crisis. For example, the Spanish programme "Escuela 2.0" launched in 2009, aimed at implementing the digital classrooms of the 21st century, was cancelled in 2012, despite positive evaluations in terms of quality of teaching, pupils' motivation and methodological changes[148]. In the meantime, investments for this programme represented around €200 million per year and hundreds of thousands of laptops were distributed.

Costs of education are rising worldwide. In the US, 43% of 25-year-olds had student debts in 2012. Nearly 18% of borrowers now have student loan debts of €19,300 to €38,600, and around 4% have balances greater than €77,200[149]. This so-called "student debt crisis" has its roots in state cuts to higher education that began in the 1980s. Several Member States are living similar situations, combining financial cuts and increasing university fees. Even access to educational materials like textbooks is becoming an issue for families in countries like Italy, Spain, Portugal or Ireland, as it is the case for years in the US[150].

In the meantime, OER, Open Courseware (OCW) and MOOCs become more and more widespread and demanded worldwide. In economic terms, they represent a unique opportunity for public and private savings. Just for the State of Washington, it is estimated that using state-adopted Open Course Library materials could save €30.9 million per year[151]. Unsurprisingly, in the US, OER are a key component of the Obama administration's Technology Plan and 2020 Graduation Goal.

In fact, the development of alternative digital forms of learning is a real necessity. Research foresees that in the next decades the level of worldwide demand for doing university studies will largely exceed the capacity of existing systems, not being economically viable to build enough new universities. The magnitude of unsatisfied demand indicates that concepts like online higher education are becoming a real need[152].

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147 Original figures in GBP, exchange rates 1€=0.8492£ as of 3/July/2013, *https://www.ecb.int/stats/exchange/*

148 Various Authors 2011: ¿Qué opina el profesorado sobre el Programa Escuela 2.0? Un análisis por comunidades autónomas? Preliminary report of the research project EDU2010-17037 funded by the Spanish Ministry of Science and Innovation, *http://ntic.educacion.es/w3//3congresoe20/Informe_Escuela20-Prof2011.pdf*

149 Original figures in USD, rounded exchange rate 1€=1.2959$ as of 3/July/2013, *https://www.ecb.int/stats/exchange/*

150 Marcus 2006: US rage at textbook price hike. In: Times Higher Education, 11th of August 2006

151 Original figures in USD, rounded exchange rate 1€=1.2959$ as of 3/July/2013, *https://www.ecb.int/stats/exchange/*

152 Athabasca University et al. 2011: Open Education Resource University. Towards a logic model and plan for action. *http://wikieducator.org/images/c/c2/Report_OERU-Final-version.pdf*

3.4. Losing worldwide leadership

Europe is lagging behind in the exploitation of opportunities coming from new phenomena like OER and open practices, with a negative impact on its innovation capacities and its leadership in the global context. While major worldwide universities are offering open courses (e.g. MIT, Harvard, the UK Open University), MOOCs are developing very fast[153] and the use of OER starts to be promoted at institutional and political levels, Europe is only a follower of these emerging trends: in most European universities the emergence of MOOCs is not discussed and there is a lack of even further information on this issue, as stated by 85% of respondents. Several positive exceptions exist though, e.g. the UK Open University[154], German MOOCs[155] or to get European MOOC providers together[156].

Meanwhile a major educational technology market is emerging worldwide. This market is expected to grow up to 20% by 2016 due to public-funded education policies that deploy digital learning infrastructures, large scale digitisation efforts by governments and the academic sector, explosive development of digital learning content, ICT investments of the educational industry and content providers, demand services, rapid growth of online student enrolments, amongst others[157]. Innovative research techniques based on collecting and analysing learners' data (learning analytics and educational data mining), allow the development of new pedagogical approaches, based on a better understanding of students needs and what works well from the didactic point of view.

Europe depends mainly on ICT infrastructures and technologies designed and/or produced abroad, with some exception market niches like interactive whiteboards. However, even though European market is currently small and fragmented nationally, it could potentially be a source of bigger growth, if exploited properly, supported with right market initiatives[158] and relying on Europe's leading edge pedagogical excellence.

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153 Lewin 2012: College of Future Could Be Come One, Come All. In: The New York Times, 19th of November 2012

154 *http://www.open.ac.uk/platform/news-and-features/study-open-education-mooc; http://www.timeshighereducation.co.uk/422137.article*

155 *http://opencourseworld.de/*

156 *http://moocs.epfl.ch/eu-mooc-summit*

157 Foray & Raffo 2012: Business-Driven Innovation: Is It Making a Difference in Education? – An Analysis of Patents. OECD Education Working Papers, No. 84
Ambient Insight 2012: Snapshot of the Worldwide and US Academic Digital Learning Market. *http://www.ambientinsight.com/Resources/Documents/AmbientInsight-2012-Snapshot-Worldwide-US-Academic-DigitalLearningMarket.pdf*

158 A snapshot of the Learning Industry in Europe in 2011. European Learning Industry Group ELIG. A summary for 2011. Produced by the ELIG Secretariat

4. WAYS FORWARD FOR SYSTEMIC INNOVATION: EXAMPLES OF BEST PRACTICES

Highlights

Over the past years several large scale pilots have been implemented across Europe, crossing national countries and even some European-wide. These pilots have as objective to be a test case for future large scale implementation in real practices.

By analyzing the various ways these pilots are implemented, with or without success, one can learn more about the underlying conditions for successful uptake and use of ICT and OER in education and which concrete problems have to be tackled.

The best practices described are very diverse in terms of targeted educational sectors; number of learners and teachers involved; geographical coverage; oriented on practices or on educational resources, etc.

The following best practices in Europe have been looked into: One-to-one learning initiatives providing every child or teacher with a personal device; eTwinning, a European-wide community of schools; large scale experimentations providing real-life laboratories of scale to develop and test scenario's for mainstreaming innovative use of ICT in education; Open Courseware; Massive Online Open Courses changing the European higher education landscape and large-scale platforms for open education.

This chapter also looks into best practices of systemic uptake of ICT and open educational resources (OER) in education on regional, national and/or European level such as the one-to-one learning models; a European wide community of schools - eTwinning; large-scale policy experimentations; MOOCs changing the higher education landscape; Open Courseware in universities; European-wide platforms for open education, etc.

4.1. One-to-one learning initiatives in Europe [159]

Until 2000, ICT in Education strategies launched across Europe aimed at a general push of technology, mainly desktop computers, into schools. During the past decade, a number of initiatives in several EU countries were initiated by national/regional governments, which focused on 1:1 computing providing every child or teacher with a personal device. The One Laptop Per Child initiative (OLPC), started supplying pupils in developing countries with affordable laptops in 2007, might be the most well-known programme, attracting considerable international attention and inspiring the emergence of others initiatives based on low cost digital devices[160].
The 'Netbooks on the Rise' report by European Schoolnet[161] identified two waves of expansion in Europe: the first wave mainly focused on spreading out computers and equipment at

[159] The section is largely based on the following IPTS reports: IPTS 2013 ICT-enabled innovation for learning in Europe and Asia. Exploring conditions for sustainability, scalability and impact at system level. JRC Scientific and Policy Reports, in collaboration with Centre for Information Technology in Education (CITE), University of Hong Kong. (EUR: JRC83503, *http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=6362*); IPTS 2013 Overview and Analysis of 1:1 Learning Initiatives in Europe. JRC Scientific and Policy Reports, in collaboration with European Schoolnet, EUR: JRC81903. *http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=6199*

[160] Foundation 2008

[161] Balanskat & Garoia 2010

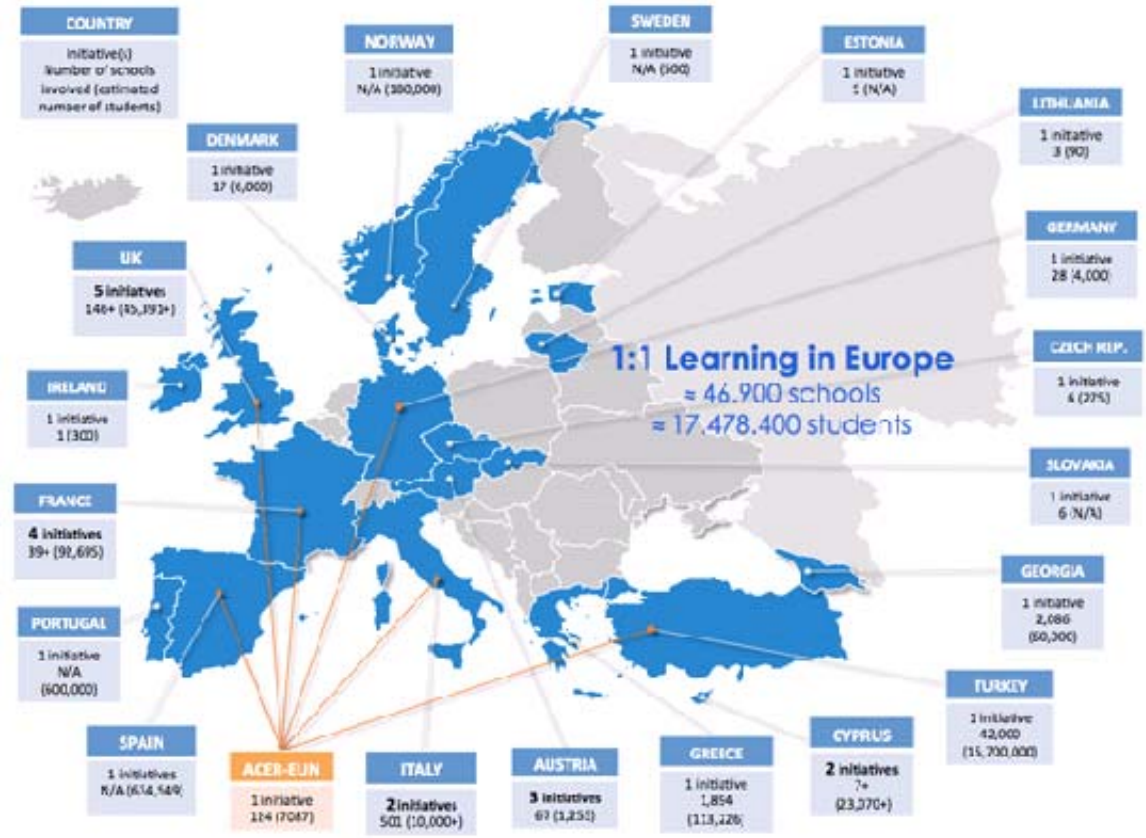
schools/classrooms level with the objective to ensure a wider provision of ICT and reduce considerably computer per pupil ratios, i.e. one netbook per learner. The second wave increasingly aimed to fulfil educational goals, such as the use of ICT in all subjects to foster competence-based education and personalisation of learning.

A more recent JRC IPTS study[162] identified in 2013, 31 recent one-to-one learning initiatives launched since 2008 in 19 European countries, equipping all students of a given school, class or age group with a portable mobile computer device. The majority of these initiatives are integral part of national/regional ICT programmes launched by education authorities in order to promote school innovation. Most of these initiatives, even when implemented at regional or local level, are significant in scale, i.e. involving a large number of students (e.g. about 600,000 in Spain and Portugal or intended 15 million in Turkey from 2013 onwards) and /or equipping all schools across the entire country (e.g. 2086 Grade 1 public schools in Georgia). Overall, identified initiatives on 1:1 learning cover an estimated number of approximately 46,900 schools and 17,480,000 students in primary and secondary education (K-12) across Europe with the vast majority coming from Turkey (15,700,000), Spain (635,000) and Portugal (600,000).

The following figure shows the geographical distribution of 1:1 learning initiatives per country (the first number indicates the initiatives; the second one indicates the schools involved; values in brackets indicate the estimated number of students). The 'Acer-European Schoolnet Educational Netbook Pilot' ran in parallel in six countries.

[162] IPTS 2013 Overview and Analysis of 1:1 Learning Initiatives in Europe. JRC Scientific and Policy Reports, in collaboration with European Schoolnet, EUR: JRC81903. *http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=6199*

Figure 16: Geographical coverage of recent 1:1 Learning initiatives in Europe[163]



The objectives pursued in these more recent initiatives are much more pedagogical and educational change driven.

Figure 17: Objectives tackled by the 31 recent 1:1 initiatives

Main Objectives of recent 1to1 Learning	*No. of initiatives*	*Initiatives by country*[164]
Innovate classroom and learning practices	7	UK, AT, IT, FR, DK
Implement 1:1 pedagogy	9	EU, ES, PT, SK, SE, IT, CZ, DE, DK
Improve students' learning outcomes	4	UK, SE, IE
Improve students' ICT skills and motivation	7	AT, FR, GE, ES, DE, CZ
Improve access to quality educational resources	3	DK, NO, TR
Foster anytime-anywhere learning opportunities (school & home use of the device)	12	AT, ES, CY, EE, FR, UK, EU
Increase ICT provision in schools	8	EL, FR, LT, TK
Provide access to (advanced) ICT equipment	4	CY, DK, LT,
Improve communication between students, teachers and parents	5	AT, CZ, EU, FR, ES
Support leadership development	1	DK
Reduce the digital divide	5	CY, IE, LT, FR, PT, TK

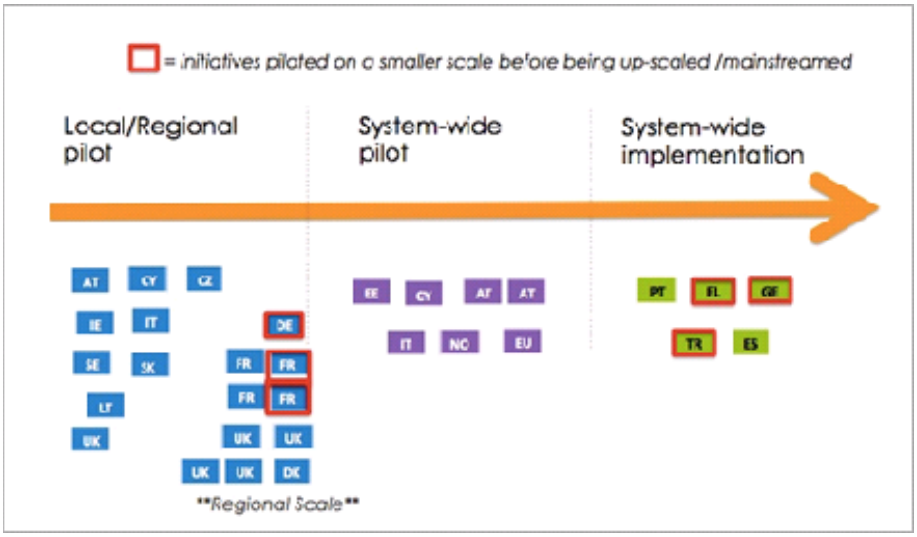
[163] IPTS 2013 ICT-enabled innovation for learning in Europe and Asia. Exploring conditions for sustainability, scalability and impact at system level. JRC Scientific and Policy Reports, in collaboration with Centre for Information Technology in Education (CITE), University of Hong Kong.; EUR: JRC83503, http://ipts.jrc.ec.europa.eu/publications/pub.cfm?*id=6362*

Overall, 1:1 learning initiatives in Europe can be considered as incremental, moving progressively to more radical approaches where the emphasis lies on 1:1 learning rather than 1:1 devices.

It is interesting to note that about half the 1:1 initiatives have already reached a significant scale, involving a large number of students (e.g. 180,000 in Norway and 113,226 in Greece) and are moving towards mainstreaming (e.g. 600,000 students in Portugal, 634,549 in Spain and 15,700,000 in Turkey). Five initiatives (i.e. in Georgia, Greece, Portugal, Spain and Turkey) are system-wide implemented, being part of a mainstreaming programme (with the equipment gradually provided to schools in the whole country).

More than half of the initiatives are embedded in regional/national strategies, but only one initiative was cross-border, involving learners from six European countries (i.e. ACER-EUN). Pilot projects carried out at local/regional level, as well as across a whole country (i.e. system–wide pilots such as in Estonia, Cyprus, Austria, Italy, Norway) were implemented in the first place before being eventually scaled-up during a second phase of the project (with more devices given to more students in the same school, at different education levels and/or to other schools in other regions). As shown in Figure xx, several initiatives have also been piloted on a smaller scale before being up-scaled, and in some cases even mainstreamed (highlighted in red).

Figure 18: Scale of innovation of recent 1:1 learning initiatives in Europe



The key outcome achieved to date by recent 1:1 learning initiatives in Europe is an increased attention and impact beyond the technology itself, including professional development, involvement of parents and school community. Although the type of adoption varies across schools and, within a school, across teachers, innovation supported by 1:1 computing affects students' learning and motivation, 1:1 pedagogy, teacher professional development, and partnership and collaboration with the community.

However while the 1:1 learning models aimed to enhancing the uptake of ICT in learning and teaching processes by offering each learner its own device, most of the initiatives did not go further than offering just the infrastructure and tools, and some teacher guidance and professional development. Incremental changes in the teaching strategies and pedagogical scenarios applied were less common. Again impact analyses of one- to-one learning pilots show that real impact and full

[164] Country codes (cfr. EC, Eurydice, 2012): AT-Austria, CY-Cyprus, CZ-Czech Republic, DK-Denmark, EE-Estonia, FR-France, GE-Georgia, DE-Germany, EL-Greece, IL-Ireland, IT-Italy, LT-Lithuania, NO-Norway, PT-Portugal, SK-Slovakia, ES-Spain, SE-Sweden, TR-Turkey, UK-The United Kingdom, EU-Europe (ACER-EUN initiative).

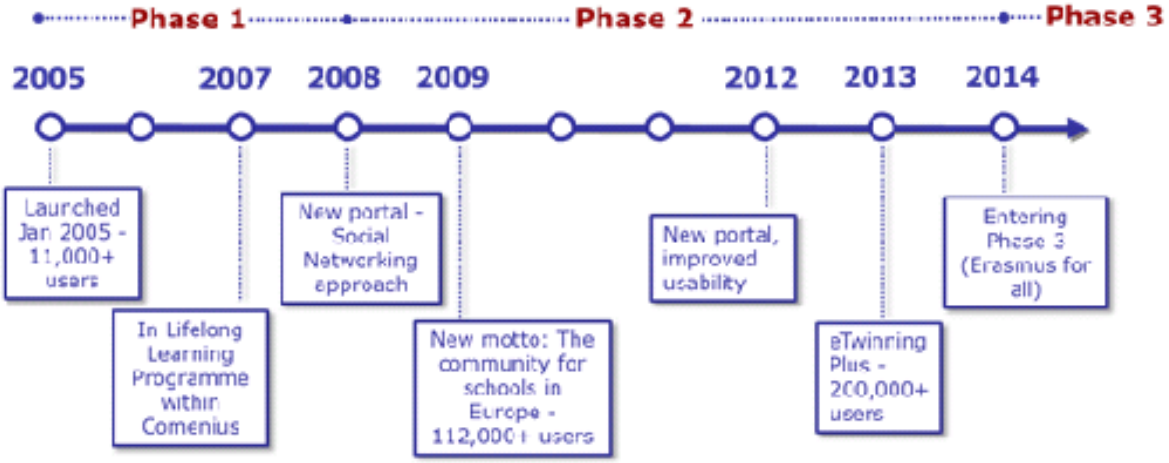
implementation of ICT in education, requires holistic approaches whereby all educational elements are being tackled at the same time within an overall vision and a full engagement of all stakeholders. It often requires also innovative individuals that provide the vision for the others.

4.2. eTwinning – A European wide community for schools[165]

eTwinning (*www.etwinning.net*), the European Commission initiative for a schools' community in Europe, is recognized by practitioners and stakeholders as a successful European ICT-enabled innovation that contributes to the modernisation of education and training in the EU[166]. Running its ninth year of development, eTwinning can be considered as a successful and stable ICT-enabled innovation for learning with good prospects for further development directed both towards improving and deepening the experience of participating students, teachers and schools and towards strategies for expanding its existing reach and scale.

eTwinning (May 2013) involves more than 200,000 teachers, head teachers, librarians, IT coordinators etc. (the so-called *eTwinners*) working in schools in one of the 33 European countries involved[167]. eTwinners can utilize the tools and the secure internet spaces offered for meeting virtually, exchanging ideas and practices, and engaging in cross-border projects using ICT. eTwinning also provides additional services to teachers including the search for partners for Comenius school partnerships[168], the opportunity of taking part in communities of practice (e.g. *eTwinning Groups*[169] and *Teachers Rooms*[170]) and professional development opportunities (*Professional Development Workshops*[171] ; *Learning Events*[172] - online and/or onsite - at regional, national or European level)[173].

eTwinning was launched in January 2005 as the main action of the European Commission's *eLearning Programme*, and has been firmly integrated in the *Lifelong Learning Programme* since 2007 (see next Figure). It responds to the request made by the Barcelona European Council[174] in March 2002 to promote school twinning through the Internet as an opportunity for all students to learn and practice ICT skills and to promote awareness of the multicultural European model of society[175].



[171] Workshops organized by the CSS and/or NSSs that are take place in different European cities throughout the school year aiming at teachers who want to improve their professional skills and competences.

[172] Short online events on a number of themes that are run by education experts offering an introduction to a topic and helping participants to develop their skills and knowledge. See also Holmes & Sime, 2012.

[173] European Commission 2013

[174] *http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/71025.pdf*

[175] The eTwinning Central Support Service (CSS) portal (http://www.etwinning.net) is run and managed by European Schoolnet on behalf of the European Commission's Directorate General for Education and Culture and it is available in

Numerous teachers' professional networks and communities of practice at national (e.g. the Internet en el Aula[176] in Spain) or cross-national level (e.g. the Commonwealth Class[177], the TES network[178)], contribute to teachers' professional development and facilitate peer-to-peer learning and collaboration. eTwinning is considered as the most sustainable and widespread educational network in Europe as well as a concrete case of on-going ICT-enabled innovation with significant impact on education and training for the following reasons:

- It is a fast-developing initiative that has a stable organisation schema and funding, a constant development, and sustainability/scalability plans in place;
- It allows new possibilities for school staff and students to connect with multiple actors (e.g. peers, external experts, wider community) opening up alternative channels for gaining skills and knowledge and broadening their horizons;

Figure 19: The timeline and milestones of eTwinning development and

- intercultural awareness among the school community in Europe;
- It supports teachers' peer learning and continuous professional development -through their active participation in collaborative projects, communities of practice and various face-to-face and online training activities;
- It contributes on the development of teachers' professional skills in ICT-enabled innovative pedagogical practices and thus accelerates educational change[179].

Now in its ninth year of development (2005-2013), eTwinning is recognized by practitioners and stakeholders as a well-established teachers' network, with a stable organisation schema and sustainability/scalability plans in place. The European Commission intends to reinforce the role of eTwinning in the context of the new "Erasmus+ (the EU Programme for Education, Training, Youth and Sport" for 2014-2020). eTwinning will become the basis for all European school cooperation activities. The expanded eTwinning will offer an upgraded Internet platform, more online professional learning activities for teachers and more opportunities for collaboration with schools outside Europe.[180].

eTwinning Plus and the international dimension of eTwinning

eTwinning Plus is a pilot for the partial extension of eTwinning to some countries of the Eastern Partnership (Armenia, Azerbaijan, Georgia, Moldova and Ukraine) and South Mediterranean (Tunisia). It got off to a very promising start in the first quarter of 2013.

Albania, Bosnia-Herzegovina, Montenegro, Kosovo and Serbia could join eTwinning in the near future.

Other countries could be involved to a lesser extent through ad hoc collaboration agreements.

twenty-five European languages. eTwinning Plus portal is at http://plus.etwinning.net. The websites of the 35 NSSs can be found at *http://www.etwinning.net/en/pub/get_support/contact.htm*

176 *http://internetaula.ning.com/*

177 *http://schoolsonline.britishcouncil.org/projects-and-resources/commonwealth-class*

178 *http://www.tes.co.uk/article.aspx?storyCode=6000208&navCode=285*

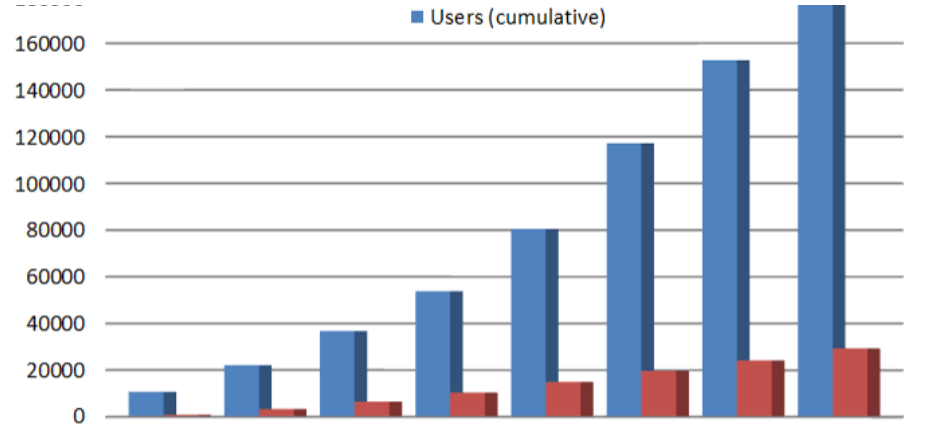
179 IPTS 2013: ICT-enabled innovation for learning in Europe and Asia - Exploring conditions for sustainability, scalability and impact at system level, by Kampylis, Law & Punie, JRC Scientific and Policy Reports, in collaboration with Centre for Information Technology in Education (CITE), University of Hong Kong. EUR: JRC83503, *http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=6362*

180 European Commission, 2011

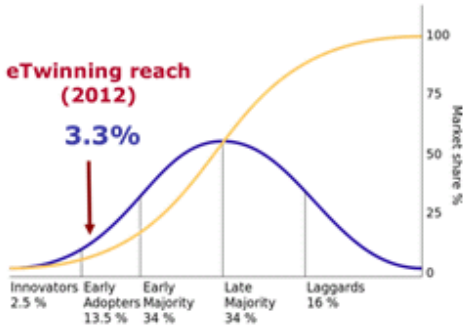
On 15 April 2013, 200,138 teachers and other practitioners from 104,567 schools in 33 countries (the 27 EU member states plus Croatia, Iceland, Norway, FYROM, Switzerland and Turkey) have been registered in eTwinning; 14,743 of them are involved in projects registered after 1.6.2012. In terms of projects, 5,768 are currently active and 21,970 closed[181] whereas the average ratio of registered 'user' per school is 1.96. According to the estimations by Wastiau, Crawley & Gilleran (2011), the participation in eTwinning projects over the first six years of its development (2005-2010) must have involved close to 750,000 students across 33 countries in Europe.

However, although these figures are constantly increasing[182] (see figure below), the eTwinning action currently reaches on average 3.3% of the potential teaching population within the participating countries. Therefore, according to Rogers' model of diffusion of innovation (2003), eTwinning in most countries still remains limited to teachers who are "innovators" in using ICT for cross-border school collaboration[183].

Figure 20: eTwinning statistics



	2005	2006	2007	2008	2009	2010	2011	2012
Users (cumulative)	10585	22162	36698	53814	80454	117223	152726	192610
Projects (cumulative)	970	3369	6578	10371	15023	19700	24184	29413



[181] The figures refer only to eTwinning -as there are not yet statistics from eTwinning Plus- and are constantly increasing. You can see the current number of registered users, schools and projects at the eTwinning CSS (Central Support Service) portal: *http://tinyurl.com/crwonh8*. See also the interactive map of eTwinning coverage and statistics by country at *http://tinyurl.com/c8ddff3*.

[182] A comparison of the figures of 15 April 2013 with the ones of 24 July 2012 (European Commission, 2013, p. 34) reveals that in a period of approximately 9 months 29,975 new users (+14.97%) and 11,652 schools (+11.14%) have registered in eTwinning platform. Accordingly, the number of projects has grown steadily. See more about recent statistics of eTwinning at *http://bit.ly/10Vx2nt*

[183] Some countries have passed the 2.5% milestone of "innovators" (e.g., Estonia, Iceland, Slovakia, the Czech Republic, Slovenia and Finland) and are currently targeting the segment of "early adopters" within their teacher population (Vuorikari et al., 2011).

On the other hand, based on calculations regarding the number of schools present in each country, it can be seen that the coverage of schools (up to 25%) is much higher than the coverage of teachers. This in turn could potentially provide an opportunity to increase the eTwinning teachers reach[184] through local dissemination as even the most experienced eTwinners still tend to work in relative isolation within their schools (European Commission, 2013). Recently, the idea of *School Teams*, namely any group of teachers, librarians, head teachers etc. within a school who are involved in eTwinning, is promoted by eTwinning as a way to increase its reach through local dissemination[185]. In summary, a wider take up is needed to move eTwinning from its current *scale* phase into the mainstream one having an impact at a systemic/organisational level.

Based on the success of European platforms such as eTwinning for schools cooperation and in line with the Council Resolution on a Renewed European Agenda for Adult Learning in Europe[186], the European Commission is launching a multilingual platform for adult learning in Europe in order to further the quality of adult learning in Europe through the internationalisation of adult learning organisations, the professional development of adult learning staff and enhanced cooperation between policy makers involved in adult learning. The platform will offer a central location for information and resources on adult learning and a space for cooperation, peer learning and sharing of best practices between all adult learning stakeholders in Europe. Such a platform will be of particular importance for the field of adult learning given its varied and disparate nature and the existing differences between countries in the performance of their adult learning systems. The future platform, EPALE – Electronic Platform for Adult Learning in Europe will address these challenges by creating a common reference point for adult learning in Europe.

4.3. Large-scale policy experimentations

One of the problems identified to scale up pilots is that all educational stakeholders need to be engaged in the project. In particular two-ways interaction between the policy, practice and research has to take place. The concept of 'Living educational labs' is looking into this and various EU-wide projects have been recently launched with much success.

For example, within a school setting, the ***iTEC (Innovative Technologies for Engaging Classrooms)*** project provides a laboratory of scale in which to develop and test scenarios for mainstreaming innovative use of ICT in schools in Europe. iTEC (2010-2014) is a major EU-funded project in which European Schoolnet is working with education ministries, technology providers and research organisations to bring about transformation in learning and teaching through the strategic application of learning technology.

With 27 project partners, including 14 Ministries of Education, and funding of €9.45 million from the European Commission's FP7 programme, iTEC is a flagship project for the design of the future learning environment in compulsory education. The iTEC project particularly addresses the growing concern of Member States and the European Commission that innovative use of ICT in schools and scenarios for the future classroom must now move beyond small-scale pilots and really be taken to scale. Currently, therefore, iTEC is piloting learning and teaching scenarios for the future classroom in >1,000 classrooms in 15 countries, making it by some margin the largest pan-European validation of

[184] eTwinning reach = the registered users / teacher population
[185] See also *http://www.etwinning.net/en/pub/news/news/etwinning_school_teams_divide.htm*
[186] *http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2011:372:0001:0006:EN:PDF*

ICT in schools yet undertaken. Evaluation is an integral part of the cycle assessing the potential of the iTEC learning activities and identifying supporting factors and barriers.

Another example in the school education area is the ***Living School Lab*** aiming to establish a pan-European network of 'living schools' demonstrating and showcasing a diverse range of innovative pedagogical practice involving ICT. Started in October 2012, Living Schools Lab is a two-year project funded by the European Commission and coordinated by European Schoolnet. It includes 12 Ministries of Education and aims to create:

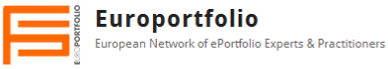
- A sustainable pan-European network of 'living schools' demonstrating and showcasing a diverse range of innovative pedagogical practice involving ICT and sharing best practice and ways to successfully embed the use of technology in teaching and learning across the whole school.
- To identify successful strategies for taking change management to scale – moving from a single class to ICT being embedded across the whole school.
- A strong community of practice, with supporting continuous professional development opportunities for teachers.
- Opportunities for schools to get involved in action-based research, creating links with outside partners including industry and other pan-European projects.
- To create a strong community of teachers, with access to continuous professional development to help them with changing pedagogical practice.

There is another launch for the European Living Learning Network by schools and for schools. It is a facilitated grassroots initiative initially formed from school networks in 6 European countries and partnerships abroad including schools in developing countries. Linked to a facilitators network of higher education institutions, thematic organisations, experts, learning content and technology providers, we.learn.it schools will be enabled to co-develop and embark into Learning Expeditions jointly with leading players in European science, creativity and innovation. It will intensify the collaboration of schools with Europe's higher education institutions that are at the forefront of European innovation in learning organisational models and pedagogical concepts, in particular the experiences of Aalto University in Finland - today considered a leading European case with new learning models like Design Factory and Aalto Entrepreneurship Society.

The Future Classrooms Lab (CCL) (*http://fcl.eun.org/*) led by EUN. It involves nine Ministries of Education in Europe or organisations delegated to act on their behalf (AT, BE/FL, BE/FR, CZ, IT, LT, PT, SI, UK), who will work closely with five leading ICT vendors (Acer, Microsoft, Texas Instruments, Samsung. SMART Technologies as Associate Partners). The aim of the experimentation is to develop coherent strategies to ensure that whole-class implementation of tablets can support innovative 1:1 pedagogies and teaching approaches (involving personalized learning, collaboration, interactivity, etc.) and be integrated in national programmes. The project makes a clear link between existing large scale research (iTEC) and the implementation in national programmes.

The Future Classrooms Lab is one of the projects using a new instrument introduced in 2013 under the Lifelong Learning programme called policy experimentations supporting trans-national co-operation through large-scale experimentation, joint policy development and exchange of good practice and innovation. The focus is on support to national, regional and local authorities in mainstreaming the use of new technologies in their school educational policies and practices through policy experimentations with 'Creative Classrooms'. *'Creative Classrooms'* are conceptualized here as

innovative learning environments that fully embed the potential of ICT to innovate learning and teaching practices. The term 'creative' refers to the innovation of learning and teaching processes through technologies (e.g. collaboration, personalisation, entrepreneurship, etc.). Likewise, the term 'classrooms' is used in its widest sense to include all types of learning environments: formal, non-formal and informal.



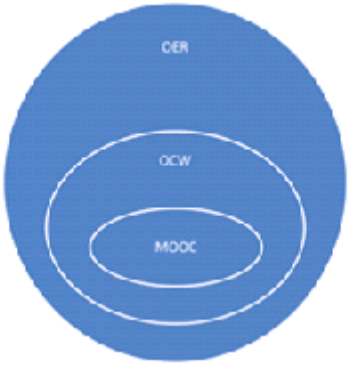
Mainstreaming EU Classroom Portfolio's (*http://www.eportfolio.eu/project*) is another policy experimentation under the Lifelong Learning programme led by the Ministry of education of Ireland with 12 other countries. The aim of the project is to design and test innovative ePortfolio models which will inform and support the implementation of innovative learning environments using ICT across Europe. The emphasis is on learning from the practical implementation of ePortfolio's in schools. The project helps policymakers draw valuable real-world lessons in order to deepen the use of ICT (specifically the portfolio approach) in teaching, learning and assessment.

In all of the above described projects looking into conditions of success for a larger implementation of ICT in education, the *balance and interaction between bottom-up and top-down initiatives* is a common feature. Educational authorities from different participating countries identify together a common challenge related to mainstreaming the use of ICT in educational practices and build a partnership addressing this challenge. The concept agreed upon by the trans-national partnership is tested ("policy experimentation") at national level in real-life learning environments, in one or more of the partner countries, in a representative sample of schools. The results of the experimentations around the use of ICT in education are evaluated first at country level and then collectively with the other partner countries, with the systematic involvement of scientific experts. Policy experimentations achieving successful results - according to scientific evidence and policy evaluation - will prompt responsible authorities to introduce changes in the education systems/curricula and foster large-scale implementation.

4.4. Open Courseware

Open Courseware (OCW) is one particular form of organising Open Educational Resources, presenting them as a complete set of materials needed for an entire course. These may include a syllabus, different forms of presentation of the content (using video, text, presentations, etc.), exercises, assignments to be performed by students and exams or other forms of assessment of learning outcomes. The Open Courseware Consortium[187] defines: «*an OpenCourseWare is a free and open digital publication of high quality college and university level educational materials. These materials are organized as courses, and often include course planning materials and evaluation tools as well as thematic content. OpenCourseWare are free and openly licensed, accessible to anyone, anytime via the internet.* »

[187] *http://www.ocwconsortium.org*



Open Courseware is a more structured concept than OER as the latter may refer to each of the individual elements of one OCW and not to the entire set.

An OpenCourseWare course is with:

- a joint start and end time;

- interactive user forums;

- assessment and (informal) certification.

Given its principles of open availability and freedom of adaptation by others, open courseware has been an important tool through which education openness has been promoted. The main higher education institutions providing OCW are represented in the Open Courseware Consortium which currently serves as an access point to OCW being provided by its members in their own platforms. Its portal indicates a total of 8760 full courses being provided there from 68 different sources spread over 20 languages[188].

Example 12 - Germany, Luxembourg, France, Belgium

'University of the Greater Region' project (http://www.uni-gr.eu/en/nc/home.htm)

The University of the Greater Region project is an interesting cross border region cooperation initiative with programmes being composed of classes at different – geographically close – universities, which include Saarland and Rhineland Palatinate in Germany as well as the Grand Duchy of Luxembourg, the French region of Lorraine and Wallonia in Belgium. Over the next two years a cross border association of universities will be created. It will involve the universities of Saarland, Liège, Luxembourg, Lorraine, Kaiserslautern and Trier. The partner universities involved have a total of around 115,000 students and around 6,000 teachers and researchers. Teaching and research is in German, French and Luxemburgish (the three national languages found in the Greater Region) as well as in English. There is both physical mobility and access to shared materials on line.

Example 13 - Germany

The Virtual University of Bavaria (http://www.vhb.org)

The Virtual University of Bavaria (VHB) promotes and coordinates the development and implementation of tailor-made online course offerings at Bavarian universities for students (for free) and others (low fee). Like its member universities, the BVU is financed predominantly by the Bavarian Ministry of Higher Education. The BVU provides online-courses with an equivalent of two to six credit points (by ECTS) which the member universities can integrate into their courses of study. The BVU helps its member universities to enlarge and enrich their programmes, and it helps the students to organize their studies in a more flexible way. The basic and most important working principles of the BVU are a focus on blended learning at the macro level of the course of study, not at the micro-level of the single course, lecture or seminar, giving priority to asynchronous forms of communication, thus facilitating the import

[188] *http://www.ocwconsortium.org/en/courses/search* as of 3/July/2013

and export of online-courses between all member universities, and the development and provision of courses tailored to the needs and the actual demand of the member universities, with an elaborate quality management, financing of the production of courses as well as the operation of these courses, especially the online-tutoring of students.

Iversity (https://www.iversity.org)

Following an 'EXIST'-Founder Scholarship from the German Federal Ministry of Science and Technology, Iversity received more than 1 million Euros in funding from the BFB (Frühphasenfonds Brandenburg (EU 75% / Brandenburg 25%) and bmp media investors in July 2011. In December of 2012 Marcus Riecke joined the team and invested in the company together with the existing investors, Masoud Kamali and T-Venture, the venture arm of Deutsche Telekom AG.

The open course platform provides: (i) a structured course environment that features multimedia teaching materials, (ii) assessment features such as multiple choice and peer review in order to keep students engaged and provide them with quantitative and qualitative feedback and (iii) a discussion board where students can engage in peer-to-peer learning by asking and answering questions or sharing links, references and general observations.

4.5. MOOCs are changing higher education

The “Open Educational Resources Movement”, advocating the free exchange of digital educational resources, has been most predominant at higher education level. The movement acquired its first momentum in 2001, when the Massachusetts Institute of Technology (MIT) announced the release of nearly all its courses on the Internet for free access. In 2002, UNESCO organized the *First Global OER Forum/Forum on the Impact of Open Courseware for Higher Education in Developing Countries* where the term "Open Educational Resources" was adopted. More recently, the concept of Massive Open Online Courses (MOOC) has appeared and currently concentrates the attention of literature and media.

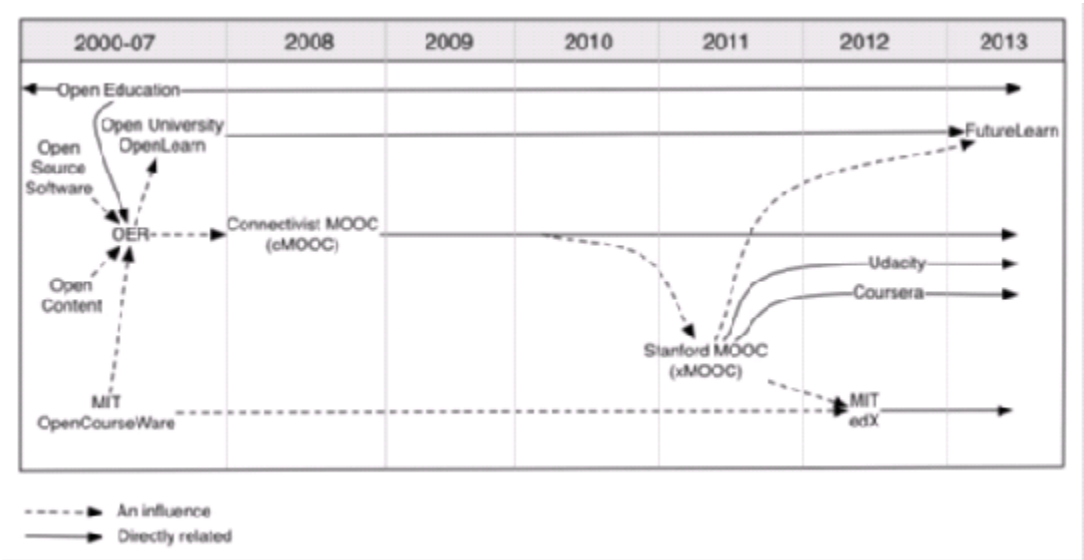


Figure 21: MOOCS and Open Education Timeline[189]

The European situation is evolving in a fast way. While this Staff Working Document is written several European universities have started to be engaged in MOOCs.

Example 14 - Norway

The Norwegian Government has appointed a Commission to look into MOOCs. The committee will survey the emergence of MOOCs and similar offers, compile data and make recommendations on how the Norwegian authorities and institutions shall relate to the development and the opportunities such education provides. The Committee shall submit an initial report by the end of 2013. The Committee has been given the task of compiling a more detailed report with specific recommendations in summer 2014.[190]

Example 15 - United Kingdom

***Futurelearn Ltd** (http://futurelearn.com/about) is an entirely new company launched by The Open University (OU) in December 2012. The universities of Birmingham, Bristol, Cardiff, East Anglia, Exeter, King's College London, Lancaster, Leeds, Southampton, St. Andrews and Warwick have all signed up to join Futurelearn, which is independent but majority-owned by the OU.*

Its aims are to (i) bring together a range of free, open online courses from leading UK universities, that will be clear, simple to use and accessible, (ii) draw on the OU's expertise in delivering distance learning and pioneering open education resources to underpin a unified, coherent offer from all of its partners, and (iii) to increase accessibility to higher education (HE) for students across the UK and in the rest of the world.

In May 2013 *Copenhagen University* has joined the still exclusive but quite rapidly growing group of European universities offering MOOCs, most of them through Coursera. *École Polytechnique Federale*, or EPFL, has been running successful MOOCs, notably in computer sciences and programming. It is with the EdX platform, launched in 2012 by the Massachusetts Institute of Technology and Harvard University. The University of Geneva is participating in Coursera. In *Spain*, IE Business School in Madrid and Autonomous University of Barcelona are participating in the Coursera consortium; in Italy it is La Sapienza in Rome; and in Germany the Technical University and Ludwig-Maximilian University, both in Munich. In the *United Kingdom*, the University of London and Edinburgh University are on the Coursera list. In *The Netherlands*, Leiden is participating in Coursera and the Delft University of Technology has joined the EdX platform (see box below).

Helsinki University developed and has been running several MOOCs in computer science on its own platform. Helsinki is also the only university that is giving credit for the computer language course SCALA. They has now established a master project "MOOCs COCKPIT" that will help lecturers assess how their course is progressing, handling large and complex data with various scripting and visualising techniques. Together with Technical University in Munich, Technical University Denmark and Technical University Eindhoven, EPFL has established the *EuroTechUniversity network* aimed at developing a series of ongoing MOOCs covering green technology and the life sciences, targeting professionals with first degrees who are seeking additional qualifications.

189 Yuan and Powell 2013

190 *http://www.regjeringen.no/nb/dep/kd/pressesenter/pressemeldinger/2013/utvalg-om-hoyere-utdanningstilbud-pa-net.html?id=731443*

And in the coming months several universities have announced more MOOCs (University of London , Munich's Maximilian University, Autonomous University of Barcelona, La Sapienza in Rome (IT), Edinburgh University (UK), Leiden University (NL), Catholic University of Leuven (BE), etc.

***EdX** - http://www.edx.org*

*EdX is a non-profit organisation started by Harvard University and MIT in 2012. Other universities have since joined, including **Delft University of Technology** and the University of California (Berkeley). The aim of edX is to provide university-level online courses free of charge for people all over the world. With Coursera and Udacity, edX is one of the best-known providers of MOOCs. What distinguishes edX from the other two is its aim of providing educational resources subject to a Creative Commons open licence, and of making edX a platform for experimentation with e-learning.*

***Coursera -** http://coursera.org*

Coursera is a for-profit enterprise started in 2012 by Daphne Koller and Andrew Ng of Stanford University. On their website, they describe Coursera as follows: "We are a social entrepreneurship company that partners with the top universities in the world to offer courses online for anyone to take, for free. We envision a future where the top universities are educating not only thousands of students, but millions. Our technology enables the best professors to teach tens or hundreds of thousands of students". Currently (June 2013), it offers 386 courses from more than 70 universities. All the courses are freely accessible, but the course material may not be freely reused by third parties. The revenue model for Coursera is based, amongst other things, on giving external parties paid access to student data, for example so that they can find the best candidate for a job vacancy.

The enormous interest in MOOCs comes exactly at the right time. Bricks-and-mortar campuses are unlikely to keep up with the demand for advanced education: according to a widely quoted calculation, the world would have to construct more than four new 30,000-student universities per week to accommodate the children who will reach enrolment age by 2025[191], let alone the millions of adults looking for further education or career training. Colleges and universities are also under tremendous financial pressure, especially in the United States, where rocketing tuition fees and ever-expanding student debt have resulted in a backlash from politicians, parents and students demanding to know what their money is going towards. MOOCs promise to solve these problems by radically expanding the reach of existing campuses while streamlining the workload for educators. European universities are using them to promote both centres of excellence and some of their most high-profile academics.

[191] *go.nature.com/mjuzhu*

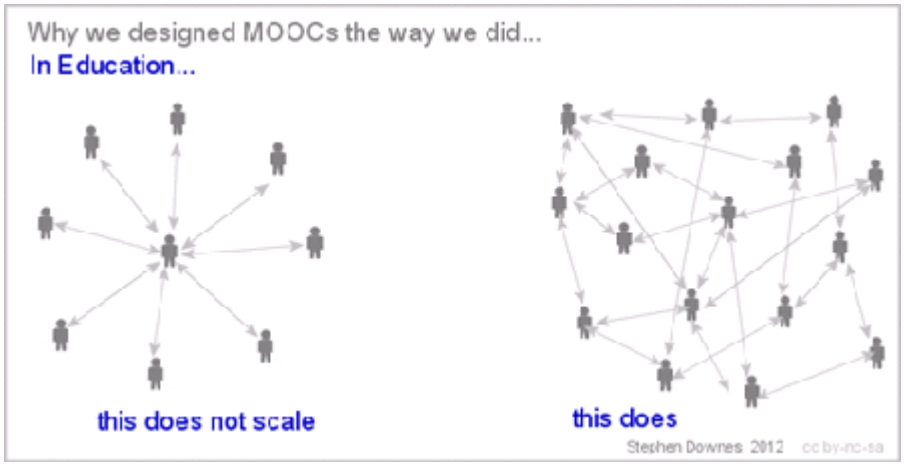


Figure 22: Downes' comparative diagrams of interaction in traditional and networked online education[192]

Despite these various initiatives launched by European universities, one can state that *Europe is still lagging behind and is trying to catch up with developments in other continents*[193]. While major worldwide universities are offering open courses (e.g. MIT, Harvard, the UK Open University), MOOCs are developing very fast[194] and the use of OER starts to be promoted at institutional and political levels[195].

Europe is only a follower of these emerging trends: in most European universities the emergence of MOOCs is not an issue of discussion in their institution as stated by 85% of respondents[196]. According to the EUA survey, the very concept of MMOCs is unknown in one third of the 200 European universities consulted and just another third has internally discussed the topic. These data are disappointing if compared with the explosion in the US, illustrated by Figure 23.

[192] Steven Downes in discussion on G+ Sept 19, 2012, *http://bit.ly/14mzWQx* and slide 6 in slideshare from Potsdam talk Oct 8, 2012 at *http://slidesha.re/SJ43zx*

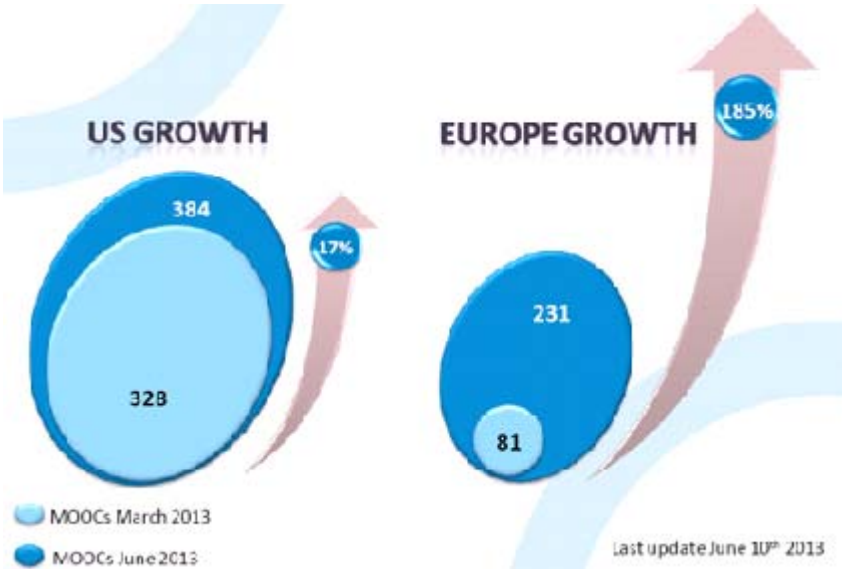
[193] Trend Report SURF 2013

[194] Lewin 2012

[195] See for instance: Attwood, R. (2011). California is an example of State promoting OER in public colleges, partly due to its financial crisis, *http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201120120SB1053*

[196] *http://www.eua.be/news/13-02-25/Massive_Open_Online_Courses_MOOCs_EUA_to_look_at_development_of_MOOCs_and_trends_in_innovative_learning.aspx*

Figure 23: MOOCs in Europe[197]



According to Gartner's MOOC Hype Cycle[198] (Figure 24), almost the peak of the initial hype has been reached: platforms have been created, masses of MOOCs are being offered, certification systems are being put into place, and the list of applications is growing. But this does not mean that full exploitation and large scale implementation of OER in education has taken place. Such peaks, according to Gartner, are often followed by several years of disillusionment and maturity, a phase of correcting the innovation's weaknesses, meeting challenges in order to produce a better product, and fine-tuning business models. Only after several years is the product fully mature and truly mainstream.

Most MOOC start-ups do not appear to have clear business plans and are following the common approach of Silicon Valley start-ups by building fast and worrying about revenue streams later[199]. Hill[200] describes a similar cycle: he believes that after their initial success, the current systems will have to resolve a number of urgent questions concerning their "revenue models, credentialing, badges or accreditation, course completion rates, and student authentication" before they can evolve. It is a mistake to see MOOCs as an isolated issue as they are part of a broader landscape of changes in HE that includes the development of open education improving teaching and opening up to different groups of students.

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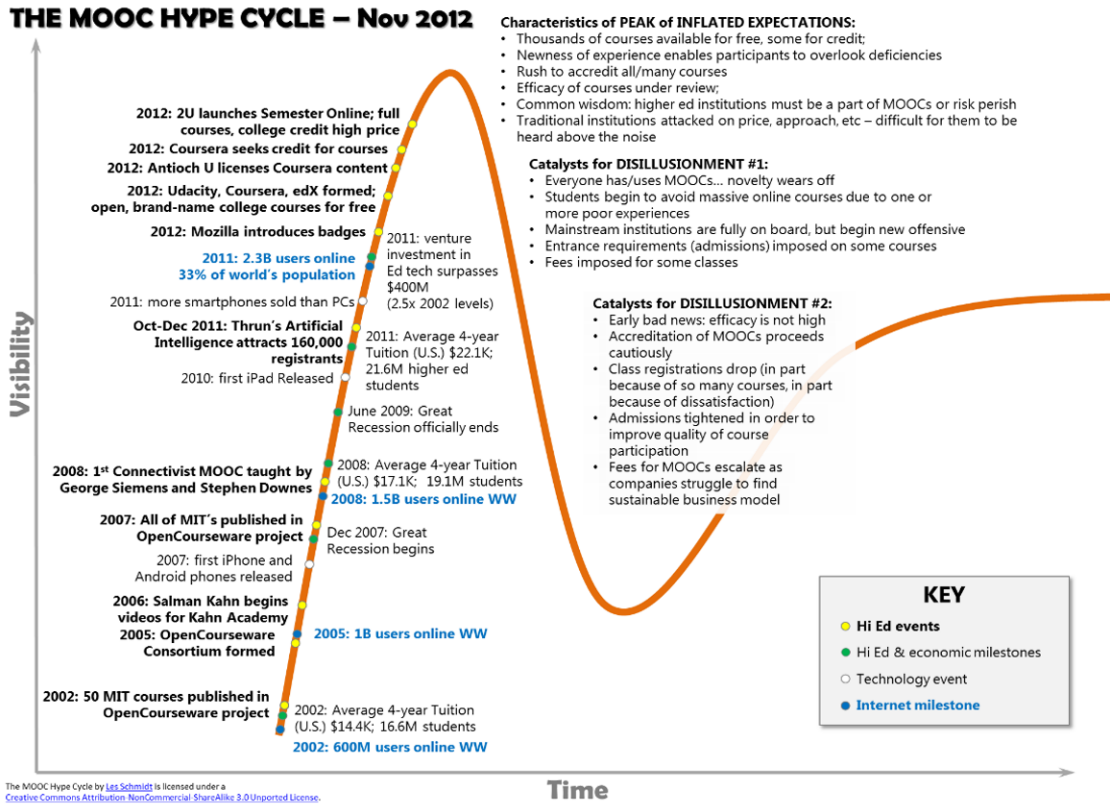
198 Gartner 2012, the information technology research firm, has applied its Hype Cycle graphic to myriad emerging technologies since 1995, using it as a "representation of the maturity and adoption of technologies - *http://www.gartner.com/technology/research/methodologies/hype-cycle.jsp*

199 Li Yuan & S. Powell 2013

200 Hill 2012: Educause Review Online

Figure 24: The MOOC Hype Cycle[201]



4.6. Large-scale platforms for open education

To enhance the use, re-use and sharing of educational resources several projects are trying out to link up the diverse OER repositories and portals towards a European-wide platform.

School education

The Learning Resource Exchange is a federated access platform operating since 2008 and is run by European Schoolnet with the support of Ministries of Education. It provides an EU-wide platform and incorporates resources from over 50 content providers across Europe into its search results, thereby providing access to more than 200,000 resources. The LREs business model is to operate not as a centralised access platform but to provide a federated search architecture to which national repositories can link into. This allows users to access the search results via national websites or even a school's virtual learning environment. While on the one hand this is a key strength of the project as it provides EU-wide access from portals already familiar to the teacher, it is also, possibly, its greatest weakness. As teachers access the Exchange not via a centralised platform, limited "community building" in the form of sharing and collaboration has occurred. This might explain the relatively low numbers of users of the Exchange.

Similar projects such as the OER directory currently under development at the eLearning Portal or the Open Discovery Space project (ODS) try to address these issues by focussing on a stronger integration with communities of users. Especially the ODS project incorporates a strong element of social networking of teachers in order to build a strong foundation for sharing resources. However, in the context of the scope of the challenge, these projects are only able to reach a certain number of teachers

[201] Les Schmidt 2012, *http://www.moocologist.com/wp-content/uploads/2013/02/MOOC_HypeCycle_12111.png*

and learners. Therefore, the problem of a highly fragmented market for OERs is currently not sufficiently addressed.

Higher Education

Recently, there are several voices for a coordinated European platform to run MOOCs. The European Association of Distance Teaching Universities set up a European MOOC platform and SAP set up the Academic Cube, an online education platform with MOOCS for ICT professionals.

Partners in 11 countries have joined forces to launch the first pan-European MOOC initiative, with the support of the European Commission. Around 40 courses, covering a wide variety of subjects, will be available free of charge and in 12 different languages in the portal www.OpenupEd.eu, officially launched on 25 April 2013. The initiative is led by the European Association of Distance Teaching Universities (EADTU) and mostly involves open universities based in France, Italy, Lithuania, the Netherlands, Portugal, Slovakia, Spain, UK, Russia, Turkey and Israel.[202]

Courses range from mathematics to economics, e-skills to e-commerce, climate change to cultural heritage, corporate social responsibility to the modern Middle East, and language learning to writing fiction. Each partner is offering courses via its learning platform and at least in its home language. Courses can be taken either in a scheduled period of time or anytime at the student's own pace. All courses may lead to recognition: a completion certificate, a so-called badge, or a credit certificate that may count towards a degree. In the latter case, students have to pay for the certificate, with the cost ranging from € 25 to € 400, depending on the course size (the hours of study involved) and institution.

Academy Cube, which launched March 2013 an online education platform under development by SAP, a world-leading German software company headquartered, with offices in some 130 countries. Academy Cube is supported by the European Commission Digital Agenda programme and its objective is to tackle youth unemployment by providing jobless youngsters with IT skills via learning management systems. It is being developed by SAP with Microsoft, LinkedIn, Software AC, Thyssen Krupp, the German Federal Employment Agency and academic institutions, and they are discussing MOOC operations with the European Institute of Technology's EIT IT-LAB, which is a high-priority European 'knowledge and innovation community'.

EU eLearning portal[203] *(http://elearningeuropa.info)*

The portal was created by the European Commission in 2002. It functions as a single point of reference for eLearning activities and resources in Europe, a European platform for co-operation, disseminating good and innovative practices, providing possibilities for debate and exchange.

It offers a common space for practitioners, policy-makers and members of academia, and serves as a reference gateway where top experts in the field identify and communicate about new trends. In 2012, the portal had more than 62,000 visits per month.

The portal shows many success stories, networks and centres of excellence in Europe upon which innovative strategies can be built to transform learning methods and boost creativity in schools, enterprises and society at large. The portal's scholarly online publication 'eLearning Papers' is rated the world's #1 journal in the field of ICT and learning.

[202] *www.openuped.eu, www.eadtu.eu*

[203] P.a.u. education 2013: Hosting, management, promotion and maintenance of the European Commission's internet portal on eLearning and prepare its translation to an Open Education Portal

5. CONCLUDING REMARKS: CONDITIONS FOR SUSTAINABILITY, SCALABILITY AND IMPACT[204]

Highlights

In order to overcome the existing implementation gap on the use of new technologies and open educational resources in Europe, the evidence calls for urgent action on the various underpinning conditions and this on all levels of policy making and practices, local, regional, national and European-wide.

Based on the evidence base and best practices provided in this Staff Working Document, several conditions for successful uptake of ICT in education have been identified.

While clearly more research is needed on how we can develop, sustain, and further implement the existing initiatives of ICT-enabled innovation for learning, the best practices examples of the former chapter provide some ideas on possible conditions for sustained and scalable impact on learning to realise the potentials of ICT to support learning.

Eight main conditions enhancing mainstreaming of ICT use in education in terms of an innovation process have been identified:

1. Whole system approach: Successful scaling up and uptake of the use of new technologies and OER in education only takes place if it looks into learning and teaching taking a holistic and whole system approach whereby common vision, strategies and agenda is being defined and agreed upon by all stakeholders and all dimensions in the learning and teaching processes are touched upon (from content and resources, curricula, learning and teaching strategies; assessment, learning outcomes, etc.). Successful uptake is thus context-dependent and there is not just one-size-fits-all approach.

2. Organic development over time: Most of these practices of ICT-enabled learning innovations started as incremental efforts from a single pilot in one classroom, in a single school, to networks of schools across countries, etc., and progressively moved towards more radical forms of innovation, indicating that these initiatives have developed organically over time. The characteristics of these initiatives as well as their respective change strategies have evolved through interactions among the various actors and the many contextual factors. Their successes are clearly not a consequence of blueprints, but rather that dynamic adaptations and adjustments were continuously developed and implemented as an integral part of the monitoring, evaluation and feedback cycles, which is consistent with an ecological model of change.

3. An articulated educational vision and roadmap: Successful scaling up only happens when the use of new technologies and OER is linked to a clearly articulated educational objective improving access, quality, and efficiency of education. A well-articulated innovation agenda and accompanying roadmap of implementation (business plan) should be developed by each educational organisation -

[204] This section is largely based on input from the following IPTS reports: IPTS 2013 ICT-enabled innovation for learning in Europe and Asia. Exploring conditions for sustainability, scalability and impact at system level. JRC Scientific and Policy Reports, in collaboration with Centre for Information Technology in Education (CITE), University of Hong Kong. EUR; JRC83503**,** *http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=6362*; IPTS 2013 Mainstreaming ICT-enabled innovation in Education and Training in Europe. Policy actions for sustainability, scalability and impact at system level. JRC Scientific and Policy Reports. EUR; JRC83502, *http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=6361*

which has both long-term vision (ensuring policy support) and achievable short term goals for the progressive take up of innovation.

4. Top-down and bottom-up should meet: Another common characteristic of these practices is that while most of these started as top-down initiatives within their respective contexts, they all have mechanisms in place to encourage and support bottom-up approaches to the innovation. While learning innovations may be initiated even at the classroom level by the teacher, impact at scale cannot be achieved without some higher level support as such innovations inevitably impinges on curriculum and assessment practices and requires access to technology infrastructure and support. One of the core conditions crucial to the scalable success of these initiatives is the deployment of top-down strategies to support bottom-up innovations. The presence and multiplicity of bottom-up strategies, whether centralized or decentralized, are indications of ownership from the bottom-up stakeholders. The challenge is to ensure that bottom-up innovations are well-aligned with the top-level goals and strategic focus of the entire project and not become as run-away developments that go off in many diverse different ways which may even be counter to the overall objectives. To ensure constructive alignment in strategic direction across the multiple levels and stakeholder groups, connectivity mechanisms and structures to serve as architectures for learning become another key strategic direction that needs to be considered.[205]

5. Develop support structures at a larger scale: Up scaling and integration of the use of new technologies and OER in education is not a matter of just multiplying the number of small scale pilots. One has to facilitate the five steps of up scaling by Clarke & Dede[206] by specific support structures, such as:

- large (cross-regional, cross-national) network of 'living schools' demonstrating and showcasing a diverse range of innovative pedagogical practice involving ICT and sharing best practice and ways to successfully embed the use of technology in teaching and learning across the whole school:
- structures to encourage the development of professional networks for peer learning, knowledge exchange and sharing innovative pedagogical best practices.
- structures (such as national and/or transnational inter-linked portals; common reference frameworks; etc.) to aggregate all learning opportunities on a larger scale (national and even European and world-wide).

6. Empowering all stakeholders to collaborate and exchange knowledge: Research reveals that successful scaling up and uptake of the use of new technologies and OER in education only takes place if there is organized support to foster connectedness[207] across and within different levels of stakeholders involved in the innovations to build trust, assure mutual objectives, and create a common vision.[208] Communication channels and platforms should be built to foster dialogue, communication and collaboration between all stakeholders (from policy, industry, research, educational practice and the wider public) involved and engaged in the educational process.

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[205] Law, Yuen & Fox 2011: Educational Innovations Beyond Technology: nurturing leadership and establishing learning organizations. New York: Springer

[206] Clarke & Dede, 2009: Design for Scalability: A Case Study of the River City Curriculum. Journal of Science Education and Technology, *18*(4), 353–365.

[207] Connectedness refers to the social and emotional factors that profoundly affect the relationships among members of a learning institution and that have a significant impact on their level of engagement and motivation. See IPTS 2012 Innovating Learning: Key Elements for Developing Creative Classrooms in Europe, JRC Scientific and Policy Reports, EUR 25446. *http://ftp.jrc.es/EURdoc/JRC72278.pdf*

[208] IPTS 2013: ICT-enabled innovation for learning in Europe and Asia - Exploring conditions for sustainability, scalability and impact at system level, by Kampylis, Law & Punie, JRC Scientific and Policy Reports, in collaboration with Centre for Information Technology in Education (CITE), University of Hong Kong, EUR: JRC83503**,** *http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=6362*

7. Elaborate the evidence base: Only when the use of new technologies and OER are felt and proven to have an added-value to the learning and teaching process, it will move towards a stage of full uptake. The evidence base has to be continuously enlarged, updated and communicated to the stakeholders.

8. Technologies as an important pre-condition: All the best practices have moved away from a technology-centric approach but still keep on investing in technologies, infrastructures and equipment as an underlying condition enhancing online learning. Despite the fact that broadband and extended Wi-Fi connections are still a concern in most of the EU countries and should be enlarged to ensure access and equity, the key technology is now becoming cloud computing with a focus on openness and connectedness.

To conclude: Based on the extensive analysis of the state of play of the use of ICT and OER in Europe, in-depth best practice cases at regional, national and European level and the possible conditions for successful mainstreaming of ICT and OER use, Europe has to take urgent action. Therefore ***the European Commission will propose a new EU-wide agenda for opening up education through new technologies and open educational resources.***

LIST OF ACRONYMS

ADSL:	Asymmetric Digital Subscriber Line
BESA:	British Educational Suppliers Association
CC:	Creative Commons Licences
CEDEFOP:	Centre Européen pour le Développement de la Formation Professionnelle (European Centre for the Development of Vocational Training)
DG CNECT:	Directorate General for Communications Networks, Content and Technology
DG EAC:	Directorate General for Education and Culture
E&T:	Education and Training
EACEA:	Education, Audiovisual and Culture Executive Agency
EC:	European Commission
ESF:	European Social Fund
EU:	European Union
FP7:	European Union's Seventh Framework Programme' for Research and Technological Development
HE:	Higher Education
ICT:	Information and Communication Technologies
IFPI:	International Federation of the Phonographic Industry
IMS	IMS Global Learning Consortium, originally (1997) from "Instructional Management Systems"
IPR:	Intellectual Property Rights
JRC-IPTS:	Joint Research Centre – Institute for Prospective Technological Studies
LLP:	Life Long Learning Programme
MIT:	Massachusetts Institute of Technology
MOOC:	Massive Open Online Courses
NGO:	Non-governmental Organisation
OA:	Open Access
OCW:	Open Courseware
OECD:	Organisation for Economic Co-operation and Development
OEP:	Open Educational Practices
OER:	Open Educational Resources
OMC:	Open Method of Coordination
OPAL:	Open Education Quality Initiative
PC:	Personal Computer

PIAAC:	Programme for the International Assessment of Adult Competencies
PISA:	Programme for International Student Assessment
R&D:	Research and Development
SCORM	Sharable Content Object Reference Model
SIF	Systems Interoperability Framework
TIMSS:	Trends in International Mathematics and Science Study
UK:	United Kingdom
UNESCO:	United Nations Educational, Scientific and Cultural Organization
US:	United States
VET:	Vocational Education and Training
VLE:	Virtual Learning Environment

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