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Mainstreaming ICT-enabled Innovation in Education and Training in Europe

Policy actions for sustainability, scalability and impact at system level

Barbara N. Brečko, Panagiotis Kampylis & Yves Punie

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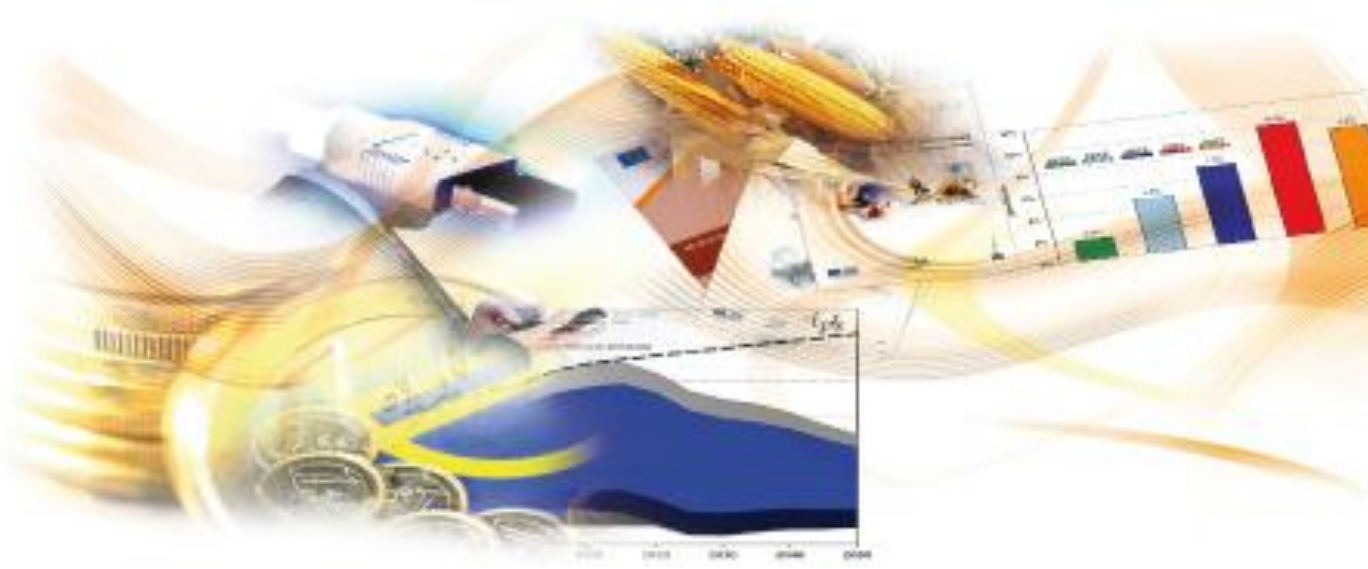

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Preface

The Europe 2020 strategy acknowledges that a fundamental transformation of education and training is needed to address the new skills and competences that will be required, if Europe is to remain competitive, overcome the current economic crisis and grasp new opportunities. Innovating in education and training is a key priority in several flagship initiatives of the Europe 2020 strategy, i.e. the Agenda for New Skills and Jobs, Youth on the Move, the Digital Agenda, and the Innovation Union Agenda, and also in the latest EC Communication on 'Opening up education'. Accordingly, one of the five targets for measuring the success of the Europe 2020 strategy is the modernisation of European Education and Training systems with the goals of reducing early school leaving and increasing tertiary education attainment.

Policy-makers and educational stakeholders recognise the contribution of ICT to achieving these targets, and more broadly, the role of ICT as a key enabler of innovation and creativity in Education and Training (E&T) and for learning in general. It is however also highlighted that the full potential of ICT is not being realised in formal education settings and major questions are being asked about the sustainability, impact, costs and mainstreaming of *ICT-enabled learning innovations* (ICT-ELI) in Europe.

This report is part of the project "Up-scaling Creative Classrooms in Europe" (SCALE CCR) launched by the Information Society Unit at JRC-IPTS[1] in December 2011 and completed in June 2013 on behalf of the Directorate-General Education and Culture (DG EAC). The project aimed to provide a better understanding of ICT-ELI that has significant scale and/or systemic impact and to propose recommendations for their sustainable development and mainstreaming across Europe.

This report presents a set of policy recommendations developed through a mixed-research approach involving around 300 educational stakeholders. These recommendations could guide different trajectories of scaling up and progressively mainstreaming ICT-ELI in different contexts and stimulate further research in the field, contributing to the momentum for modernizing Education and Training systems in Europe and beyond.

More information on the SCALE CCR project and links to the related publications can be found on the project webpage: http://is.jrc.ec.europa.eu/pages/EAP/SCALECCR.html

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Project Leader ICT for Learning and Skills

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

Acknowledgements

The authors of this report would like to thank Ana Carla Pereira, Godelieve Van den Brande and Jesus Maria Alquezar-Sabadie from the Directorate General Education and Culture (DG EAC), for their ongoing support and feedback throughout the entire SCALE CCR project. We also thank the members of the DG EAC Thematic Working Group on ICT and Education for providing valuable insights at various stages of the project.

We thank the participants of the expert workshops held in Seville (December 2012) and Hong Kong (January 2013), in which the preliminary results of the SCALE CCR project were presented and discussions about the further development and mainstreaming of ICT-ELI were conducted (list of participants is in the Annex 2). The authors are grateful to Professor Nancy Law (University of Hong Kong) for organizing the expert workshop in Hong Kong, for her contribution to the in-depth analysis of the seven cases of ICT-enabled learning innovations from Asia and Europe and for her input to the development of the policy recommendations.

Our special thanks go to the seven experts who were interviewed for the elaboration of the recommendations for policy actions: Ola Erstad (University of Oslo), Paul Kelley (Science+Technology in Learning), Marco Kools (OECD- CERI), Anne Looney (Irish National Council for Curriculum and Assessment), Irene Pateraki (Greek eTwinning National Support Service), Helle-Kirstine Petersen (Hellerup School), and Riina Vuorikari (e-Learning expert).

We are especially grateful to the 149 educational stakeholders who participated in the online consultation to validate and prioritize the proposed recommendations, and to identify crucial factors for the further development and sustainable mainstreaming of ICT-enabled innovation in Education and Training in Europe and beyond.

The authors would also like to thank Stefania Bocconi (Institute for Educational Technology of the Italian National Research Council) for her feedback on early versions of this report and Ioannis Antonopoulos (JRC-IPTS) and Jean-Baptiste Herbout (JRC-A01) for the content reviews of the final version of the report.

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Executive Summary

Education is considered to be one of the most important factors for ensuring competitiveness and prosperity in the age of globalisation and nations around the globe are striving to modernise their Education and Training (E&T) systems to keep pace with the digital economy and society. In order to modernise E&T systems, true ICT-enabled learning innovations (ICT-ELI) are needed that improve significantly upon the status quo and achieve scale and systemic impact. Large-scale pilots in real-life environments have been conducted in the E&T context in many countries in Europe and other world regions to speed up the transfer of innovation research into educational practice. However, success in initiating change does not guarantee that such changes can be sustained over time and only a few ICT-ELI manage to survive beyond the early adopter stage and become fully embedded in educational practice. As a result, although the infrastructure to mainstream ICT-ELI and a sound research base to guide the process are widely available, the full potential of new technologies is not being realised in formal education settings across Europe.

The purpose of this report is to present a comprehensive set of policy action recommendations that would help to further develop and mainstream ICT-ELI across Europe. These recommendations were developed through a mixed-research approach and validated through an online consultation with a variety of educational stakeholders. In particular, 149 educational stakeholders evaluated a set of 60 policy recommendations.

This set of 60 recommendations was developed during the 'Up-Scaling Creative Classrooms in Europe' (SCALE CCR) project and based on several consultations (two expert workshops and seven in-depth expert interviews) and evaluations (thematic analyses, internal discussion, DG EAC Thematic Working Group on ICT and Education).

Deriving from the SCALE CCR multi-dimensional concept (Bocconi, Kampylis, & Punie, 2012), the recommendations were clustered into the seven areas presenting a holistic agenda for education reform. In the following table, the seven policy action areas are presented with a mean value according to the relevance (on scale from 1-7) and the percentage of respondents who evaluated each area the highest (value 6 and 7).

Area	mean	%
School staff professional development	5.98	61.1
Infrastructure	5.88	60.8
Assessment	5.71	56.1
Organisation and leadership	5.65	47.8
Connectedness	5.58	45.4
Content and curricula	5.52	39.2
Research	5.52	37.2

As the above table shows, the areas that were perceived as the most relevant for mainstreaming ICT-ELI across Europe were *School Staff Professional Development*, *Infrastructure* and *Assessment*. Nevertheless, the seven areas are very much interrelated - change in one area requires change in others, too. Therefore, for successful further development and mainstreaming of ICT-ELI, recommendations from all areas should be addressed simultaneously.

Below the most important recommendations within each area are presented. Finally, at the end of this summary, the top ten recommendations (from different areas) that were evaluated as the most relevant for mainstreaming ICT-ELI across Europe are listed.

Content and curricula

Changing curricula has received a lot of attention in many European countries – it has been recognised as very important to keep curricula relevant in changing times. Policy should:

- Promote through the curricula innovative pedagogical practices made possible by the use of ICT;

- Support curriculum development that allows teachers to work in small autonomous and interdisciplinary teams;
- Ensure coherence between the curriculum and assessment.

Assessment

The need to revise current assessment practices is linked to curriculum reforms. It is recommended that assessment of key competences and self-assessment should be aligned with a curriculum using innovative pedagogical approaches. Policy should:

- Encourage a shift of ownership of assessment from teachers to learners;
- Revise examination systems in order to include also assessment of key competences and 21st century skills;
- Promote a formative assessment paradigm.

School staff professional development

Teachers are key agents for change and the importance of professional development has been emphasized. School Staff Professional Development relates to several other areas (e.g. Organisation and leadership, Connectedness, Infrastructure…). There is a great need to support and motivate teachers to acquire key competences and be active lifelong learners. Policy should:

- Invest significantly in updating Continuous Professional Development provisions;
- Support and motivate teachers to develop and update their digital competence and ICT skills;
- Recognize the role of teachers as agents of change.

Research

Research has an important contribution to make in developing and mainstreaming ICT-ELI. Constant monitoring and evaluation are needed to understand success and failure factors. Policy should:

- Encourage research on the implementation process of ICT-ELI;
- Support the application of various research methods to the study of complex 'ecosystems' of ICT-ELI;
- Promote research on micro-level ICT-ELI.

Organisation and leadership

Organisation and leadership is the area with the highest number of policy recommendations to the micro-, meso- and macro-level. It is a transversal area, highly related to others. Policy should:

- Encourage knowledge exchange on how innovative practices are made possible by the use of ICT;
- Create organisational structures to support and motivate teachers to participate in professional networks, disseminating pedagogical innovation;
- Encourage the development of a 'culture of innovation' at system level;
- Develop long-term strategies to develop the capacity of school leaders to adopt new methods of leadership that allow ICT-ELI to flourish.

Connectedness

Teachers and learners need to be empowered to connect with other people and ideas in order to open up and broaden the learning experience. This can be done via small networks of schools and small networks of teachers. Policy should:

- Encourage the development of small networks of schools (i.e. up to 10 schools);
- Support the development of small teacher networks;
- Invest in structures, such as national and/or transnational inter-linked portals.

Infrastructure

Distribution of infrastructure varies a lot between and within countries. Infrastructure is also highly related to other areas, such as School Staff Professional Development and Connectedness. There is still a need to narrow digital divides and policy should:

- Ensure that all learners have equal and ubiquitous ICT access, in and out of school;

- Increase efforts and investment in ICT infrastructure of appropriate performance and interoperability;
- (Re)design and/or (re)arrange physical space and infrastructure to enable innovative teaching and learning practices.

Top 10 recommendations

Recommendation 1 - *School staff professional development area*

Invest significantly in updating Continuous Professional Development provisions (including the education of teacher trainers) to ensure that in-service teachers acquire the key competences required for fostering and orchestrating learning instead of transmitting knowledge.

Recommendation 2 - *School staff professional development area*

Support and motivate teachers to develop and update their digital competence and ICT skills (e.g. through in-service training, peer-learning and informal and non-formal learning), as lifelong learners themselves.

Recommendation 3 – *Infrastructure area*

Ensure that all learners have equal and ubiquitous ICT access, in and out of school.

Recommendation 4 - *School staff professional development area*

Enable teachers to develop their ability to adopt and adapt innovative pedagogical practices (e.g. formative assessment) for diverse learning settings and purposes.

Recommendation 5 - *Organisation and leadership area*

Support knowledge exchange (e.g. through participation in national/international conferences and workshops) to gain a further understanding of how innovative practices are made possible by the use of ICT.

Recommendation 6 - *Organisation and leadership area*

Create organisational structures (e.g. formal recognition and informal reputation mechanisms, technical support, pedagogical advice, etc.) to support and motivate teachers to participate in professional networks, disseminating pedagogical innovation.

Recommendation 7 - *School staff professional development area*

Recognize the role of teachers as agents of change (rather than objects of change) and encourage them to take ownership of innovation (teacher-led innovation).

Recommendation 8 - *School staff professional development area*

Update initial teacher training (including the candidate admission process) to ensure that prospective teachers acquire the key competences required for their role as agents of change.

Recommendation 9 - *Organisation and leadership area*

Encourage the development of a 'culture of innovation' at system level, removing the fear of change and supporting decision-makers, teachers, and other stakeholders when taking sensible risks and trying new things.

Recommendation 10 – *Research area*

Encourage research on the implementation process of ICT-ELI, focusing on the possible learning gains.

1. Introduction

1.1 Background and context

Educational stakeholders recognize ICTs as key enablers of innovation and creativity in Education and Training (E&T) systems and for learning in general. Throughout Europe, there are diverse national policies for ICT in education and many activities are undertaken to promote the use of technology in Education and Training systems. Innovating in E&T is also a key priority in several flagships of the Europe 2020 Strategy (European Commission, 2010), such as the Agenda for New Skills and Jobs, Youth on the Move, the Digital Agenda, and the Innovation Agenda, and also emphasised to the European Commission's recent Communication on 'Opening up education' and its supporting documents (European Commission, 2013a).

However, there is still an implementation gap in formal education settings, which is reported in several surveys and studies (e.g. Eurydice, 2011; Kampylis, Law, et al., 2013; OECD, 2013a; b). These surveys and studies also highlight that, although the infrastructure to promote ICT use for learning and a sound research base to guide the process are widely available, the full potential of ICT is not being realised in formal education settings. Hence, the majority of schools in Europe and beyond are not reaping the benefits of new technologies as enablers to modernize teaching and learning practices.

In order to modernise E&T systems, true ICT-enabled learning innovations (ICT-ELI[2]) are needed that improve significantly upon the status quo and achieve scale and systemic impact. Large-scale pilots in real-life environments have been conducted in the E&T context in many countries in Europe and other world regions to speed up the transfer of innovation research into educational practice. However, success in initiating change does not guarantee that such changes can be sustained over time and only a few ICT-ELI manage to survive beyond the early adopter stage and become fully embedded in educational practice.

The purpose of this report is to present a comprehensive set of policy action recommendations that would help in further developing and mainstreaming ICT-ELI across Europe. These recommendations were developed through a mixed-research approach and validated and prioritised through an online consultation with educational stakeholders who are involved in a wide diversity of contexts, scales and levels of educational innovation in Europe and beyond**.**

1.2 Scope of the report

The project 'Up-Scaling Creative Classrooms in Europe' (SCALE CCR),[3] which was launched by the Information Society Unit at IPTS in December 2011 on behalf of the Directorate General Education and Culture (DG EAC), aimed to bring evidence to the debate about the mainstreaming of ICT-ELI, contributing to the Europe 2020 strategy to modernize Education and Training across Europe.

In particular, the main objectives of the SCALE CCR project as a whole were to:

- define and classify *ICT-enabled learning innovations*[4] across a range of settings and participants, including groups of learners and teachers[5] at system level, both within and outside formal education settings;
- develop the concept of *Creative Classrooms*[6] (CCR) and the related reference parameters that are key to effectively integrating new technologies for learning and scaling up ICT-ELI;

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2 ICT-ELI will be used as an abbreviation of *ICT-enabled learning innovations* throughout this report.

3 http://is.jrc.ec.europa.eu/pages/EAP/SCALECCR.html

4 In the context of SCALE CCR study, and also in this report, the term *ICT-enabled learning innovations* is used to mean profoundly new ways of using and creating information and knowledge made possible by the use of ICT, dealing with both formal and informal learning in school settings and in adult education.

5 The term *teachers* is used in this report in its broadest sense as meaning teachers, trainers, head teachers, librarians, IT coordinators and other professionals involved in Education and Training systems.

- identify and analyse the implementation strategies of a number of effective ICT-ELI in order to bring to the surface commonalities of purpose, scope and conditions for sustained impact at system level;
- support DG EAC in establishing an extensive dialogue on CCR with multiple key stakeholders; and
- propose concrete policy recommendations for the further development and sustainable mainstreaming of ICT-ELI in Education and Training (E&T) across Europe.

Built on work undertaken in previous phases of the SCALE CCR project (Bocconi et al., 2012; Bocconi, Kampylis, & Punie, 2013b, 2013c; Kampylis, Bocconi, & Punie, 2012; Kampylis, Law, et al., 2013) and on findings from the online stakeholder consultation, this report presents a comprehensive set of recommendations for policy actions to further develop and mainstream ICT-ELI in Europe and beyond.

1.3 Structure and contents of the report

As outlined above, one of the key objectives of the SCALE CCR project has been to develop a set of policy recommendations for mainstreaming ICT-ELI across Europe.

In particular, the report is organized as follows:

- Following the Introduction, Chapter 2 outlines the research approach used for developing, validating and prioritising policy recommendations for mainstreaming ICT-ELI.
- Chapter 3 presents the policy recommendations clustered in seven areas: Content and Curricula; Assessment; School Staff Professional Development; Research; Organisation; Connectedness; and Infrastructure.
- Chapter 4 draws general conclusions on the policy recommendations.
- Finally, Annex 1 provides the questionnaire used in the online survey, which aimed to validate and prioritise the policy recommendations. Annex 2 lists the participants of the two expert workshops held in Seville and Hong Kong. Annex 3 provides the statistical analyses of the recommendations according to four respondents' groups – teachers; researchers; policy- and decision-makers; and others.

[6] *Creative Classrooms* can be defined as innovative learning environments that fully embed the potential of ICT to modernise learning and teaching practices. *Creative* refers to innovative practices, such as collaboration and personalisation, whereas the term *Classrooms* is considered in its largest sense as including all types of learning environments, in formal and informal settings.

2. Research approach

The development of a comprehensive set of policy action recommendations for mainstreaming ICT-ELI in Europe was the final objective of SCALE CCR project. To achieve this objective, a multi-level and non-linear research approach was followed, which was organised over three main phases: the development of the initial set of recommendations, drawn from the results of the earlier steps of the SCALE CCR project; the development of the final set of recommendations; and the validation and prioritisation of the proposed set of policy recommendations through an online consultation with educational stakeholders (Figure 1).

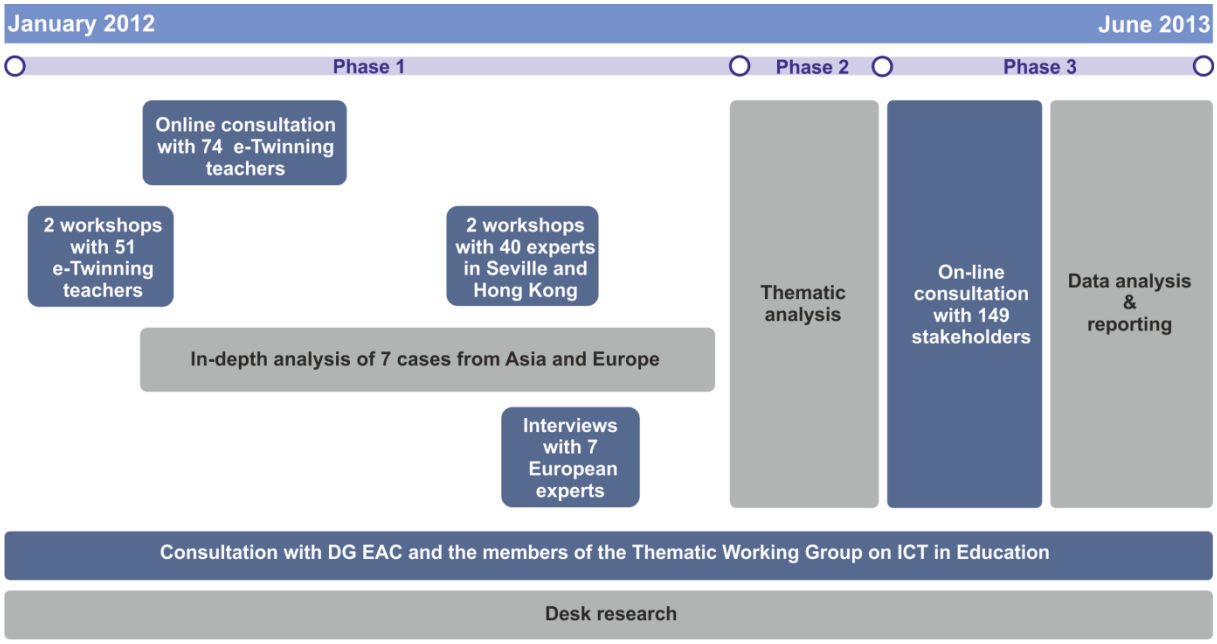

Figure 1: The three phases of the development of ICT-ELI policy recommendations

2.1 Research phase 1: Developing the initial set of recommendations

The aim of the desk research, which was carried out throughout the SCALE CCR project, was (i) to review existing EU and national policies related to ICT-ELI with significant scale and/or impact and (ii) to identify and analyse enablers and barriers for their further development and up-take. Data collection and content analysis covered a wide range of materials such as journals and conference papers; book chapters; technical, evaluation and policy reports; specialist press; portals, websites, blogs and wikis; promotional literature; video clips; and slideshow presentations.

In parallel, a number of consultation rounds with key educational stakeholders (policy- and decision-makers, teachers, researchers, IT developers etc.) were conducted to provide first-hand experiences of learning innovations and inputs from real settings for the development of policy recommendations. In particular, 2 workshops with eTwinning teachers were organized during the eTwinning Conference 2012 in Berlin and an online survey with 74 eTwinning teachers who took part in a webinar was organized by the eTwinning Creative Classrooms Group.[7] Findings from the workshops and the responses to the open-ended items of the online survey were included in the development of the policy recommendations.

In addition, the in-depth analysis of seven cases from Europe and Asia were conducted (Kampylis, Law, et al., 2013) and two expert workshops were organised (one in Seville, December 2012, and one in Hong Kong, in January 2013) offering valuable insights and evidence on effective policies

[7] http://groups.etwinning.net/web/creative-classroom/welcome

and implementation strategies of effective ICT-ELI with significant scale and/or impact at system level and recommendations for their scaling-up.

Seven semi-structured interviews with European experts and practitioners were conducted to further develop the initial set of policy recommendations for mainstreaming ICT-ELI with sustained and systemic impact. Interviews were appropriately documented by the SCALE CCR research team in the form of short written summaries.

Last but not least, there was continuous consultation with stakeholders in DG EAC and the members of the DG EAC Thematic Working Group on ICT and Education, who provided valuable insights and feedback for the development of the initial set of policy recommendations.

2.2 Research phase 2: Developing the final set of recommendations

Following the aforementioned procedure, a set of qualitative data was developed including case reports, workshop findings and conclusions, interview summaries, open items of online surveys etc.

Thematic analysis (Boyatzis, 1998) was used to code and analyse the qualitative data to develop a set of policy recommendations for sustaining and scaling up educational innovations at local, regional, national, and European level. Thematic analysis goes beyond simply counting phrases or words in a text and moves on to identifying, analysing and reporting implicit and explicit patterns (themes) within the data (Braun & Clarke, 2006). In the present study, thematic analysis was used to transcribe qualitative data; generate initial codes; search for themes (i.e. recommendations); review themes; and refine and merge themes. The thematic analysis resulted in an initial set of 100 policy recommendations.

Next, an internal procedure was undertaken by the SCALE CCR research team to conduct a clustering and further reduction of the recommendations. As the framework for clustering the recommendations in key areas of policy actions, the CCR multi-dimensional concept was used (Bocconi, Kampylis, & Punie, 2013a). The outcome of this exercise was the final set of 60 recommendations, clustered in 7 areas: Content and Curricula; Assessment; School Staff Professional Development; Research; Organisation and Leadership; Connectedness; and Infrastructure (Figure 2).

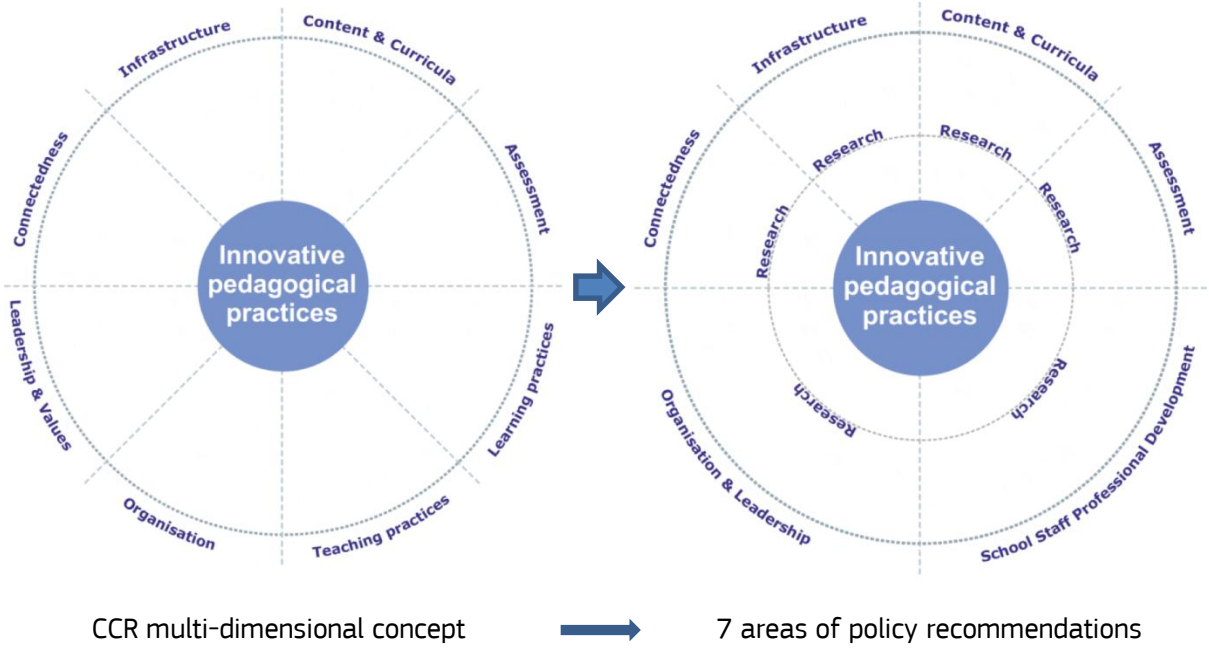

Figure 2: CCR multi-dimensional concept and related areas of policy recommendations

As can be seen from Figure 2,[8] these seven areas slightly differ from the eight key dimensions of CCR multi-dimensional concept (ibid.): Learning Practices and Teaching Practices were not separate areas of policy recommendations, but they were merged into *School Staff Professional Development* area; Leadership and Values and Organisation have been merged into *Organisation and Leadership* area of policy recommendations. *Research* is not a separate dimension of the SCALE CCR conceptual framework but during the process of developing the recommendations, many stakeholders emphasised how monitoring and constant evaluation is important for implementing learning innovations and scaling them up. So, as a number of the proposed policy recommendations call for evidence-based policy making for mainstreaming of ICT-ELI, *Research* was added as a separate and transversal area of recommendations.

In conclusion, policy actions should follow a whole-system approach for the sustainable implementation and progressive mainstreaming of ICT-ELI, with targeted interventions in all areas according to the specific context and level of policy action (local, regional, national, or EU).

2.3 Research phase 3: Validating, prioritising and reporting the final set of recommendations

In this final phase, an online stakeholder consultation to validate and prioritise the proposed set of recommendations for policy action was conducted. The 149 participants in this online consultation had diverse backgrounds in education and ICT: teachers, trainers, policy- and decision-makers, researchers and others. They evaluated the proposed 60 recommendations and also provided more than 250 comments, recommendations and suggestions through the open-ended questions of the survey. In the following section, the online stakeholder consultation is discussed in more detail.

2.3.1 The online stakeholder consultation

The online survey built on the findings of previous research activities by further exploring the stakeholders' perspectives with respect to:

- the relevance of the proposed recommendations for mainstreaming ICT-ELI;
- their suggestions for further developing and mainstreaming ICT-ELI.

The online questionnaire used for evaluating 60 policy recommendations, was developed in *1ka* tool for online surveys.[9] *1ka* is an open source online survey application, developed by researchers at Department of Social Informatics and methodology at the Faculty of Social Science, University of Ljubljana, Slovenia.

The majority of the questionnaire items (see Annex 1) were measured for relevance on a seven-point Likert-type scale ranging from 1 ("the recommendation is not relevant at all") to 7 ("the recommendation is very relevant"). There were also open-ended questions, which gave the participants the opportunity to comment, explain or propose missing policy recommendations.

In order to avoid an order effect, the sequence of recommendations within each area was randomised (namely each participant saw the recommendations in a different order, but always clustered in the same 7 areas).

2.3.2 Participants

The purpose of this phase was to have the policy recommendations evaluated by representatives of the following stakeholders in the field of ICT in Education: policy- and educational decision-makers; experts; teachers; trainers; technology providers and developers; researchers. The method of sampling used was a purposive, non-probability sampling, which is usually used to access a particular subset of the population. Despite its limitations (e.g. Black, 1999), non-probability approaches are more suitable for in-depth qualitative research in which the focus is often to

[8] In Figure 2, dotted lines present interrelation between areas, which constitute a whole. As ICT-ELI do not occur in a vacuum, the external circle is also a dotted line to show that the 7 areas are influenced by external factors.

[9] http://english.1ka.si/

understand complex social phenomena (e.g. Marshall, 1996; Small, 2009) like the mainstreaming of ICT-ELI.

One hundred and forty-nine (N=149) educational stakeholders with diverse backgrounds took part in the online consultation. The majority of the respondents were teachers, who represent 42.3% of the sample, followed by researchers (21.5%), decision-makers (10.7%), policy-makers (8.1%) and others (not specified) who represent 9.4%. Table 1 provides more detail about the background of the participants.

Table 1: Background of participants

Background	n	%
Teachers	63	42.3
Trainers	5	3.4
Researchers	32	21.5
Policy-makers (at EU, national, regional, local level)	12	8.1
Decision-makers (e.g. school head, chief education officer, university dean, etc.)	16	10.7
Technology providers/developers	7	4.7
Others	14	9.4
Total	**149**	**100.0**

The vast majority of the respondents were from 22 European countries (see Table 2) and there were also a few participants from non-European countries (not specified).

Table 2: Origin of 149 participants

Country	n	Country	n	Country	n
Spain	17	Ireland	7	Hungary	2
Non-EU country	17	Slovenia	6	No answer	2
Italy	16	Austria	5	Poland	2
United Kingdom	16	Czech Republic	3	Latvia	1
Greece	13	Denmark	3	Luxembourg	1
Romania	11	Finland	3	Malta	1
France	8	Lithuania	3	Portugal	1
Netherlands	8	Belgium	2	Sweden	1

2.3.3 Procedure

In order to optimise the response rate, it was decided that the survey would not contain any mandatory questions and also it would be anonymous, but respondents could choose to leave their contact details to be kept informed about the results.

The online survey was launched on 25 March, 2013 and closed on 15 April, 2013. The survey was disseminated to stakeholders in two ways:

- A personal invitation was sent to a list of identified stakeholders with qualifications and expertise in the field of ICT in education.
- Additionally, the survey was promoted through the Open Education Europa portal;[10] the Future of Learning LinkedIn Group;[11] the eTwinning Creative Classrooms Group;[12] the

[10] http://groups.etwinning.net/web/creative-classroom/welcome

European Civil Society Platform on Lifelong Learning;[13] the European Forum on Learning Futures and Innovation;[14] the European Forum of Technical and Vocational Education and Training;[15] the DG EAC Thematic Working Group on ICT and Education;[16] and the SCALE CCR website.[17]

Survey analytics showed that most of participants entered the survey through a direct link from the around 250 personal invitations sent by email. A small subset of the participants came from other dissemination channels such as LinkedIn, SCALE CCR webpage and eTwinning Creative Classrooms Group. No reminders were sent, as the targeted 100 responses were received in the first wave (by 8 April).

The online survey was relatively long and complex with 60 recommendations to be evaluated. Hence, throughout the survey we observed dropouts after each of the areas, which stabilised after the *Organisation and leadership* area with 120 respondents.

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11 http://www.linkedin.com/groups/Future-Learning-2266966/about

12 http://openeducationeuropa.eu/en/blogs/join-jrc-ipts-line-consultation-policy-recommendations-mainstreaming-ict-enabled-innovation-le

13 http://www.eucis-lll.eu/news/public-consultations/ipts-online-consultation-up-scaling-creative-classrooms-in-europe

14 http://www.learningfrontiers.eu/?q=story/european-forum-learning-futures-and-innovation

15 http://www.efvet.org/index.php?option=com_content&task=view&id=451&Itemid=226

16 http://ec.europa.eu/education/lifelong-learning-policy/doc/exchange/ict_en.pdf

17 http://is.jrc.ec.europa.eu/pages/EAP/SCALECCR.html

3. Recommendations for policy action

Putting ICT-ELI into practice on a large scale, involving large and diverse groups of learners, teachers and other educational stakeholders, has different enablers and barriers compared to small-scale projects and initiatives (Kampylis, Law, et al., 2013). In general, the more innovative a learning environment is, the more challenging it is to scale up and a great individual and collective effort from all the stakeholders involved is required (ibid.; Law, Yuen, & Fox, 2011).

Policy-makers recognise the role of ICT as a key enabler of innovation and creativity in E&T and for learning in general. For instance, the need for more innovative Education and Training has been confirmed by the work of the ICT cluster, which includes representatives of Member States who work under the Open Method of Coordination (OMC) E&T 2020.[18] The Digital Agenda Assembly session on "Mainstreaming e-Learning in education and training" in June 2011,[19] confirmed that only a few innovative projects manage to reach beyond the early adopters' stage. The key issue is how to tackle large-scale implementation of ICT-ELI: "We need to scale up, learn from each other, be clear on visions, goals and outcomes and we need to act now" are amongst the main messages reported.

In addition, recent initiatives taken by European Commission (European Commission, 2012, 2013a) set out a European agenda for stimulating and scaling up high-quality, innovative ways of learning and teaching through new technologies and digital content.

This report brings evidence to the debate about the scaling up and mainstreaming of ICT-ELI, providing a comprehensive set of recommendations for policy action at micro-, meso- and macro-level. Policy- and decision-makers should realise that **scaling up does not refer to a recipe for replication of successful implementation, or to 'one-size-fits-all' and 'one-off' models of innovation.** Therefore, **policies should support and encourage multiple pathways to innovate and scale up in 'organic' ways** (Kampylis, Law, et al., 2013). Scaling up should be considered as a contextualized process that involves all the challenges of implementing sustainable systemic change characterized by complexity and shifting priorities (ibid.; Law et al., 2011). Thus, scaling up educational innovation should be an 'organic' process that allows for continuous change and flexibility for future adaptations in order to address the shifting priorities and requirements of society. Last but not least, scaling up ICT-ELI does not refer to future classroom scenarios but to what is emerging in today's practices, made possible by taking advantage of existing and emerging technologies.

Education has become a strategic concern for international organisations, governments, industry, communities, families and individuals around the world and agencies for learning innovation initiatives may emerge at any of these levels (Kampylis, Law, et al., 2013; Law et al., 2011). Irrespective of the level at which the innovation is initiated, it will necessarily impinge on practices and require appropriate adaptations and changes in factors, provisions and priorities at multiple levels and actors within the system. Hence, **the proposed recommendations for policy action are targeted at all levels: local, regional, national, and EU levels, involving a wide-range of stakeholders. Top-down strategies are needed for supporting bottom-up innovations at pedagogical, technological and organisational levels.**

Finally, although the recommendations have been clustered into 7 areas, these areas (and the respective recommendations) are interrelated and interdependent. In order to achieve effectiveness and success in the mainstreaming process, significant effort should be made by policy- and decision-makers **to follow a systemic approach for implementing and progressively mainstreaming ICT-ELI, developing strategies that address concurrent changes in the seven key areas**: Content and Curricula; Assessment; School Staff Professional Development;

[18] http://europa.eu/legislation_summaries/education_training_youth/general_framework/ef0016_en.htm
[19] http://ec.europa.eu/digital-agenda/en/08-mainstreaming-e-learning-education-and-training

Research; Organisation; Connectedness; and Infrastructure. These areas are discussed in detail in the following sections. In the text the percentages in the brackets represent the percentage of respondents who evaluated each recommendation the highest (value 6 and 7)

3.1 Area 1: Content and curricula

In a snapshot:

The mainstreaming of innovative teaching and learning practices, which lie at the core of ICT-ELI, require content and curricula that are open, flexible, customised and regularly updated. Hence, policy- and decision-makers should support the involvement of educational stakeholders (i.e. teachers, researchers, parents etc.) in the co-development of open and flexible content and curricula which respond to the needs of society. Curricula should promote innovative teaching and learning practices made possible by the use of ICT; the development and assessment of key competences and 21st century skills; teachers' autonomy; and the use of Open Educational Resources. Content and curricula should be regularly updated according to research findings and the needs of society.

Respondents evaluated eight policy recommendations in this section (Table 3) where the term *curricula* is conceptualized as learning objectives and frameworks for developing activities, whereas the term *content* refers to the resources for innovative teaching and creative learning. There is a common thread to all the recommendations in this area: content and curricula require changes in order to facilitate the innovative teaching and learning practices that lie at the core of ICT-ELI. Such changes are in line with the process of curricular reforms observed in many countries worldwide, which try to change teaching content and promote innovative pedagogical practices for making curricula more pertinent to "...the true needs of our society" (to use the words of one participant). Hence, policy actions are needed (at local, regional, national, and EU levels) for **supporting the co-development of open and flexible content and curricula that allow innovative teaching and learning practices made possible by the use of ICT to flourish and become mainstream**. These innovative practices, including the ones proved to be effective in informal learning settings (e.g. self-regulated learning), should not be 'add-ons' but should replace ineffective practices that increase teachers' and learners' workload without adding value. Hence, there is a need for flexible curricula that would lessen teachers' workloads and give them the autonomy to adapt curricula to the local context and needs (67.5%).

Curriculum development that allows teachers to work in small autonomous and interdisciplinary teams (62.4%) has proved to be a very effective mechanism for empowering teachers to act as agents of change rather than objects of change and to take ownership of bottom-up innovations. For instance, at Hellerup School in Denmark (Kampylis, Brečko, & Punie, 2013) teachers work in autonomous multidisciplinary teams of five to thirteen members, each team being responsible for three or four classes. Working in teams, teachers adapt the national curriculum and co-develop timetables, content and pedagogies enabling students not only to acquire knowledge but also to develop key competences and 21st century skills.

Besides teachers, a variety of other educational stakeholders such as curriculum developers, researchers, parents, publishers, IT developers etc., should be involved in the co-development and implementation of flexible and updated content and curricula (56.4%). Policy actions should support exchanges between these stakeholders to encourage wider collaboration and innovation in this area.

The co-development of content and curricula requires more solid and systematic empirical evidence on innovative teaching and learning practices and their impact on learning outcomes. Such evidence-based research, which takes into account the multifaceted nature of ICT-ELI, would allow policy- and decision-makers to better understand how effective and innovative practices become successful and could be further developed and mainstreamed.

Effective changes of content and curricula also imply changes in assessment to ensure coherence between what is envisioned to be assessed in the curricula and what is assessed (and how this is done) in practice (60.4%). As one responded pointed out, *"...one of the fundamental challenges is to*

integrate key competences in the curriculum in all countries and to include the evaluation of key competences and transversal competences in the formal assessment."

Open Educational Resources, the content of which can be adapted by users according to their needs, have great potential to stimulate innovative teaching and learning practices (European Commission, 2013a). Combined with traditional educational resources, OERs allow blended forms of face-to-face and online learning and also have the potential to reduce the costs of educational materials. Hence, policy- and decision-makers should promote through curricula the use of Open Educational Resources and ensure their further deployment.

In conclusion, evidence-based policies are needed for content and curricula to be open, flexible, linked to real-life contexts and regularly updated in order to promote innovative pedagogical practices, be coherent with assessment of key competences and 21st century skills, and give room to teachers' autonomy.

Table 3: Content and Curricula policy recommendations

Policy- and decision-makers can ensure that content and curricula allow innovative teaching and learning practices (enabled by ICT) to become mainstream by…	**N**	**%**
1. Promoting through the curricula innovative pedagogical practices made possible by the use of ICT, which could replace ineffective practices and avoid teachers' workload.	148	67.5
2. Promoting curriculum development that leaves room for teachers to work in small autonomous and interdisciplinary teams, with enough flexibility to choose the content, timetable etc.	149	62.4
3. Ensuring coherence between what is assessed and how this is done in practice and what is envisioned in the study programme.	149	60.4
4. Encouraging the regular update of learning content and curricula based on research findings.	149	60.4
5. Promoting the use of Open Educational Resources (OER) for broadening and updating the content and process of learning.	149	57.7
6. Promoting the involvement of education stakeholders (e.g. teachers, parents, researchers etc.) in the co-development of flexible and research-based curricula.	149	56.4
7. Bridging the gap, which still exists to a lesser or greater extent, between curricula and key competences.	149	53.7
8. Promoting the incorporation into formal curricula of effective practices from informal learning (e.g. self-directed learning).	149	53.0

Relevance according to four groups of participants

There are no differences between the four groups of participants according to recommendation ratings. **Teachers/trainers**, **researchers**, **policy/decision-makers** and **others** agree that the most relevant recommendation is "Promoting through the curricula innovative pedagogical practices made possible by the use of ICT, which could replace ineffective practices and lessen teachers' workload."

3.2 Area 2: Assessment

In a snapshot:

There is a consensus among educational stakeholders that what is assessed and examined determine what is valued and what is taught in real settings. Even in Education and Training systems that follow reformed curricula, it remains a challenge to modernise assessment to support learning. For scaling up and mainstreaming ICT-ELI, policy- and decision-makers should promote the use of ICT for reforming assessment strategies and examination systems to include assessment of both factual knowledge and key competences; to encourage a shift of ownership of assessment from teachers to learners; and to promote a formative assessment paradigm where assessment is considered to be an integral part of the learning process.

This area focuses on the conceptual shift from traditional assessment of knowledge acquisition to innovative ICT-enabled assessment approaches that better capture key competences and 21st century skills (Griffin, McGaw, & Care, 2012; Redecker, Punie, & Ferrari, 2012). Even when the development of key competences and 21st century skills is reflected in content and curricula, they cannot be assessed through conventional assessment paradigms (i.e. summative) but should use innovative approaches such as self- and peer-assessment and e-portfolios. Hence, like curricula reforms, assessment strategies and examination systems are also receiving special attention and requirements to change. Policy actions at local, regional, national and EU level should reap the benefits of ICT and **promote substantial changes to the role and function of assessment, examination, certification and accreditation strategies in order to allow innovative teaching and learning practices to further be implemented and mainstreamed** (Table 4).

Policy- and decision-makers should support and motivate teachers to shift the ownership of assessment to learners (68.8%). Assessment *for* learning (as opposed to the assessment *of* learning) is considered as a learning experience – assessment is integral part of the learning process (Redecker, 2013). Hence, ownership of assessment is related to ownership of learning. In this way, self-assessment and reflection against learning goals allow learners to take ownership of their learning, in collaboration with their teachers and peers, and become self-directed and self-regulated learners.

Policy- and educational decision-makers should encourage and support not only the assessment of factual knowledge but also the assessment of 21st century skills and key competences. Assessment-related issues were also raised by many of the workshop participants organized in the context of SCALE CCR as obstacles/challenges for sustained implementation and scaling up of ICT-ELI (Kampylis, Law, et al., 2013). One of the big challenges has to do with the lack of specificity or common consensus on what *21st century skills* and *key competences* are beyond the rhetorical level, and how such skills and competences can be assessed in real settings. The assessment of 21st century skills and key competences is particularly challenging, as this kind of assessment needs to differ from traditional methods in some very fundamental ways. Policy-makers should also promote a formative assessment paradigm – where assessment is considered to be an integral part of the learning process (67.6%). Formative assessment practices are more effective in the context of ICT-ELI because they provide students with information and feedback on how they are progressing, considering their prior achievements according to their learning goals, and are better at fostering skills and competences than the summative assessment practices. This is because they allow students to understand which skills they need to develop further and which content areas they need to improve. Formative assessment practices include self-assessment, peer feedback, learning diaries, portfolios, e-portfolios, and presentations. In addition, these types of assessment can cover both individual and collaborative efforts and creative group work (e.g. on projects).

In conclusion, policies should promote assessment strategies that take advantage of ICT and are an on-going, integral and authentic part of the learning process, providing valuable formative information to the learner and the teacher to improve their practices. Policy action is needed to reform examination systems to allow ICT-ELI to further develop and mainstream.

Table 4: Assessment policy recommendations

Policy- and decision-makers could reform assessment strategies and examination systems in order to allow innovative teaching and learning practices to flourish by…	**N**	**%**
9. Encouraging a shift of ownership of assessment from teachers to learners by giving them an active role in their own assessment (i.e. self-assessment).	141	68.8
10. Revising examination systems in order to include assessment of both factual knowledge and key competences.	140	68.6
11. Promoting a formative assessment paradigm where assessment is considered to be an integral part of the learning process.	142	67.6
12. Promoting the use of ICT tools in order to reform assessment practices (e.g. cloud-based e-portfolios that follow a web 2.0/social media model).	142	62.7

Relevance according to four groups of participants

There are slight differences between the four groups of participants (teachers/trainers, researchers, policy- and decision-makers and others) regarding evaluation of assessment recommendations.

In particular, for **teachers/trainers** the most important recommendation is to shift the ownership of assessment (emphasis on self-assessment), while for **policy/decision-makers** and **others** it is more important to revise examination systems to include assessment of both factual knowledge and key competences. For **researchers,** the most relevant recommendation for mainstreaming ICT-ELI is to promote a formative assessment paradigm, where assessment is considered to be an integral part of the learning process.

3.3 Area 3: School Staff Professional Development

In a snapshot:

There was a consensus among the stakeholders involved in the development and validation of the recommendations that teachers are key agents for any sustainable implementation and further up take of ICT-ELI. Hence, there is a great need for policy- and decision-makers to invest significantly in updating Continuous Professional Development provisions; to support and motivate teachers to be active lifelong learners and acquire the key competences and skills required in the context of ICT-ELI; to recognise the role of teachers as agents of change; and encourage them to take the ownership of innovation.

Research shows (e.g. European Commission, 2013c) that for implementing sustained learning innovations, school staff professional development is a crucial factor. The data analysis of the online consultation (Table 5) also confirms the importance of the *School Staff Professional Development* for mainstreaming ICT-ELI as the statements in this area were evaluated the highest compared to other areas (see more in Section 3.8). Policy- and decision-makers should recognise the key role of teachers, among other stakeholders, in guiding and implementing ICT-ELI and **invest significantly in their updated and continuous professional development to ensure that they acquire the key competences required for fostering and orchestrating learning instead of just transmitting knowledge (81.3%)**. These *teacher competences* imply a wider, more systemic view of teachers' professionalism (compared with *teaching competences* that refer to their role in classroom), as they also include their role outside school e.g. in the local community, professional networks and so on (European Commission, 2013b; OECD, 2009).

Understanding and implementing ICT-ELI is an evolving process, which also requires learning and changes in their practices by all the stakeholders involved (Kampylis, Law, et al., 2013). As teachers are the main actors in this continuous process of innovation (i.e. applying changes to their own practices), provisions for continuous professional development that can equip and prepare them to

act as agents of change are of high importance and should be a priority for policy- and decision-makers at local, regional, national and EU levels. Only self-confident and competent teachers can educate self-confident and competent students.

As shown in the Survey of Schools: ICT in Education (European Commission, 2013c), less than one third of EU students are taught by teachers for whom ICT training is compulsory and around 70% of EU students are taught by teachers who invest their own spare time in developing ICT-related skills. This shows that, in general, teachers are motivated and willing to develop their digital competences but the need for investing in and updating initial teacher training and Continuous Professional Development is of great importance. Thus, policy-making should support and motivate teachers to develop and update their digital competence and ICT skills (through formal and/or informal learning), as lifelong learners themselves (80.1%). As one of the participants pointed out, such "*ICT skills development programmes should be key element of Initial Teacher Training*[20] *and Continuous Professional Development*".

Innovative pedagogical practices made possible by the use of ICT lie at the core of learning innovations and constitute key enablers of their further implementation and take up (Bocconi et al., 2013c; Kampylis et al., 2012; Kampylis, Law, et al., 2013). Therefore, policy- and decision-makers should empower teachers to adopt and adapt innovative pedagogical practices (e.g. formative assessment) for diverse learning settings and purposes (80%). In particular, teachers' professional skill sets should shift from subject knowledge towards expertise in pedagogy (e.g. Hannon, 2009) in order to effectively implement innovative pedagogical practices and play new roles as mentors, orchestrators, and facilitators of learning.

Depending on the context and local specificities and needs, several models of continuous professional development can be followed to support teachers in their new and challenging roles in the context of ICT-ELI. As one of the participants stated *"… teachers continuous professional development is extremely important for the uptake of innovative practices. In particular, I believe a blended learning approach, with networked learning as the online component and a limited number of offline meetings, all of which are directed towards fostering collaboration and network building (rather than content delivery) is key to this…"* Policy- and educational decision-makers should support a blended approach to continuous professional learning and development that combines online professional networks, face-to-face exchanges, informal learning etc. (69.9%). In addition policies should encourage and incentivise teachers to share their innovative practices with peers and other stakeholders through online and/or offline networks (71.1%). Establishing and participating in teacher networks and following innovative practice development of the field should become part of both initial teacher education and in-service training.

In summary, the further development and progressive mainstreaming of ICT-ELI requires ownership and creative engagement by teachers to realise changes in teaching and learning practices. Hence, strategies that acknowledge the key role of teachers in implementation should be devised by policy- and educational-decision makers and updated professional development provisions should be offered at local, regional, national and EU level.

[20] Initial Teacher Training has been reported in all the consultations in the context of SCALE CCR as one of the most challenging areas for developing the competences and professional skills teachers require to play their key role in the context of ICT-ELI.

Table 5: School Staff Professional Development policy recommendations

Policy- and decision-makers could empower teachers to play the role of agents of change by:	**N**	**%**
13. Investing significantly in updating Continuous Professional Development provisions (including the education of teacher trainers) to ensure that in-service teachers acquire the key competences required for fostering and orchestrating learning instead of transmitting knowledge.	134	81.3
14. Supporting and motivating teachers to develop and update their digital competence and ICT skills (e.g. through in-service training, peer-learning and informal and non-formal learning), as life-long learners themselves.	136	80.1
15. Enabling teachers to develop their ability to adopt and adapt innovative pedagogical practices (e.g. formative assessment) for diverse learning settings and purposes.	135	80.0
16. Recognizing the role of teachers as agents of change (rather than objects of change) and encouraging them to take the ownership of innovation (teacher-led innovation).	136	74.3
17. Updating Initial Teacher Training (including candidate admission process) to ensure that prospective teachers acquire the key competences required for their role as agents of change.	136	74.3
18. Motivating and supporting teachers to make their innovative (pedagogical) practices more explicit and visible to peers and other stakeholders, such as parents, community and businesses.	135	71.1
19. Promoting a blended approach to continuous professional learning and development that combines online professional networks and self-organized face-to-face collaboration.	136	69.9
20. Helping teachers to acquire much greater proficiency in data handling and methods such as learning analytics, which would allow them to monitor and personalize learning processes.	135	48.9

Relevance according to four groups of participants

For **teachers/trainers** and **others** the priority for policy- and educational decision-makers should be to support and motivate teachers to develop and update their digital competence and ICT skills, as lifelong learners themselves.

Policy/decision-makers said the most important priority should be to update initial teacher training and invest in continuous professional development provisions that empower school staff to take the ownership of innovation.

For **researchers,** the most relevant recommendations in this area are "Enabling teachers to develop their ability to adopt and adapt innovative pedagogical practices (e.g. formative assessment) for diverse learning settings and purposes" and "Supporting and motivating teachers to develop and update their digital competence and ICT skills, as lifelong learners themselves."

3.4 Area 4: Research

In a snapshot:

ICT-ELI constitute complex 'ecosystems' that evolve over time and therefore, continuous and multidisciplinary research is needed to provide evidence on the effectiveness of their implementation strategies, the nature of innovation and the role of technology. Policy actions at local, regional, national and EU levels are needed to ensure that further development and progressive mainstreaming of ICT-ELI is based on research evidence focusing on the innovative pedagogical, technological and organisational practices and the possible learning gains.

ICT-ELI constitute complex 'ecosystems' that evolve over time (Kampylis, Law, et al., 2013). Both success and failure are integral parts of the learning innovations: "*…failures should be expected as much as successes and what is to be learned from failures should be valued*" (participant in the online consultation). Therefore, articulation between research and innovative practices is an important factor in their successful implementation. Evidence-based, multidisciplinary research can reveal weaknesses, strengths, opportunities and challenges and increase the knowledge base for the scaling up and progressive mainstreaming of ICT-ELI.

Policy actions at local, regional, national and EU levels are needed to **ensure that the further development and progressive mainstreaming of ICT-ELI is based on research evidence which focuses on how innovative pedagogical, technological and organisational practices can enhance learning**. Research focusing on the implementation strategies of ICT-ELI (72.5%) and on models for embedding new tools, such as technology-based assessment, in teaching and learning practices should be supported. This would provide learning institutions and educational stakeholders with proven practical models that support the take up of innovative tools.

Policy- and decision-makers should also promote research that happens at micro-level (e.g. teacher-led research) empowering *"…each school/institution to develop a culture of research/experimentation"* and promoting *"…collaboration of teachers with related educational and educational-technology research programmes. Innovation in schools cannot be isolated from on-going research…."* (participants in the online consultation).

As many respondents in the online consultation pointed out, there is a lot of research being done in several fields, both at micro- (classroom/school) and macro-level (national/international). However findings and knowledge are often scattered and incomplete: *"…There is great research being done and it is highly relevant to the educational process and agents, but teachers, school leaders, parents and educators do not ever learn about it. This is (a) because research is not available (they need to pay or go to a licensed library to download) or (b) because they do not know that this research exists or (c) because the academic writing of most studies is difficult for them. There are many things to be done with regards to this"* (participant in the online consultation). Therefore, policy-makers should take the initiative to bring knowledge from micro- and macro-level research together in a coherent way and look critically at what is effective and what is not for developing and scaling up ICT-ELI. Supporting policy actions for open research and dissemination of data (e.g. open access publications, open data repositories, data protection strategies etc.) are also needed at local, regional, national and EU levels (58%).

Last but not least, policy should support the application of various research methods (e.g. teacher-led research, control groups, experimental research, longitudinal studies, social networks analysis, learning analytics, big data research, etc.) to study in-depth the complex 'ecosystems' of ICT-ELI (61.8%).

Table 6: Research policy recommendations

Policy- and decision-makers could ensure that the continuous evolution of ICT-ELI is based on research findings by:	**N**	**%**
21. Encouraging research on the implementation process of ICT-ELI, focusing on the possible learning gains.	131	72.5
22. Supporting the application of various research methods (e.g. teacher-led research, control groups, experimental research, longitudinal studies, social networks analysis, learning analytics, big data research, etc.) to the study of complex 'ecosystems' of ICT-ELI.	131	61.8
23. Promoting research on the ICT-ELI that happens at micro-level and could be scaled-up.	129	58.9
24. Supporting policies and initiatives for open research and free dissemination of data (e.g. open data, open access publications etc.), taking into account intellectual property, security and data protection issues.	131	58.0
25. Supporting research on the perspectives of various actors and stakeholders such as policy-makers, school leaders, teachers, learners, parents, IT providers, educational content providers etc.	129	58.0
26. Encouraging the dissemination of findings from a variety of research fields (e.g. neuroscience) to stakeholders, in order to help them to further the evolution of ICT-ELI.	130	57.7
27. Supporting the development of common metrics (indicators, measurements, and approaches) for studying and monitoring ICT-ELI.	130	46.9
28. Supporting research on (physical and mental) health, security and legal issues related to ICT-ELI.	130	43.1

Relevance according to four groups of participants

There were no differences between the four groups of participants when selecting the most relevant policy action recommendations for evidence-based development and mainstreaming of ICT-ELI.

The four groups were also unanimous on the recommendation they found the least important: Supporting research on (physical and mental) health, security and legal issues related to ICT-ELI.

3.5 Area 5: Organisation and leadership

In a snapshot:

Changes in learning institutions' organisation and leadership strategies are required for sustainable implementation and progressive mainstreaming of ICT-ELI. Policy-makers should empower learning institutions to develop well-articulated innovation strategies (with both long-term vision and short-term goals) that include changes in organisational structures/routines and leadership models, which allow innovative teaching and learning practices to flourish. Furthermore, policy actions should focus on knowledge exchange and dissemination of innovative practices; the development of a 'culture of innovation' at system level, removing the fear of change; and on mixed approaches of mainstreaming ICT-ELI that combines top-down policies and bottom-up innovative practices at technological, pedagogical and organisational level.

Implementing pedagogical and/or technological innovations without changing organisation and leadership models, does not lead to sustainable change and systemic impact. Research reveals that organisational risk aversion, conservative cultures and excessively hierarchical arrangements constitute key barriers for scaling up ICT-ELI (Kampylis, Law, et al., 2013; OECD, 2013a). Organisation strategies in the context of ICT-ELI should be co-owned and shared among all the stakeholders involved to meet local circumstances and needs. Monitoring mechanisms should evaluate progress and effectively refocus organisational practices. These changes in organisation strategies will also require changes in learning leadership, which should be as open and

participatory as possible for orchestrating innovations at organisational, technological and pedagogical level. Hence, policy actions at micro-, meso-, and macro-level are needed to **empower learning institutions to develop well-articulated innovation agendas with both long-term vision and short-term goals. These agendas should include changes in organisation structures/routines and leadership models to make learning innovation a mainstream activity**.

Policies should encourage learning organisations to embrace the technological opportunities available for opening up their learning materials (e.g. open educational resources) and practices and also support informal learning. Policies are needed that help learning organisations to promote networking with other organisations and stakeholders across sites and also within the same organisation, in order to encourage the emergence and scaling up of learning innovations. For instance, policies at micro-, meso- and macro-level should develop organisational structures (e.g. formal recognition and informal reputation mechanisms, technical support, pedagogical advice, etc.) to support knowledge exchange (77.9%). This could be, for example, participation by teachers in national/international conferences, workshops and professional networks for dissemination of innovation at local level and beyond (73.3%).

All these policies should focus on developing a 'culture of innovation' at system level, removing the fear of change and supporting bottom-up innovations and risk taking (73.3%). Changing practices (i.e. developing a culture of innovation) is a long and complex process that requires, among other conditions, political commitment and sustained effort over time including (i) a significant level of financial investment, (ii) a complex array of different types of support and strategies (targeted at different levels of the education system and the whole eco-system of education, including industry and other service providers), and (iii) multi-pronged strategies targeted at school leaders, teachers, teacher trainers, parents and other stakeholders.

In conclusion, policy actions should initiate and facilitate the profound changes in organisation and leadership strategies needed to allow learning organisations to envisage and follow their own pathways to innovation and to scale up in an 'organic' way, focusing on authentic learning for the 21st century.

Table 7: Organisation and leadership policy recommendations

Policy- and decision-makers could ensure that effective organisational practices and open and participatory leadership allow the progressive take up of innovation for learning by:	**N**	**%**
29. Supporting knowledge exchange (e.g. participation in national/international conferences and workshops) to gain a further understanding of how innovative practices are made possible by the use of ICT.	122	77.9
30. Creating organisational structures (e.g. formal recognition and informal reputation mechanisms, technical support, pedagogical advice, etc.) to support and motivate teachers to participate in professional networks, disseminating pedagogical innovation.	122	74.6
31. Encouraging the development of a 'culture of innovation' at system level, removing the fear of change and supporting decision-makers, teachers, and other stakeholders when taking sensible risks and trying new things.	120	73.3
32. Developing long-term strategies to advance the capacity of school leaders to adopt and adapt new methods of leadership (e.g. distributed leadership) in order to envisage, support and orchestrate ICT-ELI.	122	72.1
33. Making sure that technological innovation (e.g. 1 to 1 computing) in formal education settings is part of a wider transformation agenda which includes pedagogical and organisational innovation.	122	71.3
34. Ensuring the stable and sizeable budget that is required for ICT-ELI to have sustainable success and impact at system level.	122	70.5
35. Encouraging the scaling up of innovation at local level (e.g. through school teams and mentoring programmes) so that it is used more broadly in different areas of a given organisation.	122	67.2
36. Developing a well-articulated innovation agenda which has both long-term vision (ensuring policy support) and achievable short term goals for the progressive take up of innovation.	122	66.4
37. Ensuring the political commitment and sustained effort over time that is required for ICT-ELI to flourish.	122	65.6
38. Developing mechanisms and standards for recognizing, validating, and rewarding innovative practices (pedagogical, organisational and/or technological).	119	65.5
39. Promoting diversity in ICT-ELI by funding a number of pilots in different contexts and with diverse implementation strategies.	122	64.8
40. Promoting mixed approaches for scaling up ICT-ELI, which combines centralized top-down policies and bottom-up, self-organized practices.	122	63.9
41. Developing monitoring mechanisms to ensure that the well-being of teachers and learners and values like equity and inclusion are taken into account.	122	63.1
42. Encouraging learning organisations to build on their strengths, available resources and readiness to implement innovation for learning, following a step-by-step approach that could lead to a sustainable momentum towards a radical (or even disruptive) end.	122	60.7
43. Supporting multi-stakeholder involvement in the creation and sharing of the common vision so that all of them understand the added value of innovation.	122	59.8
44. Promoting programmes and initiatives that develop the knowledge- and innovation-management abilities of stakeholders (i.e. education decision-makers, school leaders etc.).	120	59.2
45. Revising performance appraisal strategies for teachers and schools to allow more innovative teaching and learning to flourish.	122	59.0
46. Setting evaluation, communication and feedback mechanisms (e.g. platforms for collecting big and/or rich data and learning analytics) right from the start of different pilots or initiatives.	121	57,0
47. Encouraging collaboration and communication channels between supra-national agencies (i.e. European Commission, OECD, UNESCO etc.) in order to co-develop indicators and benchmarks for ICT-ELI.	122	55.7
48. Taking the initiative (e.g. forming cross-sector working groups and/or partnerships) to promote communication between stakeholders from policy (e.g. Ministries of Education), industry (e.g. IT providers) research (e.g. research centres), educational practice (e.g.	122	55.7

teacher associations) and the wider public (e.g. parents associations) to build trust, assure mutual objectives, and create a common vision.		
49. Supporting research-based changes in organisational structures and routines, such as timetables and learner grouping, in order to meet local needs (self-organisation - grass roots innovation).	121	52.1
50. Following the Open Method of Coordination* for identifying common challenges and opportunities, in order to support peer learning and exchange of effective policies and practices among the Member States.	121	49.6

Relevance according to four groups of participants

For **teachers/trainers** and **researchers** the most important recommendation is "Encouraging the development of a 'culture of innovation' at system level, removing the fear of change and supporting decision-makers, teachers, and other stakeholders when taking sensible risks and trying new things", while for **policy/decision makers** and **others** it is: "Creating organisational structures to support and motivate teachers to participate in professional networks, disseminating pedagogical innovation."

3.6 Area 6: Connectedness

In a snapshot:

'Connectedness' refers to the extent to which innovative pedagogical, technological and organisational practices reach beyond the model of isolated learner/classroom/school. ICT opens up a whole new frontier in learning, empowering both teachers and learners to connect with ideas and people beyond the classroom walls -such as peers, experts and parents- giving the sense of being a part of something larger than oneself. Policy- and decision-makers should design and implement strategic plans for connecting knowledge, innovative practices and people/efforts in order to open up and broaden the learning experience at local level and beyond.

ICT-enabled learning innovation is a complex and slow process that requires cultural change and collaboration between stakeholders from policy (e.g. Ministries of Education and local authorities), business (e.g. IT providers), research (e.g. research centres), higher education (e.g. teachers trainers), cultural bodies (e.g. museums), educational practice (e.g. school leaders, teachers, teacher unions), families, and the wider public (e.g. local communities) to build trust and endorse the common vision. ICT offers unprecedented opportunities for educational stakeholders to connect with others beyond the constraints of time and space in order to open up and broaden the learning experience at local level and beyond (European Commission, 2013a).

Connectedness (e.g. Law et al., 2011) also refers to the extent to which the institution or individuals are involved in the innovative pedagogical, technological and organisational practices in the context of ICT-ELI through networks, synergies and partnerships. Recent research reveals that increased and wide-ranging connectedness lies at the core of ICT-ELI with significant scale and/or impact (Kampylis, Law, et al., 2013). Hence, policy should **encourage and support connectedness of teachers and learners with other educational stakeholders at local level and beyond in order to open up and broaden the learning experience and mainstream ICT-ELI.** Research reveals that effective implementation of new pedagogical technologies is best ensured through learning opportunities that are (i) directly linked to the experiences of teachers and (ii) enhanced by horizontal communication with peers who are already successful in practising these technologies. This requires the creation and maintenance of 'learning networks' that provide opportunities for professional peer exchanges (65.8%) (e.g. Vuorikari et al., 2012). Small and overlapping networks of teachers/schools have proved to be more flexible and personalised and enable more in-depth exchange and collaboration (Miyake, 2013).

Policy- and educational decision-makers should develop strategies for integrating these small networks into bigger network-of-networks, to create large communities and mainstream innovative

teaching and learning practices. For instance, policy- and decision-makers should invest in structures, such as national and/or transnational inter-linked portals (64.2%), to aggregate learning opportunities and knowledge exchange on a large scale. Cross-border professional networks, such as eTwinning (e.g. Kampylis & Punie, 2013), have been also proved to be effective vehicles for disseminating innovative teaching and learning practices and should be further supported by policy-makers (61.3%).

Table 8: Connectedness policy recommendations

Policy- and decision-makers could design and realize strategic plans to empower teachers and learners to connect with people and ideas in order to open up and broaden the learning experience by:	**N**	**%**
51. Encouraging and supporting the development of small teacher networks (up to 10 participants at local level and/or beyond) for learning from each other in a more flexible and personalized way.	120	65.8
52. Encouraging the development of small networks of schools (i.e. up to 10 schools) for connecting knowledge, innovative practices and people/efforts at local level and/or beyond.	120	64.2
53. Investing in structures, such as national and/or transnational inter-linked portals, to aggregate learning opportunities on a large scale (e.g. learning resources for School Staff Professional Development) and exchange knowledge.	120	64.2
54. Developing long-term sustainability and scalability strategies for cross-border professional networks, such as eTwinning, for disseminating pedagogical innovation.	119	61.3
55. Supporting data portability and interoperability between online professional networks, making it easier for teachers to participate in a number of them (e.g. without having to duplicate data).	120	60.8
56. Supporting the development of bigger teacher professional networks (networks of networks) that offer a wider range of opportunities for peer learning and collaboration than the smaller networks.	120	57.5

Relevance according to four groups of participants

Teachers and **others** prioritise the recommendation "Encouraging and supporting the development of small teacher networks (up to 10 participants at local level and/or beyond) for learning from each other in a more flexible and personalized way."

Researchers, however, value most the recommendation "Investing in structures, such as national and/or transnational inter-linked portals, to aggregate learning opportunities on a large scale (e.g. learning resources for teachers' professional development) and exchange knowledge."

Policy/decision-makers give their highest recommendation to developing data portability and interoperability between online professional networks, making it easier for teachers to participate in number of them.

3.7 Area 7: Infrastructure

In a snapshot:

Infrastructure is a key enabler of educational innovations. ICT infrastructure could extend the boundaries of the learning across time and space whereas user-centred and flexible physical spaces could enable innovative teaching and learning practices. Policy should increase efforts and investment in infrastructure developments (e.g. broadband, cloud computing, creative learning spaces etc.) to support effective implementation and progressive mainstreaming of ICT-ELI.

For further development and mainstreaming of ICT-ELI an ICT infrastructure of appropriate performance and reach is required to facilitate, communicate and disseminate innovative practices at organisational, technological and pedagogical level. Such ICT infrastructure could extend the boundaries of the learning space across time (access to resources 24/7) and space (virtual learning spaces). As shown in the Survey of schools: ICT in education (European Commission, 2013c), insufficient equipment is still reported as a major obstacle for ICT use by teachers and headmasters. Nevertheless, it was also shown that there was no overall relationship between high levels of infrastructure provision and teacher and student use, confidence and attitudes.

However, development of infrastructure varies a lot between and within countries; as one of the participating stakeholders pointed out "*...efforts to increase infrastructure and access are needed in some countries more than others. In most (see Survey of Schools: ICT in Education) lack of infrastructure is not a major inhibitor. There is no relationship between provision of ICT and its use. Other factors have more effect.*" Therefore, policy-makers should support public-public and/or public-private partnerships between learning organisations, research centres, IT developers etc. to support R&D into technological innovations that fit the local needs (65.8%) and context and ensure that all learners have equal and ambiguous ICT access – in and out of school (80%). Such ICT access requires not only appropriate ICT infrastructure (e.g. cloud computing), but also the effective support structures (e.g. helpdesk services) needed to implement smoothly all the necessary learning technologies. Infrastructure is a key enabler of educational innovations.

Updated ICT infrastructure should be complemented by physical learning spaces that offer inspiration, flexibility and comfort and allow innovative teaching and learning practices to flourish (69.2%). For instance, the ground-breaking design of Hellerup school in Denmark, entails rethinking the physical spaces in which learning takes place (e.g. user-centred premises and furniture) and high investment in school infrastructure to support the longstanding innovation history of the school (Kampylis, Brečko, et al., 2013). For the sustainable implementation and further up-take of ICT-ELI, policy- and decision-makers should support initiatives for (re)designing and/or adapting physical learning spaces to facilitate innovative teaching and learning practices.

In conclusion, policy should **increase efforts and investment in infrastructure developments (e.g. broadband, cloud computing, creative learning spaces etc.) to support effective implementation and progressive mainstreaming of ICT-ELI**.

Table 9: Infrastructure policy recommendations

Policy- and decision-makers should take advantage of the full potential of infrastructure for enabling innovative teaching and learning practices by:	**N**	**%**
57. Ensuring that all learners have equal and ubiquitous ICT access, in and out of school.	120	80.0
58. Increasing efforts and investment in ICT infrastructure (e.g. broadband, cloud computing) of appropriate performance and interoperability (any device, anywhere, any system, any time) to support effective implementation and evolution of innovation for learning.	120	70.8
59. (Re)designing and/or (re)arranging physical space/infrastructure to allow for innovative teaching and learning practices, based on research findings on the impact of factors such as ventilation, lighting, and noise on learning.	120	69.2
60. Supporting public-public and/or public-private partnerships between learning organisations, research centres, IT developers etc. to support R&D of technological innovations that fit the local needs and context.	120	65.8

Relevance according to four groups of participants

Three groups –**researchers**, **policy/decision-makers** and **others**– believe that the most important recommendation is to ensure that all learners have equal and ubiquitous ICT access in and out of school, while for **teachers/trainers** increased efforts and investments in ICT infrastructure to support effective implementation and evolution of innovation for learning is more important.

3.8 Interrelation between the seven areas and top recommendations

In order to see which of these seven areas are considered to be more relevant by the participants, the recommendations were aggregated to seven (predefined) areas and the mean and frequency distribution of relevance of each area were computed (Table 10).

For each of the areas, an index was computed (on a scale from 1–7) and in Table 10 mean values for each scale (area) are presented. Although we observe there are relatively small differences in the mean values for the seven areas, when we check frequency distributions, we observe more differences between the areas. The table also presents mean values for each area and the percentage of respondents who selected the highest values (6 and 7) for the items comprising the scale.

Table 10: Relevance of the areas

Area	**mean**	**%**
School staff professional development	5.98	61.1
Infrastructure	5.88	60.8
Assessment	5.71	56.1
Organisation and leadership	5.65	47.8
Connectedness	5.58	45.4
Content and curricula	5.52	39.2
Research	5.52	37.2

As seen from the table, *School Staff Professional Development*, *Infrastructure* and *Assessment* were perceived in general as the most relevant areas. More than 6 out of 10 respondents evaluated all recommendations for School Staff Professional Development very high. Also recommendations for Infrastructure are perceived as very important (60.8%). In the process of education, teachers are

the most important players. It is recognised that the support to teachers is necessary for successful implementation of change.

Which 'individual' recommendations received the most support? In the table below (Table 11), recommendations with the highest share of respondents, who think the recommendation is relevant or very relevant, are presented. As already indicated by total scores (Table 10), the 10 most relevant recommendations include five which belong to the cluster *School Staff Professional Development* (13, 14, 15, 16, 17), three from the cluster *Organisation and Leadership* (29, 30, 31), one from *Infrastructure* (57) and one from *Research* (21).

Table 11: Top 10 recommendations

13. Investing significantly in updating Continuous Professional Development provisions (including the education of teacher trainers) to ensure that in-service teachers acquire the key competences required for fostering and orchestrating learning instead of transmitting knowledge.	81.3	134
14. Supporting and motivating teachers to develop and update their digital competence and ICT skills (e.g. through in-service training, peer-learning and informal and non-formal learning), as life-long learners themselves.	80.1	136
57. Ensuring that all learners have equal and ubiquitous ICT access, in and out of school.	80.0	120
15. Enabling teachers to develop their ability to adopt and adapt innovative pedagogical practices (e.g. formative assessment) for diverse learning settings and purposes.	80.0	135
29. Supporting knowledge exchange (e.g. participation in national/international conferences and workshops) to gain a further understanding of how innovative practices are made possible by the use of ICT.	77.9	122
30. Creating organisational structures (e.g. formal recognition and informal reputation mechanisms, technical support, pedagogical advice, etc.) to support and motivate teachers to participate in professional networks, disseminating pedagogical innovation.	74.6	122
16. Recognizing the role of teachers as agents of change (rather than objects of change) and encouraging them to take the ownership of innovation (teacher-led innovation).	74.3	136
17. Updating Initial Teacher Training (including candidate admission process) to ensure that prospective teachers acquire the key competences required for their role as agents of change.	74.3	136
31. Encouraging the development of a 'culture of innovation' at system level, removing the fear of change and supporting decision-makers, teachers, and other stakeholders when taking sensible risks and trying new things.	73.3	120
21. Encouraging research on the implementation process of ICT-ELI, focusing on the possible learning gains.	72.5	131

As can be seen from the table above, **it is highly recommended that more investment be made into teachers' Continuous Professional Development and Initial Training and that knowledge exchange is encouraged to ensure that they acquire the key competences (including digital competence) required to apply and share (e.g. through professional networks) innovative pedagogical practices.**

Research on the implementation process of ICT-ELI should be supported and the development of a 'culture of innovation' to remove the fear of change at system level should be encouraged.

To enable ICT-ELI, fundamental infrastructure needs have to be fulfilled – e.g. it must be ensured that all learners to have equal and ubiquitous ICT access, in and out of school.

As already mentioned at the beginning of the report, the seven areas are very much interrelated and are not stand-alone. Change in one area demands change in others, too. For instance there is strong relationship between *Assessment* and *Content and Curricula*. Curricula reform requires a

reform of assessment, which should be able to capture 21st century skills using innovative approaches, assessing key competences and giving learners an active role in their own assessment. Student assessment and evaluation are an integral part of the teaching and learning process and as such must be thoughtfully integrated into the planning and delivery of content and curriculum. Thus, changes in *Content and Curricula* should go hand in hand with changes in *Assessment* strategies and examination systems in order to have a sustained impact on scaling up ICT-ELI. As pointed out by one of the participants: "*...There must be constructive alignment between curriculum and assessment. Formative assessment should feature at all times and should include self-assessment and peer-assessment, to develop critical, self-awareness and overall confidence."* Changes in curricula and learning objectives are ineffective, if assessment practices remain the same (Cachia, Ferrari, Ala-Mutka, & Punie, 2010).

Curricular changes (see Section 3.1) are evolving processes that require the engagement of several stakeholders, especially teachers. They also affect teachers' continuous professional development. Changing curricula requires not only changing content, but also changing teaching and learning practices. This means increasing teacher competence in the teaching practices applicable to new curricula and also an additional workload for teachers.[21] Teachers' competences are developed and strengthened through continuous professional development and initial teacher education and also through networking and peer-collaboration (*Connectedness*).

Any policy interventions related to *Infrastructure* should be part of a wider strategic plan that takes into account many parameters. For instance, only digitally-competent teachers (see *School Staff Professional Development*) are able to use ICT infrastructure efficiently for innovating teaching and learning practices.

Organisation and leadership has an overall influence, and directs and supports teachers in their innovative practices.

Therefore when applying changes, they should be applied in all areas, as simultaneously as possible.

[21] Teachers' workload due to extensive and heavily prescribed curricula and/or curricular changes was also a common theme arising throughout the wide-ranging consultation process followed in the context of SCALE CCR project.

4. Conclusions

The purpose of the this report was to present a comprehensive set of policy action recommendations for further developing and mainstreaming ICT-ELI across Europe. These recommendations were developed through a mixed-research approach and validated and evaluated through an online consultation with educational stakeholders involved in a wide diversity of contexts, scales and levels of educational innovation in Europe and beyond.

The number and variety of the recommendations provided depict the complexity of ICT-ELI and the systemic approach needed for their mainstreaming. This report is not a step-by-step guide for mainstreaming ICT-ELI, nor does it offer 'recipes' for success. It should be used to inform the policy-making process at all levels (local, regional, national, and EU) throughout long-term strategic planning and implementation of sustainable ICT-ELI based on the following key dimensions for policy action:

1. Policy- and decision-makers should understand that scaling up does not refer to recipes for replication of successful implementation, or to 'one-size-fits-all' and 'one-off' models of innovation and encourage learning organisations to follow **their own pathways to innovate and scale in 'organic' ways**.
2. Policy- and decision-makers should encourage the involvement of a **wide-range of stakeholders** in ICT-ELI and develop well-articulated **top-down strategies for supporting bottom-up innovations**.
3. Significant effort should be made by policy- and decision-makers to follow a **systemic approach** in implementing and progressively mainstreaming ICT-ELI, developing strategies that address concurrent changes in seven areas: Content and Curricula; Assessment; School Staff Professional Development; Research; Organisation; Connectedness and Infrastructure.
4. Policy actions are needed (at local, regional, national, and EU levels) for supporting the co-development of open and flexible **content and curricula** that allow innovative teaching and learning practices, made possible by the use of ICT, to flourish and become mainstream.
5. Policy actions at local, regional, national and EU levels should reap the benefits of ICT and promote substantial changes to the role and function of **assessment**, examination, certification and accreditation strategies in order to allow innovative teaching and learning practices to be further implemented and mainstreamed.
6. Policy- and decision-makers should recognise the key role of teachers, among other stakeholders, in guiding and implementing ICT-ELI and invest significantly in updating their continuous **professional development** to ensure that they acquire the key competences required for applying innovative pedagogical practices in real settings.
7. Policy actions at local, regional, national and EU levels are needed to ensure that the further development and progressive mainstreaming of ICT-ELI is based on **research** evidence focusing on how innovative pedagogical, technological and organisational practices can enhance learning.
8. Policy actions at micro-, meso-, and macro-level are needed for empowering learning institutions to develop well-articulated innovation agendas (with both long-term vision and short-term goals) that include changes in **organisation** structures/routines and **leadership** models, which result in learning innovation being regarded as a mainstream activity.
9. Policy should encourage and support **connectedness** of teachers and learners with other educational stakeholders at local level and beyond in order to open up and broaden the learning experience and mainstream ICT-ELI.

10. Policy should increase efforts and investment in **infrastructure** developments (e.g. broadband, cloud computing, creative learning spaces etc.) to support effective implementation and progressive mainstreaming of ICT-ELI.

We hope the policy action recommendations presented in this report will guide different trajectories of scaling up and progressive mainstreaming ICT-ELI in different contexts and stimulate further research in the field, contributing to the modernisation of Education and Training systems in Europe and beyond.

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Annex 1 – Online Questionnaire

Developing and mainstreaming ICT-enabled learning innovations in Europe

This survey is part of the study 'Up-Scaling Creative Classrooms in Europe' (SCALE CCR) undertaken by JRC-IPTS on behalf of the Directorate General Education and Culture. The objectives of the study are to:

- understand ICT-ELI with significant scale and/or impact;
- define what is meant by Creative Classrooms;
- develop policy recommendations for mainstreaming systemic innovation in Education and Training

You can learn more about the project and follow the developments on our webpage: http://is.jrc.ec.europa.eu/pages/EAP/SCALECCR.html.

The survey includes a number of policy recommendations for further developing and meanstreaming ICT-ELI in Europe. These recommendations address the technological, organisational and pedagogical aspects of innovation for learning and derive from the previous phases of the project, namely: extensive consultation with stakeholders, semi-structured interviews with education experts and practitioners and a number of case reports of ongoing ICT-ELI in Europe and Asia.

Please join the consultation process and share your views. Your involvement in the development of the final set of policy recommendations could have a direct impact on European policies on ICT-ELI and shape the upcoming initiatives on regional/national and European level. The survey takes approximately 20 minutes and the data you provide will be anonymous and confidential. If you have any questions or concerns, please do not hesitate to contact us.

Many thanks for your contribution!

In the first section we ask you for information related to your profile. All the information provided will be treated confidentially and used for the purposes of this survey only.

1. What is your background?

◯ teacher
◯ trainer
◯ researcher
◯ policy-maker (at EU, national, regional, local level)
◯ decision-maker (e.g. school head, chief education officer, university dean, etc.)
◯ technology provider/developer
◯ Other:

2. Where do you come from?

◯ Austria
◯ Belgium
◯ Bulgaria
◯ Cyprus
◯ Czech Republic
◯ Denmark
◯ Estonia
◯ Finland
◯ France

◯ Germany
◯ Greece
◯ Hungary
◯ Ireland
◯ Italy
◯ Latvia
◯ Lithuania
◯ Luxembourg
◯ Malta
◯ Netherlands
◯ Poland
◯ Portugal
◯ Romania
◯ Slovakia
◯ Slovenia
◯ Spain
◯ Sweden
◯ United Kingdom
◯ non EU country

3. What is your gender?

◯ male ◯ female

4. The year of birth:

19 [ ]

On following pages there are several policy recommendations, which address the technological, organisational and pedagogical aspects of innovation for learning. Please read them carefully and evaluate how relevant they are for **developing and mainstreaming ICT-ELI in Europe.** Please use the scale from 1 to 7, where 1 means "**recommendation is not relevant**" and 7 "**recommendation is very relevant**".

5. The following recommendations refer to content and curricula. Please evaluate how relevant is each of the recommendations for further developing and mainstreaming ICT-ELI. **Policy-** and **decision-makers** can ensure that **content and curricula** allow innovative teaching and learning practices (enabled by ICT) to become mainstream by:

	1	2	3	4	5	6	7
Bridging the gap, which still exists to a lesser/greater extent, between curricula and key competences.	◯	◯	◯	◯	◯	◯	◯
Promoting the involvement of education stakeholders (e.g. teachers, parents, researchers etc.) in the co-development of flexible and research-based curricula.	◯	◯	◯	◯	◯	◯	◯
Ensuring coherence between what is assessed and how this is done in practice and what is envisioned in the study programme.	◯	◯	◯	◯	◯	◯	◯
Promoting curriculum development that leaves room for teachers to work in small autonomous and interdisciplinary teams, with enough flexibility to choose the content, timetable etc.	◯	◯	◯	◯	◯	◯	◯
Promoting the use of Open Educational Resources (OER) for broadening and updating the content and process of learning.	◯	◯	◯	◯	◯	◯	◯
Promoting through the curricula innovative pedagogical practices made possible by the use of ICT, which could replace ineffective practices and avoid teachers' workload.	◯	◯	◯	◯	◯	◯	◯
Promoting the incorporation into formal curricula of effective practices from informal learning (e.g. learning by trial and error).	◯	◯	◯	◯	◯	◯	◯
Encouraging the regular update of learning content and curricula based on research findings.	◯	◯	◯	◯	◯	◯	◯

5a. If you have additional policy recommendations regarding content and curricula, please write them down.

6. The following recommendations refer to *assessment*. Please evaluate how relevant is each of the recommendations for further developing and mainstreaming ICT-ELI using a scale **from 1**(not relevant at all) **to 7** (very relevant). **Policy-** and **decision-makers** could reform **assessment strategies and examination systems** in order to allow innovative teaching and learning practices to flourish by:

	1	2	3	4	5	6	7
Promoting a formative assessment paradigm where assessment is considered to be an integral part of the learning process.	○	○	○	○	○	○	○
Revising examination systems in order to include assessment of both factual knowledge and key competences.	○	○	○	○	○	○	○
Promoting the use of ICT tools in order to reform assessment practices (e.g. cloud-based e-portfolios that follow a web 2.0/social media model).	○	○	○	○	○	○	○
Encouraging a shift of ownership of assessment from teachers to learners by giving them an active role in their own assessment (i.e. self-assessment).	○	○	○	○	○	○	○

***Formative assessment** refers mainly to those formal and informal procedures undertaken by teachers, and/or by students, which provide information to be used as feedback to enhance learning. Formative assessment is ongoing and repetitive (*during* the learning process) and typically involves qualitative feedback (rather than scores).

6a. If you have additional policy recommendations concerning assessment, please write them down.

7. The following recommendations refer to School Staff Professional Development. Please evaluate how relevant is each of the recommendations for further developing and mainstreaming ICT-ELI. **Policy-** and **decision-makers** could empower **teachers** to play the role of agents of change by:

	1	2	3	4	5	6	7
Recognizing the role of teachers as agents of change (rather than objects of change) and encouraging them to take the ownership of innovation (teacher-led innovation).	○	○	○	○	○	○	○
Updating Initial Teacher Training (including candidate admission process) to ensure that prospective teachers acquire the key competences required for their role as agents of change.	○	○	○	○	○	○	○
Investing significantly in updating Continuous Professional Development provisions (including the education of teacher trainers) to ensure that in-service teachers acquire the key competences required for fostering and orchestrating learning instead of transmitting knowledge.	○	○	○	○	○	○	○
Enabling teachers to develop their ability to adopt and adapt innovative pedagogical practices (e.g. formative assessment) for diverse learning settings and purposes.	○	○	○	○	○	○	○
Helping teachers to acquire much greater proficiency in data handling and methods such as learning analytics, which would allow them to monitor and personalize learning processes.	○	○	○	○	○	○	○
Supporting and motivating teachers to develop and update their digital competence and ICT skills (e.g. through in-service training, peer-learning and informal and non-formal learning), as life-long learners themselves.	○	○	○	○	○	○	○
Promoting a blended approach to continuous professional learning and	○	○	○	○	○	○	○

	1 2 3 4 5 6 7
development that combines online professional networks and self-organized face-to-face collaboration.	
Motivating and supporting teachers to make their innovative (pedagogical) practices more explicit and visible to peers and other stakeholders, such as parents, community and businesses.	○ ○○○○○○

7a. If you have additional policy recommendations concerning School Staff Professional Development, please write them down.

8. The following recommendations refer to research .Please evaluate how relevant is each of the recommendations for further developing and mainstreaming ICT-ELI. **Policy-** and **decision-makers** could ensure that the continuous evolution of ICT-ELI is based on **research** findings by:

	1 2 3 4 5 6 7
Supporting policies and initiatives for open research and free dissemination of data (e.g. open data, open access publications etc.), taking into account intellectual property, security and data protection issues.	○ ○○○○○○
Encouraging research on the implementation process of ICT-ELI, focusing on the possible learning gains.	○ ○○○○○○
Supporting the application of various research methods (e.g. teacher-led research, control groups, experimental research, longitudinal studies, social networks analysis, learning analytics, big data research, etc.) to the study of complex 'ecosystems' of ICT-ELI.	○ ○○○○○○
Supporting research on the perspectives of various actors and stakeholders such as policy-makers, school leaders, teachers, learners, parents, IT providers, educational content providers etc.	○ ○○○○○○
Supporting research on (physical and mental) health, security and legal issues related to ICT-ELI.	○ ○○○○○○
Promoting research on the ICT-ELI that happen at micro-level and could be scaled-up.	○ ○○○○○○
Supporting the development of common metrics (indicators, measurements, and approaches) for studying and monitoring ICT-ELI.	○ ○○○○○○
Encouraging the dissemination of findings from a variety of research fields (e.g. neuroscience) to stakeholders, in order to help them to further the evolution of ICT-ELI.	○ ○○○○○○

8a. If you have additional policy recommendations concerning research, please write them down.

9. The following recommendations refer to organisation and leadership. Please evaluate how relevant is each of the recommendations for further developing and mainstreaming ICT-ELI. **Policy-** and **decision-makers** could ensure that effective **organisational practices** and open and participatory **leadership** allow the progressive take up of innovation for learning by:

	1 2 3 4 5 6 7
Revising performance appraisal strategies for teachers and schools to allow more innovative teaching and learning to flourish.	○ ○○○○○○
Developing a well-articulated innovation agenda which has both long-term vision (ensuring policy support) and achievable short term goals for the progressive take up of innovation.	○ ○○○○○○
Supporting multi-stakeholder involvement in the creation and sharing of the common vision so that all of them understand the added value of innovation.	○ ○○○○○○

	1	2	3	4	5	6	7
Developing mechanisms and standards for recognizing, validating, and rewarding innovative practices (pedagogical, organisational and/or technological).	○	○	○	○	○	○	○
Encouraging the scaling up of innovation at local level (e.g. through school teams and mentoring programmes) so that it is used more broadly in different areas of a given organisation.	○	○	○	○	○	○	○
Making sure that technological innovation (e.g. 1 to 1 computing) in formal education settings is part of a wider transformation agenda which includes pedagogical and organisational innovation.	○	○	○	○	○	○	○
Supporting research-based changes in organisational structures and routines, such as timetables and learner grouping, in order to meet local needs (self-organisation - grass roots innovation).	○	○	○	○	○	○	○
Ensuring the political commitment and sustained effort over time that is required for ICT-ELI to flourish.	○	○	○	○	○	○	○
Supporting knowledge exchange (e.g. participation in national/international conferences and workshops) to gain a further understanding of how innovative practices are made possible by the use of ICT.	○	○	○	○	○	○	○
Developing monitoring mechanisms to ensure that the well-being of teachers and learners and values like equity and inclusion are taken into account.	○	○	○	○	○	○	○
Encouraging the development of a 'culture of innovation' at system level, removing the fear of change and supporting decision-makers, teachers, and other stakeholders when taking sensible risks and trying new things.	○	○	○	○	○	○	○
Promoting diversity in ICT-ELI by funding a number of pilots in different contexts and with diverse implementation strategies.	○	○	○	○	○	○	○
Setting evaluation, communication and feedback mechanisms (e.g. platforms for collecting big and/or rich data and learning analytics) right from the start of different pilots or initiatives.	○	○	○	○	○	○	○
Ensuring the stable and sizeable budget that is required for ICT-ELI to have sustainable success and impact at system level.	○	○	○	○	○	○	○
Encouraging collaboration and communication channels between supra-national agencies (i.e. European Commission, OECD, UNESCO etc.) in order to co-develop indicators and benchmarks for ICT-ELI.	○	○	○	○	○	○	○
Following the Open Method of Coordination* for identifying common challenges and opportunities, in order to support peer learning and exchange of effective policies and practices among the Member States.	○	○	○	○	○	○	○
Promoting programmes and initiatives that develop the knowledge- and innovation-management abilities of stakeholders (i.e. education decision-makers, school leaders etc.).	○	○	○	○	○	○	○
Promoting mixed approaches for scaling up ICT-ELI, which combines centralized top-down policies and bottom-up, self-organized practices.	○	○	○	○	○	○	○
Taking the initiative (e.g. forming cross-sector working groups and/or partnerships) to promote communication between stakeholders from policy (e.g. Ministries of Education), industry (e.g. IT providers) research (e.g. research centres), educational practice (e.g. teacher associations) and the wider public (e.g. parents associations) to build trust, assure mutual objectives, and create a common vision.	○	○	○	○	○	○	○
Encouraging learning organisations to build on their strengths, available resources and readiness to implement innovation for learning, following a step-by-step approach that could lead to a sustainable momentum towards a radical (or even disruptive) end.	○	○	○	○	○	○	○
Developing long-term strategies to develop the capacity of school leaders to adopt and adapt new methods of leadership (e.g. distributed leadership) in order to envisage, support and orchestrate ICT-ELI.	○	○	○	○	○	○	○
Creating organisational structures (e.g. formal recognition and informal reputation mechanisms, technical support, pedagogical advice, etc.) to support and motivate	○	○	○	○	○	○	○

	1	2	3	4	5	6	7
teachers to participate in professional networks, disseminating pedagogical innovation.							

9a. If you have additional policy recommendations concerning organisation and leadership, please write them down.

10. The following recommendations refer to connectedness. Please evaluate how relevant is each of the recommendations for further developing and mainstreaming ICT-ELI. **Policy-** and **decision-makers** could design and realise strategic plans to empower teachers and learners to **connect with people and ideas** in order to open up and broaden the learning experience by:

	1	2	3	4	5	6	7
Encouraging the development of small networks of schools (i.e. up to 10 schools) for connecting knowledge, innovative practices and people/efforts at local level and/or beyond.	○	○	○	○	○	○	○
Encouraging and supporting the development of small teacher networks (up to 10 participants at local level and/or beyond) for learning from each other in a more flexible and personalized way.	○	○	○	○	○	○	○
Supporting the development of bigger teacher professional networks (networks of networks) that offer a wider range of opportunities for peer learning and collaboration than the smaller networks.	○	○	○	○	○	○	○
Supporting data portability and interoperability between online professional networks, making it easier for teachers to participate in a number of them (e.g. without having to duplicate data).	○	○	○	○	○	○	○
Developing long-term sustainability and scalability strategies for cross-border professional networks, such as eTwinning, for disseminating pedagogical innovation.	○	○	○	○	○	○	○
Investing in structures, such as national and/or transnational inter-linked portals, to aggregate learning opportunities on a large scale (e.g. learning resources for School Staff Professional Development) and exchange knowledge and 'success stories' of innovation for learning.	○	○	○	○	○	○	○

10a. If you have additional policy recommendations concerning connectedness, please write them down.

11. The following recommendations refer to infrastructure. Please evaluate how relevant is each of the recommendations for further developing and mainstreaming ICT-ELI. **Policy-** and **decision-makers** should take advantage of the full potential of **infrastructure** for enabling innovative teaching and learning practices by:

	1	2	3	4	5	6	7
Increasing efforts and investment in ICT infrastructure (e.g. broadband, cloud computing) of appropriate performance and interoperability (any device, anywhere, any system, any time) to support effective implementation and evolution of innovation for learning.	○	○	○	○	○	○	○
Ensuring that all learners have equal and ubiquitous ICT access, in and out of school.	○	○	○	○	○	○	○
Supporting public-public and/or public-private partnerships between learning organisations, research centres, IT developers etc. to support R&D of technological innovations that fit the local needs and context.	○	○	○	○	○	○	○
(Re)designing and/or (re)arranging physical space/infrastructure to allow for innovative teaching and learning practices, based on research findings on the	○	○	○	○	○	○	○

	1	2	3	4	5	6	7
impact of factors such as ventilation, lighting, and noise on learning outcomes.							

11a. If you have additional policy recommendations concerning infrastructure, please write them down.

12. If you have additional comments and **suggestions** regarding **developing and mainstreaming ICT-ELI in Europe**, you can write them here:

In case you are interested in being updated with the results of the SCALE CCR study, please enter your email address (e.g. john@email.com).

Annex 2 – Workshop participants

Participants in the expert workshop 'Scaling up ICT-enabled innovation for learning: Inputs from Asia and Europe' held in Seville on 12-13 December 2012.

Name	Affiliation
Stefania **Bocconi**	National Research Council of Italy
Barbara **Brečko**	JRC-IPTS
Roberto **Carneiro**	Portuguese Catholic University, Portugal
Miroslava **Cernochova**	Charles University in Prague, Czech Republic
Jonatan **Castaño-Muñoz**	JRC-IPTS
Anusca **Ferrari**	JRC-IPTS
Conor **Galvin**	University College Dublin, Ireland
Seungyeon **Han**	Hanyang Cyber University, South Korea
Kampei **Hayashi**	Japan Society for the Promotion of Science
Panagiotis **Kampylis**	JRC-IPTS
Paul **Kelley**	Science+Technology in Learning, United Kingdom
Marco **Kools**	CERI-OECD
Carmen **Lazaro**	Ítaca School, Spain
Nancy **Law**	University of Hong Kong
Chee-Kit **Looi**	National Institute of Education, Singapore
Carlos **Medina**	Institute of Educational Technologies, Spain
Irene **Pateraki**	eTwinning National Support Service, Greece
Helle-Kirstine **Petersen**	Hellerup School, Denmark
Yves **Punie**	JRC-IPTS
Magdalena **Sverc**	Institute Anton Martin Slomsek, Slovenia
Christine **Redecker**	JRC-IPTS
Tamotsu **Tokunaga**	University of Tsukuba, Japan
Keith **Turvey**	University of Brighton, United Kingdom
Stella **Vosniadou**	National and Kapodistrian University of Athens, Greece
Riina **Vuorikari**	e-Learning expert, Belgium

Participants in the 'Scaling up ICT-enabled innovation for learning: Asia – Europe expert seminar' held in Hong Kong SAR on 22-23 January 2013.

Name	Affiliation
Stefania **Bocconi**	National Research Council of Italy
Catherine K. K. **Chan**	Education Bureau, Hong Kong SAR
Horn Mun **Cheah**	Ministry of Education, Singapore
Kai Ming **Cheng**	University of Hong Kong
Seungyeon **Han**	Hanyang Cyber University, South Korea
Ronghuai **Huang**	Beijing Normal University, China
Dae Joon **Hwang**	Korean Council for University Education, South Korea
Yu **Kameoka**	Ministry of Education, Culture, Sports, Science and Technology, Japan
Panagiotis **Kampylis**	JRC-IPTS
Gwang-Jo **Kim**,	UNESCO Bangkok
Nancy **Law**	University of Hong Kong
Chee-Kit **Looi**	National Institute of Education, Singapore
Jingyan **Lu**	University of Hong Kong
Naomi **Miyake**	University of Tokyo, Japan
Jonghwi **Park**	UNESCO Bangkok
Yves **Punie**	JRC-IPTS
Mang **She**	Education Bureau, Hong Kong SAR
Seng Thah **Soon**	Ministry of Education, Malaysia

Annex 3 – Statistical analyses

Table 12: Content and curricula policy recommendations - frequency distribution (%)

	1	2	3	4	5	6	7	Cumulative (6 and 7)
Promoting through the curricula innovative pedagogical practices made possible by the use of ICT, which could replace ineffective practices and avoid teachers` workload.	1.4	2.7	6.1	5.4	16.9	21.6	45.9	67.5
Promoting curriculum development that leaves room for teachers to work in small autonomous and interdisciplinary teams, with enough flexibility to choose the content. timetable etc.	2.7	4.7	5.4	6.7	18.1	30.9	31.5	62.4
Ensuring coherence between what is assessed and how this is done in practice and what is envisioned in the study programme.	0.7	3.4	2.0	11.4	22.1	26.8	33.6	60.4
Encouraging the regular update of learning content and curricula based on research findings.	2.0	3.4	5.4	6.7	22.1	30.2	30.2	60.4
Promoting the use of Open Educational Resources (OER) for broadening and updating the content and process of learning.	2.7	4.7	4.7	12.1	18.1	26.8	30.9	57.7
Promoting the involvement of education stakeholders (e.g. teachers, parents, researchers etc.) in the co-development of flexible and research-based curricula.	2.7	4.0	6.7	10.1	20.1	25.5	30.9	56.4
Bridging the gap, which still exists to a lesser/greater extent, between curricula and key competences.	3.4	2.0	4.7	11.4	24.8	24.8	28.9	53.7
Promoting the incorporation into formal curricula of effective practices from informal learning (e.g. learning by trial and error).	2.0	2.7	4.7	13.4	24.2	26.8	26.2	53.0

1 - not relevant at all; 7 - very relevant

Table 13: Assessment – policy recommendations - frequency distribution (%)

	1	2	3	4	5	6	7	Cumulative (6 and 7)
Encouraging a shift of ownership of assessment from teachers to learners by giving them an active role in their own assessment (i.e. self-assessment).	1.4	3.5	5.0	5.7	15.6	31.9	36.9	68.8
Revising examination systems in order to include assessment of both factual knowledge and key competences.	1.4	2.9	5.0	6.4	15.7	32.1	36.4	68.6
Promoting a formative assessment paradigm where assessment is considered to be an integral part of the learning process.	2.1	2.1	5.6	9.2	13.4	30.3	37.3	67.6
Promoting the use of ICT tools in order to reform assessment practices (e.g. cloud-based e-portfolios that follow a web 2.0/social media model).	1.4	3.5	3.5	6.3	22.5	31.0	31.7	62.7

1 - not relevant at all; 7 - very relevant

Table 14: School staff professional development – policy recommendations - frequency distribution (%)

	1	2	3	4	5	6	7	Cumulative (6 and 7)
Investing significantly in updating Continuous Professional Development provisions (including the education of teacher trainers) to ensure that in-service teachers acquire the key competences required for fostering and orchestrating learning instead of transmitting knowledge.		3.0	.7	4.5	10.4	28.4	53.0	81.3
Supporting and motivating teachers to develop and update their digital competence and ICT skills (e.g. through in-service training, peer-learning and informal and non-formal learning), as life-long learners themselves.	.7	1.5	.7	5.1	11.8	23.5	56.6	80.1
Enabling teachers to develop their ability to adopt and adapt innovative pedagogical practices (e.g. formative assessment) for diverse learning settings and purposes.		2.2	1.5	5.2	11.1	33.3	46.7	80.0
Recognizing the role of teachers as agents of change (rather than objects of change) and encouraging them to take the ownership of innovation (teacher-led innovation).		1.5		2.9	21.3	28.7	45.6	74.3
Updating Initial Teacher Training (including candidate admission process) to ensure that prospective teachers acquire the key competences required for their role as agents of change.		2.2	4.4	1.5	17.6	27.2	47.1	74.3
Motivating and supporting teachers to make their innovative (pedagogical) practices more explicit and visible to peers and other stakeholders, such as parents, community and businesses.	.7	2.2	3.0	8.1	14.8	31.1	40.0	71.1
Promoting a blended approach to continuous professional learning and development that combines online professional networks and self-organized face-to-face collaboration.	.7	2.2	4.4	8.1	14.7	27.2	42.6	69.9
Helping teachers to acquire much greater proficiency in data handling and methods such as learning analytics, which would allow them to monitor and personalize learning processes.	1.5	3.0	5.2	11.9	29.6	25.9	23.0	48.9

1 - not relevant at all; 7 - very relevant

Table 15: Research – policy recommendations - frequency distribution (%)

	1	2	3	4	5	6	7	Cumulative (6 and 7)
Encouraging research on the implementation process of ICT-ELI, focusing on the possible learning gains.	.8	.8	3.1	7.6	15.3	31.3	41.2	72.5
Supporting the application of various research methods (e.g. teacher-led research, control groups, experimental research, longitudinal studies, social networks analysis, learning analytics, big data research, etc.) to the study of complex 'ecosystems' of ICT-ELI.	.8	.8	4.6	8.4	23.7	29.8	32.1	61.8
Promoting research on the ICT-ELI that happen at micro-level and could be scaled-up.	.8	3.9	3.9	10.1	22.5	34.1	24.8	58.9
Supporting policies and initiatives for open research and free dissemination of data (e.g. open data, open access publications etc.), taking into account intellectual property, security and data protection issues.	.8	4.6	3.8	11.5	21.4	22.9	35.1	58.0
Supporting research on the perspectives of various actors and stakeholders such as policy-makers, school leaders, teachers, learners, parents, IT providers, educational content providers etc.	1.5	2.3	6.1	9.9	22.1	35.1	22.9	58.0
Encouraging the dissemination of findings from a variety of research fields (e.g. neuroscience) to stakeholders, in order to help them to further the evolution of ICT-ELI.	.8	3.1	3.1	11.5	23.8	26.9	30.8	57.7
Supporting the development of common metrics (indicators, measurements, and approaches) for studying and monitoring ICT-ELI.	1.5	5.4	4.6	8.5	33.1	21.5	25.4	46.9
Supporting research on (physical and mental) health, security and legal issues related to ICT-ELI.	.8	4.6	13.1	11.5	26.9	24.6	18.5	43.1

1 - not relevant at all; 7 - very relevant

Table 16: Organisation and leadership - policy recommendations - frequency distribution (%)

	1	2	3	4	5	6	7	Cumulative (6 and 7)
Supporting knowledge exchange (e.g. participation in national/international conferences and workshops) to gain a further understanding of how innovative practices are made possible by the use of ICT.	1.6	1.6	2.5	5.7	10.7	37.7	40.2	77.9
Creating organisational structures (e.g. formal recognition and informal reputation mechanisms, technical support, pedagogical advice, etc.) to support and motivate teachers to participate in professional networks, disseminating pedagogical innovation.	1.6	1.6	1.6	6.6	13.9	32.8	41.8	74.6
Encouraging the development of a 'culture of innovation' at system level, removing the fear of change and supporting decision-makers, teachers, and other stakeholders when taking sensible risks and trying new things.	.8	.8	5.0	5.8	14.2	24.2	49.2	73.3
Developing long-term strategies to develop the capacity of school leaders to adopt and adapt new methods of leadership (e.g. distributed leadership) in order to envisage, support and orchestrate ICT-ELI.	1.6	1.6	1.6	9.0	13.9	42.6	29.5	72.1
Making sure that technological innovation (e.g. 1 to 1 computing) in formal education settings is part of a wider transformation agenda which includes pedagogical and organisational innovation.	.8	1.6	3.3	11.5	11.5	32.0	39.3	71.3
Ensuring the stable and sizeable budget that is required for ICT-ELI to have sustainable success and impact at system level.	.8	1.6	1.6	10.7	14.8	36.1	34.4	70.5
Encouraging the scaling up of innovation at local level (e.g. through school teams and mentoring programmes) so that it is used more broadly in different areas of a given organisation.	.8	2.5	4.1	9.8	15.6	30.3	36.9	67.2
Developing a well-articulated innovation agenda which has both long-term vision (ensuring policy support) and achievable short term goals for the progressive take up of innovation.	.8	3.3	.8	8.2	20.5	36.9	29.5	66.4
Ensuring the political commitment and sustained effort over time that is required for ICT-ELI to flourish.	.8	.8	6.6	7.4	18.9	28.7	36.9	65.6
Developing mechanisms and standards for recognizing, validating, and rewarding innovative practices (pedagogical, organisational and/or technological).	.8	3.4	5.0	6.7	18.5	31.9	33.6	65.5
Promoting diversity in ICT-ELI by funding a number of pilots in different contexts and with diverse implementation strategies.	.8	3.3	3.3	7.4	20.5	27.9	36.9	64.8
Promoting mixed approaches for scaling up ICT-ELI, which combines centralized top-down policies and bottom-up, self-organized practices.	.8	2.5	5.7	12.3	14.8	36.9	27.0	63.9
Developing monitoring mechanisms to ensure that the well-being of teachers and learners and values like equity and inclusion are taken into account.	1.6	4.9	3.3	7.4	19.7	32.0	31.1	63.1
Encouraging learning organisations to build on their strengths, available resources and readiness to implement innovation for learning, following a step-by-step approach that could lead to a sustainable momentum towards a radical (or even disruptive) end.	.8	1.6	5.7	10.7	20.5	35.2	25.4	60.7

Supporting multi-stakeholder involvement in the creation and sharing of the common vision so that all of them understand the added value of innovation.	1.6	1.6	4.9	8.2	23.8	29.5	30.3	59.8
Promoting programmes and initiatives that develop the knowledge- and innovation-management abilities of stakeholders (i.e. education decision-makers, school leaders etc.).	1.7	.8	3.3	15.8	19.2	42.5	16.7	59.2
Revising performance appraisal strategies for teachers and schools to allow more innovative teaching and learning to flourish.	.8	4.1	4.1	9.8	22.1	26.2	32.8	59.0
Setting evaluation, communication and feedback mechanisms (e.g. platforms for collecting big and/or rich data and learning analytics) right from the start of different pilots or initiatives.	.8	1.7	6.6	16.5	17.4	26.4	30.6	57.0
Encouraging collaboration and communication channels between supra-national agencies (i.e. European Commission, OECD, UNESCO etc.) in order to co-develop indicators and benchmarks for ICT-ELI.	3.3	4.1	8.2	5.7	23.0	32.0	23.8	55.7
Taking the initiative (e.g. forming cross-sector working groups and/or partnerships) to promote communication between stakeholders from policy (e.g. Ministries of Education), industry (e.g. IT providers) research (e.g. research centres), educational practice (e.g. teacher associations) and the wider public (e.g. parents associations) to build trust, assure mutual objectives, and create a common vision.	1.6	2.5	4.9	13.9	21.3	26.2	29.5	55.7
Supporting research-based changes in organisational structures and routines, such as timetables and learner grouping, in order to meet local needs (self-organisation - grass roots innovation).	.8	1.7	5.0	14.9	25.6	28.1	24.0	52.1
Following the Open Method of Coordination* for identifying common challenges and opportunities, in order to support peer learning and exchange of effective policies and practices among the Member States.	.8	3.3	5.0	17.4	24.0	29.8	19.8	49.6

1- not relevant at all; 7 - very relevant

Table 17: Connectedness – policy recommendations - frequency distribution (%)

	1	2	3	4	5	6	7	Cumulative (6 and 7)
Encouraging and supporting the development of small teacher networks (up to 10 participants at local level and/or beyond) for learning from each other in a more flexible and personalized way.	.8	3.3	1.7	11.7	16.7	35.8	30.0	65.8
Encouraging the development of small networks of schools (i.e. up to 10 schools) for connecting knowledge, innovative practices and people/efforts at local level and/or beyond.	.8	2.5	6.7	5.8	20.0	29.2	35.0	64.2
Investing in structures, such as national and/or transnational inter-linked portals, to aggregate learning opportunities on a large scale (e.g. learning resources for teachers professional development) and exchange knowledge.	2.5	3.3	6.7	5.8	17.5	31.7	32.5	64.2
Developing long-term sustainability and scalability strategies for cross-border professional networks, such as eTwinning, for disseminating pedagogical innovation.	1.7	3.4	7.6	10.1	16.0	26.9	34.5	61.3
Supporting data portability and interoperability between online professional networks, making it easier for teachers to participate in a number of them (e.g. without having to duplicate data).	.8	3.3	6.7	12.5	15.8	26.7	34.2	60.8
Supporting the development of bigger teacher professional networks (networks of networks) that offer a wider range of opportunities for peer learning and collaboration than the smaller networks.	2.5	4.2	4.2	11.7	20.0	27.5	30.0	57.5

1- not relevant at all; 7 - very relevant

Table 18: Infrastructure – policy recommendations - frequency distribution (%)

	1	2	3	4	5	6	7	Cumulative (6 and 7)
Increasing efforts and investment in ICT infrastructure (e.g., broadband, cloud computing) of appropriate performance and interoperability (any device, anywhere, any system, any time) to support effective implementation and evolution of innovation for learning.	.8	1.7	2.5	10.0	14.2	23.3	47.5	70.8
Ensuring that all learners have equal and ubiquitous ICT access, in and out of school.	2.5	1.7	1.7	6.7	7.5	33.3	46.7	80.0
Supporting public-public and/or public-private partnerships between learning organisations, research centres, IT developers etc., to support R& D of technological innovations that fit the local needs and context.	.8	1.7	3.3	8.3	20.0	34.2	31.7	65.8
(Re)designing and/or (re)arranging physical space/infrastructure to allow for innovative teaching and learning practices, based on research findings on the impact of factors such as ventilation, lighting, and noise on learning.	.8	4.2	2.5	5.8	17.5	30.8	38.3	69.2

1- not relevant at all; 7 - very relevant

Breakdowns according to the background of experts

Table 19: Content and curricula policy recommendations according to the background

	background							
	teacher/ trainer		researcher		policy/ decision-maker		other	
	m (sd)	n	m (sd)	n	m (sd)	n	m (sd)	n
Bridging the gap, which still exists to a lesser/greater extent, between curricula and key competences.	5.32 (1.51)	68	5.44 (1.34)	32	5.79 (0.99)	28	5.24 (2.17)	21
Promoting the involvement of education stakeholders (e.g. teachers, parents, researchers etc.) in the co-development of flexible and research-based curricula.	5.26 (1.71)	68	5.75 (1.48)	32	5.43 (1.32)	28	5.33 (1.65)	21
Ensuring coherence between what is assessed and how this is done in practice and what is envisioned in the study programme.	5.59 (1.5)	68	5.78 (1.1)	32	5.93 (1.02)	28	5.33 (1.49)	21
Promoting curriculum development that leaves room for teachers to work in small autonomous and interdisciplinary teams, with enough flexibility to choose the content, timetable etc.	5.51 (1.64)	68	5.56 (1.58)	32	5.68 (1.25)	28	5.24 (1.73)	21
Promoting the use of Open Educational Resources (OER) for broadening and updating the content and process of learning.	5.62 (1.65)	68	5.41 (1.39)	32	5.54 (1.29)	28	4.67 (1.85)	21
Promoting through the curricula innovative pedagogical practices made possible by the use of ICT, which could replace ineffective practices and avoid teachers` workload.	5.85 (1.53)	68	5.81 (1.4)	32	6.14 (1.08)	28	5.3 (1.75)	20
Promoting the incorporation into formal curricula of effective practices from informal learning (e.g. learning by trial and error).	5.35 (1.47)	68	5.75 (1.22)	32	5.32 (1.06)	28	5.14 (1.96)	21
Encouraging the regular update of learning content and curricula based on research findings.	5.72 (1.38)	68	5.75 (1.22)	32	5.39 (1.4)	28	4.9 (1.95)	21

1- not relevant at all; 7 - very relevant; () std. deviation

Table 20: Assessment policy recommendations according to the professional background

	background							
	teacher/ trainer		researcher		policy/decision -maker		other	
	m (sd)	n	m (sd)	n	m (sd)	n	m (sd)	n
Promoting a formative assessment paradigm where assessment is considered to be an integral part of the learning process.	5.68 (1.45)	66	6.07 (1.19)	29	5.81 (1.39)	26	5.1 (1.87)	21
Revising examination systems in order to include assessment of both factual knowledge and key competences.	5.73 (1.5)	64	5.83 (1.1)	29	5.88 (1.4)	26	5.48 (1.57)	21
Promoting the use of ICT tools in order to reform assessment practices (e.g. cloud-based e-portfolios that follow a web 2.0/social media model).	5.58 (1.49)	66	5.83 (1.23)	29	5.85 (1.12)	26	5.38 (1.56)	21
Encouraging a shift of ownership of assessment from teachers to learners by giving them an active role in their own assessment (i.e. self-assessment).	5.78 (1.43)	65	5.97 (1.32)	29	5.65 (1.29)	26	5.38 (1.77)	21

1- not relevant at all; 7 - very relevant; () std. deviation

Table 21: Teachers professional development according to the background

	background							
	teacher/ trainer		researcher		policy/ decision-maker		other	
	m (sd)	n	m (sd)	n	m (sd)	n	m (sd)	n
Recognizing the role of teachers as agents of change (rather than objects of change) and encouraging them to take the ownership of innovation (teacher-led innovation).	6.1 (1.13)	62	6 (0.96)	29	6.04 (0.87)	26	6.53 (0.77)	19
Updating Initial Teacher Training (including candidate admission process) to ensure that prospective teachers acquire the key competences required for their role as agents of change.	5.97 (1.27)	62	6.03 (1.09)	29	6.04 (1.25)	26	6.32 (1.2)	19
Investing significantly in updating Continuous Professional Development provisions (including the education of teacher trainers) to ensure that in-service teachers acquire the key competences required for fostering and orchestrating learning instead of transmitting knowledge.	6.25 (1.24)	60	6.24 (0.99)	29	5.77 (1.31)	26	6.53 (0.7)	19
Enabling teachers to develop their ability to adopt and adapt innovative pedagogical practices (e.g. formative assessment) for diverse learning settings and purposes.	6.02 (1.22)	61	6.41 (0.82)	29	6.04 (1.22)	26	6.11 (1.1)	19
Helping teachers to acquire much greater proficiency in data handling and methods such as learning analytics, which would allow them to monitor and personalize learning processes.	5.47 (1.47)	62	5.14 (1.22)	29	5.38 (1.33)	26	5.22 (1.44)	18
Supporting and motivating teachers to develop and update (e.g. through in-service training, peer-learning and informal and non-formal learning) their digital competence and ICT skills, as life-long learners themselves.	6.27 (1.2)	62	6.34 (0.9)	29	5.96 (1.11)	26	6.26 (1.41)	19
Promoting a blended approach to continuous professional learning and development that combines online professional networks and self-organized face-to-face collaboration.	5.9 (1.35)	62	5.93 (1.13)	29	5.62 (1.53)	26	5.95 (1.47)	19
Motivating and supporting teachers to make their innovative (pedagogical) practices more explicit and visible to peers and other stakeholders, such as parents, community and businesses.	6.02 (1.24)	61	6.07 (1.1)	29	5.46 (1.48)	26	5.68 (1.42)	19

1- not relevant at all; 7 - very relevant; () std. deviation

Table 22: Research policy recommendations according to the background

	background							
	teacher/ trainer		researcher		policy/ decision-maker		other	
	m (sd)	n	m (sd)	n	m (sd)	n	m (sd)	n
Recognizing the role of teachers as agents of change (rather than objects of change) and encouraging them to take the ownership of innovation (teacher-led innovation).	6.1 (1.13)	62	6 (0.96)	29	6.04 (0.87)	26	6.53 (0.77)	19
Updating Initial Teacher Training (including candidate admission process) to ensure that prospective teachers acquire the key competences required for their role as agents of change.	5.97 (1.27)	62	6.03 (1.09)	29	6.04 (1.25)	26	6.32 (1.2)	19
Investing significantly in updating Continuous Professional Development provisions (including the education of teacher trainers) to ensure that in-service teachers acquire the key competences required for fostering and orchestrating learning instead of transmitting knowledge.	6.25 (1.24)	60	6.24 (0.99)	29	5.77 (1.31)	26	6.53 (0.7)	19
Enabling teachers to develop their ability to adopt and adapt innovative pedagogical practices (e.g. formative assessment) for diverse learning settings and purposes.	6.02 (1.22)	61	6.41 (0.82)	29	6.04 (1.22)	26	6.11 (1.1)	19
Helping teachers to acquire much greater proficiency in data handling and methods such as learning analytics, which would allow them to monitor and personalize learning processes.	5.47 (1.47)	62	5.14 (1.22)	29	5.38 (1.33)	26	5.22 (1.44)	18
Supporting and motivating teachers to develop and update (e.g. through in-service training, peer-learning and informal and non-formal learning) their digital competence and ICT skills, as life-long learners themselves.	6.27 (1.2)	62	6.34 (0.9)	29	5.96 (1.11)	26	6.26 (1.41)	19
Promoting a blended approach to continuous professional learning and development that combines online professional networks and self-organized face-to-face collaboration.	5.9 (1.35)	62	5.93 (1.13)	29	5.62 (1.53)	26	5.95 (1.47)	19
Motivating and supporting teachers to make their innovative (pedagogical) practices more explicit and visible to peers and other stakeholders, such as parents, community and businesses.	6.02 (1.24)	61	6.07 (1.1)	29	5.46 (1.48)	26	5.68 (1.42)	19

1- not relevant at all; 7 - very relevant; () std. deviation

Table 23: Organisation and leadership policy recommendations according to the background

	background							
	teacher/ trainer		researcher		policy/ decision-maker		other	
	m (sd)	n	m (sd)	n	m (sd)	n	m (sd)	n
Revising performance appraisal strategies for teachers and schools to allow more innovative teaching and learning to flourish.	5.66 (1.45)	53	5.67 (1.14)	27	5.4 (1.5)	25	5.47 (1.66)	17
Developing a well-articulated innovation agenda which has both long-term vision (ensuring policy support) and achievable short term goals for the progressive take up of innovation.	5.66 (1.41)	53	6 (0.78)	27	5.72 (1.21)	25	5.53 (1.42)	17
Supporting multi-stakeholder involvement in the creation and sharing of the common vision so that all of them understand the added value of innovation.	5.53 (1.48)	53	5.96 (1.09)	27	5.32 (1.25)	25	5.71 (1.49)	17
Developing mechanisms and standards for recognizing, validating, and rewarding innovative practices (pedagogical, organisational and/or technological).	5.76 (1.46)	50	6.07 (0.78)	27	5.32 (1.49)	25	5.41 (1.62)	17
Encouraging the scaling up of innovation at local level (e.g. through school teams and mentoring programmes) so that it is used more broadly in different areas of a given organisation.	5.72 (1.47)	53	6.07 (0.87)	27	5.6 (1.41)	25	5.59 (1.54)	17
Making sure that technological innovation (e.g. 1 to 1 computing) in formal education settings is part of a wider transformation agenda which includes pedagogical and organisational innovation.	5.79 (1.41)	53	6 (1.11)	27	5.52 (1.45)	25	6.24 (1.03)	17
Supporting research-based changes in organisational structures and routines, such as timetables and learner grouping, in order to meet local needs (self-organisation - grass roots innovation).	5.5 (1.45)	52	5.59 (1.01)	27	5.16 (1.31)	25	5.35 (1.27)	17
Ensuring the political commitment and sustained effort over time that is required for ICT-ELI to flourish.	5.72 (1.38)	53	6.07 (1.27)	27	5.4 (1.15)	25	5.94 (1.39)	17
Supporting knowledge exchange (e.g. participation in national/international conferences and workshops) to gain a further understanding of how innovative practices are made possible by the use of ICT.	6.08 (1.43)	53	5.89 (1.22)	27	5.8 (0.91)	25	5.94 (1.43)	17
Developing monitoring mechanisms to ensure that the well-being of teachers and learners and values like equity and inclusion are taken into account.	5.89 (1.5)	53	5.48 (1.42)	27	5.04 (1.34)	25	5.65 (1.46)	17
Encouraging the development of a 'culture of innovation' at system level, removing the fear of change and supporting decision-makers, teachers, and other stakeholders when taking sensible risks and trying new things.	6.12 (1.31)	52	6.19 (1.04)	27	5.67 (1.4)	24	5.88 (1.45)	17
Promoting diversity in ICT-ELI by funding a number of pilots in different contexts and with diverse implementation strategies.	5.85 (1.39)	53	5.93 (1.17)	27	5.24 (1.36)	25	5.88 (1.45)	17

Setting evaluation, communication and feedback mechanisms (e.g. platforms for collecting big and/or rich data and learning analytics) right from the start of different pilots or initiatives.	5.55 (1.45)	53	5.59 (1.39)	27	5.12 (1.27)	25	5.75 (1.48)	16
Ensuring the stable and sizeable budget that is required for ICT-ELI to have sustainable success and impact at system level.	5.79 (1.38)	53	6.04 (0.9)	27	5.52 (1)	25	6.06 (1.48)	17
Encouraging collaboration and communication channels between supra-national agencies (i.e. European Commission, OECD, UNESCO etc.) in order to co-develop indicators and benchmarks for ICT-ELI.*	5.57 (1.41)	53	5.52 (1.42)	27	5.4 (1.32)	25	4.12 (2.12)	17
Following the Open Method of Coordination* for identifying common challenges and opportunities, in order to support peer learning and exchange of effective policies and practices among the Member States.	5.34 (1.39)	53	5.19 (1.33)	27	5.56 (1.16)	25	4.88 (1.54)	16
Promoting programmes and initiatives that develop the knowledge- and innovation-management abilities of stakeholders (i.e. education decision-makers, school leaders etc.).	5.42 (1.45)	52	5.52 (1.09)	27	5.32 (0.99)	25	5.56 (1.21)	16
Promoting mixed approaches for scaling up ICT-ELI, which combines centralized top-down policies and bottom-up, self-organized practices.	5.47 (1.34)	53	5.96 (1.34)	27	5.36 (1.41)	25	5.53 (1.37)	17
Taking the initiative (e.g. forming cross-sector working groups and/or partnerships) to promote communication between stakeholders from policy (e.g. Ministries of Education), industry (e.g. IT providers) research (e.g. research centres), educational practice (e.g. teacher associations) and the wider public (e.g. parents associations) to build trust, assure mutual objectives, and create a common vision.	5.36 (1.56)	53	5.74 (1.46)	27	5.44 (1.23)	25	5.47 (1.33)	17
Encouraging learning organisations to build on their strengths, available resources and readiness to implement innovation for learning, following a step-by-step approach that could lead to a sustainable momentum towards a radical (or even disruptive) end.	5.55 (1.44)	53	5.52 (1.12)	27	5.28 (1.14)	25	6.06 (1.3)	17
Developing long-term strategies to develop the capacity of school leaders to adopt and adapt new methods of leadership (e.g. distributed leadership) in order to envisage, support and orchestrate ICT-ELI.	5.64 (1.44)	53	5.96 (1.06)	27	5.64 (0.99)	25	6.12 (1.27)	17
Creating organisational structures (e.g. formal recognition and informal reputation mechanisms, technical support, pedagogical advice, etc.) to support and motivate teachers to participate in professional networks, disseminating pedagogical innovation.	5.83 (1.5)	53	6 (1.21)	27	5.92 (1.12)	25	6.29 (0.85)	17

1- not relevant at all; 7 - very relevant; () std. deviation

*($F(3, 118)=4.233$; $p<0.05$)

Table 24: Connectedness policy recommendations according to the background

	background							
	teacher/ trainer		researcher		policy / decision-maker		other	
	m (sd)	n	m (sd)	n	m (sd)	n	m (sd)	n
Encouraging the development of small networks of schools (i.e. up to 10 schools) for connecting knowledge, innovative practices and people/efforts at local level and/or beyond.	5.81 (1.47)	53	5.54 (1.56)	26	5.67 (0.96)	24	5.59 (1.42)	17
Encouraging and supporting the development of small teacher networks (up to 10 participants at local level and/or beyond) for learning from each other in a more flexible and personalized way.	5.94 (1.31)	53	5.38 (1.47)	26	5.71 (0.95)	24	5.24 (1.44)	17
Supporting the development of bigger teacher professional networks (networks of networks) that offer a wider range of opportunities for peer learning and collaboration than the smaller networks.	5.47 (1.72)	53	5.31 (1.38)	26	5.75 (1.22)	24	5.18 (1.59)	17
Supporting data portability and interoperability between online professional networks, making it easier for teachers to participate in a number of them (e.g., without having to duplicate data).	5.62 (1.58)	53	5.35 (1.35)	26	5.92 (1.21)	24	5.18 (1.59)	17
Developing long-term sustainability and scalability strategies for cross-border professional networks, such as eTwinning, for disseminating pedagogical innovation.	5.7 (1.59)	53	5.38 (1.39)	26	5.83 (1.19)	23	4.88 (1.87)	17
Investing in structures, such as national and/or transnational inter-linked portals, to aggregate learning opportunities on a large scale (e.g., learning resources for teachers professional development) and exchange knowledge.	5.66 (1.59)	53	5.65 (1.57)	26	5.58 (1.14)	24	5.18 (1.78)	17

1- not relevant at all; 7 - very relevant; () std. deviation

Table 25: Infrastructure policy recommendations according to the background

	background							
	teacher/ trainer		researcher		policy / decision-maker		other	
	m (sd)	n	m (sd)	n	m (sd)	n	m (sd)	n
Increasing efforts and investment in ICT infrastructure (e.g., broadband, cloud computing) of appropriate performance and interoperability (any device, anywhere, any system, any time) to support effective implementation and evolution of innovation for learning.	5.98 (1.38)	53	5.77 (1.31)	26	6.08 (0.97)	24	5.94 (1.6)	17
Ensuring that all learners have equal and ubiquitous ICT access, in and out of school.	5.85 (1.68)	53	6.08 (1.16)	26	6.25 (0.85)	24	6.12 (1.17)	17
Supporting public-public and/or public-private partnerships between learning organisations, research centres, IT developers etc., to support R& D of technological innovations that fit the local needs and context.	5.79 (1.38)	53	5.81 (1.27)	26	5.71 (1.08)	24	5.53 (1.12)	17
(Re)designing and/or (re)arranging physical space/infrastructure to allow for innovative teaching and learning practices, based on research findings on the impact of factors such as ventilation, lighting, and noise on learning	5.75 (1.48)	53	5.81 (1.3)	26	5.83 (1.24)	24	5.94 (1.39)	17

1- not relevant at all; 7 - very relevant; () std. deviation

European Commission

EUR 26601 – Joint Research Centre – Institute for Prospective Technological Studies

Title: Mainstreaming ICT-enabled Innovation in Education and Training in Europe: Policy actions for sustainability, scalability and impact at system level

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Abstract

Technologies for learning are considered as key enablers of educational innovation. However, their full potential is not being realised in formal education settings and major questions are being asked about the sustainability, systemic impact and mainstreaming of ICT-enabled learning innovations (ICT-ELI) in Europe. This report presents 60 recommendations for immediate strategies and actions to be undertaken by policy-makers at local, regional, national, and EU level to further develop and mainstream ICT-ELI with systemic impact, contributing to the modernisation of Education and Training systems in Europe. The recommendations were developed in the context of the 'Up scaling Creative Classrooms in Europe' (SCALE CCR) project, carried out by JRC-IPTS on behalf of the European Commission, DG Education and Culture, based on desk research; case reports from Europe and Asia; continuous stakeholders consultations; and in-depth expert interviews. The final set of recommendations was further validated and prioritised through an online consultation with 149 educational stakeholders. The recommendations were clustered into seven areas presenting a holistic agenda to guide the further development and mainstreaming of ICT-ELI: Content and Curricula; Assessment; School Staff Professional Development; Research; Organisation and Leadership; Connectedness; and Infrastructure. The number and variety of the recommendations provided depict the complexity of ICT-ELI and the systemic approach needed for their mainstreaming across Education and Training systems in Europe.

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Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.

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