

Open Book of Educational Innovation

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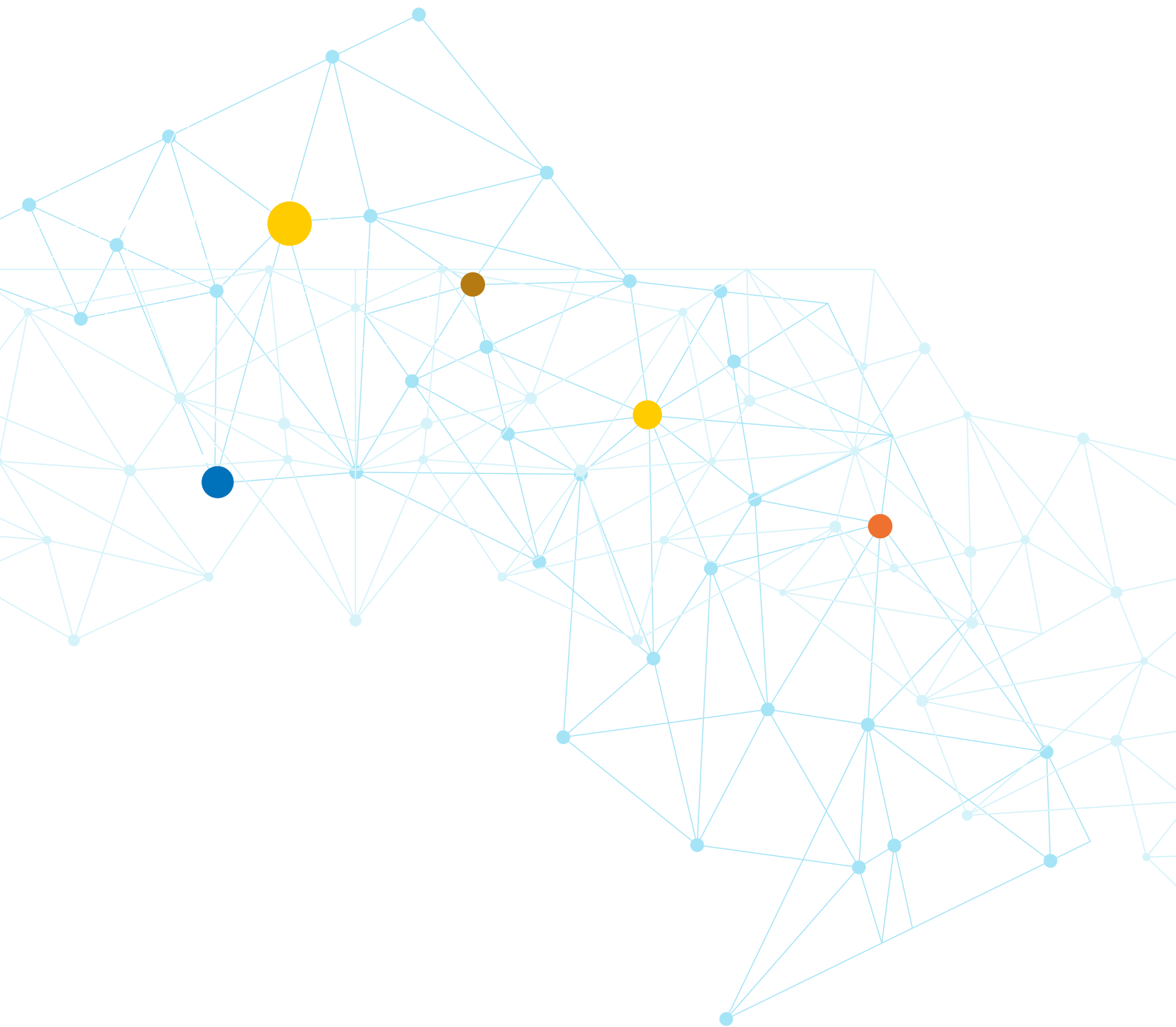
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Open Book of Educational Innovation





PREFACE

European Schoolnet, as a network of over 31 education ministries across Europe, stands firmly for innovation in education, and we are delighted on its behalf to present a first edition of this **Open Book on Educational Innovation** in our 20th anniversary year.

Innovation in education is a tough challenge: it is hard to identify it and to know when it can be considered mature enough to be evaluated. With an already busy schedule, innovative educators rarely have the time to communicate about their work, and the term ‘innovation’ itself can in different circumstances be inflated or shied away from.

And yet, innovation happens daily in education everywhere, but it is normally hidden away, too granular, too small-scale to attract widespread attention. We also do not have easy and accepted ways of modelling innovation: top-down versus bottom-up; the process from idea to implementation and evaluation; how fertile and receptive our educational ecosystems are; and of course the role of education authorities in capturing, supporting, and sharing innovation.

Efforts have been growing over the last 20 years to pin down what educational innovation is, how it comes about, and how it can be fostered, evaluated and then disseminated. This book is part of that effort and we owe our thanks to the colleagues in our member organisations for their work in compiling the examples we present. This publication looks at how innovation, especially technology-inspired innovation, is defined and provides a showcase for over a hundred ground-breaking initiatives in schools across Europe. The Chinese proverb says that a book is like a garden carried in the

pocket: as regards innovation, we hope that this book will fertilise the ground, seed thought and nurture growth so that more and more of our children can reap the benefits from the innovations our teachers are creating.

This Open Book is our first attempt to start making innovation more visible. It is intended to support all those involved in education innovation: policymakers who can help to create the right conditions; practitioners eager to learn and innovate; those who conduct research on innovation; and foundations and enterprises which can fund and promote innovative practices.

The next steps will be about widening our sources and partners so that next time we achieve an even richer and more diversified map of innovation, engaging discussions of existing ‘models’ so that we can better grasp the essence of how the disruptive effects of innovation can be positively harnessed and emulated.



Giovanni Biondi

Chair of European Schoolnet



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1 INTRODUCTION

a. Starting to map innovation

This book is about the many ways in which policy-makers, school leaders, teachers, students, and sometimes parents, are calling into question and changing their views and practices so as to meet head-on the core challenges of our educational times. Which student competences are needed in the 21st century? Which teaching and learning processes are able to develop and nurture them, and which assessment models can meaningfully empower students and monitor the acquisition of those competences? What is the role of school leaders and teachers in this new learning environment? How best to recruit, educate and train the educators throughout their whole career? What nowadays should the role of the school be and what kind of social organisation should the school be? How can we articulate policy-making and practice to support the changes in values, models, roles, methods and practices introduced by the 3rd digital revolution in our societies and, of course, permeating education? How best to use technology itself to support education in addressing all these challenges? How to design learning spaces as ‘learning agents’? How to connect student learning in and out of school?

This book takes stock and celebrates initiatives and organisations at the core of the transformation underway across several European countries at primary and secondary levels of formal education systems (ISCED 1 to 3, also referred to as K12). Several interesting initiatives illustrate also cooperation between *formal* and *non-formal education providers*. All these initiatives have been collected, and in many cases (co-)implemented, by ministries in charge of education

and/or national agencies with a specific remit for supporting its modernisation, usually with the help of technology used as a tool and support for change rather than simply for the sake of change. European Schoolnet's view is indeed that technology has to become transparent in education, i.e. fully integrated when relevant, used as a facilitator to implement new teaching and learning practices, organisational and communication processes, and reinforcing the cultural and mindset changes required to align education with current society's needs and values.

The examples gathered here represent the first cross-country endeavour of such a kind at EU level. These examples are intended first to testify to the manifold changes initiated and the prospective ideas and efforts invested by all those engaged in the transformation process at school and system levels. It promotes myriads of new ways of designing key aspects of learning: teaching and learning practices; time or space related organisational processes; whole school strategies; and multi-player partnerships. Most actors in educational innovation are aware of only a small fraction of innovative initiatives implemented elsewhere. Through this collection of innovative initiatives, this Open Book intends to inspire and give ideas to teachers, school leaders and policy-makers to help them develop innovative learning environments suited to their specific context, rather than offer copy & paste 'solutions'. It also aims to trigger some re-thinking of respective roles and contributions within truly collaborative approaches. Local, regional and central policy-makers can indeed help create effective governance to align needs that emerge from practice with the overall vision for the system as whole. In all the areas we mention, technology has substantial potential to help deliver the intended changes, already evidenced for example in supporting situated learning or sustainable cross-schools relationships to give only two instances.

Education may often be considered 'slow to change', with teachers and school leaders in some cases reluctant to disclose their innovative practices - sometimes because they themselves still doubt their value, but frequently because they simply lack the time to spread the word. Working in isolation is also a trait associated with the education world. There is in addition a dearth of channels to collect and circulate information widely, physical or virtual places for

sharing and - more importantly - discussing innovative practices. Concepts, tools, methods, processes, systemic thinking are barely accessible in the absence of ‘information hubs’ available to education professionals who are usually not that aware of what is tried and tested elsewhere, sometimes even just next door.

This book is only a very first attempt to fill this gap. The innovations presented are implemented from single school level upwards, by groups or networks of professionals or schools, acting at local, regional, national, or even sometimes transnational level. The initiatives presented are not intended to offer a representative mapping of all types of innovation implemented in European countries, or of their respective importance. The innovation territory covered by this first edition is limited and is a first step towards developing further a knowledge base about educational innovations in progress and as they flourish in practice and hopefully exceed their intentions. There are many innovative approaches this book does not cover, many countries not sufficiently represented, and several initiatives described only in very summary form.

b. Defining educational innovation

Innovation is a very broad concept which is addressed by many definitions that vary depending on the specific area of application and the point of view adopted (economical, sociological, organisational, technological, etc.). In this book, we mostly refer to innovation as ‘... *an idea, practice, or object that is perceived as new by an individual or other unit of adoption...[and] It matters little [...] whether or not an idea is “objectively”*¹ new as measured by the lapse of time since its first use or discovery.’ (Rogers, 2003, p 12). Rogers’ reference to the subjective nature of innovation is clearly borne out in the array of initiatives presented in this book and variety in the country/education systems featured. In this book, we also emphasise the fact that innovation has to lead to improvement, as argued by Kirkland and Such (2009, p. 10) where it is specified that ‘*Innovation is the application of a new resource or approach that changes social practice, creating some value*’ i.e. that is better or more effective than its predecessor.

1. The word “objectively” is underlined by Rogers, E. in the original text.

The Institute for Prospective Technological Studies (JRC Seville- ex IPTS) (2012, p.6) has identified the key characteristics which miscellaneous definitions of innovation usually have in common. This JRC-IPTS overview presents innovation usually as an intentional activity implying action (beyond thinking), addressing unsolved problems and benefits through the development or improvement of a product, process or method. Whether incremental, radical or disruptive, innovation is usually defined as a dynamic process. According to Clayton Christensen in *The innovator's dilemma* (2003), incremental refers to limited change leading to continuous improvement; radical corresponds to a major change affecting a key component or pillar in the area concerned; and disruptive refers to (incremental or radical) change dismissing the way of doing things previously in place. JRC Seville (ex-IPTS) also emphasises that most definitions envisage innovation as ‘...an unpredictable social process involving complex interactions between various actors’, and is context- specific what also has an impact on its diffusion potential (see the mainstreaming section later for more details).

Looking more specifically at the concept of educational innovation, OECD/CERI (2010, p. 14) build on the basic ideas of novelty and improvement mentioned above, extending it to “...*any dynamic change intended to add value to the educational process and resulting in measurable outcomes, be that in terms of stakeholders satisfaction or educational performance*” (see the evaluation section later for more details).

According to Fullan (2007), significant educational innovation – or change in practice – must contain three elements:

- Use of new revised materials (curriculum materials or technologies)
- Use of new teaching approaches (teaching strategies or activities)
- Alteration of beliefs (pedagogical assumptions).

Especially when it comes to innovation at school level, Fullan considers that developing innovation as a process requires the necessary skills, an approach aiming at empowerment, a climate of trust, and a lot of energy to implement new ways of organizing things, rewarding people, and communicating.

Technology-supported innovation is a key component in the very large majority of the initiatives presented in this book. According to Kozma (2003), *'ICT-supported innovation in education is defined as pedagogical solutions and means supporting a shift from traditional paradigms towards emerging pedagogical approaches based on our current understanding of learning, such as fostering learner-centred and constructivist processes, and the acquisition of lifelong learning skills'*. More recently, IPTS (2012) refers to ICT-enabled innovation for learning as *'... the profoundly new ways of using and creating information and knowledge made possible by the use of ICT (as opposed to using ICT for sustaining or replicating traditional practices).'* The IPTS report emphasises the new culture of learning afforded by technology, putting the learners at the centre, through teaching and learning processes that cannot be as easily implemented without technology, for example personalisation, authentic learning, social learning, peer-to-peer interactions, etc. The IPTS report also underlines the accompanying changes in values, practices, and infrastructure at the institutional level and beyond. Hannon (2009, p. 5) refers to a complete shift in the educational paradigm, driven by the four principles of social innovation, i.e. openness, collaboration, freedom, and direct participation of those involved.

The initiatives presented in this book evoke all these characteristics, albeit in a very summarised way given the context of the exercise, and without all the characteristics being systematically present in any one single example.

The initiatives presented under this heading have been collected at national level between February and June 2017; only a few of them are cross-country level.

They are structured according to the '7+3' framework for innovative learning environments developed by the OECD (2013, 2017).

This OECD framework for innovative learning environments is conceptually grounded in a research review published in 2010 (Dumont, H., Instance, D., Benavides, F. (eds), *The nature of learning: Using research to inspire practice*) focusing on different aspects of learning. This review identified the fundamentals shaping individual learning environments as well as wider systems, and led OECD

to define seven design principles – to be looked at interactively - as building blocks in educational innovation design.

These seven principles maintain that:

1. *learning environments should make learning and engagement central;*
2. *ensure it is understood as social;*
3. *be highly attuned to learners' emotions;*
4. *reflect individual differences;*
5. *be demanding for all while avoiding overload;*
6. *use broad assessments and feed-back;*
7. *promote horizontal connectedness.'* OECD (2017).

OECD complemented these seven principles by three additional dimensions as follows to optimise the conditions for putting them into practice:

- The pedagogical core of the learning environment, distinguishing between elements (learners, i.e. 'who'; educators, i.e. 'with whom'; content, i.e. 'what' and learning resources, i.e. 'with what') and *dynamics* (as combinations of several of the elements listed above);
- Schools (and other learning environments) as *formative* organisations i.e. organisations implementing visionary leadership informed by evidence from practice and research;
- Opening up to partnerships by working with 'external' players such as families, communities, other education levels, cultural institutions, other schools, etc.

The figure below, provided by OECD, summarises the 7 + 3 ILE Principles and their interaction:

The 7 + 3 ILE Principles

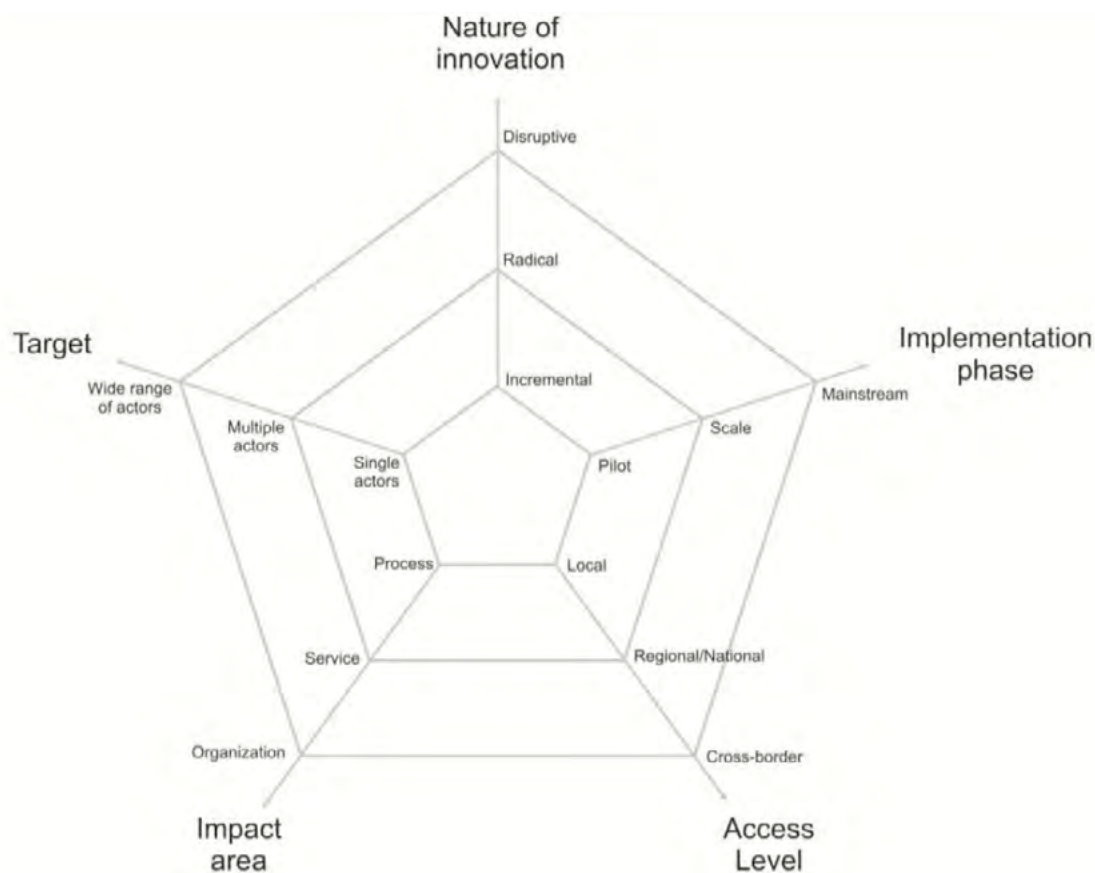


Source: Figure 2.3 in OECD (2017), *The OECD Handbook for Innovative Learning Environments*

The choice of this OECD 7 + 3 Principles ILE Framework to structure the initiatives presented below reflects our wish to start mapping and illustrating the territory of educational innovations collected for this book. At this very initial stage of the mapping process, our interest lies less in the strict categorisation of the innovative initiatives than in the illustrative trends they suggest. Several initiatives may indeed be presented under two or even three of the OECD dimensions: for example when they combine innovation addressing the pedagogical core as well as the school as a formative organisation informed by evidence, while also working in partnership with hundreds of schools (this is the case for example with initiatives like the *Avanguardie Educative in Italy*). This is one of the reasons why we offer a thematic index at the end of the book for readers interested in specific topics or areas of innovation so that they can be more efficiently guided through this emerging collection of initiatives.

We could also have used another interesting framework, developed by JRC Seville (Kampylis, Bocconi, Punie, 2012) to map innovation on a five-dimensional framework of ICT-enabled innovation for

learning, comprising: the nature of innovation; its implementation phase; the access level; the impact area; and the target, as shown in the figure below developed by JRC Seville (IPTS, 2012):



We considered this interesting framework to be difficult to fully apply, given the limited level of detail in the information provided for each initiative collected at this preliminary stage of the mapping process, especially regarding the nature of innovation (incremental, radical or disruptive) and even more its implementation phase.

2 INITIATIVES INNOVATING THE PEDAGOGICAL CORE

A. KEY ELEMENTS

a. Content- rethinking competences

Addressing innovation in the key elements of the pedagogical core, we look first at the **content** of learning. The initiatives presented in this section provide an insight to a shift in focus from knowing about content to developing competences. This shift is particularly illustrated in two specific areas of the curriculum: **programming** (computational thinking), and **entrepreneurship** education. While key and transversal competences are considered essential in today's world, it is not always clear:

- what they are precisely;
- how to practically develop them in a school lesson context;
- how they relate to the development of other competences;
- and if they serve as an end or a means to achieve other targets.

The innovative initiatives you are about to read address these questions.

Programming activates a cognitive process that is about logical reasoning (predicting and analysing), making steps and rules to create algorithms, breaking down into parts, removing unnecessary detail, developing patterns and generalisation, and making judgments. All these thinking processes and approaches are useful in many other domains than computer sciences. They can be trans-

ferred to other areas of student learning and more generally into action in their real life context as inspirational examples of hand-on and minds-on practices. Programming also enriches learners' views on various ways they can use computers and technology, and when, how, and where it brings added value.

In the initiatives like *Scratch Aveyron*, *Coding@scuola*, *Recreo con Condigos* and *Apps for good*, programming is very often associated with problem-based learning, an interdisciplinary approach and/or project-based learning or collaborative learning. Its specific added value lies in the fact that the various cognitive processes involved are most obviously apparent; are potentially most effectively learned through the rigorous and creative process of writing code; and in addition lead to meaningful and tangible evaluation: the programme works, or not, the robot acts as intended, or not. Solving the problem possibly faced at the end the programming process nurtures the motivation to identify and understand the mistake, and help the learning to be more sustainable.

When activities aiming at developing students' digital skills take place in a Makers Labs and are offered in a partnership between formal and informal stakeholders (*Bee Creative* initiative), the educator-learner hierarchy may even become obsolete. Developing students' digital skills also offers opportunities to promote their autonomy in learning (*Learn to program* initiative) and leads to projects reaching out beyond the school level (*Touris-Tic* Tour initiative).

Entrepreneurship education, sometimes associated with programming as in the *Apps for good* initiative, develops the skills and mind-set to be able to turn creative ideas into entrepreneurial action. Entrepreneurship is a transversal competence, which applies to all spheres of life: from nurturing personal development, to actively participating in society, to preparing for the job market as a future employee or as a self-employed person. Interestingly, the topic as a subject of the curriculum is often associated with pedagogical approaches like problem-based learning, inquiry-based learning and situated learning as in the *Youth Start* and *Kids Keep-Invest-Donate-Spend* initiatives. Entire schools are sometimes encouraged to focus their teaching and learning activities on en-

trepreneurship (*Entrepreneurial Schools* initiative), combining the use of technology and innovative learning approaches to support student creativity and collaboration.

Programming and entrepreneurship, often used in the context of innovation, are thus woven into the intentional development of a bundle of skills such as creativity, social skills (for example communication as in the *CIEPS Santo Domingo* initiative), problem-solving, and critical thinking skills. Furthermore, they can be related to/ associated with other subjects such as citizenship or the mother tongue/national language. The learning process usually gains added value, becoming more engaging and diversified as it is linked to methods that are student-centred and active. Initiatives like *Theme Weeks* and *Maths Week* Ireland are organised as incentives to engage students in more attractive and exciting learning contexts: they also offer a congenial way of generating systemic impact.

Innovation in the content of learning is not limited to the learning content itself but also affects the relationships between teachers, students and communities. The “products” of students are usually shared through networking. Moreover, some initiatives not only target learners but also support complementary activities at community level and/or teacher professional development. Families also become more involved as they are invited to participate to their children’s projects. For these reasons, some of the initiatives presented in this section could also fit into the *Innovating the pedagogical core – Dynamics connecting elements* section of this book.

As these innovative activities are not mainstreamed but rather the exception, only some of them are evaluated through policy experimentation with field trials or research project at large scale in real context, while others are yet to be evaluated

1. Scratch Aveyron /France

The “Scratch Aveyron”¹ project introduces French primary school students based in the Aveyron department (south of France), to coding and enables them to learn how to build algorithms that include simple instructions (actions triggered by an event, sequences of instructions, loops, conditional statements, variables etc.).



This is a solutions-based approach towards acquiring new skills. Approaching programming in a solution-based way builds students’ numerical and social skills, motivation and creativity.

The project focuses on supporting teachers and their students to practice coding in order for them to understand the basic concepts needed to organise their thoughts, imagine, create and record achievements. The project offers teachers a course allowing them to become familiar with the necessary pedagogical practices that will facilitate the introduction of coding to their students.

At the same time, concrete tasks have been developed for students as well. During the school year, various challenges are launched, allowing students to put to the test their understanding of basic logic concepts (sequence, iteration, condition), as well as to learn how to organise their thoughts, to imagine, to create, and to share.

1. <http://eduscol.education.fr/primabord/le-defi-scratch-aveyron-2015>

Each challenge comes with a specific tutorial allowing teachers and students to get started with their applications. All outcomes are made available online and serve as inspiration to other teachers and students.

programming; problem based learning ; key competences; teacher continuous professional development; resources sharing.



2. Introduction to Programming in Primary Schools /Portugal

The aim of this project is to enable Portuguese students at the age 7 to 10 in the Group of schools of Vila Real de Santo António², to learn concepts of computer programming applied to non-computer activities and relate them to school subjects such as Mathematics, Portuguese language, Science, History and Citizenship.

Programming, in addition to developing students' creativity in computer science, can promote a broader view of the different uses of the computer and contributes to the development of computational thinking. Students view the new technologies both as means for achieving their goals and as tools to help accomplish tasks in a faster and more effective way.

The project is divided into two main phases:

- In the first phase, the concepts of programming are introduced through games and activities, without using computer systems. Occasionally, computers are used, but only as a complement to the activity.
- In the second phase, and using computer systems, children are invited to create programming games that involve concepts from their school curriculum. Programming projects focus on topics interesting for the students, using resources such as Code.org, Scratch and Kodu.

These activities are presented, explained and monitored by an ICT teacher in partnership with the class teacher. Activities are appro-

2. <http://www.aevrsa.com/index.php?pag=inicio>

appropriate to students' daily learning and are matched with their level of education.

Classes take place in various locations: a common classroom, the computer room, outside the classroom, or other places that suit the activity.

Students are invited to participate in their own learning process by suggesting activities or even by making the rules for the activities. Materials such as chalk, tables or chairs are used as active elements to define obstacles that the programmer must overcome, or as goals of an action in which the students themselves are the programmer and the computer.

programming ; interdisciplinary approach; digital competences
game based learning; active learning.



3. Coding@Scuola Pre and Primary School /Italy

Coding@scuola³ combines the use of robotics, computational thinking and design group approach in pre-school and primary school teachers. Led by INDIRE (the National Institute for Documentation, Innovation and Educational Research) the initiative operates in mixed age groups where pupils work on various projects through problem solving and computational thinking.

Furthermore, a design group comprising teachers from both primary school and pre-school is created with the objective to collaborate and create coding activities for pre-school using the technical experience of the primary teacher. The teachers use Cubetto, a friendly wooden robot toy that teaches children the basics of computer programming through adventure and hands-on play. Design instruments based on computational thinking are also provided for teachers.

The innovative dimension in this project is twofold: first, introducing and testing robotic tools in pre-school, primary and secondary schools, while creating a bridge between them. Second, in practice

3. <http://www.indire.it/progetto/coding-a-scuola/>

through their work, primary school teachers involve their students as tutors for the pre-school pupils, thus fostering interaction, creation of continuity and facilitate the passage from pre-school to primary school.



The next stages of this project foresees to link it to related projects such as the 3D printer at pre-school initiative, creating a Cubetto competition, and create an online networking between teachers across pre- and primary school levels.

programming; mixed age groups learning; cross schools/teachers relationship.



4. Coding@Scuola Secondary Schools/Italy

A new experimental approach to use coding and computational thinking in language and Mathematics teaching is underway in Italy, helping to improve student engagement and reduce drop-out rates.

Coding@scuola⁴ sets the following goals:

- Make Italian language and Mathematics studies more engaging and hence reduce drop out;

4. <http://www.indire.it/progetto/coding-a-scuola/>

- Develop multidisciplinary activities that enable students to develop skills in creating interactive objects, as well as communication skills using Italian language and Mathematical literacy and computational skills.

In practice the experiment focuses on practical integration of coding (mainly Scratch) into the teaching of theoretical subjects. A multidisciplinary team of four teachers - two Informatics, one Mathematics, and one Italian language teacher – was established in the school. The Informatics teachers develop the computational thinking approach and the use of Informatics towards problem-solving strategies in order to create virtual objects. Then, they train other teachers in the school to use design tools based on computational thinking when preparing activities within the Mathematics and Italian language curricula for 14-15-year-old students.

programming; interdisciplinary approach; key competences; problem based learning; collaborative teaching.



5. Recreo con Codigos: a Creative Spiral/Spain

In Spain, a project has been developed with the aim of gradually introducing programming so that students at primary school (age 6-12) are able to understand algorithms and find out how to use them in their daily lives.

Coding is used transversally, across various subjects and ages, starting from early primary students. The main educational objective is to help students, by providing them with information and allowing them to experiment, explore, design and create, become creative thinkers and connect their learning to programming.

During this process, they are free to create a project based on their ideas, share it with their friends, reflect on it, and develop it further. This is a spiral, with the proposal beginning and continuing in the students' imagination: this means a process of constant improvement, allowing the enrichment of the initial activity with more alternatives or topics.

Students use different free apps, depending on their age, and the tasks performed are fully integrated into the curriculum: in the first and second years of primary education, ScratchJr⁵ is used, in the third and fourth years, Hopscotch is used, and in the fifth and sixth years, Scratch is used.

Each school year may see a different thematic focus: for example “Programming in Primary Education”⁶, or “Gamification and programming video games”⁷. Allowing students to gain new skills and knowledge in the field.

programming; creative thinking; project-based learning;
collaborative learning.



6. Learn to program/Belgium (Wallonia- Brussels)

Part of the digitalisation project in the Wallonia- Brussels federation⁸, the Learn to Program initiative aims to provide learners with the tools to become active creators and participants in the digital world.

In the project, pupils learn how to use Scratch[®]1program, Raspberry Pi[®] computers and Makey Makey[®], an electronic invention tool and toy that allows users to connect everyday objects to computer programs. Using these tools, pupils learn how to program, create and use technology. Furthermore, they actively learn logical concepts, maths, science and learn how to be autonomous in the digital world. Teaching staff also participate in the learning process, as they are required to use creative teaching methods and apply innovative teaching methods.

Due to the success of the project, the teachers who carried out the initiative were asked to train their colleagues and to follow an advanced professional course in order to be able to support advanced pupils. Accordingly, the learning benefits of the program are apparent and affect all participants.

5. <https://www.scratchjr.org/> and then to <https://scratch.mit.edu/>

6. <https://www.youtube.com/watch?v=MBCJvRWC-ZA>

7. <https://www.youtube.com/watch?v=V6A8RDdDjpE&feature=youtu.be>

8. <http://www.ecolenumerique.be/qa/>

In fact, $\frac{3}{4}$ of the teaching staff in the participating school have chosen to adopt ICT in their classes. Also, advanced pupils created a database with online tutorials (cf. Khan Academy) that can assist pupils with difficulties when using the digital tools mentioned above.

The initiative has also promoted collaboration between schools, as participating schools share their student-created resources and artefacts as well as with interesting projects and further plans for future collaboration. One such plan is a collaboration between two schools and the municipality of Charleroi to give pupils the possibility of developing an audio guide for their city.

digital competences; game based learning; teacher professional development; networking; collaborative teaching; collaborative learning; school-community relationship; programming.



7. Touris-Tic Tour/Belgium (Wallonia- Brussels)

Imagine a normal bus transforming itself into a digital bus! This became a reality thanks to two vocational training schools in Wallonia. This initiative is part of the digitalisation project in the Wallonia-Brussels federation⁹.

In this initiative, the classes who participated in the project were part of the “Coach Driver” study section and had a first hand opportunity to create, learn and explore historic sites with the digital bus. The pupils experienced at first hand how to drive, plan and practice tourist visits and guide round the city. The pupils prepared an historic and economic overview of the place visited: interesting sites, routes, restaurants and other tourist information. Furthermore, the pupils created a map with the detailed route of the visit. All these activities were carried out in the digital bus by the pupils: using various applications such as Taleblazer©, Etigloss©, Google Docs© and online resources. During their visits, pupils participated in educational games related to the city they visited. All the information they collected and created is used by their classmates and has been integrated in the curricula. The project continues to

9. <http://www.ecolenumerique.be/qa/>

inspire other schools and various teaching materials and support material is available for teachers who would like to participate with their class in this initiative¹⁰.

digital competences; game based learning.



8. Apps for Good/Portugal

“Apps for Good”¹¹ is an open-source technology education movement that partners with educators in schools and learning centres to deliver courses to young people 10-18 years of age. In Portugal, the project is promoted by CDI Portugal and sponsored by Direção-Geral da Educação (Ministry of Education).

Middle school and high school students work together as teams to find real day-to-day issues (e.g. energy-saving; food supply) they care about and learn to build a mobile, web or social app to solve them.

The main purpose is to secure students’ spontaneous expression, the search for original, diversified and innovative solutions to problems, the selection of techniques and instruments with persuasive intent and participation in the process of technological creation.

The teams are supported by two teachers, who act as facilitators, while students share their ideas and clarify any doubts through video conferences with experts from Portugal and India.

Teachers and students, with or without an IT background, have access to a platform where subjects are organised in different modules, videos and class tutorials and materials that will help them build an app.

Through “Apps for Good”, and its different stages and methodologies, students are encouraged to think outside the box, to create business models in which everyone has a specific role in the team plus to have a clear objective and a strong team spirit that will help them reach their goal. Like professional entrepreneurs, students go

10. <http://ressources.ecolenumerique.be/2016/07/06/creer-un-roman-photo-afin-de-mettre-en-avant-les-prejuges-sur-les-wallons-et-les-flamands-2-2/>

11. <http://cdi.org.pt/apps-good/>

through all key aspects of new product development, from idea generation, technical feasibility and programming to product design, deciding on business models and marketing.

programming; entrepreneurship education; problem based learning ; collaborative learning.



9. Bee Creative- Makerspace Network/Luxembourg

The Bee creative¹² initiative connects formal and non-formal education throughout Luxembourg. Creating makerspaces in six schools throughout the country, this initiative equips pupils with digital skills while also encouraging and fostering their entrepreneurial spirit.

Designed as places of discovery, the network of makerspaces are creative and multidisciplinary spaces open to young people and anyone who is interested in using new media in a creative and innovative way. The makerspace enables young people creatively to realise their own digital projects. The makerspaces help young people to realise their dreams and become digitally literate, by provide young people with the practical tools and assistance in using technology and new media.

The activities offered at makerspaces stimulate talent, encourage young people to take an interest in technological tools and motivate them to invest themselves in this field. Unlike a traditional classroom makerspaces are all about creativity, experimentation, craftsmanship, learning by experience, learning by doing and bringing ideas to fruition.

The makerspace operates according to the principles of non-formal education and there is no teacher / pupil hierarchy. It is equipped with machines that can be used by young people and by trainers: hand tools, computers, robots, 3-D printers as well as more complex tools such as a laser cutting machine.

Bee Creative also organises makers' workshops¹³ in various languag-

12. <http://www.bee-creative.lu/#about>

13. <http://www.bee-creative.lu/workshops>

es; topics include 3D printing, robotics, electronics programming and design. Furthermore, for those who don't live close to a makerspace, Bee creative provides DIY manuals in four languages that help young people aged eight or over to create their own mini- makerspace by using tools and objects available in every home and grocery shop. Bee Creative organises Makerfest¹⁴, a two-day event open to the public where visitors can meet the makers and participate in a range of workshops.

makers approach; creative thinking; digital learning environment; inquiry based learning; entrepreneurship education; digital competences; programming; robotics; game based learning.



10. Youth Start – Entrepreneurial Challenges/ Austria, Luxembourg, Portugal, Slovenia

Youth Start – Entrepreneurial Challenges¹⁵ is the largest entrepreneurship education project in Europe and is co-funded by the Erasmus+ Programme. It is planned as an innovative, transferable and scalable program through the collaboration of the public authorities in Austria, Luxembourg, Portugal and Slovenia.

The programme operates at compulsory school level which fully builds experiential learning into education for entrepreneurship and personal growth. Students develop their own entrepreneurial mind-set, innovation capabilities, employability skills and an ability to make a positive contribution to society.

Throughout the programme, students perform hands-on/minds-on learning experiences, share results, reactions and observations with their peers, analyse and discuss problems and solutions, search for meaning through real world examples and principles, and, finally, apply the entrepreneurial lessons learned through experience.

Flexibility is built in by having intensive and extensive versions of the programme, making it accessible for teachers to apply in all kinds of schools and disciplines in order to use the entrepreneurial challenges with their students.

14. <http://www.bee-creative.lu/events>

15. <http://www.youthstartproject.eu/>

The challenges encompass three segments:

- “*Core Entrepreneurial Education*”: basic qualifications for entrepreneurial thinking and acting, namely the competence to develop and implement ideas.
- “*Entrepreneurial Culture*”: the promotion of personal competences in a social context, such as open-mindedness, empathy, teamwork and creativity as well as risk-taking and awareness of risks.
- “*Entrepreneurial Civic Education*”: enhancing social competences and empowering students in their role as citizens.

The effectiveness of the learning is assessed through a randomised controlled trial methodology. Teachers are specifically asked to create two pedagogic resources per entrepreneurial challenge, using at least one web tool. Teacher training includes e-learning, the use of forums and collaboration tools.

Moreover, measuring the effectiveness of learning provides an interesting insight and possibility to inform policy makers in the field of education.

entrepreneurship education; situated learning; problem based learning; inquiry based learning; teacher continuous professional development; evidence-based policy; field trials.



11. Kids Keep Invest–Donate–Spend/Portugal

The OECD’s Principles and Good Practices for Financial Education and Awareness recommend that Financial Education start as early as possible within schools. We report here the experience of Portuguese schools in implementing an Erasmus+ project to help children internalise concepts like money, earning and spending money, making investment, risking, starting entrepreneurship and to equip the next generation with better knowledge and skills to make effective choices and wise decisions in the future.

The project does not only target pupils but also parents and teachers through different workshops. Workshop modules on how to be financially literate were prepared by the pedagogical team after analysing data from a needs analysis questionnaire, looking at topics

such as budget planning and management, financial systems and basic products, savings, credit, ethics and social responsibilities.

The project has had a great impact on pupils, parents and teachers, with proven increases in knowledge of financial literacy.

The project relies heavily on technical as well as creative use of media tools for primary students, allowing them to use and record their written ideas and findings.

All students engaged in the project not only covered the national curriculum content but they were very motivated and obtained better results. They discovered real, different and meaningful ways to communicate in English and became far more familiar with ICT, particularly Web 2.0 tools. They became more aware of consumer decisions, more skilled in contributing to the family budget, embodying the attitudes and behaviours gained from the project in their daily lives.

financial literacy; entrepreneurship education; situated learning; collaborative learning; teacher continuous professional development; school-parents relationship.



12. Maths Week/Ireland

Maths Week is a partnership of organisations concerned with promoting mathematics across the island of Ireland. Over 50 partners are involved including universities, institutes of technology, teacher training colleges, further education, professional bodies, museums, libraries and visitor centres and other groups. Events are run by partners, delivered online and most schools run their own special activities. The guiding principle of Maths Week is “Maths for All”.

One of the main aims of the programme is to develop problem-solving skills among students. The organisers run workshops aimed at increasing problem-solving skills and in particular:

- Developing a growth mind-set - believing that intelligence can grow depending on the amount of effort students put in.

- Developing mathematical thinking – making connections and thinking logically.
- Developing mathematical understanding – without understanding, children are just following procedures which will be forgotten outside of the maths lesson.
- Developing language – the ability to talk about ideas gives the pupils the potential to be efficient mathematical problem solvers, and to take on more challenging work.

Maths Week has been running in Ireland since 2006, co-ordinated by CALMAST, the Centre for the Advancement of Learning of Maths, Science and Technology at the Waterford Institute of Technology, and it is supported by the Department of Education and Skills.

During Maths Week 2017, 340 000 pupils participated in the initiative, playing games, learning through the learning support tools provided on the Maths Week website, participating in an online competition, and much more! ¹⁶

mathematics; school-experts relationship; learning resources.



13. Theme weeks/Hungary

Hungary has an annual programme of “Theme Weeks” aimed at enhancing 21st century skills, opening up education to the public, and raising awareness on core issues in education such as digital skills for example. They provide a playful and entertaining way to gain practical skills that can be used in everyday life, and encourage teachers to try out new pedagogical approaches.

The Ministry of Human Capacities announces Theme Weeks every year, with topics related to the main development areas of the core curriculum and which are priorities in public education-related strategies. The Theme Weeks are organised annually and usually in the spring. In spring 2018 the Financial and Business Theme Week will be organised for the fourth time; the Sustainability Theme Week

¹⁶ <http://www.mathsweek.ie/2017/>

and the Digital Theme Week for the third time.

Educational institutions can ask volunteers to support their events and the programme coordinators engage appropriate professionals to strengthen the bridges between schools and their local communities and civil sector.

In 2017:

- The Financial and Business Theme Week¹⁷ reached over 166 000 students in more than 1 100 schools. Educators could choose from two categories: finance and business, and were supported with lesson plans and teaching material for each age group, with lessons of 1-3 hours. Topics in focus vary from year to year. In 2018 the theme week in the Finance category will be “Smart on Loans”, while the Business theme will be “Business Ideas and Cooperation”.
- The Sustainability Theme Week¹⁸ reached 1 909 schools and 350 000 students. To support the thematic lessons, organisers offer lesson plans and project plans with different content for three different age groups. Teachers can also implement their own projects and are supported with lesson plans and teaching material. Schools are also provided with the possibility to collaborate with local NGOs and professionals.
- The Digital Theme Week¹⁹ reached 1 037 schools and teachers’ work is supported by a large number of sample project packages and pedagogical materials. The aim of this theme week is to encourage the use of informatics in all subjects and help teachers and pupils to develop their digital skills. Over the whole school year, workshops and webinars are organised to support teachers and enhance their digital skills. During the theme week, school groups can participate in activities and workshops provided by partners, for example a workshop on programming and coding²⁰.

17. <http://www.penz7.hu/>

18. <https://www.fenntarthatosagi.temahet.hu/>

19. <http://digitalistemahet.hu/>

20. <http://digitalistemahet.hu/tudasbazis/esemeny>

To conclude, Theme Weeks aim to develop, connect and disseminate innovative practices, to develop content-related materials and methodologies in order to allow both pupils and teachers to practice and develop their digital skills. Formal and informal learning opportunities, opened up to the public, mean that digital competence and the motivation to learn and develop skills are now firmly built into educational activities for learners of all ages.

school-community relationship; school-experts relationship; digital competences; teachers continuous professional development; mainstreaming innovation; financial literacy; digital competences.



14. Entrepreneurial Schools/Luxembourg

‘Entrepreneurial schools’²¹ in the Grand Duchy is a joint venture between the Education Ministry and the Secretary of State for Economy. These secondary schools encourage their students to develop multidisciplinary skills enabling them to succeed in future entrepreneurial challenges, while fostering interest in STEM subjects.

The development of a spirit of initiative and entrepreneurship helps young people to discover their personal talents and ambitions, stimulates their creativity and originality, makes them aware of the ecological, political and economic issues of our time, helps them take responsibility and develops the positive mind-set necessary to anticipate and adapt to the future.

The entrepreneurial schools share the following aims:

- To develop fundamental multidisciplinary skills, including creativity, cooperation, spirit of initiative, mastery of information and communication technologies;
- To prepare students better for working life and stimulate a spirit of active citizenship;
- To combat early school leaving by adopting an innovative educational approach;

21. <http://www.cedefop.europa.eu/en/news-and-press/news/luxembourg-promoting-entrepreneurship-secondary-education>

- To make students more ‘employable’ and stimulate the creation of start-ups;
- To bridge the gap between school life and working life.

STEM; entrepreneurship education.



15. Educational Project on Communications – CEIPS Santo Domingo/Spain



In one part of Madrid in Spain, the enforced closure of a school, combined with imaginative new approaches to ICT-enabled education, had led to new school provision that extends the primary and infant education offer into the secondary level. The initial situation has been reversed and the school is now one of the most popular schools in the city.

This new project²² at CEIPS Santo Domingo (Algete, Madrid) was initiated by a new management team five years ago when the imminent closure was announced as a result of the decrease in enrolment rates. The backbone is the promotion of communication skills. Communication and research are considered the two basic principles of teaching/learning process. Since communication is a

22. <http://www.ceipsantodomingo.com/page92/page96/page119/index.html>

key element, teachers post children's assignments on the Internet. All these didactic resources are then used by different public media: TV, radio and the digital press. The basis of work in the school are:

- methodological changes with an emphasis on the didactic use of ICT, especially, through the widespread use of tablets
- active participation of students and fostering creativity and peer learning
- opening the centre to the participation and collaboration of families, as well as cooperation with various companies and institutions
- developing a protocol to welcome and support new teachers and Personal Development plans developed by the staff.

Textbooks are rare, and interdisciplinary projects are developed where students create didactic aids through the use of mind-maps. These resources are published in different formats, including interactive and multimedia designs, and they are used by other students in the learning process. Social networks are used to distribute the sources of information, propose educational activities and games, and disseminate initiatives.

communication skills; key competences; interdisciplinary approach; active learning; collaborative learning; project-based learning; school-parents relationship.



b. Learners- better to include them all

The use of technology in learning content is one element of innovative learning environments, but it is not the only one. The use of technology, as we know it in the 21st century - internet, social media, online applications, and rich variety of ICT tools - can also serve as a medium to enhance and promote inclusive education. Inclusion in this sense has a broad perspective: including all types of learners and their educational needs.

One area presented is how to prepare refugee children to enter regular classes, as in Customised Schools for Newcomers with the Use of ICT initiative. This is possible through preliminary personalised learning that aims to compensate for and bridge differences in language competence and allow refugee children to master the language of the education system they are entering. Children from minorities and/or marginalised groups in society can also benefit from the use of technology and innovative methods when educational staff master the tools and knowledge in how to reach, engage and support these communities. As in the Inclusive Education for Roma communities initiative where children are reached through collaboration with their parents, or the Tanoda initiative operating outwith the formal education system but in cooperation with it.

Addressing the needs of all learners also entails providing support for children and students with chronic diseases, keeping them in the educational and learning process. Keeping such learners in their peer social circle by using distance learning modalities is illustrated in the Bednet initiative. This can also be achieved by better integration of learners with writing and reading disabilities thanks to technology-enabled learning facilities, such as in the Adibib initiative; or learners with dys-type problems as in the A2RNE initiative.

Finally, 'all learners' means also addressing the needs of gifted students in STEM through additional learning opportunities and incentivisation as happens in the Junior Science Olympiad initiative.

Other initiatives presented in this book give the opportunity to

students from different schools and places to experience learning together through technology-supported teaching and learning. They are nonetheless not included in this section of the Book as bringing students together in that way is not their core focus.

16. Customised Schools for Newcomers with the Use of ICT/Netherlands

Over the last decade, extensive flows of refugees and economic migrants across Europe have challenged public authorities to find new ways to ensure effective education of incoming children.

The Netherlands is a case in point and has created a number of special schools²³ offering personalised educational support in the use of ICT in order to facilitate the successful integration of children within the normal educational system. Children in these schools are taught the Dutch language, so that they can continue on to regular primary education after 1-2 years. ICT education also forms part of the program for children in these schools for newcomers.

The diversity of these children is huge. Some have never been to school before while other children may have attended school but have been taught in a non-European language only. There are children who do not speak English and children who may have received some education in the Netherlands but have moved from one location to another. Finally, some children often have suffered trauma or other problems (e.g. learning difficulties) that require personal attention.

1-on-1 education is difficult to achieve, but the use of ICT can provide solutions. With tablets, teachers are able to get the kids started independently while ICT helps teachers to monitor children's progress while reducing their administrative tasks.

The documentary *"The Children of Juf Kiet"*²⁴ shows to a wide audience the joys and challenges of newcomers' education.

special educational needs (refugee children); personalised learning.



23. https://maken.wikiwijs.nl/94052/Maatwerk_voor_nieuwkomers_met_behulp_van_ict

24. <https://youtu.be/OczAqkhz8MI> (in Dutch)

17. Inclusive Education for Roma Communities/ Slovakia

Various initiatives aim at better integration and adaptation of Marginalised Roma Community (MRC) children in kindergartens in Slovakia, the current project aims to provide an inclusive model for better adaptation of children. Throughout the project Roma-speaking kindergarten teaching assistants are trained in transporting and escorting children from remote Roma settlements. These steps have greatly facilitated the attendance of children in nursery school and improved communication in the Slovak language. Working alongside with parents and children in joint school and extracurricular activities helps combat bias and reduces the segregation of Roma and non-Roma children.

Training and support using interactive systems and didactic equipment is provided to the general pedagogical and professional staff throughout the project. Pedagogical and professional staff who complete the training are able to support further inclusion of children from MRC as multipliers in their schools and organisations. This ensures sustainability and continuity of positive effects of the project.

The positive effects are reported by those kindergartens which were involved in the project. Kindergarten staff shares that children who participated in the project are more independent and self-confident. Furthermore, by breaking prejudice and de-stigmatizing Roma communities at schools and kindergarten level, the project paves the road to a change in legislation and bring up further support and participation of state level officials in improving the situation for marginalised Roma children.

special educational needs; teacher continuous professional development; school-community relationship.



18. Tanoda/Hungary

A key challenge in Hungary is to enhance the educational experience of disadvantaged and Roma students with the help of extra lessons and tutoring in the afternoon, organised by study halls (known as ‘Tanodas’). The most important aim is to help students finish primary school, progress to secondary education and finish their secondary level education²⁵.

This program operates outside the public education system and aims to compensate for disadvantages while at the same time opening up opportunities for its participants. Tanodas are run and maintained by civil or religious organisations, and children and young people attend them on a voluntary basis after school or during the weekend. Activities are tailored to the local conditions and they happen in an autonomous community space.

The Tanodas adapt their approaches and methodologies to the special needs of disadvantaged and minority Roma students, and the approaches are different from those shared in traditional schools. The Tanoda is separated from the school geographically and activities are organised independently. However, it is essential that each Tanoda works closely with the public education institution that is close to it, although the Tanodas do not engage teachers from that school so as to provide pupils with the opportunity to experience different learning and teaching methods.

In these extracurricular afternoon institutions the learning experience is adapted to the characteristics of the target group and therefore the pedagogical approach is complex. The goal is to strengthen the identity of the students, connect them to their community and connect their community and families to educational institutions.

The first Tanodas emerged in the mid-1990s and they were primarily financed from donations and PHARE grants. During the last decade, the number of Tanodas continues to grow: in Autumn 2017, 275 Tanodas started the school year. The knowledge sharing process and the coordination of activities between Tanodas is supported by the local Educational Authority and by civil communities

25. https://www.schooleducationgateway.eu/files/esl/downloads/09_HU_Tanoda.pdf

through the Tanoda Platform, a network created by educators and activists in Tanodas. The platform collects best practices, organises training and workshops for educators and teachers, as well as serving as representation for its members.

school-community relationship; special educational needs;
school- local authorities relationship; school-parents relationship;
out of school hours provision.



19. Bednet/Belgium (Flanders)

The Bednet²⁶ project enables chronically ill children in Belgium to take lessons at distance via appropriate technology and stay in contact with their school, teachers and classmates.

Bednet is not a school as such but a service that provides a link between the child at home and his or her own school, one that makes sure the child can be virtually seen in the classroom and can participate in class in as normal a way as possible.

Bednet is a private initiative set up by the well-known Flemish journalist and presenter, Kathy Lindekens which was originally intended for cancer patients and which is based on a belief that children have the right to be able to access school and to remain part of their peer group, even when they are ill.

For over 25 years the right to education has been established as a right of every child, as formulated in the Convention on the Rights of the Child. Also, since September 2015 synchronous internet education (SIE) is structurally embedded in the educational system of the Flemish Community, giving every child with a chronic or long term illness the right to SIE. Since its start in 2002, Bednet has been able to help more than 1533 sick children in Flanders and Brussels, across all networks and all educational institutions.

Bednet, which is financially supported by the Flemish government, provides the ICT platform and hardware (e.g. computer, webcam, headset, scanner / printer, etc.) as well as guidance on the project

26. <http://www.bednet.be>

as a whole. About 9 out of 10 children using Bednet are able to join their friends and continue to the next grade. Bednet offers its services completely free for the child and the school involved.

special educational needs; at distance learning.



20. Adibib/Belgium (Flanders)

Technology comes to the aid of students with serious writing or reading disabilities (or both).

In Belgium (Flanders) ADIBib²⁷ provides digital versions of normal printed textbooks for students with serious reading and/or writing problems in primary and secondary education. ADIBib receives print-pdfs from the Flemish (Belgium) educational publishers of schoolbooks and converts them to customised digital files. Children with reading and/or writing restrictions can use these versions on their laptop. They access everything in the printed version of the textbook on their computer screen. They can then use reading software, and read and listen simultaneously to what is in their textbook, and fill in their own material.

Participation of publishers is central in making this possible by making a wider selection of materials available to such students. Consequently, a long-term agreement between ADIBib and publishers has been established.

ADIBib started in 2008 as a pilot project. Since September 2011, ADIBib receives financial support from the Flemish government. In just over the six years to March 2017 more than 10,000 students have benefited from the initiative.

special educational needs; digital resources; school publishers relationship.



27. <http://www.adibib.be/>

21. Accessibility and adaptability of digital resources for schools - A2RNE/France

Digital technology offers personalised, adapted solutions for the special educational needs of students with disabilities.

Within the framework of the Accessibility and Adaptability of Digital Resources for Schools²⁸ (Accessibilité et adaptabilité des ressources numériques pour l'École - A2RNE), the French Ministry of Education has published recommendations to authors and publishers to help them produce digital resources designed from the beginning to be accessible and embedding functionalities that meet the needs of students with disabilities, including students with dys-type problems (e.g. dyslexia, dyscalculia).

The A2RNE offers a simplified version²⁹ of international and national standards (WCAG and RG2A), making them easier to implement, thereby encouraging publishers to produce resources that will be part of the French digital resources for schools (BRNE), itself part of the large-scale French digital plan for education offering an array of digital content and services designed for educational purposes available free of charge for teachers and their pupils.

Publishers are both audited and supported by the Ministry of Education to encourage them to provide accessible French digital resources for schools.

The French digital resources for schools collection will eventually constitute the largest body of resources in French for schools. They may gradually converge towards a more demanding A2RNE and conform to the French General Accessibility framework for administrations (Référentiel général d'accessibilité des administrations -RG2A).

special educational needs; digital resources; school publishers relationship.



28. <http://eduscol.education.fr/cid56843/ressources-numeriques-adaptees-soutenues-et-realisees.html>

29. <http://ecolenumerique.education.gouv.fr/brne/>

22. Junior Science Olympiad/Malta

Citius, Altius, Fortius! The Malta Junior Science Olympiad (MJSO)³⁰ offers students the possibility of thinking out of the box by solving three investigative tasks related to Biology, Chemistry and Physics and is also designed so that students within each team can collaborate with each other to reach their goal.



This is an event that targets gifted and talented Year 11 students (final year of compulsory secondary education, 11 years old). During the event, a team of three students from each participating school has to complete three investigations (one from each subject area) within 3 hours. The team that scores the highest points in the shortest period wins the Olympiad.

Apart from the usual awards for first, second and third placings, this event has been coupled with another initiative by the name of Go4Research³¹ where the first seven teams are offered a student internship programme in research laboratories at the Faculty of Science within the University of Malta.

30. <http://sciencecentremalta.net/mjso2016/>

31. <http://sciencecentremalta.net/go4research/>

The Malta Junior Science Olympiad is organised by the Directorate for Learning and Assessment Programmes in collaboration with the European Commission Representation in Malta.

STEM; inquiry based learning, collaborative learning, problem based learning.



c. Educators: new ways to extend their competence profile

Among the initiatives collected, none really has as its principal aim the involvement in teaching – alongside teachers – of parents, professionals external to the school (artists, scientists, researchers,...), or community members. The Teachers Learning Community initiative targeting STEM teachers in Israel nonetheless deserves special attention thanks to its close and regular collaboration with researchers of the Science Teaching Department of the Weizmann Institute of Science, and the implementation of a ‘fan model’ based on the circulation of knowledge between teachers and researchers.

A large majority of the initiatives specifically addressing educators are first and foremost about broadening teacher competence profiles and doing that through new instructional approaches, potentially capable of reaching large numbers and better adjusting professional development provision to classroom and schools needs in real-life contexts.

The initiatives concerned with the teacher competence profile are moving away from a focus on the operational use of technology in the classroom towards the implementation of active, collaborative and personalised learning supported by technology to (hopefully) be easier to implement and more efficient. The European Schoolnet Academy, Top-Keskus, Virtual online Campus, Les traams, Smart lesson for every school, OppiminenOnline and its Open Badge Factory (cross-institution assessment) and M@gistère initiatives illustrate such trends, through online or blended solutions. Some of these initiatives also offer accompanying services to teachers such as blog creation tools and media publishing materials. More recently and interestingly, ‘lighter’ formats are emerging, such as the NOOCs (Nano Open Online Courses) and Edupills initiatives in Spain.

Several of these initiatives implement active instructional design, peer-learning and new assessment models, and offer a platform for online professional communities where teacher networks can exchange and share practices between peers. Teachers learn from each other, opening up to new methods and school cultures and enriching the repertoire of their practice. These new approaches

have the potential to encourage the development of the teaching profession as a reflective one, an aim enabled particularly by initiatives like the Digital Competence Assessment Rubric giving teachers a tool to assess their level of competence and start planning further steps in their competence development.

Examples of emulation and specific support from external experts are provided through initiatives like the Webathon on learning active networked methodology, and the Mediacoach initiative coaching teachers (and other professionals) in the area of media literacy.

Teacher professional development aiming at nurturing student transversal competences, such as intercultural and ethical skills, enters the scene for example through the Sharing Inclusive Practice initiative in Ireland, developed around the ‘community of practices’ approach as a way of sharing good practices and increasing teachers’ progress and confidence in cultivating mutual understanding and character education amongst their students.

Investigation of new models for teacher professional development as illustrated by the initiatives mentioned above is mirrored in the innovative work being done in the continuum between initial teacher education and entry into the profession. The National reform of the pre-service teacher induction model in Italy illustrates recent changes, through a new model alternating classroom studies with on-the-job training, and encourages self-reflective attitudes in new teachers through continuing dialogue.

23. The European Schoolnet Academy/cross country

In the context of an increasing push to open up educational activities and content, reflected by the launch of the European Commission's Opening Up Education Communication in 2014, European Schoolnet decided to explore how MOOCs, Massive Open Online Courses, could address the increasing demand for professional development of teachers across Europe. The result of this exploration was the launch of the European Schoolnet Academy in December 2014, a MOOC platform dedicated primarily to school practitioners in Europe.

Since its launch, the Academy has offered 24 courses with close to 45.000 enrolments from more than 130 countries, awarding close to 12.000 certificates. It continues to grow with an increasing number of courses on offer each year. Academy courses cover a range of topics linked to areas of European Schoolnet's expertise such as technology-enhanced teaching, innovative pedagogical approaches, and STEM subjects.

The Academy's pedagogical approach is based on three premises. Firstly, the need to scale cost-effectively professional development offers to larger numbers of teachers. Secondly, the conception that teachers need to be self-reflective practitioners, willing to exchange with peers and with a high level of self-efficacy. And thirdly, research results show that successful professional development encourages the development of teachers' learning communities where teachers share their expertise³².

Accordingly, Academy courses offer a light-weight content structure that facilitates the creation of a learning community in which the teachers share their experiences, questions, and expertise, and as a community develop ownership over the course's outcomes. Academy course content is designed to trigger reflection and exchange amongst participants and usually is produced by or features school practitioners. Rather than offering top-down answers to challenges teachers face, the idea is to prompt a sharing of experiences, ideas, resources, etc. which allows the participants to grow into a learning community. Other course activities consist of the production of

32. Schleicher, A. (2016), Teaching Excellence through Professional Learning and Policy Reform: Lessons from Around the World, International Summit on the Teaching Profession, OECD Publishing, Paris.

practical outputs such as lesson plans which allow the participants to easily turn their learning on the course into daily practice in their school. These outputs are peer assessed and peer validated for certification, thereby further strengthening the community dynamics and highlighting the importance of contextualisation and implementation in the classroom.

This model of professional development has allowed the European Schoolnet Academy, for the last four years, to be at the forefront of addressing the challenge of scaling up teacher professional development so that teachers feel supported and ready to address the increasing challenges they face today.

teacher continuous professional development (online); professional learning community; (teacher) peer assessment; badges.



24. Top-Keskus – Centre for ICT in Learning/Finland

ICT training for school teachers can evolve in ways that support schools more generally in innovating their curriculum and its delivery.



In Finland, TOP-keskus³³ is a unit within the City of Turku's Education Division which serves local schools and other educational institutions from early childhood education to adult education.

33. <https://edu.turku.fi/top-keskus/>

When it was first established in 1986, its main purpose was to provide training in the use of computers in EDUCATION. Today, with ICT being an inseparable part of education, 1,700 participants have been trained both at school and online. The courses given are practical and taught with classroom-ready materials and ideas. The courses given address teachers of all levels, locally and regionally, catering to both beginner and experienced users of ICT.

TOP-keskus is quick to adapt to various needs and all services are offered free-of-charge to the local teachers. It now helps schools find new ways to apply ICT in education. Development projects for implementing the use of ICT are supported by expert staff. These projects are usually funded by the Finnish National Agency for Education or the Ministry of Education and Culture. Best practices are always shared nationally, in events and online.

Developing online services for education together with local ICT administrations are also part of TOP-keskus' role. These services include learning management systems, blog creation tools, media publishing platforms, e-materials, and cloud services.

teacher continuous professional development (online); cross education levels approach.



25. Virtual Online Campus (VPH)/Austria

Guiding pupils in their use of digital and social media and fostering one's own continuous professional development are key skills for digitally competent teachers of today. To help teachers become and remain digitally competent, the VPH has been set up in Austria with the goal of supporting pre-service students and teachers in their professional development. The best and most convenient way for this is to offer all courses solely online.

The Virtuelle Pädagogische Hochschule (VPH) is a service centre maintained by the Austrian Federal Ministry of Education and has been attached to the Pädagogische Hochschule Burgenland since 2011. It offers continuous professional development to teachers and

pre-service teachers in Austria, with a particular focus on digital competencies, i.e. being able to implement technology-assisted teaching into classrooms and knowledge of current teaching and learning methods.

Currently the VPH offers three sets of courses: cooperative online seminars, eLectures (webinars), and “coffeecup” learning units. The academic year is divided into trimesters and teachers and pre-service teachers can attend the courses at their own convenience.

Courses are offered online via a learning management platform and a videoconferencing tool. Both enable cooperative learning while learning about digital tools occurs simultaneously with learning with digital tools. All courses are offered via Moodle and via Adobe Connect (eLectures). Gamification and microlearning are also part of the courses.

initial teacher training (online); teacher continuous professional development; (teacher) collaborative learning



26. Les Traams/France

The core idea of the *Les Traams* initiative is to pool expertise on how digital innovation can improve teaching and support the improvement of teacher skills in this area.

This is part of a national “Bringing schools into the digital age” strategy and is aimed at the lower secondary school level. It has been initiated by the Directorate of Digital Technologies for Education and the General inspectorate in France.

The 30 different Regional Education Authorities in France, through teams of teachers, gather, evaluate, and produce resources for their national database of scenarios (“Edu’bases”³⁴). Up till now some 700 teachers spread throughout 126 teams right across France have been involved, producing teaching scenarios in 16 school subjects.

34. <http://eduscol.education.fr/cid57544/edu-bases-des-usages-repertoires-pour-les-enseignants.html>

Above all, this scheme has been able to generate a fresh dynamic: new uses of digital technologies in pedagogical practice are helping develop new subject skills as well as cross-disciplinary capabilities, which overall contribute to the creation of a digital culture.

key competences; interdisciplinary approach; (teacher) professional community; learning resources creation; learning resources sharing; teaching scenarios.



27. Smart Lesson for Every School/Estonia

“Smart lesson for every school” is an Estonian initiative by the Informatics Teachers Association to open up classrooms to a wider audience.

Schools agree to offer at least one lesson where teachers use digital devices (computers, tablets, smartphones, and robotics) and share it in the Facebook group established for the project. In the first four months, 102 schools and kindergartens shared their lessons in 700 posts.

This peer learning and sharing process - across different subjects, levels, and technologies – empowers teachers to take small but significant steps towards more innovative teaching, including extra-curricular sessions which may also bring in the local community.

Every month brings a new thematic focus: innovative teachers and their stories; future learning; digital music creation; digital safety awareness; coding and art.

The initiative is also supported by business (IT, telecommunications, and publishing), through monthly prizes and various other forms of support.

Interdisciplinary approach; collaborative teaching; teaching scenarios; school-community relationship; education-industry relationship.



28. OppiminenOnline – Competence-based Approach to Teacher Upskilling/Finland

Learning Online (“OppiminenOnline” in Finnish)³⁵ is national competence development program for school teachers funded by the National Board of Education in Finland. It provides online and blended learning opportunities in three locations around Finland. Location based teams compete with each other to collect badges which are earned by providing evidence of a skill competency in different online forms. For each badge, an online training session is offered on the skill set for the specific subject to allow the participant to meet the badge criteria.

The pedagogical model consists of three essential elements:

- learning material
- competence-based online assessment and guidance
- inspiring competition.

The model serves both teachers interested in learning new educational technology related skills and those who want their existing competence recognised.

OppiminenOnline provides learning materials in a form of video and downloadable documents such as presentations. After the self-assessment stage, users can apply for a badge providing evidence of the competence they claim in their application. The application is processed by an Open Badge Factory, with a national board of issuers that review and ensure the quality of each application. The model of cross-assessment between different educational institutions is exceptional: the best professional to guide the student on a specific topic is always available and every teacher in the team is qualified to assess all badges. Delay is minimal and applications are processed almost immediately.

35. <http://www.oppiminenonline.com>

The programme is the outcome of a three-partner collaboration: Oulu University of Applied Sciences (project co-ordination), Häme University of Applied Sciences, and the Joint Authority of Education in the Espoo Region.

teacher continuous professional development (online); teacher self assessment; cross institutions assessment; badges; university-local authority partnership.



29. M@gistère/France

M@gistère³⁶ is a national platform in France offering shared production of personalised distance education courses to lower and higher school teachers and education staff. It is also a platform with communities and co-working spaces.

Teachers can access a blended approach of distance learning and on-site learning. Independent self-training courses are also available. The courses are produced by teams composed of trainers and pedagogical managers. They are managed by the Directorate-General for School Education (DGESCO), which manages the national offer through an editorial committee. 250.000 teachers were engaged in these courses in 2016-2017.

teacher continuous professional development (online); (teacher) collaborative learning.



30. Blended Learning courses Implemented via Virtual Worlds/Greece

Thanks to the use of Virtual worlds, the isolated setting of the South Aegean islands in is no longer a barrier to learning.

In order to meet the continuous pedagogical development needs of teachers in these isolated islands, a set of online seminars on “Internet Safety” and the use of ICT were designed and delivered based on a blended learning training model. For the asynchronous part, the distance-learning platform Moodle hosted all material and activi-

36. <http://eduscol.education.fr/cid73451/m@gistere.html>

ties, while for the synchronous part the “Opensimulator”³⁷ software was used. With the help of this software, the team designed a virtual (3D) educational island including all the tools that had been used in the training.

During these sessions, teachers had the opportunity, to work, through their personal avatars, closely with other colleagues, move to different rooms depending of the type of activity they were performing, receive guidance and feedback and finally produce their own lesson plans. Assessment was based on qualitative criteria for blended learning education, and the findings have been used to improve subsequent seminars.

The use of this virtual environment showed that adults perform better when they are working together and they receive guidance. For the majority of the teachers, the internet and online applications they became familiar with during these seminars turned into helpful tools for their day-to-day teaching.

The “Opensimulator” platform is still in use by teachers while additional pilot activities i.e. focusing on language learning for students³⁸, have been recently concluded.

(blended) teacher continuous professional development; (teacher) collaborative learning.



31. NOOC INTEF – Nano open online learning experiences/Spain

Offered through INTEF (the Spanish National Institute of Educational Technologies and Teacher Training), NOOCs are innovative Nano Online Courses targeting teachers and the public which help participants improve their digital competences in an easy and accessible way.

Nano Learning Experiences help participants improve a specific digital competence from the Common Digital Competence Framework For Teachers. The course empowers learners to explore, learn and be assessed on the key aspects of one competence, skill or area

37. <http://opensimulator.org>

38. <http://dl.acm.org/citation.cfm?id=3123616>

of knowledge over a period of time ranging from one hour to a maximum of 20 learning hours.

The core of a NOOC is the Nano Learning Experience (NLE). For a NLE to be considered as such, it must include content to be learned, activities to give evidence of that content, assessment and acknowledgement/certification (i.e. open digital badge). All NOOCs are open and the user support provided on the platform is available through any device (smartphone, pc, tablet) and does not require the internet.

A NOOC should be understood as a training course and must have enrolment, start and end dates. The Learning Experience will start from day one – after a few days of enrolment - and will be open until the end of the course. Additionally, the content and materials in the course will always be accessible to subscribers, even after the course closure. Also, as happens in all learning experiences of this kind, a NOOC includes activities in which learners can give evidence of the learning acquired, the goal achieved and the competence developed. Participants who successfully complete the NOOC receive a digital badge to acknowledge their learning achievements.

Since May 2016 over a thousand registered learners have enrolled in these NOOCs. Nowadays, due to the success of the initiative, second, third and fourth phases are now planned.

teacher continuous professional development; learning community; learning resources; resources sharing; at distance learning; badges.



32. EduPills: Self-training educational pills for mobile devices/Spain

The EduPills³⁹ initiative based in Spain takes a step forwards in implementing mobile learning, providing teachers the opportunity to learn “on the go”. Available in Spanish and English, EduPills is a platform that offers micro-training for teachers through educational pills to be consumed on the users’ mobile devices in a simple and fast way. The platform helps teachers acquire and foster their own digital skills and competencies.

39. <http://edupills.educalab.es>

The most innovative change regarding teachers' training relies on its flexible features- allowing users to participate in training at any time and in any place.

The pills are categorised according to the Five Areas of the Common Digital Competence Framework for Teachers⁴⁰ by INTEF (the Spanish National Institute of Technological Activities and Teachers' Training), thus giving users the choice when deciding which competence they need to work on and allowing them to manage their self-training.

The application is based on a Content Management System (CMS) developed using open source technology, where the smart pills are created, stored and shared under a shared code⁴¹. The app is available free of charge in both Google Play Store and in the App Store. To this extent, it is available also to the wider public, including interested pupils and parents.

teacher continuous professional development; learning community; learning resources; resources sharing; at distance learning.



33. Webathon on Learning Active Networked Methodologies/Spain

As a means of networking and sharing experience in active web-based learning methodologies, a first Spanish webathon was held by INTEF (*Instituto Nacional de Tecnologías Educativas y de Formación de Profesorado*) in November 2016 following an open call for participation for this online event. The Webathon established an online space where teachers are encouraged to share and learn innovative practices, especially ones that relate to active teaching methods using technology.

Over 3,000 teachers and educators followed the eight-hour nonstop webathon, broadcasted live while the conversation was spread on Twitter through #DirectoINTEF.

All the teachers' experiences presented used technology as a means of transforming education into a meaningful learning experience

40. <http://aprende.educalab.es/mccdd/>

41. <https://creativecommons.org/licenses/by-sa/4.0/legalcode>

for life and of fostering professional, digital teaching and learning competencies. Thus inspiring other teachers to adopt innovative teaching methods and collaborate with other colleagues.

teacher continuous professional development; peer learning; webathon.



34. Digital Competence Assessment Rubric/Estonia

Today's schoolteachers need to be able to judge the level of their own digital skills in ways that are reliable and recognised in the profession.

To meet this need in Estonia, the digital competence assessment rubric⁴² has been developed as a tool for school teachers and for academic staff in higher education to facilitate their professional growth in the digital age. By using the digital competence assessment tool, teachers realise, in which way they have to move on – which training is useful and what do they have to improve in order to integrate technology in their teaching.

This rubric provides a recognised framework for evaluating digital competences in the context of teaching. It can be used as a guideline for those wishing to become a professional teacher and also as a framework for compiling a digital development portfolio (e-portfolio) for the purposes of accreditation, job seeking, or career development.

The evaluation scale is based on the International Society for Technology in Education (ISTE) digital competence standards for teachers. It is also consistent with the digital competence reference model presented in the European Commission report. "DIGCOMP: A Framework for Developing and Understanding Digital Competence in Europe"⁴³.

teacher (self)-assessment; rubrics (for assessment); teacher continuous professional development.



42. http://britishcouncil.confent.com/wp-content/uploads/2017/03/HITSA_The-Digital-Competency-Model-for-Teachers.pdf

43. <http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=6359>

35. Mediacoach/Belgium (Flanders)

Technology can be used to enhance the traditional school curriculum to reflect specialist professional areas and career opportunities.

Mediacoach⁴⁴ is one such initiative: a training program for professionals working with children, young people or adults, who want to integrate media literacy into their own practice and organisation.

Mediacoach, run however by the Flemish Knowledge Centre for Media Literacy, funded by the Ministry of Education and the Ministry of, Culture, Youth and Media, offers a theoretical framework for initiating media literacy training in different contexts. The focus of this course is on carrying through specific activities and practices in media literacy. Demonstration of good practices and concrete tools provides inspiration, with the participants being invited to establish independently a project within their own organisation.

Schoolteachers who follow the Mediacoach training enrol in the MOOC. The MOOC modules are then used in an e-flipped classroom setting for nine days of face-to-face meetings. Teachers finally have to carry out a concrete project in their school while being coached by an expert or experienced Mediacoach.

media literacy (for educators); (flipped) teacher continuous professional development; coaching.



36. Teachers' learning community/Israel

About 20 percent of physics, mathematics and science and technology teachers in middle school participate in teachers' communities in Israel. Each community consists of about 15 to 20 teachers who meet every two weeks for four hours in the afternoon throughout the school year and in a concluding conference in the end of the year. During the meetings teachers share activities, methodologies and pedagogical methods from their classrooms. They develop activities together, aiming to promote enquiry-based learning methods and active learning in their classrooms.

44. <https://mediawijs.be/nieuws/mediacoach-opleiding-mediawijs-traject-professionelen>

Initiated by the Science Division in the Pedagogic Secretariat in the Ministry of Education in Israel, this process of knowledge sharing and collaborative work in the learning communities is accompanied by more experienced teachers and researchers from the Science Teaching Department of the Weizmann Institute of Science. The more experienced teachers (leading teachers) serve as mentors and help the teachers in their regional learning communities to develop their teaching and accompany the process through research.

The leading teachers work together with researchers at the Science Teaching Department of the Weizmann Institute of Science who developed diagnostic programmes and questionnaires enabling the learning communities to identify misconceptions and problems in physics and stimulate a productive and engaging process of learning with their students about these misconceptions.

The teachers' community programme sets the following goals:

- To assist teachers in developing their teaching practices by providing teaching scenarios, innovative teaching methods and tools, providing a non-judgmental “safe space” to discuss their challenges and needs and providing teachers with the opportunity to share their knowledge and skills with other teachers;
- On a systematic level, to promote mentoring among teachers, enhance their knowledge and skills, open up a discussion between teachers and promote a learner-centred approach.

In this sense, the learning community operates according to the “fan model” in which researchers and experts from the Science Teaching Department of the Weizmann Institute of Science mentor, share and collaborate with the leader teachers' community of 25 mentors and more experienced teachers. The leader teachers, in pairs and groups of three, train and collaborate with the regional communities of physics teachers all over the country. The regional communities consist of 200 teachers - about a quarter of all physics teachers in Israel in high school. The “fan” operates both ways: it brings insights, ideas and initiatives from practice (schools and regional teachers) to the learning community and the community promotes, shares and disseminates knowledge gathered and initiated in the institute together with the leading teachers. Thus there is circulation of knowledge from both upstream and downstream.

In the light of the success of the physics learning communities, additional communities have been established in mathematics, science and technology, chemistry, biology and environmental sciences.

STEM; teachers learning community; school-experts relationship.



37. Pedagogical Education Centres Hungary

Knowledge-sharing and teachers' peer learning is furthered in 15 regional Pedagogical Education Centres in Hungary. These centres support teachers' professional development by collecting and analysing the training needs of educational institutions, organising accredited and non-accredited training events, and providing consultancy services for pedagogical staff in schools and kindergartens.

To support knowledge-sharing between educational institutions, the Educational Authority and its regional centres (departments) work with so-called "basis institutions". These institutions are schools and kindergarten where innovation is successfully implemented and their best practices can inspire and be adapted by similar institutions. In 2017, 273 organisations successfully applied to be basis institutions. The task of these basis institutions is to share best practices at local and regional level, and host workshops, classroom visits, competitions and training events.

Regional centres support the knowledge-sharing process of basis institutions and facilitate dissemination of their work.

dissemination of innovative practices; teachers continuous professional development; (teachers) peer learning; mentors.



38. The Sharing Inclusive Practice Initiative, the National Council for Curriculum and Assessment/ Ireland

The Sharing Inclusive Practice Initiative involves teachers developing, recording and sharing inclusive practice related to children’s cultural, ethnic and belief backgrounds. The teachers involved come from primary schools representing a broad range of contexts and school communities. Building on the work of the Intercultural Guidelines for Primary Schools (NCCA, 2005) and recent developments on a national curriculum in Education about Religions and Beliefs (ERB) and Ethics⁴⁵, this initiative generates examples of intercultural, religious and ethical education from across Irish classrooms.

The initiative began in early 2017, In terms of design, it takes a ‘communities of practice’ approach enabling the creation of a shared space for schools to come together, to articulate and share their practice with each other. Through sharing, practice is examined and often affirmed in a process of open and honest engagement by participating teachers. This is not to say that every teacher or school agrees with each and every practice, indeed a level of critical discourse is necessary for authentic learning to take place.

During the first phase, the community focused on two broad concepts related to intercultural and ethical education—‘mutual understanding’ and ‘character education’. As teachers grew in confidence, they developed short videos on a range of inclusive practices that took place in their schools. These include Child-led Assemblies, Philosophy for Children, Religions and Beliefs Class Projects, Human Rights Month, Intercultural Week, and Morning Rituals⁴⁶. These innovative practices support other schools in developing their teaching and learning, as well as informing wider curriculum developments at national level in areas such as Well-being and Child Voice.

teachers continuous professional development; (teachers) peer learning; learning community.



45. www.ncca.ie/consultation/erbe

46. <https://vimeopro.com/ncca/sharinginclusivepractice>

39. National Reform of the Pre-service Teacher Induction Model/Italy

The Italian training and development model for schoolteachers has recently seen complete reform. Together with dedicated devices and technological solutions developed by INDIRE (the National Institute for Documentation, Innovation and Educational Research) and the Ministry of Education, Universities and Research, the balance of skills - methodological and digital - this reform has improved the continuing education of 200,000 teachers, is a key innovation in Italy.

The improvements that have materialised over the first three years of the reform result from a training methodology of both conceptual and technological tools in support of more effective reflection on teacher professional practice.

The new model alternates classroom studies with on-the-job training. It is also based on the assumption that the newly qualified teacher is not meant to be “instructed” or “modelled” but accompanied through dialogue between theoretical knowledge and practical knowledge, where skills of critical analysis and interpretation of his or her own work are key elements of professionalism in teaching. The acquisition, recognition and strengthening of such knowledge is particularly important in Italy, where teachers in their induction training often have extensive prior teaching experience. Encouraging - as in the Italian model - paths of alternation allows the gradual acquisition of a reflective attitude to practice and identity development, which can then evolve further as teachers undergo in-service training.

The Italian alternation system, based on the systematic and structural use of a digital training portfolio, has so far involved up to 200,000 teachers, paving the way for extension of some key characteristics of the model (especially digital skills) to all in-service teachers ⁴⁷.

teacher continuous professional development; alternate training; induction of beginning teachers; reflexive teaching; technology-supported teaching; ePortfolios.



47. http://www.istruzione.it/allegati/2016/Piano_Formazione_3ott.pdf, October 2016

d. Resources: learning resources and system level actions

Learning innovatively, in an engaging and active way, is not limited to virtual platforms for students and teachers to access resources about specific subjects (like The adventure of learning and the STEM-focused Biohist platform initiatives), or toolboxes (the Photonics Explorer initiative). Resources can support re-inventing the pedagogical core in a safe experimental virtual environment. This is the case with the EdMondo initiative, where learning and teaching are extended into virtual space where both teachers and students engage in meaningful active learning processes.

Moreover, innovative elements can also manifest themselves in online environments such as portals featuring chat components on specific issues, such as in the CLB chat initiative which brings technology to the aid of pupils' wellbeing. In addition, the Makers approach and 3D printing, for students and teachers, serve as exciting tools where innovation can directly support the cognitive and learning processes such as problem-solving, self-evaluation, peer review and reflection (3DIndire initiative and the Gutenberg 3D).

Other initiatives offer access to more 'classical' resources such as applications for developing very specific competences such as cognitive operation (the Big Data in the service of learning mental calculation initiative), logical thinking, spatial citizenship, multi-literacy skills, and problem-solving for example. These may at the same time be efficiently supporting new pedagogies, as does the Paikkaoppi initiative. Portals giving access to digital learning resources, such as the Edia, Exelearning.net, BRNE, KlasCement, Scoilnet/Scoilnet Threads and Edulabs initiatives, are innovative elements that bring a change from text (book) and increase the diversity of both teacher and pupil experiences. The networking dimension of teacher or education labs (cf. Edulabs) can also foster innovation and change in teaching by opening the door to many new inspiring practices.

The second part of this section presents several initiatives which, while not directly concerning learning resources per se, can be considered as resources at whole system level. They usually frame, shape and organise large sets of processes and services available

to support innovative teaching and learning supported by technology. These initiatives achieve this in various ways:

- securing access to and mutualising all IT services, as with the UNI-LOGIN, Trust and usability with Skolfederation and Pro-común initiatives;
- making available to schools a digital maturity assessment tool as does the Digital Mirror initiative;
- providing databases giving access to thousands of innovative and experimental projects like the Experitheque initiative itself embedded in the holistic portal covering all aspects of the education system, i.e. Eduscol; or
- supporting all education stakeholders in the design and implementation of personalised learning supported by ICT as do the Doorbraakproject Onderwijs and ICT and the Progetiger programme initiatives, or concerning pluri-disciplinary after school activity such as in Edukateka.

40. EdMondo - The Virtual World for School/Italy

How to promote the use of virtual worlds in formal learning contexts? edMondo⁴⁸ project in Italy allows teachers and students to “build” virtual online places where learning takes place in an inquiry-based science environment.

Students can also create - or re-create - places for a deeper understanding of events and phenomena (e.g. rebuilding an historical site that no longer exists). This process is done by using videogames engaging pupils in an active learning method.

Based on an open source application server and used by schools since 2012, edMondo successfully addresses the typical drawbacks affecting most virtual worlds when it comes to their use in educational institutions (e.g. controlled access; identity safeguards; free usage).

edMondo also offers training courses and lessons for teachers, aimed at developing new methodological skills in the use of virtual

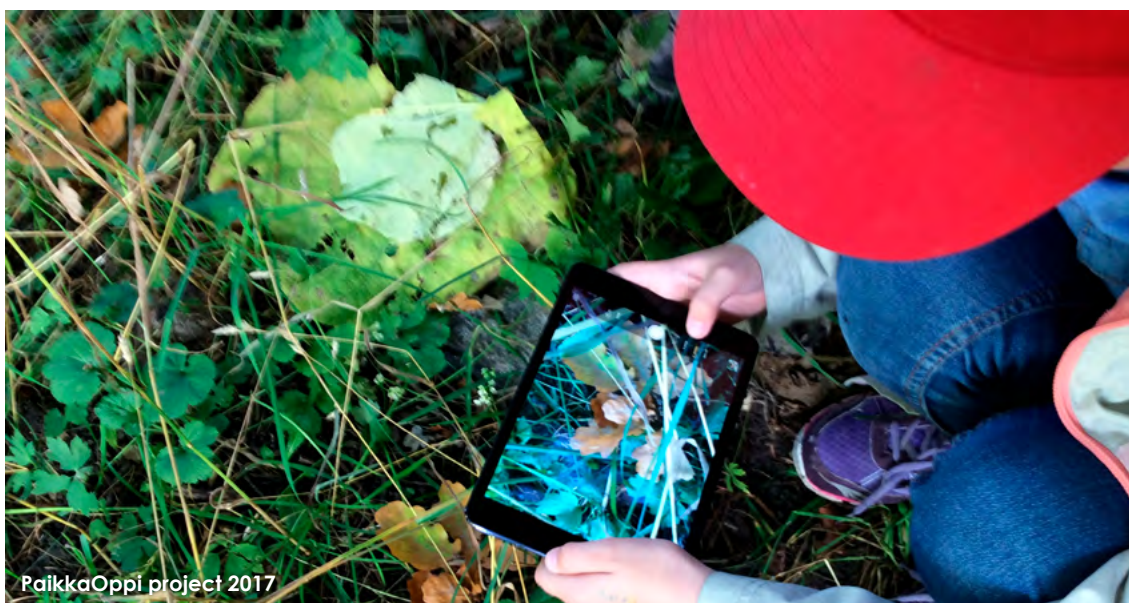
48. <http://www.mondivirtuali.it/en/2016/04/18/edmondo-italian-education-digital/>

worlds within their teaching practices. It promotes and supports the starting of new school projects based on immersive learning practices. Although the use of virtual worlds in schools is a niche phenomenon, the adoption of edMondo among Italian teachers and students is in constant growth, with, so far, more than 2,500 teachers/students joining, more than 1,200 teachers having attended training courses in edMondo, and more than 200 teachers having developed learning projects with their students.

STEM; inquiry based learning; game based learning; virtual learning environment; teacher continuous professional development.



41. PaikkaOppi - from a Learning Environment Project to Supporting New Pedagogy in National Education/Finland



PaikkaOppi is a Finnish educational innovation supporting open science and the information society. It is an open web-based learning environment for Geographic Information System (GIS) usage in schools. Moreover, It is a potential spearhead in national policy for the development of skills and education by integrating disciplines and promoting the use of digital learning environments. The project is based on the belief that education should help to boost economic renewal and active citizenship.

PaikkaOppi service can be used to view and produce GI datasets, ready-made exercises and project frameworks. This supports many school subjects such as geography, biology, history, social studies, Finnish language, physical and health education as well as encouraging the development of multidisciplinary activities.

Students are able to view, analyse and share their data collaboratively or individually with browser-based map applications. Mobile applications for Android and iOS devices are for saving personal data in the field trips or at home.

Being accessible to all users free of charge, PaikkaOppi is very cost efficient for municipalities. The service supports teaching with new pedagogies: competences for spatial citizenship, multi-literacy skills, logical thinking, and problem solving skills.

The service is being used all over the country as a project platform for several school subjects and multidisciplinary learning modules from primary schools to upper secondary. Dissemination occurs through networks of coordinating organisations and its partners, in educational seminars and events and in workshops for teachers. The project website⁴⁹ gathers all pedagogical ideas and has included a series of pedagogical models addressing several levels of education from primary to secondary level. The models support the idea of an integrated curriculum while the emphasis is on student-centred and problem-based or project learning.

Interdisciplinary approach; problem solving; project-based learning; key competences; digital learning environment; (online) networking.



42. Digital Resources Databank for Schools BRNE/France

In France, giving schools a single access point for digital resources for teaching is the aim of BRNE (Digital Resources Databank) which forms part of a broader large-scale French digital plan for education.

49. <http://www.paikkaoppi.fi/>

The databank⁵⁰ allows thousands of items of Digital Contents and Services to be accessed free of charge by teachers and pupils from 9-15 years old. They are designed for educational purposes. The materials can be modified, are largely downloadable, and are structured according to the curricula. Furthermore, these resources have been designed to meet the needs of students with special needs (many subjects are covered at all levels concerned). They can be used on any device, allowing users to learn individually or in groups. Teachers subscribe and access the web platform through their professional email address.

The fundamental objective is: teaching and learning. These digital resources increase the possibilities for learning for all pupils while maintaining and extending the teacher's pedagogical approaches.

online portal; digital resources.



43. EDIA Project (Educativo, Digital, Innovador y Abierto)/Spain

In Spain, the EDIA Project⁵¹ promotes the creation of new educational content for primary, secondary and upper secondary education (both academic and vocational) through an online shared platform. Teachers are offered a wide range of resources to assist them in developing educational experiences within the official curriculum while incorporating active methodologies such as project-based learning, flipped classroom, or task-based learning.

Started in 2010, EDIA (Educativo, Digital, Innovador y Abierto - Educational, Digital, Innovative and Open) is run by CeDeC (the National Centre for Curricular Development in Non-Proprietary Systems).

The project's comprehensive resources include documents, guides and complementary materials to attain the curricular objectives established for different subjects.

Teams of teachers from different regions work collaboratively to cre-

50. https://cache.media.eduscol.education.fr/file/Numerique/68/8/AFFICHEBRNEV4ANGLAIS_696688.pdf

51. <https://enmarchaconlastic.educarex.es/238-nuevo-emt/buenas-practicas/2306-edia-educativo-digital-innovador-abierto>

ate and experiment resources in their classroom. This content is then shared through the EDIA project. It is flexible and editable, which makes it adaptable to the needs of specific groups of students as well as encouraging teachers to adapt new methodologies. ICT is not used simply as a complement for teaching but rather as a platform to encourage methodological changes in the classes and in schools. These resources are published online and are free and easy to access. They feature new digital educational contents that offer everything teachers and students need to make efficient use of computers and mobile devices in learning contexts.

In order to assure the quality of the educational content, two institutions are in charge of monitoring the initiative: the Ministry of Education and the Department of Education in Extremadura, which carry out annual revisions. Teachers and schools from different parts of Spain are partnering the project.

dissemination of innovative practices; teachers continuous professional development; (teachers) peer learning; flipped learning; project-based learning.



44. Exelearning.net/Spain

Based in Spain, eXeLearning is an Open Source authoring application to assist teachers and academics in the publishing of web content. It is a free code-authoring tool ⁵² used by teachers, educators, pupils of all ages and web developers since 2010. This tool serves as a model when creating educational content. Public and private institutions, as well as volunteers, are involved in its development.

In order to assure the quality and the usability of the tool, CEDEC (the National Centre for Curricular Development in Non-Proprietary Systems) performs ongoing monitoring of this initiative as well as its annual review. In addition, various Regional Educational Administrations and the Ministry of Education are generating eXeLearning-based content banks ensuring the continuity of the project and its growth.

52. <http://exelearning.net/?lang=en>

Thanks to eXeLearning, teachers are able to create more complete, motivating and customisable educational content that can be adapted to their students' digital environment. As a free and open tool, it is accessible to every member in the educational community. Furthermore, the tool allows the creation of different kinds of educational content that can be adapted to the needs of each classroom and educational centre. Since a great variety of materials can be embedded (rubrics, documents, multimedia files, etc.), eXeLearning is a very helpful and convenient tool when introducing new methodologies (project-based learning, flipped classrooms, gamification...). Teachers and students are no longer mere consumers but rather become authors, as they can create and share their own materials.

dissemination of innovative practices; teachers continuous professional development; flexible learning environment; teaching scenarios.



45. Scoilnet – a single access point for digital resources/Ireland

Scoilnet⁵³ is the Department of Education and Skills' official portal for education in Ireland and is available online to all schools. The fundamental objective of Scoilnet is to provide high quality digital content to schools to enhance teaching and learning.

The website is managed by the Professional Development Service for Teachers on behalf of the Department. The aim of Scoilnet is to develop digital literacy and confidence in using technology in teaching and learning, bring together existing resources, and facilitate authenticated 'crowdsourcing' to promote idea and resource sharing amongst the education community. It is a key source of online digital reference content. It is both a "referratory" and a "repository" with 17,000+ open education resources aligned with the Primary School Curriculum and Post Primary Subject Syllabus and is available free of charge to all schools. The Scoilnet portal was enhanced in 2014 to allow all teachers registered in Ireland to share their own curriculum-tagged resources through the website. Between September 2016 and September 2017 the portal recorded over 1.6

53. <https://www.scoilnet.ie/>

million page views with over 400,000 resources opened.

Examples of open education resources contained on the website include curriculum based subject tutorials, notes / guides, lesson plans, videos / audios, games and other multimedia.

The Scoilnet initiative also licenses external digital content for use in schools and through this gives free access to online encyclopaedias, archives of Irish newspapers, and reference books.

A number of independent websites with specific relevance to the Irish curriculum have been developed under Scoilnet in collaboration with professional development and curriculum support services and other organisations. This includes websites such as:

- Scoilnet maps - interactive mapping tool featuring detailed Ordnance Survey Ireland maps, world maps, GIS data layers. Launched in 2008, revised in 2013.
- Science Hooks - an initiative of National University of Ireland, Galway and provides science educators with a collection of videos that capture novel and engaging aspects of Chemistry, Physics and Biology.
- French.ie - providing support for the French Junior and Senior Cycle curriculum.
- German.ie – collaborative project to support Junior and Senior Cycle German.
- CensusAtSchool: an international project promoting statistical literacy, this website facilitates the collecting and disseminating of real data for use by teachers and students in class. Launched in 2009.
- Irish Flag - presents ‘stories’ and a ‘timeline’ around the historical evolution of the Irish tricolour flag and its acceptance as the flag of the Irish state.

online portal (whole system areas); learning resources; resources sharing; peer learning.



46. Scoilnet Threads – digitally connecting local stories/Ireland

Threads⁵⁴ is an initiative that provides an online space for schools to store and share their student’s oral history projects. Threads is all about encouraging students to become active ‘oral historians’ and to engage in the collection of stories and history about their locality and to gather living people’s testimony about their own experiences and memories.

The idea for threads was inspired by the Schools Collection project undertaken in the 1930s by the Irish Folklore Commission which collaborated with the Department of Education and the Irish National Teachers’ Organisation. The project saw almost 50,000 schoolchildren collect and document folklore and local tradition with approximately 740,000 pages compiled by pupils in around 5,000 primary schools between 1937 and 1939.

The Threads of 2017 sees schools and students presenting their oral history through a variety of digital formats - digital text, digital photos, sound, video, animations and combinations of some or all of these formats. Threads provides the online space to build new tapestries of local historical knowledge.

Threads is an initiative of Scoilnet – the Department of Education and Skills official portal for schools. It is aimed at both primary and post-primary schools.

resources sharing; learning resources; online portal; inquiry based learning.



47. Big Data in the Service of Learning Mental Calculation/France

Mathador⁵⁵ is a digital application focusing on the development of mental mathematics skills and is the basis for a large-scale project in France which brings together 75 schools (both primary and lower secondary schools) who produce 700,000 mental calculation rows playing the Mathador game over an entire school year⁵⁶.

54. <https://www.scoilnet.ie/threads/>

55. <http://www.mathador.fr/index.php>

56. <http://www.mathador.fr/territoirecalculant.html>

Using mental calculation tests conducted at the beginning and end of the school year for two groups of classes, it has been possible to evaluate the contribution of the game in the learning process of mental calculation. This is accomplished through the scientific analysis of the issues related to Mathador's mass data analysis (big-data issues) and the fostering of interactions between research and classroom practice.

This involved 1500 students in Cycle 3 (last 2 years in elementary school and 1st year in lower secondary school) from the regional education authority of Dijon. 20 control classes, not playing Mathador, are also part of the project.

This initiative is carried out under the e-FRAN project (Training, research and digital animation spaces) and is part of the future Investments of the French Ministry of Education.

The initiative is supported by institutional actors, teacher teams, research teams and laboratories' researchers including Canopé⁵⁷; the local education authority of Dijon, the Data Mining and Apprenticeship Methodology (MSDMA) team, the Cédric laboratory of the National Conservatory of Arts and Crafts (Cnam)⁵⁸ and the team of the didactic laboratory André Revuz⁵⁹ (Universities of Paris Diderot and Cergy-Pontoise).

game based learning; mathematics; digital resources;
research project.



48. KlasCement/Belgium (Flanders)

KlasCement in Belgium (Flanders) offers a professionally managed digital network for users and suppliers to share educational resources. The network aspires to provide a spur for the Flemish Open Educational Resources policy and the international OER networks.

The KlasCement⁶⁰ educational portal has been at the forefront of educational Web 2.0 use in Belgium for several years. It serves as a Web 2.0 application in itself with its content being largely

57. <http://www.cndp.fr/crdp-dijon/>

58. <http://www.cnam-bourgogne.fr/les-centres-de-bourgogne/dijon/centre-cnam-dijon-566192.kjsp>

59. <http://www.lar.univ-paris-diderot.fr/>

60. <https://www.klascement.net/>

user-generated since the portal is meant to be an exchange platform for content by and for teachers.

KlasCement makes validated pedagogical resources (open or not) available according to international standards. Moreover, users can make use of their personal profiles in order to contact others, exchange and promote the better use of available resources. KlasCement strives to be the network of reference for teachers, educational institutions and organisations that:

- search for and share inspiration and resources for their daily practice and professionalisation;
- focus on remedial, adaptive, interactive, differentiating, innovative teaching;
- want to network and strengthen one another.

KlasCement also offers free services to schools and teachers by organising workshops on the creation, sharing and identification of suitable educational resources.

online social platform; digital resources; users networking.



49. 3DIndire: the 3D Printer in the Classroom/Italy

In Italy, 3DIndire⁶¹ has been developed as an environment to facilitate the configuration and use of 3D modelling and printing programs giving special attention to technological settings and the needs of school environments. It includes model sharing, co-design, and tracking makers' activities. This online environment is a dedicated space to support the process of self-evaluation, peer review, reflection and sharing.

Class activities (kindergarten, primary, and middle school levels) are based on the core characteristics of the “act and learn” Maker approach to knowledge;

61. <http://3d.indire.it/index.php?act=in3Dire>

- an hacker approach to knowledge
- a “tinkering” methodology, based on Think-Make-Improve (TMI) cycle
- collaboration and sharing knowledge with a perfect “open” philosophy.

The methodology is based on a storyline. A background story is organised as a quest with different open problem tasks to solve. The objects created within the tasks are the key pieces for moving on with the story. All the tasks given to students require a problem-focused, action-oriented participatory process. A unique solution is not the goal: rather, thinking through different options and finding a wide variety of possible solutions for reaching the goal.

Tasks are aligned with the Italian National Curriculum and teachers are free to choose which skill and/or discipline to focus on.

The wider research aims of the 3DIndire experimentation are:

- to identify a structure to sustain experimentation with 3D printing based on the TMI cycle so as to establish “good practices” that can be used as guidelines for everyday educational activity
- to develop framework software/hardware based on the open source philosophy so as to promote an independent, low cost alternative to commercial products.

Finally, various academic studies have analysed experiences of the using the “Maker” logic within education, where new technologies are considered not only as a way to optimise the existing educational system, 3DIndire project shows how these technologies serve as a force for transformation capable of generating radically new ways of knowing and learning.

problem solving; active learning; collaborative learning; makers approach; online environment; research project.



50. Gutenberg 3D/Spain

The main aim of this Spanish project is to incorporate 3D printing new technologies in the educational environment so that both teachers and pupils learn to use them and explore all their possible functions, not only in the classroom but also in the wider environment. Students develop prototypes and use them to enhance the school's resources. For example, students can replicate 3D printers and build robots.

The project also aims to improve the quality of life of people in the community, for example by printing prosthetics, Braille printers and humanoid robots to help senior citizens exercise.

key competences; 3D printing; school-community relationship.



51. Pilot Programme on the Development of Open Educational Resources (Edulabs)/Greece

Large-scale development and deployment of open technology is an ambitious pilot program by the Greek Ministry of Education focusing on the creation and networking of 145 open technology laboratories (“Edulabs”) across the country.

An open technology lab is established and operates exclusively on open hardware and software technologies. Its distinctiveness lies in two main areas:

- the technological infrastructure and
- the teaching of how to use it.

Moreover, it consists of a network of economic workstations (PCs), i.e. Raspberry PI, robotics kit, three-dimensional printers and scanners, interactive projectors, multifunction peripherals, and various sensors. The aim is to make the people who work in it, teachers and pupils, into a broader community whose main concern is free access to knowledge, the diffusion of any new knowledge, and the use of good practices.

At the same time, the Ministry of Education has organised technical support, access to a wealth of technical information and teaching materials through user communities of open technologies, and support and training activities on any issues arising from the use of equipment. These target the operators of the open technology laboratory and the teachers interested in using it.

The main purposes of digital open standards equipment are (a) to improve basic skills in science, technology and the digital competence of students in primary and secondary education, (b) to create the conditions for learning motivation and taking initiative, and (c) to facilitate the acquisition of basic life skills, enhancing self-esteem, confidence and sociability through group-collaborative actions.

STEM; collaborative learning; users community.



52. eSafety Label/Cross country

In every country, young people are carrying with them increasingly powerful access devices and are linking to social network sites, building their own online communities and creating and sharing content. Schools and parents cannot impose all-encompassing restrictions on the use of technology in order to protect young people.

To provide practical solution to this challenge, European Schoolnet (EUN) has set up the 'eSafety Label'⁶² (eSL), a European wide accreditation and support service for schools. This represents a major step forward in the drive to develop and maintain high standards of eSafety. It includes:

- **Accreditation:** Schools can review their own eSafety practices against internationally agreed standards. When they put forward evidence of their practice, they can be accredited as an eSafety-certified school. On completion of the self-assessment process, they will receive a personalised action plan to enable them to develop further their level of eSafety practice. They can also see where their school stands compared to other schools in their own country and abroad.

62. www.esafetylabel.eu

- Resources: The eSL portal provides schools with an ever-growing set of resources: eSafety advice and guidance, fact sheets, checklists and templates.
- Online community: Users and experts exchange tips, advice and information on eSafety issues, help each other and share examples of effective practice.

Since its launch in 2011, over 4,000 teachers and 3,400 schools across the EU and beyond have become part of the eSafety Label community. Especially in the past two years, the eSafety Label received great acknowledgment, resulting in over 1,200 new community subscriptions in 2016 only. As of today, 1,437 labels have been awarded in 35 countries (16 Gold, 72 Silver and 1,349 Bronze).

Over the years, the eSafety Label community has developed itself as one of European Schoolnet's largest communities for teachers. Currently the eSafety Label portal is accessible in 17 languages. In terms of website traffic, an average of around 3,000 sessions can be identified monthly.

school assessment tool; learning community; learning resources; teacher self assessment.



53. Learning Resource Exchange/Cross country

Open Educational Resources (OERs) are digital learning resources made freely available online under open licenses. Most OERs are educational content like simulations, animations, quizzes, videos, lesson plans and educational games. Although they can be embedded into learning management systems, they are generally online objects that can be viewed, downloaded or played from a web site.

The Learning Resource Exchange (LRE) is an online catalogue of OERs for K-12 teachers in Europe. The LRE catalogue is managed, maintained and curated by European Schoolnet (EUN) where its development is steered by an LRE Subcommittee.

At the time of writing (October 2017), this catalogue references about 350.000 OERs from more than 80 content providers in more than 20 countries. OERs in the LRE are selected based on

their potential to be used in different countries and educational contexts. For example, they must cover trans-national topics such as mathematics and/or be available in multiple languages

The LRE catalogue is available as a service. Ministries of Education who are part of the LRE Subcommittee use this service to increase the number of learning resources they offer to their teachers via their national portals.

The LRE service can also be accessed using a mini-interface that can be easily inserted into any web page allowing users to search the LRE collections without having to visit a separate portal. This interface can be set up (with the help of the EUN's technical team) to filter resources in specific collections, topics or languages.

Examples of LRE mini-interfaces embedded into web pages can be seen using the LRE Directory, an online tool that presents the various LRE collections. The LRE directory is available [here](#).

mathematics; users community; learning resources.



54. Photonics Explorer/cross country

The Photonics Explorer⁶³ is an educational toolbox, available in 10 languages, that gives students a more informed basis for their decisions regarding a career in science and engineering. It therefore contributes to the effort to spark students' interest in STEM study and STEM careers.

Initiated by the Vrije University of Brussels, with applications in both Belgium and Greece, the Photonics Explorer kit teaches Optics using a kit that contains mirrors, LEDs, lasers, polarizers, colour filters and slit diaphragms. It also includes a class-set of generic and versatile components for hands-on experiments, a multimedia collection, and a comprehensive, guided-inquiry based didactic framework with worksheets, lesson outlines and background information for teachers.

63. <http://www.eyest.eu/STEM-Programs/Photonics-Explorer>

Using this equipment, the students are invited to discover rather than learn by heart the laws of optics. For instance, students discover the significance of the focus of a lens by experimentation. They realise that at that particular point the image is inverted. They construct a telescope by moving a lens in respect to another and they calculate its length as being equal to the sum of two focal distances. They play a game that they should transmit a message in code through a fibre optic, using LEDs of three colours, imitating the operation of the internet.

Emphasis is also given to practical applications of this knowledge to modern technology like the internet, the displays, the lamps, the construction of a spectrometer, the telescope etc.

Each kit includes a class-set of generic and versatile components for hands-on experiments, a multimedia collection, and a comprehensive, guided-inquiry based didactic framework with worksheets, lesson outlines and background information for teachers.

There are plans to distribute 250 Photonics Explorer kits with the associated teacher training in 10 EU countries. In one year one kit can reach on average 50 students. As the kits have been designed to last for at least 5 years, the 250 distributed kits may reach up to 62,500 students in Europe.

STEM; interdisciplinary approach; inquiry based learning.



55. Biohist Platform/Austria

Opening up learning materials in new and flexible ways can be an exciting complement to more traditional sources of expertise.

Biohist⁶⁴ is an Austrian teachers' platform facilitating interaction with students, parents and teachers. The platform contains freely accessible content for various subjects (i.e. physics, biology, history). Additional video, interactive content and images are also provided while students and parents can access additional video footage from their children in action.

64. <http://www.biohist.at>

An additional advantage is that students can access the platform through their own devices. Individual class activities are made available in an appealing way while the interdisciplinary content facilitates exchanges and students' engagement.

digital resources; interdisciplinary approach; school-parents relationship.



56. The adventure of learning- La Aventura de Aprender/Spain

In Spain, the education ministry (MECD) is collaborating with national television (Radio Televisión Española) in the co-production of educational audio-visual content for the TV program “*La Aventura del Saber*”⁶⁵ broadcasted in the state national channel la 2.

In 2014 when both partners reviewed and renewed their collaboration, they agreed to include a new license for the audio-visual materials the show produced. As a result, “*La Aventura de Aprender*” was born as an independent website⁶⁶, hosting audio-visual content enabling the analyses of educational practices, spaces and agents engaged in the learning process. The website also includes a section with didactic proposals to encourage the implementation of collaborative projects which connect classroom activity with the outside world.

Acting within its educational mission, the project allows learners and the wider public to enjoy the best of both worlds: internet and television, which have evolved independently for a long time. The web is a perfect complement to serve a community of users interested in the materials developed alongside the broadcasting schedule. The educational benefits, given the emphasis on learning processes, are undeniable.

education-industry relationship; virtual learning environment.



65. <http://www.rtve.es/television/la-aventura-del-saber/>

66. <http://laaventuradeaprender.educalab.es/>

57. CLB Chat/Belgium (Flanders)

CLB are pupils' guidance centres in Flanders/Belgium. Every school in Flanders has to have an agreement with such centres which plays an important role in pupils' physical health (i.e. vaccination schemes), overall wellbeing while also providing study guidance for pupils, teachers and parents.

Pupil guidance forms a key part of guidance and support services in Flanders/Belgium and CLB chat is a new communication functionality where children and youngsters can talk to a guidance contact in a private (even anonymous) chat.

CLB chat is meant to simplify the steps needed to contact a CLB centre while it offers a mean of communication online that is safe and closed to children's communication styles.

online guidance services (for pupils/students).



58. Administration of information technologies of the city of Pilsen/Czech Republic

The Administration of Information Technologies for the City of Pilsen (SITmP), established in 2001, aims to provide advanced IT services for the city of Pilsen and other organisations managed by the city, commercial organisations, foundations and other associations. SITmP activities address all ages and sectors, from schools to leisure in various themes and frameworks. SITmP provides technological support for over 100 organisations, including 26 primary schools and 40 pre-primary schools. The SITmP offers complete technical support to these schools, including internet connection, equipment such as interactive whiteboards or tablets, research-oriented sets, robots and language laboratories.

The Centre for Robotics (CR is part of SITmP and supports teachers in the meaningful use of digital technology as a part of their professional development. The Centre organises competitions and exhibitions for teachers, student teachers and pupils on the themes

of robotics, 3D printing, electronics, natural sciences and the use of touch devices and online tools in classrooms. The Centre also offers accredited seminars, organises meetings for teachers and pedagogical experts and provides support for teachers who wish to integrate innovative methods and technological tools into their classes.

The activities of the Centre for Robotics are closely linked to the education of pupils on Pilsen's pre-primary and primary schools. The CR helps primary school teachers to include the elements of robotics and coding into their everyday teaching. The CR provides material, professional and methodological support. This support includes training and seminars for teachers and the possibility of tandem teaching. In a similar way the CR assists schools in the teaching of science, providing primary schools with Pasco sets for research-oriented teaching. These sets enable pupils to work in teams, make and test hypotheses by using sensors, and to draw conclusions.

In order to encourage technical and science education, the CR organises leisure activities for children and youth aged five to 16 in the form of clubs, competitions and thematic camps focused on graphics, photography and video, coding, robotics, drones, 3D modelling and printing, natural sciences and electronics. One of the clubs is The Geek Club, which supports talented pupils from primary and secondary schools in coding and other skills.

In addition, the CR also organises activities for the general public, including weekend workshops for children and young people as part of the Code week or the Hour of Code campaign. Furthermore, the CR is also the national coordinator of the European week of robotics and a partner in the Children's University in the Pedagogical Faculty of the University of West Bohemia. The SITmP also coordinates the Smart Edu initiative for secondary technical schools and technical departments of the University of West Bohemia. Smart Edu includes competitions, mediates professional experiences for students of secondary schools and universities, conferences for educational advisors and Study Map Day (a fair focused on technical education and the possibilities of employment for graduates in the Pilsen region).

It is not only schools that benefit from the Centre. Start-up companies and aspiring individuals can use it and find suitable conditions

starting up their own companies. As part of the virtual University of the Third Age, senior citizens can learn online.

The SITmP initiative has shown that innovation and technology are not only the preserve of hi- tech companies but can be integrated in schools, teacher training, leisure activities and building synergies with industry. By creating and enabling these links the city of Pilsen ensures that its citizens are technologically competent and active, which in turn increases the prestige and competitiveness of the region.

education-multiple partners relationship; school- local authorities relationship; robotics; programming; STEM, teacher continuous professional development; networking; learning community.



59. Digital Mirror/Estonia

How can schools assess their level of digital maturity?

In Estonia, the Information Technology Foundation for Education in co-operation with Tallinn University has developed and tested a new online assessment tool for comprehensive schools, vocational schools and school owners to allow them to assess and monitor their digital maturity.

Based on digital innovation models, schools assess their maturity in three different fields: (i) pedagogical innovation, (ii) change management, and (iii) digital infrastructure.

Following the self-assessment, each school develops a digital plan with specific development activities. School authorities in different regions build on the schools' plans so as to develop a digital vision for the area over the coming period and confirm their moral and financial support for the planned development activities within schools.

school assessment tool (digital maturity).



60. UNI-Login/Denmark

To facilitate secure access to IT services by users of the education system, Denmark has created UNI-Login as a digital ID for children, young people and employees at institutions that provide access to national services and a wide range of educational services and on-line learning resources.

Under this system, more than 1m users in education have a unique ID and password, including all children and teachers in primary schools, all publishers of educational content in Denmark, all museums, and many students and teachers in other education institutions

The UNI-Login gives access to:

- national tests by the Ministry
- online subscriptions by private publishers
- video streaming from the National Broadcasting Company
- local intranets at school level
- local network access at schools.

digital identity.



61. Trust and usability with Skolfederation for easy and safe access to services/Sweden

In Sweden, a single login for schools for access both internal and external services reduces time-consuming administration of accounts and passwords to numerous services. Schools can feel more confident in giving access to different services when the use of sensitive data can be limited and only the information necessary for access to the service needs to be provided.

Skolfederation in Sweden provides this infrastructure for login that facilitates access to digital resources, protects user privacy and

provides a secure service for members. It is fundamental that the identification made by the principal organisers and which is used in school can also be used for logging into the services of service providers.

To allow members to use and rely on each other's identities and credentials, all members need to follow the regulations of *Skolfederation*. The federation operator (IIS, The Internet Foundation in Sweden) manages the operational activities such as membership management, metadata management, operation and development of the common infrastructure, management of contracts and the legal framework.

More than a hundred and fifty stakeholders are engaged in the work of *Skolfederation*. Many schools have already joined and enjoy the services provided and many more are about to join. Based on members' wishes, development is ongoing (a) to be able to handle higher security with an enhanced level of assurance between principal organisers of the school and online services, and (b) to facilitate the administration of the members' metadata.

The project is also creating common guidelines for the use of digital learning resources, and practices on how they should be applied, as well as spreading knowledge and awareness of how to use them.

Furthermore, A partnership between *Skolfederation* and Sunet gives students and teachers in Swedish schools access to wi-fi at about 7,000 locations via eduroam. Eduroam has previously only been available to universities and colleges, but is now also available for primary and secondary schools as part of *Skolfederation*.

education-multiple partners relationship; digital identity; education-industry relationship; learning resources; online guidance services.



62. Procomún: Open Educational Resources Network/ Spain

Procomún is a web service based in Spain which enables access to the repository of open digital educational resources provided by the Ministry of Education and the regional educational administrations. There, users can search and find didactic materials categorised in a standardised way through metadata (LOM-ES), in line with the curriculum set for pre-university educational levels (kindergarten, primary and secondary) and ready to be used in the classroom or to be modified and adapted to different contexts and needs. Different download formats are available to promote their integration in LMS (Learning Management System) platforms.

*Procomún*⁶⁷ is endowed with semantic properties that allow it to be connected to existing educational communities on the Linked Open Data Cloud. After a pilot version launched in 2014, the service has run successfully since 2015⁶⁸.

Teaching materials are offered under an open use license, which allows free access, modification and redistribution by others with no or limited restrictions. *Procomún* also incorporates information backup systems that allow faceted searches based on natural or iterated reasoning. It also allows users to perform searches in context, since the selection of an educational content comes with related information coming from linked sources.

Procomún also incorporates a Professional Social Network where members have personal and social spaces where they can create, evaluate and disseminate educational experiences. This is integrated within *Procomún*, allowing users and educational resources to be closely connected through a system of social tagging and voting, with recommendations on use and peer learning all made available. Ultimately, this encourages the exchange of views and suggestions about learning and educational practice.

In a nutshell, using *Procomún* enables teachers to interchange methods and experiences, thus encouraging collaborative work on topics

67. <https://procomun.educalab.es>

68. Launched and supervised by INTEF (Spanish National Institute of Educational Technologies and Teacher Training)

of common interest in virtual learning. Furthermore, it serves as a tool to allow access, modification and distribution of educational content. By means of standard formats and open licenses, teaching and learning activities are guaranteed to be developed within a proper legal framework and with no borders.

teacher continuous professional development; learning community; learning resources; resources sharing.



63. Expérithèque/France

The French national library, Bibliothèque nationale des expérimentations pédagogiques- “*Expérithèque*”⁶⁹ provides a database of more than 5000 innovative and experimental projects implemented in schools, offering various thematic tools for information, analysis, piloting and evaluation.

This national database focuses on innovation and offers a national platform to make the projects known throughout France and making new organisational approaches and new pedagogical practices better known, enhancing the value of the public investment in these projects.

online portal; dissemination of innovative practices.



64. Éduscol - the Portal for Educational Professionals/France

In France, a powerful single portal has been created for the benefit of the whole range of education professionals.

Éduscol⁷⁰ is a database that includes all the resources and publications of the French Ministry of Education, as well as multiple domains dedicated to specific themes and sites. Alongside the main Éduscol website, which houses all the information about education in French schools, there are also several thematic sites, disciplinary

69. <http://eduscol.education.fr/cid57491/experitheque-bibliotheque-nationale-des-innovations.html>

70. <http://eduscol.education.fr>

sites, teacher training sites, and a bank of resources. The portal is divided into 5 categories of websites: the original website that includes information on education in France, 7 thematic sites, 19 sites specific to different disciplines taught in schools, 9 teacher training resource sites, and 4 sites of pedagogical resources.

Most of the information on the main site about education in France is available in German, English and Spanish as well as the original French. The thematic sites are concerned specifically with specific subjects such as technology, responsible internet use etc.

The goal of the disciplinary sites is to present news and resources for the disciplines taught in schools such as art, history and geography, physics and chemistry, earth sciences, philosophy, and mathematics, among 19 disciplines in total. These sites are developed and tailored specifically for teachers.

The teacher training sites offer expert oversight of resources to support the initial and continuous training of teachers. These offer access to indexed resources, including:

- édubase - presents different pedagogical scenarios online for teachers to share and use for collaboration
- prep'exam offers students and teachers the chance to access examinations that have previously taken place in different baccalaureate subjects
- expéριθèque offers a data base of innovative pedagogical experimental projects

Songs that Made History gives students the opportunity to listen to songs that have great historic and cultural importance, as well as a contextual explanation by experts to accompany the song.

online portal (whole system areas).



65. Education & ICT Breakthrough Project/ Netherlands

The “Doorbraakproject Onderwijs en ICT” (breakthrough project education and ICT) supports schools, school boards, school leaders and teachers in developing personalised education supported by ICT. The project works on taking away barriers, and on creating a transferable, integral, and affordable approach for schools in primary and secondary education.

The project functions at three levels:

- School: Clarifying the questions and needs schools have in working with ICT for personalised learning. These are bundled so that suppliers of ICT solutions can address them.
- Synergies: Developing methodologies, agreements and standards to allow systems to work together across all the ICT systems schools use for personalised learning. Schools want safe, reliable and secure ways of accessing digital learning materials regardless of the supplier. Teachers and learners want quick and easy insight in their progress.
- National: Creating agreements, safeguards and shaping the conditions necessary to better leverage ICT.

The project is an initiative of the national councils for primary and secondary education, the Ministry of Education and the Ministry of Economic Affairs.

online guidance services; accompanying measures.



66. The Progetiger Programme/Estonia

A systemic approach to embedding technology education across the curriculum is championed by the ProgeTiger programme ⁷¹ for Estonian preschool, general and vocational education teachers, educational institutions and learners.

This programme supports the integration of technology in differ-

71. <http://www.hitsa.ee/it-education/educational-programmes/progetiger>

ent subjects. For example, teachers are encouraged to use robot sets and sensors in physics and chemistry lessons, or programming platforms in mathematics and music lessons and 3D printers in art and biology lessons. Activities can be built into elective courses (informatics, robotics, programming, 3D technology etc.) and extracurricular activities (after school clubs). The aim is to support pupils' ability to solve problems and think critically (logical & algorithmic thinking), to create and collaborate, and finally to understand technology and how it works.

The programme is initiated and funded by the Estonian Ministry of Education and Research. When the programme started back in 2012, only few schools and kindergartens were active in the field of technology education. Today, half of all Estonian institutions of preschool, general and vocational education are involved in it with the network covering the entire country.

By increasing the availability and attractiveness of technological activities for different age groups, it encourages children's and young people's interest, in the fields of engineering sciences, along with the development of their algorithmic thinking, problem-solving skills and programming skills.

Since 2014, ProgeTiger has created 31 resources with guidelines and examples on how to integrate technology with teaching and learning. A digital resources toolkit with 52 tools for teachers is also developed for use in classroom. Over 3000 teachers have participated to the Information Technology Foundation in Education (HITSA) ⁷² free trainings in one of the three available proficiency levels – basic, intermediate and advanced. Over the same period of three years HITSA has also supported more than 300 kindergartens and schools in acquiring robotics kits and additional sensors, microcontrollers, minicomputers, Kano, and 3D printers.

programming; problem solving; interdisciplinary approach;
teacher continuous professional development.



72. <http://www.hitsa.ee/en>

67. Edukateka/Lithuania

Combining computer science, English and cultural learning all in one activity? The Edukateka⁷³ institute in Lithuania makes this possible! Its vision is to become an organisation that provides versatile, complex and high quality educational services, involving all interested organisations, formal and/or informal groups and developing local and international partnership network.

Three teachers from different subjects - ICT, English, and Dance – have progressed from what started as an informal after-school activity to a successful educational and scholarly institution. Today, Edukateka runs informal child, youth and adult education programmes including teacher training, community-based projects, and international partnerships through e-Twinning, Comenius and NordPlus projects.

Children, youth and adults benefit from innovative learning spaces to create and develop their own projects. These multidisciplinary activities give children and youth the chance to enhance their creativity, communication and digital skills, using modern equipment such as 3D printing, laser cutting, coding, Arduino software, micro:bit, webpages and apps, 360 photos for virtual reality glasses and much more.

Teachers and educators also benefit from Edukateka: they are offered various creative workshops, scientific conferences, and seminars organised by Edukateka's founders. In addition, pedagogical publications, research and teaching materials are made available to teachers. Setting as its goal to “ensure the development of youth and children self-expression as well as to improve teachers’ competences, develop creative skills, abilities, and forms of activities”, Edukateka provides an inspiring example of a multidisciplinary and community based approach.

interdisciplinary approach; out of school hours provision.



73. http://edukateka.lt/lt_LT/

B. DYNAMICS CONNECTING ELEMENTS

a. Re-organising learning space and time

Re-visiting the relationship between space, time and learning is essential to educational innovation. The standard design of schools and classrooms inherited from the past is directly aligned with the pedagogical and didactic approaches associated to the transmissive model characterising that period. The learning ‘script’ of that period was simple: LISTEN (the teacher who possess the knowledge), DIGEST (without introducing alteration) and REMEMBER (to possibly repeat it in turn). The key and transversal competences that students need to master in our knowledge societies require a completely different script that is more about ENGAGE, COLLABORATE, EXPERIMENT, APPLY, TRANSFER and CREATE. Here, the teacher role is still to pass on knowledge but also to offer personalised guidance aiming at deep learning and critical thinking. Such a script needs to be supported by new ways of organising time and space in schools.

The whole school itself has to become an open, integrated and flexible learning space, mixing different zones meaningfully designed as a function of the activities hosted and the specific learning processes involved (investigation, collaboration, experimentation, presentation, etc.). Innovative multifunctional and modular zones are used all day long by learners and teachers, working in groups and individually. Specific areas are also designed for broader social interactions aiming at nurturing the school community and interacting with its surrounding environment. That way, schools can be learning organisations where students build and maintain their identity in today’s societies as a foundation for being open to the world.

The most effective learning environments for the students of these times are still being researched worldwide. Shaping space so that it can support today’s learning needs in formal education is still in its infancy. Pilot projects are being carried out as a way of contributing to such investigations: the various Future Classroom Lab, and Educational Innovation Studio initiatives, illustrate this. They

also underline the importance of accompanying measures such as teachers' capacity-building on optimal use of new and innovative space organisation. Pilot and research projects, also looking at architectural design to advance optimal use of technology and the 'intelligent school', are generating frameworks and supporting tools, such as the Archicl@sse and 1+4 Learning Spaces for a new generation of schools Manifesto initiatives, starting to pave the way for initial action and change. This research investigates both new buildings as well as old structures needing to be renovated, updated, upgraded and sometimes even re-invented.

Initiatives in this section also address interesting mobile options to be considered and tested, like for example the 'classroom on wheels', where technological kits can easily transform any regular traditional classroom into an innovative and interactive classroom (cf. From Future Classroom Labs to Present Day Classes).

The reorganisation of time and space is particularly suitable, and in some cases even required, for participative and collaborative processes involving teachers, students and parents, as illustrated by the De School initiative.

68. The European Schoolnet Future Classroom lab/ FCL/Cross country

In January 2012, European Schoolnet launched a 'Future Classroom Lab' (FCL) as part of its offices in Brussels. The lab is a physical space that brings together learning space design, development of key competences and technology in one place. FCL is not meant to be a prototype of a classroom that schools should implement, but it aims to encourage and invite visitors to rethink their own learning spaces, their ways of teaching and learning and the role of technology in it.

FCL was originally created to support the dissemination of the results of the iTEC project (Innovative Technologies for Engaging Classrooms), a large-scale pan-European pilot focused on the use and mainstreaming of ICT in schools. The project originated *innovative pedagogical scenarios* some of which prompted teachers to start thinking about how to adapt typical classroom layouts or about

new methodologies such as ‘flipped classroom’. Therefore, FCL was originally created as a way to introduce different stakeholders to new teaching and learning approaches that incorporate innovative use of ICT and challenge them to rethink their current pedagogical practice within a flexible and reconfigurable space.

Even if the idea of a reconfigurable learning space was not a new one, it was unsure to predict how the initiative would take off. Today, the FCL has proven to be a success in many terms. The FCL offers ‘food for thought’ for everyone: school leaders, teacher trainers, teachers, policy-makers, through the *combination and visualisation* of learning space design (organised as ‘learning zones’), pedagogy, and the integration of technology. In addition to showcasing touchable and visible elements, FCL also helps to open minds as it brings together different stakeholders, encourages exchange of practice and aims to inspire professionals at different levels.

Moreover, some visitors get so inspired by the idea of the FCL learning zones, that they started creating their own learning labs. Today there are tens of such FCL-inspired labs across Europe and beyond, created in different contexts and for different purposes thanks to the *flexibility of the FCL model*. Some are school-based labs used directly with students, while some are created by the ministries of education, or by teacher training universities, and more are being created continuously.

Since the very beginning, FCL has been independently funded initiative, supported by the EUN’s member ministries of education and, very importantly, a number of educational technology providers who have wanted to be part of the FCL development. Today the FCL is actively used to host workshops for teachers as well as events for different stakeholders, such as industry, policy-makers and researchers. So far, over 3000 teachers have taken part in the FCL-specific on-site workshops and courses with very positive notes.

teacher continuous professional development; teacher networking; teaching scenarios; learning space organisation.



69. From Future Classroom labs to Present Day Classes/Portugal

*Sala do futuro e Laboratório de aprendizagem e multimédia*¹ is a learning space equipped with 3 high definition video cameras, video editing software, robots, Lego Mindstorms for software engineering, 3D printer, tactile screen, tablets, learner response systems and devices, snoezlen elements, augmented reality software, magic wall, interactive table. All the furniture in the room is on wheels or moveable providing a flexible space for teachers and students to arrange the space according to their needs. The future lab is focused on bringing innovative teaching methods into teaching and learning.



The opening of the future classroom lab (FCL) at Agrupamento de Escolas de Alcanena secondary school in Portugal was a turning point for everyone: teachers and students became more motivated and integration of ICT in education became tangible. Vocational education students whose motivation was low and special needs students also benefited. Vocational students have been trained to become FCL resident monitors.

However, the FCL alone could change neither mentalities nor teaching practices. It is necessary to extend the way students learn and the way teachers teach in FCL to a regular classroom.

1. <http://fcl.eun.org/sala-do-futuro-e-laboratorio-de-aprendizagem-e-multimedia>

Thus more projects were created, such as “classroom on wheels”, which consists of technological kits which can easily transform any regular traditional classroom into an innovative and interactive classroom. The teachers’ training plan was reinforced and the heads of the different subjects are learning how to deliver new methodologies making use of technological equipment, so that they can disseminate these new methods among the other teachers (about 150).

Teachers are developing their pedagogical skills so that they can shift from the expositional teaching mode to active methods, such as learning by scenarios; flipped classroom; and bring your own device (BYOD). Students feel more motivated, and are improving their concentration as they learn according to their own path and needs and they can do different things and be in different areas during a single lesson. This is about self-regulation, playing active roles and developing 21st Century skills.

flexible learning environment; learning space organisation; technology-supported teaching; technology-supported learning; teaching scenarios; key competences.



70. Future classroom- El Aula del Futuro/Spain

This Spanish initiative has its origins in the Future Classroom Lab project of European Schoolnet (EUN) and is aimed at policy makers, technology providers, teachers and educational researchers. The goal of the *Aula del Futuro* is to help users to visualise how current classrooms can be re-organised to promote changes in teaching and learning styles.

Launched in 2017 under the support and guidance of INTEF (the Spanish National Institute of Technological Activities and Teachers’ Training²), this new space in the Ministry of Education itself provides teachers and educators with the opportunity to use technologies and explore the concept of space organisation while focusing on the development of students’ skills beyond the acquisition of content as such. The teacher becomes a mentor and students become the

2. <http://educalab.es/intef>

centre of their own learning. Teachers are encouraged to use active methodologies where students become researchers and creators of knowledge, resources, ideas, etc. Different pedagogical approaches are put into practice: flipped classroom, Activity Based Pedagogy, etc. and different technologies used – Smart School, Gear VR, mobile devices. Students develop skills that are applicable in different contexts and allow them to successfully navigate through the personal, social, and employment worlds in which they live.

In the *Aula del Futuro*, various accessible technologies and resources are used to promote students' learning in a flexible and active environment. Through the use of technology, when organised and used in an open and active way, students can accomplish various tasks. Moreover, the space is flexible and adaptable to new emerging technologies that can be integrated in future in the different learning zones to respond to students' needs at any time.

The *Aula del Futuro* is not restricted to the classroom: other services and projects are connected with it, including:

- On-site and online continuous professional development opportunities for teachers.
- European projects led by INTEF.
- Educational innovation services in the Spanish Ministry of Education and the Autonomous Communities.
- Experimentation projects with technologies in which Spain participates (Samsung Smart School, etc.).

This initiative is supported by an ambassador's network³ which operates in all the autonomous communities and cities in Spain and is coordinated by the Ministry of Education. The ambassadors are teachers of different backgrounds that are interested in disseminating the *Aula del Futuro* model and helping those centres and teachers who wish to move forward in the direction of innovative student-centred learning. Consequently, several autonomous communities (e.g. Canary Islands, Aragón, Comunidad de Madrid, Comunidad Foral de Navarra, Comunidad Valenciana) have launched or are now designing their own Aulas del Futuro, located

3. <http://fcl.educalab.es/>

in Teacher Professional Development Centres where schools and teachers can be inspired by them.

dissemination of innovative practices; teachers continuous professional development; flipped learning; flexible learning environment; active learning; learning space organisation; technology-supported teaching; technology-supported learning; teaching scenarios; key competences; networking.



71. The Archicl@sse Project/France

What school architecture provides the most favourable environment for pupils to succeed in an increasingly connected world? What are the implications of digitalisation for school architecture?

The Archicl@sse⁴ project, initiated by the French Ministry of National Education, Higher Education and Research, aims to draw up guidelines that will enable school stakeholders to re-think school architecture to take account of technological innovations, infrastructure options, and new teaching strategies.

The project addresses two questions:

- For new schools, how can we combine active pedagogy integrating digital technology with intelligent school architecture and design?
- For older schools, how to teach in the 21st century, in classrooms and schools inherited from the 19th century?

Numerous examples of school renovation or new builds are emerging and demonstrate the need for an institutional framework for decisions on space design and utilisation which meet the different usage needs (teachers, pupils, institutions, parents, administrative officers). With the classical rectangular format becoming unsuitable for mobile furniture, connected devices and collaborative work, rethinking school architecture becomes essential.

This guidance (available online at the beginning of 2018) should be able to meet these needs, identify the important questions that

4. <http://eduscol.education.fr/cid84395/archicl@sse-impact-du-numerique-sur-l-architecture-des-ecoles-et-des-etablissements.html>

officials must address in relation to school creation or renovation, and recognise the importance of involving teachers and their pupils in a participative decision-making process.

active learning; learning space organisation.



72. 1+4 Learning Spaces for a New Generation of Schools/Italy

This initiative takes a deeper look at new approaches to learning spaces. It seeks to examine and disseminate a new cultural framework for designing such educational spaces in existing and future schools in Italy.

Developed by INDIRE (the National Institute for Documentation, Innovation and Educational Research), 1+4 Learning Spaces initiative promotes a manifesto for innovative learning spaces. Its brochure and book address how to shape the evolution of the learning environment from the historical past through to the future. In cultural terms, it provides a framework for longer-term interventions in schools, aiming to change the shape and effective use of available spaces as well as encourage collaboration/dissemination initiatives aimed at architects and local authorities. Notably, the initiative promotes a switch to the use of ICT-enabled one-to-one use of network technologies to replace traditional desk-based classroom settings with cluster configurations and open educational landscapes.

This also promotes different types of personalised active learning. Effective learning needs personalisation of learning pace, learning setting, learning space. When we study and work at home nobody sits for hours at a desk and chair: we try to collaborate, explore, search for information looking always for the best and more comfortable setting. So why should the school continue to provide a classroom setting that is no longer effective?

personalised learning; active learning; learning space organisation.



73. Educational Innovation Studio (EIS)/Austria



The Educational Innovation Studio (EIS) lab in Austria is an innovative space that supports 21st century skills of students of different grades, starting with the primary level. The studio uses various kinds of educational applications and narratives as well as mobile furniture to allow students to explore and construct models of robots, by using, for instance, Lego pieces. Moreover, this mobile furniture enables students to engage in their learning processes in different ways and different learning areas

Using Robotics in Education can bring a much wider range of benefits than may be apparent. Constructing and manipulating robots allows students to learn a broad range of concepts and working methods.

To start with, students are introduced to coding. Each student, within a group, assumes a specific team role: presenter, organiser, storyteller, constructor or programmer. Students can then engage in a number of playful experiments involving coding and robots linked to specific missions or challenges. Finally, students have the opportunity to present and reflect on what they have developed, allowing them to receive feedback but also gain in-depth understanding of their own solutions.

The elements of the EIS Studio are simple to learn, but leave plenty

of room for on-going exploration, rewarding first-timers as well as those that spend long hours in it.

The content and methodology used are interdisciplinary, taking on board concepts from mathematics, physics, mechanics, electronics, informatics, engineering, language learning and psychology. This approach has been successfully applied in several schools worldwide, being used from primary education onwards with suitably adapted pedagogical methodology at each level.

The EIS lab also includes activities that support educators to identify and consider the impact of trends in their local context.

robotics; interdisciplinary approach; collaborative learning; project-based learning; key competences; learning space organisation; teacher continuous professional development.



74. Learning Labs Initiative (FCL)/Portugal

Set up in 2014 by the Portuguese General Directorate for Education (DGE)⁴⁵, through the Resources and Educational Technologies Team (Equipa de Recursos e Tecnologias Educativas - ERTE), together with European Schoolnet (EUN), the Learning Lab Initiative (LA) is directly connected with the EUN Project “Future Classroom Lab”. The main goal of this project is to spread methodologies for the integration of ICT in the curricula, within the Portuguese context.

The initiative has as its aim to unveil to teachers, schools and other education partners the guidelines and resources produced by European Schoolnet to support the construction, testing and implementation of innovative teaching and learning scenarios. This is planned to include a teacher network aiming at nationwide integration of innovative practices.

The methodologies and resources offered to teachers have been validated by various pilot-projects within the European framework and are directly associated with testing and validation of innovative learning scenarios using technology.

The learning scenarios, along with good practices examples, inspired by advanced pedagogic strategies, provide inspiration for the conception of other scenarios, stories and innovative activities to be implemented in the Portuguese teachers' classrooms.

The LA initiative is fostered by a team of ambassador-teachers, who supported by ERTE, have developed throughout the period of three years. The ambassador-teachers designed several free formative activities that address teachers of various age groups. The activities aim to create a network of teachers who would promote the implementation of innovative practises through ICT at a national level.

collaborative learning; key competences; teacher networking; student centered approach; teacher leadership; teaching scenarios; learning space organisation.



75. De School/Netherlands

De School⁵ in Zandvoort aimed to create a facility where students and educators are able to work together, discover their talents and evolve. In this unique facility every student is respected, valuable and given the attention s/he needs. De School aims to promote a stress-free, non-competitive environment that in turn promotes and facilitates learning.

De School is open 50 weeks per year from 8:00 till 18:00. During these 50 weeks students follow a minimum of 900 tuition hours with most of them opting for 1200 tuition hours of tuition. Parents have the possibility to choose between two options: one with fixed school hours and holidays, and a more flexible option that allows kids to attend school in more flexible pattern while still having full access to learning material during the entire year. 80% of parents chose the second option.

Learning material is divided in themes that students follow for approximately 10 weeks at a time. Every theme starts with a meeting, where the student, parents and responsible teacher agree of the student's individual learning path and aims. A similar meeting

5. <http://www.deschool.nl/>

takes place at the end of each theme, providing everyone with the opportunity to reflect on the process and activities that have been used and draw lessons for the next one. Through this process parents gain an active role at school, as their participation is required for specific activities, research and guest lessons that complement each theme.

Furthermore, dedicating more time to cover various learning material, students have the possibility to learn at their own pace. This flexibility along with the continuously provision of guidance throughout the year, offers equal opportunities to all students in reaching their potential and developing skills.

active learning; (self) regulated learning; personalised learning; reflexive teaching; learning time organisation; shared leadership; school-parents relationship.



b. Innovating pedagogical options and holistic changes

According to the OECD, technology can re-define traditional ways of learning, enabling “student driven learning and inquiry, collaboration, personalisation and flexibility” (OECD, 2017). Several initiatives in this section are investigating in which ways technology can enhance innovative teaching and learning practice, and other schemes have accumulated years of practice and involve larger numbers of students, teachers and/or schools.

The Digital school day 1:1 with iPad, and School on the Cloud initiatives combine the use of innovative resources with the implementation of active pedagogy approaches as well as action to sustain teacher professional development and collaboration. Re-organising the learning space at local level is also part of the first of these projects, while the focus on an interdisciplinary approach at school level is an important feature of the second project.

The Makers approach is seeing significant uptake in schools, as illustrated by the Maker@scuola initiative specifically combining the use of innovative resources with a pedagogy supporting the development of self-reflection, self-regulation, spatial intelligence, critical mind, etc. through the use of 3D prints. The Makerspace 2087 initiative focuses on developing student creativity through a cross-curricular approach using technology and design skills.

Idea and product development, Participator Classes, School on the cloud and Årtaskolan are initiatives illustrating the way diverse combinations of innovative ‘elements’ (as defined in the previous sections) can be implemented at school level.

Innovative methods using ICT in maths is illustrated by the MathemaTIC initiative using ICT to enhance collaboration, and by the Write to learn initiative which addresses both maths and literacy.

Laterna Magica, Digitalis and De Nieuwste School are all located in the Netherlands where the education system offers schools a high degree of autonomy. Here we see three “whole school” approaches where structural change introduces, in a consistent and articulated

way, multi-dimensional innovation: in learning content, the profile of learners, the role of teachers, the pedagogical approach, the involvement of parents, and time and space organisation.

The Student Voice in educational Reform closes this section with a recent, inspiring, and forward-looking initiative towards framework for participation in curricular development using a children's rights approach.

76. Digital School Day, 1:1 with iPad/Norway

The municipality of Bærum in Norway is an inspiring local initiative demonstrating how technology can improve learning outcomes, enhance collaboration between teachers and students, build a new school culture, and reshape traditional learning methods such as learning to read and write - while following the national curricula and being assessed according to national regulations.

Started in 2015 as a pilot in five schools and now counting 15 participating schools and expanding to all regional schools in the project by 2018, the Digital School Day, 1:1 with iPad initiative⁶ is a success story.

Throughout the project, each student received a tablet that became his/her central learning source; this entailed a complete revision of pedagogical methods and teaching approaches of teachers. In addition, the school has created a digital igloo, a special space dedicated to innovative and collaborative digital work. As a consequence, school structures have become flexible and dynamic, with teachers working in collaboration and sharing classes.

As an example, success rates of 1st graders in reading and writing have significantly improved following the introduction of technology in the school. This is confirmed by independent researchers and the municipality's schools are now being visited by pedagogical staff of other schools eager to learn about the rapid technological transformation of the school culture.

Using technology and being able to participate in professional devel-

6. <http://www.jongskole.no/>

opment sessions, teachers are experiencing increased motivation, higher mastery, and supported learning achievements by students. School management reports that the project has improved class leadership, adapted education methods to 21st century required skills, provided greater variety in teaching, and overall re-shaped the class environment.

key competences; collaborative teaching; flexible learning environment; teacher leadership; school leadership; teacher continuous professional development.



77. **Maker@Scuola/Italy**

Maker@Scuola project initiated by INDIRE (the National Institute for Documentation, Innovation and Educational Research), aims to analyse characteristics of the Makers' Approach in education and the way it is implemented in schools.

The initial insight was that Makers' ways of working, if replicated in the classroom, could encourage students to learn in a more participatory, aware and immersive way.

The project involves almost 100 schools and is focuses mainly on the use of the 3D printers in Pre-Primary and Primary Schools. Teachers report that the use of 3D printers has led to an improvement in spatial, logical and lateralisation processes of their pupils.

The next 3 years from September 2017 will involve:

1. Testing the Maker's approach as a way of encouraging STEM engagement following children's development of mathematical and logical thinking;
2. Studying the positioning of Maker technologies that are more reflective than interactive and how they support critical, self-regulatory and inclusive processes.
3. Assessing the inter-relationship between 3D printer and Maker pedagogy and the STEM disciplines.

4. Deeper investigation of technological settings that involve the use of the 3D printer.

From a pedagogical point of view, the concept of “Maker education” is based on “doing” pedagogy, on critical pedagogy embracing constructionism and transformational and emancipatory processes. From a psychological point of view, the Think Make and Improve process, specific to the Maker-oriented didactic actions, involves all the higher cognitive functions (planning, memory, problem solving, decision making, mental simulation, etc.) and even socio-cognitive ones.

STEM; key competences; active learning; reflective learning; makers approach.



78. Makerspace 2087 - preparing students for their future/Norway

In Byskolen primary school - one of the oldest schools in Sandefjord, Norway - Makerspace 2087⁷ opened in 2017 as a physical learning arena for all students. The title of the project refers to the year 2087 when Byskolen will celebrate its 200 year anniversary, first graders in 2017 will be 76 years old, and 2017’s graduation class will be 83. The school’s mission is to prepare their students for a long life and the school believes that an understanding of technology, coding and automation is important in a seventy year perspective.

Inspired by the international Maker Movement, the project’s goal is to facilitate an arena where the student can explore, create and experiment. Curiosity and creativity are key words. Innovation, creativity and the joy of creating will become essential skills in many students’ future livelihood. General knowledge of technology and coding also has a democratic aspect: all pupils will not become programmers, but an understanding of coding enables them to have qualified opinions about how technology should be used.

All pupils (6-12 years of age) at Byskolen are included in the Makerspace 2087 project and participate at least once a week. The focus is mainly on the natural sciences, arts and crafts and mathematics, through the cross-curricular topic “Technology and design.”

7. <http://portal.sandefjordskolen.no/?sandefjordskolen.txt>

A separate room for the project ensures that “gadgets” do not disappear into “dark corners” where they might be forgotten. This also creates synergies as classes see each other’s projects and stimulate each other’s interest in research methods and curiosity. Teaching occurs most of the time with the door open so that others can see and take part in what is happening. Makerspace 2087 has a lot of free floor space enabling students to build and use robots on the floor and be able to work in more varied positions than traditional desks. Students and teachers are provided with access to software, 3D printers, CNCs, laser cutters, sewing machines, robots, coding tools and competent supervisors.

The goal is for the majority of teachers to be familiar with the educational opportunities offered by the Makerspace equipment in their classrooms. To support this, Makerspace 2087 has a full-time educator with good technological and pedagogical skills, programming experience and a special interest in didactics, ensuring academic support for the other teachers.

makers approach; teacher continuous professional development; learning space organisation; active learning; peer learning (teachers)



79. Idea and Product Development, Design and Electronic Circles Project/Norway

Cross-curricular working and collaboration with universities, local businesses, and governmental offices have made teaching and learning more effective, supported students’ creativity and collaboration as well as preparing them better for today’s labour market.

Initiated by the school leadership in Kuben secondary school in Oslo, Norway, this project is an interesting example of departure from traditional teaching methods of separate disciplines towards innovative and cross-curricular activities. Combining Technology and Theory of Research, Mathematics, Programming, Information Technology and Physics, this initiative brings new practices into both teaching and learning. With the goal of making teaching and learning more effective, students develop basic skills across subjects and are more fully prepared for the world of work.



Focusing on creativity, collaboration and productivity, 12 students are currently participating in the project with a team of educators working in collaboration with the school of leadership and the Norwegian Labour and Welfare Administration (NAV). The teacher plans the project work with help from colleagues from the Technology program and other VET programs, and coordinates the teaching process and activities. Students work collaboratively across subjects to create a prod-

uct, guiding their own learning process, simultaneously combining and applying knowledge and skills from different disciplines. The product needs to have one or more clearly defined functions, with electronic circuits playing a central role (e.g. plastic bag dispenser, vehicle that measures temperature on the go, interactive mirror). Students work collaboratively in groups where each student has a clear role and responsibility. Students finally present their projects at Technology Day at their school, with the most successful product being presented at a national competition at the Norwegian University of Science and Technology.

STEM; interdisciplinary approach; collaborative learning; project-based learning; creative thinking; makers approach; teacher collaboration; school leadership; school-community relationship.



80. The Great Chemical Escape/Israel

A popular pastime becomes educational with the highly successful “chemical escape room⁸.” These popular escape rooms are a form of entertainment in which a group of up to six people are locked in a room together and have an hour to solve a series of puzzles in order to open the lock and escape. To escape the chemical escape room, students must crack codes, find clues and conduct chemistry experiments.

In Israel alone, some 300 escape rooms have popped up over the past two years. The National Center for Chemistry Teachers, an organisation run by the chemistry group in the Science Teaching Department of the Weizmann Institute of Science in collaboration with the Science Division in the Pedagogic Secretariat, is the sponsor of a new kind of escape room – one that combines the fun experience of the escape room with learning chemistry along the way. The initiative aims to increase the motivation of high school students to study chemistry and provides them with hands-on experience in solving chemistry problems in a stimulating and fun way. Furthermore, the institute guides and trains teachers who in turn collaborate in creating the puzzles and challenges in the escape rooms ensuring they are in line with national curricula.

Every week, a different school hosts the escape room. Like the standard escape rooms, the chemical escape rooms require cooperation and collaboration between students, creative thinking and finding ad hoc solution to chemical problems. Promoting active and meaningful learning methods in chemistry, the escape room sets an example of how a different type of activity can take place in schools. The escape room takes place in the school’s lab with equipment lent by the Weizmann Institute of Science, the school supplying the necessary chemicals. In this way, the rooms contain both “dry” puzzles solved by thinking and applying learnt knowledge alone and “wet” puzzles that must be solved through actively conducting experiments.

8. <https://wis-wander.weizmann.ac.il/science-education/great-chemical-escape>

More than 300 students and 200 chemistry teachers have already managed to escape from the rooms and teachers are already working on the second edition of escape rooms in chemistry

STEM; active learning; collaborative learning; game based learning; problem based learning; inquiry based learning; teacher continuous professional development; school-experts relationship; school-teacher education institutions relationship.



81. Participator Classes/Turkey

The Participator Classes project was initiated by the Silifke TOKİ Secondary School, in Mersin, Turkey.

This schools has decided to use the “Flipped Classroom” methodology, in order to help students with their preparation, increase the attendance rates and motivation and boost their academic achievements.

Students are able to produce their own digital products with the support of web 2.0 tools. Every student and every class has its own Wall created via padlets, enabling the sharing of images, documents and videos to be shared both during and after the school hours. For example, a student who cannot attend school due to unforeseen circumstances can share with his friends an article from a newspaper he is reading on the padlet wall.

In the flipped classroom model, the transfer of information to the student can be achieved through complementary materials such as course videos, articles, Excel files, PDFs, images and slides prepared by teachers. This sustains the acquisition of knowledge student’s need, while continuing the full involvement of teachers and classmates.

key competences, flipped learning.



82. MathemaTIC/ Luxembourg

A mathematics resource that adapts to pupils' needs and bridges language barriers? MathemaTIC does this, and more. In response to the growing diversity of Luxembourg's school population, the Ministry of National Education, Children and Youth (MENJE) introduced MathemaTIC⁹ in September 2015. MathemaTIC is a project where 1,700 ten to eleven year olds from 40 schools practise mathematics in German, French, Portuguese or English by using an adaptive digital environment. MathemaTIC capitalises on technology that adapts learning to individual student needs by using a language-independent solution. This benefits students who have a lower command of the language of instruction and whose achievements would suffer from not being able to fully grasp the precise mathematical context.

With MathemaTIC, students and teachers have 24/7 access to mathematics resources on any device, including computers, laptops, tablets, and smartphones, both at school and at home. The interactive, visual, audio and video resources are divided into national curriculum learning modules. Exercises include technology simulations of real-world scenarios that connect abstract maths concepts to practical applications, hence demystifying the subject. Teachers normally use MathemaTIC with the whole class during lessons alongside the textbook, as part of a group discussion, or as a resource that students use to work alone, revise or complete their homework. Students' performance and progress over time are tracked through graphs and tables that enable both the teacher and the students to visualise, in real time, their individual learning paths. Those who are falling behind are offered additional help while faster learning students receive advanced tasks to help them move ahead. MathemaTIC acts like an intelligent tutor and offers immediate feedback during learning.

MathemaTIC has been carefully tailored to meet the specific needs of students. This has been achieved through close collaboration and partnership with pedagogy, technology and research experts from Luxembourg, Canada and France. It is therefore no surprise

9. <http://www.mathematic.lu/>

that two years after the pilot launch, MathemaTIC is now offered to students from Grades 3 to 8 (age 8/9 to 14/15) in Luxembourg.

mathematics; digital learning environment; inquiry based learning; personalised learning; regulated learning; student centered approach; school-experts relationship.



83. School on the Cloud/Lithuania

Kuršėnų Lauryno Ivinskio gimnazija (Gymnasium) in Lithuania is an inspiration to many schools, setting an ambitious agenda for whole-school ICT innovation and professional learning for teachers.

With innovative projects and extensive use of ICT tools in the classroom, this 4-year secondary school's goal is to enable its students to become lifelong learners and develop 21st century skills, while creating healthy and safe learning environments for its students.

Lesson plans and their delivery are planned using technology, starting from computer labs, multimedia projectors, interactive boards, computerised library, language library and many other digital aids.

The school's innovative side goes beyond technological equipment alone and includes a culture of collaboration and innovation. Careful design of learning space encourages collaboration between students and enhances creative thinking, and specific projects are in place to enhance social support for students of disadvantaged backgrounds.

Among the school's innovative projects are:

- *Creating Learning Environments* where students' self-governing bodies initiate, plan and implement different activities and events and share their visions for learning and recreational spaces at school.
- *The Teacher's Professional Learning Community*, a sequence of monthly workshops for pedagogical staff – delivered by national specialists - where 21st century competences and ICT skills are analysed. One competence is analysed in each workshop:

learning to learn, communication, social, personal, creativity and initiative and cognition competences.

Over and above this collaboration and peer learning, the school's teaching staff apply collaborative methods while planning, implementing and reviewing each other's work; teachers follow individual professional development plans including observation and discussion after attending each other's lessons.

key competences; collaborative learning; collaborative teaching; learning space organisation; teacher continuous professional development; learning community.



84. Årstaskolan - the road to a digital ecosystem/ Sweden

Årstaskolan¹⁰ - a public school in Stockholm, built in 1946 - enables its 930 preschool and middle school students (grade 1-9, age 6-15) to experience not only innovative learning methods but to become authors, journalists and novelists!

Having used digital resources and platforms since 1999, the school adopts an explorative approach where teachers and pupils are invited to test, propose and use ICT tools and platforms in their learning process, within these goals:

- To create arenas for teachers to test and try new methods and ideas
- To create arenas for pupils to publicly distribute and share their work
- To do authentic work - not just school assignments - with an authentic audience

Pupils are given the opportunity to become real authors, speakers, and programmers, as the school believes that everyone's work has to be appreciated and provided a platform

10. <http://arstaskolan.stockholm.se/>

The school's first video website was launched in 2007, starting out with teachers filming science experiments and other learning-based situations. Between 2008 and 2012 the first suite of web services was launched, which would be the base of what would later become the Årstaskolan's digital ecosystem.

Starting from a Kunskapshubben in 2008 - a movie site like YouTube, where teachers and pupils could upload movies -, the school in 2010 launched a blog network where all classes have their own blogs. In 2012, pupils received their own devices and the Bibblis platform was successfully used in the class. This is an e-library where the pupils create and publish their books and novels, thus becoming young authors! Pupils' digital media - books, podcasts, radio, movies, software, blogging or poetry - find their place in the school's digital ecosystem.

In order to provide students with the possibility of being "real" authors, all websites and services have their own branded names, domain names and distinct identities. This is consistent with an active learning and situated learning approach where pupils are given authentic assignments for longer periods of time resulting in a product that will be shared publicly, e.g. a book or a movie.

Since 2013 more pedagogical projects have been developed and launched, and more sites and services have been built. To name a few: Tänktanken (podcast - 2013), FETT13 (an in-house ICT-event, live streamed - 2013), talasomTED (a rhetorics project carried out in hundreds of schools in Sweden nowadays - 2013), Tänktanken Talkshow (live streamed staff talkshow with guests from all over Sweden - 2014), HOPP14 (in-house event - 2014), Värmeradio (podcast - 2014), Livsviktig Poesi (poetry app - 2015), Looper (teacher tool - 2015), Kodknäck (computational thinking teacher material - 2016), Supportsajten (online support - 2016), Kursportalen (Mooc with courses in programming - 2017) and many more. The projects above are supported by Vinnova - the Swedish innovation agency and Skolverket - the Swedish national agency for education.

Since all the school's projects and platforms are shared publicly and for free - they try to maintain complete transparency. Due to their

success, many of these projects are now being used all over Sweden and the Nordic countries. Furthermore, since the project uses open source software, other schools can duplicate the platform and activities and continue to spread knowledge and share resources.

online portal; digital identity; situated learning; active learning; digital learning environment; resources sharing; student centered approach.



85. Write to Learn method/Sweden

The Write to Learn (WTL) method aims to improve literacy and mathematics and close gaps in attainment through ICT enhanced collaboration. WTL allows 1st grade pupils to use several ICT tools in order to write texts and subsequently discuss and refine them together with classmates and teachers using digital real-time formative feedback and assessment. The central learning aspect addressed, in mathematics as well as in literacy, is written communication, allowing learners to interact with peers and teachers.

WTL draws on methods from socio-cultural theory, including continuous social interaction and written real-time formative feedback among peers, using shared electronic forums for collaboration, thereby providing social meaning and increased learning of literacy and mathematics among both boys and girls. When comparing pupils that did not participate in WTL method¹¹, WTL yields by far best results: higher average scores in both literacy and mathematics, reduced gender gap, and significantly better results for under-achievers.

The WTL method is based on the goals of the Swedish National curriculum (Lgr 11), and it uses active writing, publishing, peer feedback and formative assessment as main distinctive components. Supporting components include inspiration and preunderstanding, text genres, and writing strategies.

11. This comparison was made in the study "Closing the gaps – Improving literacy and mathematics by ICT-enhanced collaboration" by Annika Agélii Genlott and Åke Grönlund.

How does the method work?¹²

1. First, the teacher plans the lessons by choosing which abilities, core content, and knowledge requirements, in accordance with the curriculum (Lgr 11), that are the aim of the lessons. It is important that the teacher helps students understand what they are aiming at. The goals of the work must be clearly specified and documented, e.g. on the classroom wall.
2. Second, the teacher shall inspire the students in conjunction with setting the topic. At the same time, the teacher shall give the students examples from the genre to be produced in order to create a preunderstanding among the students.
3. Before the students begin writing it it's important to give them knowledge about how that particular text genre is to be written. For example, what kind of words are suitable to use in this context, who will be reading such a text, etc.
4. After making this introduction the students begin writing while getting linguistic support from the teacher and feedback from both their peers and the teacher.
5. Depending on topic and type of assignment the texts can either be published directly on the class web site or written in a document shared with teachers and peers, two ways to make communication and feedback possible during the writing phase. Either way, after the texts are published different kinds of feedback from the receivers is mandatory. The purpose is to make sure the students know that they are writing for real readers, and that they will get written feedback directly after publishing their texts.
6. Finally, the work is formatively assessed by the teacher and the students.

In order to make sure the method is consistently delivered across schools, teachers from all over the country are trained to use the method under the auspices of the Swedish Association of Local and Regional Authorities. For the current nation-wide training course

12. <https://www.oru.se/english/research/research-projects/rp/?rdb=p1695>

some digital material has been produced, including a number of videos and a website with social forums for interaction, making training accessible over distance and in asynchronous mode as similar as possible to on-site training.

formative assessment; peer assessment; student centered approach; collaborative learning; school-experts relationship; teacher continuous professional development.



86. Laterna Magica¹³/Netherlands

Laterna Magica¹⁴ was founded in 2007 in Amsterdam. The mission of the school is to help children discover their respective talents and focus on their development. Children are encouraged to think independently, creatively and critically, work on their own but also in teams and take responsibility for the world around them. Focus is placed on the abilities each child has and not what s/he lacks.

A different school schedule has been introduced as a better way of supporting learning: Children can be at school between 7:30 and 18:30. Also the traditional division in classes based on age group has been revised. There are three types of units: for children between 0-3, 3-8 and 8-12. Each age group is broken down into smaller units with each unit having approximately 100 pupils that are guided by a team of 8-10 educators. Children do not sit in a class the whole day but they get together via different groups and clubs that have a specific purpose e.g. taking care of the garden or feeding the animals.

At the beginning of the day, each child decides, with the help of his coach, the tasks s/he will carry out throughout the day. This selection is made based on each child's interests and abilities and at the end of each day pupils take pictures of their work or write up results they can add to their portfolio. In this way the coach and the parents can follow up on what the child is doing, identify possible problems etc. Every three months the coach along with the child

13. The following three examples - Laterna Magica, Digitalis, and The Newest School – are three of the eight schools presented in “*Schools to learn from*”, an inspirational book (available in Dutch only) which provides insights on how these schools have been transformed in order to offer pupils a personalised learning experience within the limits of the Netherlands educational system.

14. <http://www.obslaternamagica.nl/corp/?site=37>

and the parent, review the portfolio and decide on the child's next unit based on learning objectives and capacity.

The school has put together a concept based on natural learning and social constructivism, combined with elements of cognitivism and behaviourism. This was a completely new direction in learning. During the first years of its operation and due to a continuous increase in admission applications, the school had to move to bigger buildings four times. Finally in 2011, the school moved to its own building where among other facilities, it has a kitchen for kids only, an indoor and outdoor theatre, animals, garden and mini-spaces that can be used as mini-schools.

student centered approach; personalised learning; (self) regulated learning; active learning; mixed age groups learning; (teachers as) mentors; learning time; learning space organisation; school-parents relationship.



87. Digitalis/Netherlands

A new school with a special focus on digitalisation has emerged from school merger plans in Almere in the Netherlands.

In 2010 the public education department in Almere had decided to merge four existing schools in order to create one school for the neighbourhood having all possible facilities. A parent survey pointed out, however, that there was the need to have two schools: one with a particular focus on arts and culture and one focusing on digitalisation. As a result the four schools did merge, but into two, with Digitalis¹⁵ being one of them.

In Digitalis new computer equipment has been provided and school operations have been digitised as far as possible, with the majority of communication taking place via email. The school is located in a diverse area which includes mixed and single parent families, children from disadvantaged background, alongside children from wealthy families, and therefore the provision of personalised education makes great sense.

15. <http://digitalis.asg-almere.nl/>

The children work in “tribal” groups, led by their coach, and follow workshops given by teachers in ateliers. These workshops are specialised in different areas and students with their parents are free to choose which to attend. In the “tribal groups” and workshops children from different ages can attend. All students have their own iPad with educational apps that they can use in the tribal groups and the workshops. The apps provide each child with exercises that fit differing levels of learning.

student centered approach; mixed age groups learning (i.e. ‘tribal groups’ and workshops); school-parents relationship; school-community relationship.



88. De Nieuwste School/Netherlands



A new school has opened its doors in Tilburg, Netherland, inspired by the educational thinking of John Dewey and based on the belief that children are better served if they take an active part in the process of their own learning. The main philosophy of this school was to use the natural curiosity of students, help them become owners of their learning process and identify ways to help them learn.

The Newest School¹⁶ started in 2005 with 75 students joining its first year of secondary education. The school is divided into years

16. <http://www.denieuwsteschool.nl/>

of study with group mentors (foundation level), personal mentors (superstructure), and mentors who guide students in their learning process and their social-emotional development.

Since mentors are following students from their first days at school, they get to know them quite well and have a good picture of each child's abilities, talents and needs.

Students work on themes that last for six weeks. Each student is encouraged to approach the respective theme via one of the three available angles: humanities, arts, or science. Students then research their themes according to the angle chosen, but they also work with their peers and learn from each other. Depending on their research topic, students are supported towards subjects like English, Spanish, German, Mathematics and Dutch that are essential for progressing in their research.

The research follows a type of inquiry-based approach, reflecting the educational theory of the philosopher and educator John Dewey, based on the formulation of a question that students tackle by formulating hypotheses which they then investigate.

active learning; inquiry based learning; personalised learning; (self) regulated learning; (teachers as) mentors; learning time.



89. Student Voice in educational reform: Ireland

As part of Ireland's National Policy Framework for Children and Young People, the National Council for Curriculum and Assessment (NCCA) has been working with young people to build opportunities for young people to have their voices heard in the day-to-day classroom, using active pedagogies and through the formation of assessment practices including sharing/discussing learning intentions and success criteria, questioning, formative feedback, peer and self-assessment and reflection.

The process was influenced by the Lundy model for child participation which prioritises 'voice, space, audience and influence' (Lundy 2007, Lundy and Welty 2013). NCCA staff have met with groups of students

to support them in building confidence and co-constructing language in order that they could meaningfully engage in conversations and discussions on curricular development. This co-construction embodies democratic and collective responsibility for education reform. This work has gathered student reaction and input in respect of curriculum documents and all subject specifications to date. Schools are encouraged to offer young people opportunities for authentic involvement in decision-making about Wellbeing in their school. The workshops intentionally do not focus on consulting with representative groups of students but rather encourage the school to reach out to all students, particularly those who may not make their voices heard or may be on the margins of the school.

NCCA are partners with Junior Cycle for Teachers (a professional development support team for Junior Cycle (first three years of second-level education)), in a three-year Erasmus+ project entitled, ‘Student Voice – The Bridge to Learning. The specific aims of the project are:

- to build teachers’ commitment and capacity to work in partnership with students in support of their learning
- to support students to become more active, responsible and engaged learners and consequently develop their self-regulating abilities
- to develop models of partnership between students and teachers which are underpinned by democratic engagement and respect so that students can reach their full potential as learners and as democratic citizens.

NCCA/JCT are working closely with nine post-primary schools facilitating a process of ‘deep collaboration’ between the teachers both within and between schools. Teachers’ commitment to and engagement with student voice has been very encouraging notwithstanding the challenges that it can present for teachers in re-envisioning their role as teachers and a change in how ‘power’ is shared in the classroom. Young people have a right to have a say in matters that affect them and for their feedback/concerns to receive a response.

school-experts relationship; student centered approach; active learning; formative assessment.





3 INITIATIVES SUPPORTING LEARNING LEADERSHIP AND SCHOOLS AS FORMATIVE ORGANISATIONS

Learning leadership is needed for educators to handle complex and rapidly changing environments while continuing to improve student achievement in a context of large scale transformation. Leaders in education at system, regional, local, and school levels act as change agents understanding the change needed, leading cultural change, embodying the moral purpose, cultivating positive relationships, creating and sharing knowledge, enhancing the expertise of practitioners, and achieving coherence in their overall approach.

OECD (2017) examines the learning leadership exercised by those with formal leadership responsibility at various levels of the system through visions and strategies intensively focused on learning. Such leadership is expected to be informed by evidence from practice and research about the learning taking place and the effect of the changes implemented.

At school level, leadership is about analysing the changes in the environment, proposing a way forward and a corresponding strategy, having adequate tools to plan the future and ensure that all students are prepared for the society they will be part of. Exercised by groups as well as individuals, leadership may in some cases be independent of positions held in the formal hierarchy of authority (contrary to school management directly related to hierarchy). Depending on the context, the school leadership can derive from roles formally assigned and/or shared informally with a larger group of teachers. This would be consistent with the concept of shared/distributed leadership (leadership divided across several leaders sharing complementary influence and expertise) and teacher lead-

ership (shared responsibilities, peer-collaboration, group work, etc. even throughout the school). Any teacher can indeed lead in a variety of ways (resource provider, mentor, curriculum expert, learning facilitator, change agent, data analyst, digital support, etc.). School leadership sometimes provides opportunities for teachers and administrators to work together to identify school needs as well as for students to be empowered to participate in leadership opportunities in their classroom and school.

Six initiatives have been included in this section (to which we can add the Innokas initiative presented in the next 'Partnership for Learning' section). Such limited number of initiatives does not necessarily reflect a lack of initiatives specifically supporting learning leadership. (This first collection of initiatives in this Open Book has not aimed at representativeness.) This may nonetheless signal a possible lack of concrete support measures/programmes in this specific area, an issue which definitely requires further investigation followed possibly by corresponding policy action.

Avanguardie educative (which could just as well belong to the next 'Partnerships for learning' section) opens this section. It illustrates a holistic and systemic learning leadership approach, articulating bottom-up initiative with sustained support from central level. That initiative is part of a research project aiming at better understanding of the conditions for bottom-up approaches to be successful in mainstreaming innovative practice. Ubiko and School leadership in the digital age are two other interesting initiatives implemented beyond single school level.

The Participative, digital and creative workshop, Cooperation-Creativity-Knowledge Building and Multidisciplinary public health initiatives illustrate school learning leadership experiences. Collaboration between teachers or schools, capacity-building through coaching, professional communities, training programmes or cooperation with research organisations are evident in these initiatives.

Not all of the initiatives presented explicitly refer to an evidence-based approach; those which do so (Avanguardie Educative, Ubiko) are themselves research projects.

While the development of partnerships is not their core aim, the Multidisciplinary Public Health and Ubiko initiatives are developing relationships with external partners, mostly teacher education institutions.

90. Avanguardie Educative/Italy

*Avanguardie Educative*¹ is a movement of innovative schools that is being researched by INDIRE (the National Institute for Documentation, Innovation and Educational Research) with the aim of studying how teaching and organisational changes may be implemented within a school and then mainstreamed to other schools on a bottom up approach. *Avanguardie Educative* makes an extensive use of ICT as catalyst for innovation.



The main ideas of the “movement” are described in its Manifesto, which has been written by INDIRE with the contribution of the 22 school head teachers who are the co-promoters of the movement. The Manifesto for innovative schools built around seven pillars provides a vision for a new school model more aligned with the challenges of an ever-changing and demanding knowledge society.

The main ideas of this “movement” are described in seven pillars:

- transforming the transmission model of education (where the teacher speaks and the students listen)

1. <http://avanguardieeducative.indire.it/>

- exploiting the potential of ICT to promote new ways of teaching, learning and assessment
- re-thinking the learning environment
- re-arranging school time
- aligning school culture with the knowledge society's challenges
- investing in networking and fostering relationships (i.e. school-community and school-work relationships)
- making innovation transferable and sustainable.

These seven pillars underpin a gallery of innovative practices in which students themselves became the protagonists in their own learning process, fostering creativity and critical thinking (for example: in the “Debate” practice, a discussion where two groups of students are positioned for and against a particular stance; in the production of “digital educational content” in which students and teachers collaborate to create digital resources; in the “ICT Lab” practice which involves making both digital and physical artefacts, coding and physical computing). The learning practices advocated by the Movement call for a change in school management and school architecture. For example, the practices “Subject-related classroom lab” and “Flexible spaces” promote the customisation of classroom layouts according to subjects, and the use of modular learning settings. At organisational level, the practice “Block scheduling” reflecting the need for more efficient collaboration between the school itself and its socio-cultural setting; it implies the rearrangement of the school year so that all the hours planned in certain subject are concentrated in only one term, in a single block. This different management of time allows teachers to move from a lecture-based lesson model towards collaborative activities and workshops that usually require longer time. The “Flipped classroom” is another example where class time is redesigned: students develop critical and reflective thinking in class based on what they learned at home.

Avanguardie Educative aiming at transforming the school system through a bottom up and contextualised approach, grounds the change process in the analysis of schools' innovative experiences. This approach is participatory and collaborative, where all the actors

have an opportunity to contribute to change and innovation, and by activating networks of schools. This strategy is consistent through all the stages of the project: in the innovative practices selection phase, in the design of the support to newcomers and in the coaching model and community of practice designed to co-construct the whole transformation process. Researchers from Indire and teachers have been working with a twofold logic of theory and practice, trying to implement a blended coaching process encompassing experience, reflective observation, theory and experimentation. This is to avoid the misunderstanding according to which “first you know and then you act”, highlighting the cognitive value of the action.

Starting from 22 founding schools in 2014, today the *Avanguardie Educative* movement enjoys great success, involves 604 schools and is open to new membership by schools wishing either to test/adapt one or more innovation practices or to propose new ones. Schools that do choose to adopt one or more innovative practices take part in a blended learning course and are given coaching assistance by the 22 founding schools and by INDIRE.

key competences; active learning; learning space organisation; learning time; blended teacher continuous professional development; coaching between schools; professional community; school leadership; mainstreaming innovation; research project.



91. UBIKO – Towards a Knowledgeable, Inspired and Skilful/Finland

UBIKO is a research-based development project funded by the Finnish National Board of Education aiming to renew the school and to understand what kind of school promotes inspired and skilful learners. The name UBIKO means ubiquitous technology supported learning. UBIKO consists of 110 4th and 5th graders (age 10-11) working with their teachers in a designated unit of Oulu University Teacher Training School (OUTTS).

UBIKO wants pupils to be aware of their own abilities so they can set personal goals for their learning and modify those if necessary. They should be able to utilise efficient learning strategies (analyse, practice, take notes) in their studies and to monitor and evaluate the attainment of their goals. To support their learning, pupils should know how and when to modify and regulate their environment.

Self-regulated learning was both the research focus of the project and the theoretical background steering the related activities and development work.

The goals were to be achieved by developing the curriculum, the assessment of learning and self-regulated learning, as well as teamwork between teachers. Operationally, the UBIKO project is based on a school unit comprising five classrooms and a shared school unit which joins the classrooms together. The research concentrated on all third- and fourth-grade pupils enrolled at the school as well as their teachers. In total, the project participants comprised 111 pupils, six teachers and one project manager.

Key properties of the facilities in terms of the project include flexibility, versatility and comfort. The facilities provide excellent physical means for developing self-regulated learning. Structural changes were implemented and new furnishings acquired. The significance of the changes to the physical learning environment, as well as the design process itself, have been the subject of extensive research.

(self) regulated learning; collaborative teaching; learning space organisation; school leadership; school-teacher education institutions relationship; research project.



92. School Leadership in the Digital Age/Estonia

The central role of the school leader in shaping and inspiring change in today's and tomorrow's schools has always been recognised, and in Estonia three specific training and development programmes are supporting school leaders with the digital agenda.

The first two consecutive components of the training programme are:

“Managing the study process in the digital age“ and *“Developing digital infrastructure in an educational institution”*, followed by a stand-alone third component: *“Improving digital competencies in an educational institution“*.

“Managing the study process in the digital age” tackles the way study processes have evolved as result of new technological tools, while *“Developing digital infrastructure in an educational institution”* helps each institution analyse the state of its digital infrastructure, and map out its development needs and the activities required to achieve its objectives. An action plan to improve digital competencies in the school staff is one of the planned outputs from the third component *“Improving digital competencies in an educational institution”*.

During the training period, participating institutions are invited to complete a practical project reflecting the actual needs, objectives and level of the institution concerned. Ideally, a significant proportion of school employees and learners will be actively involved in the project and help create a so-called digital team per institution.

The training culminates in a final seminar which includes all teams from that semester. Teams present their development projects and their implementation in their institutions, share experiences, and receive final feedback from the trainers.

teacher continuous professional development (for school leaders);
school staff collaborative learning; school leadership.



93. Participative digital and creative workshop (Fablab- Atelier numérique participatif & créatif)/ Belgium (Wallonia- Brussels)

The Royal School in Nivelles is an interesting example of one of the 500 schools that participate in the digitalisation program² in schools in the Wallonia-Brussels federation in Belgium.

The school embarked on a journey of digitalisation, implemented through a shared decision-making process in a “round table”: on a regular basis, discussions and meetings between parents representatives, teachers, school leaders and school unions took place. The discussions and meetings turned around the implementation of the digitalisation program and its impact on the learning process and learning environment. The school leadership (head teachers and director) presented a plan to this steering group and it was followed up throughout the implementation process. Furthermore, in order to simplify the transition, training actions were organised for teachers. The aim of the training was to develop teachers’ digital skills, to boost their class management skills, promote collaborative work, resource-sharing, and interdisciplinary lesson planning. All this was in line with the digitalisation plan the “round table” agreed.

As a consequence, teachers in the school are collaborating between disciplines, learning how to use the various ICT tools (tablets, PC etc.) in the most beneficial way to their pupils, while encouraging and supporting the development of the students’ own digital skills.

school-community relationship; teacher continuous professional development; school-parents relationship; digital competences.



2. <http://www.ecolenumerique.be/qa/appel-a-projets-ecole-numerique-2017/>

94. Cooperation - Creativity - Knowledge-Building/ Norway

New school, new vision: when the new Teglverket School in Norway was opened in 2015, the new teaching staff decided to follow their vision: “Opening doors to the world and the future”³. They acknowledged that we are living in a rapidly changing environment and that preparing for the future entails guiding and teaching students to develop 21st century skills and work comprehensively and innovatively using digital competences.

The school has introduced new and innovative methods of teaching and learning, using ICT tools combined with a variety of non-traditional activities for children during and after the school day. Digital tools such as iPads and online learning resources are integrated into lesson preparation and delivery. In this way, teachers are using the boundless possibilities technology offers in order to improve the processes for learning process, for example through formative assessment, cross-curricular activities, and supported social interaction. Furthermore, teachers and pupils build their digital competencies using code clubs and makerspaces. By using various technologies, adapted to the learning material and content at a time, students not only expand their technological horizons but also avoid being dependent on one specific technology to build their digital skills.

In order to ensure full engagement and participation of pupils, teachers and parents, an “expectations” document is created. It entails a description of how classes should be held and how all participating parts: students and teachers are expected to organise their learning and teaching. By sharing expectations, students develop a sense of responsibility and are aware of what is expected from them. Same is valid to teachers.

Teachers work collaboratively on a regular basis in weekly staff meetings: all lessons are planned collectively and are coordinated, so that both teachers and students have a clear vision of the programme. As a way of providing students with further opportunities to learn and develop their skills, the school has established an after-school

3. <http://osloedtech.no/en/2016/04/interviewheidi/>

programme offering lessons in programming, electronics and microcontrollers, all taught by qualified engineers.

interdisciplinary approach; collaborative teaching; formative assessment; out of school hours provision; school leadership.



95. Multidisciplinary Public Health/Norway

“Multidisciplinary public health” project is part of a whole school initiative and is an instructive example of a departure from the traditional teaching in separate disciplines towards innovative practices and cross-curricular activities. The project embraces Physical Education, Geography, Social Science and Natural Science.



This initiative has been carried through by the school leadership in the Nordahl Grieg secondary school in Bergen⁴, Norway. It is an example of a school as a learning organisation that opens up to partnerships with teacher education institutions.

Teachers in cooperation with school leadership plan and conduct collaborative cross-curricular innovative pedagogical practices that are technology-supported. The school has an internal network as well as partnership with faculty for teacher education. Students' learning is central and the focus is on their motivation, active engagement and preparation for participation in society.

4. <https://www.youtube.com/watch?v=o1CYXH7Doo8>

At the beginning of the school year teachers prepare a joint teaching plan for the project. Students are then introduced to the competence aims and purpose of the cross-curricular project. They choose their research questions, with list of topics including food additives, cosmetics, artificial hormones and micro plastic, food industry, municipal planning (public health, training opportunities in the municipality), eating disorders, food health markers, lifestyle diseases, drugs and doping, and local plans for the town's forest area (political processes). The formal criteria for assessment include presentations and group work. The presentations should contain research questions, results from the fieldwork, reflections on their own ability to influence political decisions in the community, on the relationship between sustainable development, standards of living and quality of life.

Pupils guide their own learning process and learn to combine and apply simultaneously knowledge, skills and competencies from different disciplines and across subjects in order to solve and deal with real life problems situations.

interdisciplinary approach; key competences; situated learning; collaborative learning; school leadership; school-teacher education institutions relationship.





4 INITIATIVES TO OPEN UP TO PARTNERSHIPS FOR LEARNING

Partnerships for learning are defined by OECD (2017) as opportunities for capacity building through access to more expertise and knowledge resources, while avoiding isolation; these partnerships support “horizontal connectedness’ across areas of knowledge and subjects as well as to the community and the wider world”. The partners can be identified in different groups (families, local community bodies, cultural institutions like museums and libraries, business, etc.). OECD emphasises that the primary success factor for these partnerships is for their members to be strategically chosen so as to strengthen the vision for learning and the learning leadership of the education body initiating them.

Initiatives connecting teachers and schools have particular strategic value for developing, sharing, and disseminating innovative educational practice and culture. The eTwinning and Scientix initiatives illustrate approaches to implementing such partnerships transnationally, right across the subject curriculum in the first case and specifically in STEM subjects in the second. Goodness me, Goodness you illustrates this at country level through the introduction of a story-telling approach in the curriculum, and iKlasse in the pedagogical use of technology in teaching practice.

Other initiatives presented in this section demonstrate diverse connections:

- students and teachers with scientists, artists and universities across borders (Opera)
- schools with universities, teacher colleges (Demonstration Schools)

- schools with experts (Network of Educational Technologists)
- schools with policy makers (C.R.A.F.T. and DM in Digital Skills).

Other initiatives focus on partnerships between teachers across schools and with industry (MORE) and also transnationally (STEM Alliance). Several initiatives aim at horizontal connectedness between multiple players within the whole education system (Opeka/Oppika/Ropeka, eEducation network, Innokas network).

While all the initiatives presented have a clear and strong focus on learning, their specific aims differ: from broadening the reservoir of attractive and diversified learning resources (Eduthèque, FIS), to providing an interdisciplinary context and approach to help develop active learning (Opera), and finally monitoring students', teachers', and schools' digital competence across all schools (Opeka/Oppika/Ropeka) as a way of supporting evidence-based teaching and policy-making.

Partnerships aiming at sharing and/or co-constructing teaching and learning practices (Demonstration Schools Project, C.R.A.F.T. and DM in digital skills, Iklase, MORE) and/or developing competences and their assessment (through badges as in the eEducation network) have the characteristics of learning communities or networks of teachers.

Through its scope and diversity of activities, and its focus on developing an Innovation School model, the Innokas network initiative (that could just as well have been presented in the Learning leadership section) is a research project which should be closely monitored: indeed it may inspire networking approaches which become enablers of mainstreaming innovative practice.

Initiatives such as the Innovation Days, Computer at school conferences and STEM and research open conference represent a congenial way to encourage networking and dissemination across the whole education system.

96. e-Twinning /European Commission- Cross country

eTwinning – the Community for schools in Europe – is an action for schools funded by the European Commission, via the Education, Audiovisual and Culture Executive Agency, within the framework of the Erasmus+ programme. eTwinning incorporates a sophisticated digital platform that has both public and private areas and is available in 28 languages. eTwinning is a vibrant community that has involved, in its 12 years of existence, more than 500,000 teachers working in 182.000 schools in currently 38 countries. More than 61,000 projects have been run, involving more than 2,000,000 pupils across the continent over the years.

Born originally as a partnerships' development platform, eTwinning has gradually evolved into a community over the years, first incorporating professional development opportunities, and then also social and learning networking features, culminating with the launch of eTwinning Live, in late 2015.

There are two aspects which enhance community enhancement and networking:

- The presence of a safe, multilingual platform which allows users to interact transversally (via internal messaging, forums, video-conferencing features, personal feeds and posting), and within specific sub-communities called eTwinning Groups (specific virtual collaborative workspaces). Hundreds of Groups involving thousands of eTwinners are active.
- The strong community feeling of eTwinners, which share a vision of what education is or should be: open, cross-borders, collaborative, innovative, democratic. eTwinning users share practice and are eager to grow as a strongly connected network rather than a constellation of separate entities.

eTwinning is open to all teachers in Europe and aims at 'normalising' innovation via promoting a less traditional pedagogy: all methodologies which involve the use of ICT, from project-based learning to CLIC, from flipped-classrooms to collaborative learning and many others are present in eTwinning projects and professional development activities and constitute the backbone of the programme itself.

eTwinning teachers are supported by a National Support Service present in each country, which promotes, encourages and disseminates new approaches and methodologies.

Innovation is recognised and awarded via National and European Quality labels, national and European Prizes and in general by sharing practice and examples on the European and national portals.

eTwinning is also present in many countries' educational policies as part of national reforms, professional development opportunities, schools digitalisation plans and other areas with the objective of embedding eTwinning in national educational systems.

teacher continuous professional development; learning resources; education-multiple partners relationship; dissemination of innovative practices; learning community; global partnership



97. Scientix/ Cross country

Scientix¹ was originally born at the initiative of the European Commission and has, since its inception, been coordinated by European Schoolnet. Scientix promotes and supports a Europe-wide collaboration among STEM (science, technology, engineering and mathematics) teachers, education researchers, policymakers and other STEM education professionals.

In its first stage (2009-2012), the project built an online portal to collect and present European STEM education projects and their results, and organised several teacher workshops. The main networking event was the Scientix conference, held in May 2011 in Brussels.

The goal of the second phase of the Scientix project (2013 – 2015) was to expand this community to the national level. Through a network of National Contact Points (NCPs), Scientix reached out to national teacher communities, and contributed to the development of national strategies for wider uptake of inquiry-based and other innovative approaches to science and mathematics education.

1. <http://www.scientix.eu/>

This activity is continued in the third stage of Scientix (2016-2019), which is funded by the Horizon 2020 programme of the European Union for research and innovation. Scientix carries out a variety of activities including: webinars, MOOCs, Science project workshops in the Future Classroom Lab, Scientix workshops at other European events, Scientix observatory papers. The initiative is supported by 19 Ministries of Education and 9 organisations acting as National Contact Points, as well as over 300 Scientix Ambassadors (STEM teachers), helping improve Science Education via teacher training, dissemination and exchange of practices.

STEM; teacher continuous professional development; learning resources; education-multiple partners relationship; dissemination of innovative practices; learning community; global partnership



98. The Global Science Opera in Real Time/Greece



Global Science Opera (GSO)² is the first opera initiative in history to envision, produce and perform operas as a global community. Inspired by the International year of Light 2015, this unique project brings together pupils, teachers, scientists and artists to produce a science opera that is streamed and performed around the world. Furthermore, throughout its work, GSO created a network of scientists, art institutions, schools, universities, and projects, in all of the inhabited continents.

2. <http://globalscienceopera.com/>

Since 2015 GSO produced two successful global science operas, “SkyLight”³ (2015) and “Ghost Particles”⁴ (2016). Both were written and performed globally and streamed online. In 2017, the Global Science Opera will produce the “Moon Village”⁵ opera. A year-long creative inquiry shared by schools, universities and art institutions.

Coordinated by EllinoGermaniki Agogi (a primary and secondary education school) in Greece, Global Science Opera in real time (GSOrt) aims to produce interactive settings of Opera practice enabling a global community, to explore in an interwoven way science, art and technology within a creative and democratic inquiry process. The initiative allows rural and remote schools to collaborate in all aspects of the development (developing sound contributions, stage performances, sets, music sound/music recordings, dialogues etc.).

Remote students participate also in the planning, preparation and performance of a video-recorded and live-multicasted artistic web-event. Students participate by making teams that analyse scientific terms in order to be interpreted with accuracy as performance actions. Teams also collaborate by exchanging ideas of how to dramatise deep scientific concepts combining movement, simple materials, costumes, sound and music as elements of a detailed performance practice. They use stage-acting as an interactive element that engages all students in seeking answers in various scientific fields or physical phenomena from microcosmos to macrocosmos. They understand Science as a challenging procedure of making questions and seek for their answer through both body and mind motivation in real life settings, for example the idea of “sonification”, which is the challenge of explaining a scientific concept through sound.

interdisciplinary approach; STEM; active learning; learning community; global partnership; active learning.



3. <http://globalscienceopera.com/productions/skylight/>
4. <http://globalscienceopera.com/productions/ghost-particles/>
5. <http://globalscienceopera.com/productions/moon-village-2017/>

99. The Demonstration Schools Project/Denmark

Through a collaboration in Denmark between three universities, seven university colleges, 28 primary and lower secondary schools, and more than 500 teachers exploring how technology in the classroom and beyond can facilitate students' participation and learning, important findings were made:

- the use of IT has the potential to re-allocate time in the classroom
- the use of IT can facilitate and accelerate innovative teaching
- students who use IT to perform basic and problem-solving tasks score higher in several 21st century skills than students who use IT to a lesser extent

These findings and many others demonstrate the importance of promoting the use of ICT in classes and its benefit as an accelerator for innovative teaching.

Focusing on students' learning process, this Danish project⁶ aimed to provide teachers with tools and inspiring examples that would help them use IT in the classroom. The project gave participants first-hand experience in innovative teaching methods, time management, and the use of 21st century skills.

Throughout the project, participants learned how to include computer-based teaching and learning practices in their lessons; how to allocate time for IT-based activities, plan their lesson collaboratively with other teachers according to digitally supported learning goals, and engage in multidimensional teaching methods that promote innovative practices. A longer-term impact was the exploration of the impact and benefits of changing roles for teachers and students when implementing collaborative learning and computer-based teaching practices.

key competences; collaborative learning; changing role (teachers/students); across education level partnership.



6. <http://www.emu.dk>

100. Goodness Me, Goodness You/Ireland

The recently established Community National School (CNS) model in Ireland offers multi-denominational education which aims to be child-centred and inclusive. There are currently 12 CNS schools all of which teach an innovative multi-belief and values curriculum called Goodness Me, Goodness You! (GMGY). The approaches supported by the curriculum foster a culture that honours and respects difference by affirming the right of all human beings to practise their beliefs in public life.

This innovative curriculum has four strands:

1. *'Story'* offers children an opportunity to explore the arts and in doing so gives children a space to develop their own imagination and creativity.
2. *'We Are a Community National School'* is guided by a values education approach and offers children an opportunity to explore the concepts of equality, self-identity, citizenship and human rights.
3. *'Thinking Time'* strand is grounded in the Philosophy for Children approach and seeks to develop children's thinking and debating skills, facilitating their understanding of their own ideas and those of others.
4. *'Beliefs and Religions'* seeks to develop children's understanding of religion and belief, encouraging inter-belief dialogue and the sharing of personal experiences (both religious and secular). In this strand, parents are enabled to nurture the belief of their child and the school supports them in this process called 'belief-nurturing'.

GMGY⁷ is a process curriculum which evolves as the school changes and develops. The development of the curriculum takes place through authentic collaboration. On a national level such collaboration takes place between national agencies, including the National Council for Curriculum and Assessment, the Department of Education and Skills, and the Educational Training Boards of Ireland. At

7. www.gmgy.ie

a local level, collaboration takes place between the schools themselves and development is informed by engagement with a School Network Group consisting of teacher representatives from each CNS. The role played by the School Network Group ensures the curriculum is developed in line with the needs of the school community and in particular, the needs of the children attending these schools

active learning; cross schools/teachers relationship; networking, school-community relationship.



101. iKlase: Smart Devices for Smart Lessons /Lithuania

In Lithuania, a one-teacher initiative - iKlase⁸ - to share knowledge with a few colleagues and encourage them to use smart devices in their lessons has developed into a large community of teachers on Facebook and on a dedicated website including resources on how to improve education and use technological devices.

iKlase now numbers hundreds of enthusiastic teachers in Lithuania. They exchange good practices, organise events and promote the use of innovative devices in class. Through their social media group and website, members have the opportunity to learn from their peers online and attend various events and learning sessions.

With these various opportunities to share best practices, resources, ideas and insights, it is no wonder that the platform has generated a leading team of teacher trainers and business representatives who work together to encourage and help teachers to develop innovative ideas to improve education quality using smart technological devices.

Due to the high level of commitment of teachers and stakeholders to the project means that since 2017 monthly meetings are organised in different schools, where teachers learn at first-hand how to incorporate the use of smart devices in their lessons. Students have also become involved in the project, teaching their peers, leading workshops and even teaching teachers to use smart devices.

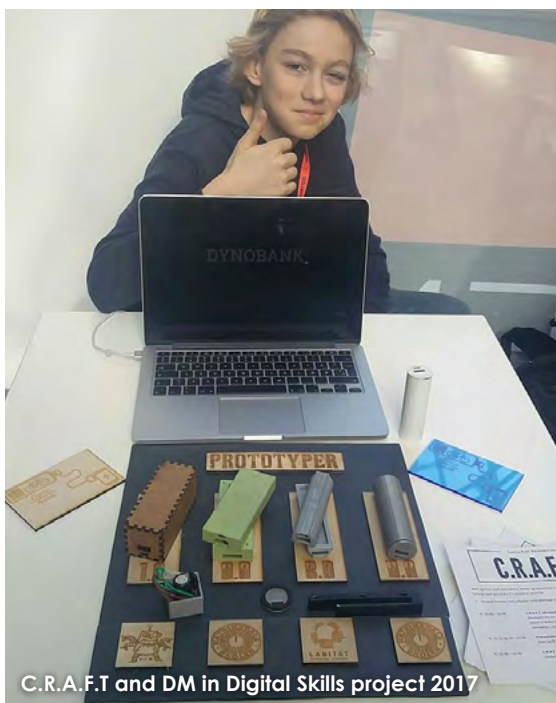
8. <http://www.iklase.lt/>

Regular visits to other countries are now featuring, giving teachers the opportunity to learn from other teachers in the field. As a way of making all these initiatives, articles, best practices and workshops available to a wider audience, you can now find iKlase as an educational App called *Isidėmėtinos rašybos lietuvių kalbos žodžiai*, easily downloaded and accessed through a smartphone.

collaborative learning; teaching/learning resources; (online) teacher professional community; education-industry relationship.



102. C.R.A.F.T and DM in Digital Skills/Denmark



How can you inspire lower secondary students, teachers, school leaders and local policy makers all in one project? The common factor identified by the Danish initiative C.R.A.F.T. and DM in digital skills⁹ is the promotion of digital awareness, the use of 21st century skills, and using digital information environments as a problem-solving tool.

Over a full year, students, teachers and local policy-makers come together to solve real-life problems using technology, expand their mind-sets, and learn about didactics, pedagogics, and how to put to use the various 21st skills they've learned. Acknowledging the importance of adapting to quickly changing technological realities, this project aims to provide students with the right technological tools for different audiences.

Throughout the process, participants - of varying ages and backgrounds - not only gain confidence in using technology, but also share knowledge, build a common language and inspire each other in an annual Learning Festival, where they present the various projects they've been preparing throughout the year.

9. <http://www.emu.dk/modul/craft-dm-i-digitale-skills>

Due to its success, *C.R.A.F.T. and DM in digital skills project* – sponsored by the Danish National Agency for IT and Learning - keeps evolving and includes more and more stakeholders from the public/private sectors. Moreover, the project aims in the coming years to expand beyond national level and include Nordic and other European countries.

problem solving; key competences; multiple partners networking.



103. STEM Alliance/Cross country

The STEM Alliance – inGenious Education and industry, brings together Industries, Ministries of Education and education stakeholders to promote Science, Technology, Engineering and Math education and careers to young European's and address anticipated future skills gaps within the European Union.

The project was triggered from the substantial shortage of STEM skilled workers, which jeopardises the success of the European economy. This affects all industrial sectors and slows down the pace of innovation, which in turn has adverse effects on employment and productivity in the related industries. Consequently, the shortage of STEM professionals at all levels weakens Europe's ability to compete globally.

With this in mind, industry and the Ministries of Education have agreed to work together to improve the situation of STEM education in Europe. Under the coordination of European Schoolnet and CSR Europe and with the support of major industries and private partners, the STEM Alliance promotes STEM jobs in all industrial sectors and contributes to build a STEM-skilled workforce. The STEM Alliance joins forces to improve and promote existing industry-education STEM initiatives (at national, European and global levels) and contributes to innovation in STEM teaching at all levels of education.

The improvement and promotion of good initiatives is achieved through three main actions: encouraging Professionals Go Back

to School¹⁰, advancing Teacher Discovery Placement¹¹ and building Knowledge, providing training and resources¹² with a variety of activities including the organisation of campaigns like the STEM Discovery Week¹³ and the “STEM ahead” competition¹⁴.

STEM; teacher continuous professional development; learning resources; education-industry relationship; digital competences; resources sharing.



104. MORE - Mobile Resources on Education: let's learn with each other/Portugal

The aim of MORE is to spread knowledge through national networks of teachers who specialise in particular STEM subjects.

This project, originated in Portugal and networked through Scientix¹⁵, a project that promotes and supports a Europe-wide collaboration among STEM teachers, education researchers, policymakers and other STEM education professionals. In line with Scientix, MORE project aims to create synergies with other countries, each one specialised in a technical area of knowledge. Four countries have various teaching expertise: Portugal with long experience in programming, France in electronics, Italy in Robotics, and Slovenia with primary school experience in European projects and willingness to test the solutions created by the other countries and their students.

The four schools bring different perspectives to peer working aimed at learning new teaching approaches, address new ways of introducing technologies (robots, mobile programming, microcontrollers) in their classes while teaching other subjects such as Mathematics, Science, Environmental problems, and Social problems.

Teachers became guides rather than knowledge centres and students take the driving seat when it comes to their learning.

10. <http://www.stemalliance.eu/pgbs>

11. http://www.stemalliance.eu/teacher_placement

12. <http://www.stemalliance.eu/resources>

13. <http://www.stemalliance.eu/stem-week-2017>

14. <http://www.stemalliance.eu/stem-ahead-competition>

15. <http://www.scientix.eu/about>

The students' vision in relation to these technologies has also changed, allowing them to use newly acquired knowledge to solve everyday life problems and apply them in their school projects.

interdisciplinary approach; STEM; problem solving; active learning; (self) regulated learning; teacher networking; global partnership.



105. Opeka, Oppika and Ropeka – Gathering Information about ICT Use in Schools/Finland

Faced with understanding and assessing ICT usage in their schools, school leaders need reliable tools which analyse usage in a consistent way across schools and regions. A set of tools to monitor the situation has been created collaboratively by seven Finnish cities (Espoo, Helsinki, Hämeenlinna, Jyväskylä, Tampere, Turku and Vantaa) and the University of Tampere. The initiative is funded by the Finnish National Agency for Education.

While in the past most cities in Finland had their own surveys on this, school leaders nation-wide now have three free online instruments to help measure and analyse the usage of information and communication technology in schools:

- Opeka¹⁶ for gathering information from teachers
- Oppika¹⁷ for gathering information from students (four surveys for pupils' of different ages with the questions based on the ICT goals of the national core curricula) and
- Ropeka¹⁸ for gathering information from principals.

In addition to gathering important data about the current situation, the tools give immediate feedback to the respondent. The data helps teachers and principals to assess pupils' and students' performance in ICT-related goals, principals and administrative coordinators to assess teachers' level of ICT use in classroom and needs for in-service training, and heads of local education departments in making decisions related to all the above. These tools also enable various researches on ICT use in education, both locally and nationally.

16. <http://opeka.fi/en>

17. <http://oppika.fi/>

18. <http://ropeka.fi/en>

Answering questions about ICT use in classroom gives both teachers and students an opportunity to really stop and think about the subject in hand and reflect on their skills and practices. Teachers get new insights on pupils' knowledge and habits, which they can then use in lessons. Principals get a view on the skills and practices in their own school and can discuss further developments with their staff. At the same time, the local and national administration can make use of the data in strategic planning and monitoring of goals.

system monitoring (online); digital competences formative assessment (students and teachers; schools); evidence-based policy; across education system networking.



106. Innokas Network/Finland

Innokas' appeal is as follows: *“The Innokas Network guides and encourages students, teachers, school administrators and other stakeholders to be creative and innovative using available technology. We encourage kids and adults to come up together with new ways to make use of technology in everyday school life. (...) By participating in events and trainings by Innokas you can learn by doing - finding new ways to take advantage of creativity, innovation and technology in your school.”*

This Finnish Innokas network¹⁹ is designed to fuel educational reform for the learning of 21st century competences. The key question driving the Network is how we can teach and support the learning of 21st century competence in practice.

The Innokas Network is focused on answering this question through the Innovation Education approach, within a framework developed by the Innovative School model. This is an educational approach developed through practical network activity and associated research. It is a combination of the cross-disciplinary Finnish traditions in crafts, arts, science, technology, engineering, and mathematics (STEAM), and other school subjects including methods of digital fabrication, coding and robotics, hands-on learning and technology education. Innovation Education is closely related to “maker culture,” an approach for learning through doing in a social environment.

19. <http://www.innokas.fi/en>

Students are guided and encouraged to use creative planning processes, thinking skills, and engage in teamwork and in projects that cross the traditional boundaries between school subjects. Students identify technological innovations that are in use in contemporary society, the changes these innovations have brought and are still bringing to society, and the opportunities for using technological innovations in the future. They then envision, design, and implement their own innovations. A key guiding principle in the model is the comprehensive and versatile use of digital technology in learning and teaching and in schools' daily operational processes.

The Network has an intensive work programme, including professional training courses for teachers and nationwide coding and robotics roadshows, national-level Innovation Education events with extensive participation by school students, teachers, parents, and administrative/industry stakeholders interested in the teaching of 21st century competence. Practical research is also conducted on the learning of 21st century competences, on Innovation Education and on the Innovative School model.

key competences; teacher continuous professional development; school leadership; across education system networking; school-industry relationship; mainstreaming innovation; research project.



107. The Edutheque Portal/France

The Ministry of Education in France has established partnerships with more than 30 key institutions (like ARTE, Centre Pompidou, CNES/National Centre for space studies, CNRS/National Centre for scientific research, INA (National Institute for audiovisual, the Louvre museum, etc.) to create and regularly fuel Éduthèque²⁰, the national portal in France which offers free access to a wide selection of digital educational resources from leading cultural and scientific institutions in the public sector. It is open to all primary and secondary school teachers for pedagogical purposes.

On the occasion of the European Year of Cultural Heritage (2018), Europeana offers for Éduthèque a collection of resources translated

20. <http://www.edutheque.fr/>

into French from its collections, galleries and exhibitions belonging to European cultural institutions. These are images, texts, sounds and videos, largely downloadable and free to use and reuse.

The Éduthèque portal is the only portal that brings together so many partners offering so many resources and providing free access and reuse rights to all teachers.

The available multimedia resources can be downloaded and re-used in any teacher project. The resources are of several types: images, videos, audio files, animations, services, texts, models, and 3D animations as well as teaching aids developed by partner organisations. Teachers can use these resources in their educational projects, and thereby benefit from an expansive range of rich digital resources.

digital resources; online portal; education-multiple partners relationship.



108. FÍS/Ireland

FÍS is a highly successful film project for Irish primary schools that explores film as a medium of expression in relation to the arts, and introduces children to aspects of the film-making process. FÍS²¹ is the Irish word for ‘vision’ and is an acronym for ‘Film in Schools’

Originally set up as a pilot project in 28 schools by the third level college, Institute of Art Design and Technology, Dún Laoghaire, FÍS has now been rolled out to all schools nationwide with the support of the Department of Education and Skills and the Professional Development Service for Teachers (Technology in Education) – the national support service for teachers.

The overall programme culminates in an annual event, the FÍS Film Festival with an award ceremony, attended by approximately 900 primary school pupils with their teachers. To enter the Festival, primary schools across the country are required to create a five-minute film on a subject of their choice. The film has to be pro-

21. <http://www.fisfilmproject.ie/>

duced by the children and their teachers, with entries judged on imagination and creativity, the originality of the story, excellence in set design, costume design, film direction and production, as well as the use of sound, acting and cinematography. Those that use special techniques, such as animation or special effects, are awarded extra points.

Awards are made in a wide variety of categories including comedy, editing, animation, history, adaptation, special effects, environment, documentary, direction, script, junior classes, local interest, acting, curriculum relevance, storyboarding as well as special category awards. The FÍS methodology empowers teachers and children to explore the medium of film and digital media in the primary school curriculum. FÍS helps develop active learning, creative thinking, language, imagination, collaborative learning and problem solving skills, as well as giving children hands-on experience of using technology as part of the film-making process.

collaborative learning; creative thinking; interdisciplinary approach; makers approach; education-multiple partners relationship; active learning; school-experts relationship.



109. e-Education Network/Austria

In Austria, a new network – eEducation²² – has been created by the national Ministry of Education to provide education system-wide exchange and coordination, embracing all levels of school education.

Over the last 10 years, the Federal Ministry of Education in Austria has built up expertise in different eLearning-frameworks for schools. Originally, the approach was based on specific networks for each school level (primary schools, lower and upper secondary), but over time there was an increased need for effective coordination and communication between the networks. With eEducation, a new network has been established, uniting all the existing eLearning networks and facilitating the roll-out of national strategies for digital media.

22. <http://www.eeducation.at>

This initiative focuses on gaining breadth in the use of digital media in schools but also facilitate different school types and levels to exchange information and concepts. Across and within three categories - *digi.komp4* (primary level), *digi.komp8* (lower secondary) and *digi.komp12* (upper secondary), teachers work with digital media in their classroom work thereby strengthening their digital competence as well developing their students' ICT-skills.

Both students and teachers can assess their digital skills undergoing digital assessments (*digi.check*). So-called “expert schools” which have built up their expertise in the use of digital media operate within the system and can retain this status through activities in a badge-based system. Member schools can work towards expert school status. A quality assurance system operates through state coordinators. This process is reset at the end of each school year so a continuing process of documentation and authorisation of activities is implemented. It is a success story that within the first three months of operation, the number of schools in the system has more than doubled.

across education levels networking; teacher digital competences
formative assessment; badges.



110. Network of Educational Technologists/Estonia

The use of new technologies requires new teaching approaches and the right support mechanisms for teachers is crucial.

With teachers often facing difficulties putting into practice a wide range of new technological tools, a new support mechanism has been put into place in Estonia, where Educational technologists work together to support teachers and help them identify programmes, environments and methods to facilitate their use of ICT.

The educational technologists analyse, design, implement and evaluate both processes and tools to enhance learning. They help teachers and the whole school to be innovative and creative. The network includes educational technologists from different educational levels (pre-school, basic school, secondary school, vocational education,

higher education). They have their own website²³, Facebook group, mailing list and Skype group, which they use to communicate with each other and exchange information on tools and approaches that they can offer and introduce to schools.

school-experts relationship; networking.



111. Networks for Primary and Secondary Education/France

In France there are specialist networks supporting schools in several areas of digital development and operations²⁴:

Secondary

- A network of digital correspondents in local education authorities (*Interlocuteur Académique pour le Numérique- IAN*)
- At national level, digital technology is led by a network of national disciplinary animators from the national Directorate of Digital Technologies for Education (DNE). Within local education authorities, digital technology is led by a network of digital correspondents who are advisors to the senior management, as well as by a network of secondary school education animators. The digital correspondent in the local education authorities belongs to a National network. The DNE relies on 32 teachers (disciplinary experts) to form a network of more than 450 teachers, secondary school education correspondents (13 local education authorities networks, 17 disciplines). The experts work closely with the General Inspectorate. The digital correspondents in each local education authority contribute to the development of the national strategy for digital education within their local education authority. Locally, they are in charge of disseminating digital educational resources (Éduthèque, portals, resource banks for the School, ...), pedagogical content (EDU'Base), and projects developed nationally level by the DNE. Nationally, they organise the sharing of good practices through the ÉDU'base,

23. <http://www.haridustehnologid.ee>

24. <http://eduscol.education.fr/cid57283/reseaux-et-interlocuteurs-du-second-degre.html>

and promote projects implemented in their own local authority so they can find their niche in the different national content collections (éduscol, Lettres Edu_Num, social network @Edu_Num).

Primary

- There is one school inspector responsible for digital matters in primary education (IEN) in each French *département* (local government area), so therefore about 100 nationwide. They meet twice a year. They are in charge of implementing and spreading digital development within their *département*, and developing digital policy according to local needs. They serve as an intermediary for the school inspectors of lower secondary education in their *département*. They network all useful information from research surveys and good practices.

school-experts relationship; professional community



112. Innovation Days - Journées de l'innovation/ France

In France, Innovation Days²⁵ are an opportunity to award prizes to innovative pedagogical projects selected following a call for projects.

For several years now, the Ministry of National Education has been promoting and enhancing the inventiveness and creativity of the education system through prizes. Experienced professionals and high-level researchers are invited to share their vision and experience in order to serve as wide an audience as possible.

The 7th edition of Innovation day took place in March 2017: eight Innovation Awards were awarded, including the prize for innovative schools and institutions and the special prize for innovation.

dissemination of innovative practices school-experts relationship; professional community.



25. <http://www.education.gouv.fr/cid56374/journee-de-l-innovation.html>

113. Copernicus Science Centre projects and collaborations/Poland

Changes in the curriculum and educational reforms in Poland emphasise on preparing young people and adults for the digital world, from introducing computer science classes in the curriculum to specific projects and initiatives that aim to encourage young people to develop their digital skills. So far, attention has focused on developing students' abilities in using computer applications, digital resources and network communication, by engaging all students in learning about ICT.

One interesting collaboration in this field is the ongoing partnership with the Copernicus Science Centre²⁶, a robotics laboratory in Warsaw. Funded by the City of Warsaw, the Ministry of Science and Higher Education and the Ministry of National Education, the centre promotes and popularises scientific communication. Visitors can learn about the laws of nature by conducting their own experiments on interactive exhibitions.

The original area in the centre comprises a series of galleries: World on the Move, Man and the Environment, Roots of Civilisation, Light Zone and Bzzz! Since then, more exhibitions and galleries have opened to teachers, students and the general public: a Youth Gallery, a planetarium known as Copernicus Sky, the Explorers' Park, and chemistry, biology, robotics and physics laboratories. The centre offers workshops for teachers, pupils, adults and families and the opportunity to take part in science projects such as Fablab, science shows, meetings with scientists and educational conferences.

The centre also runs science projects in collaboration with the Ministry of Science and Higher Education, for example the EducoBus²⁷ (Nauko-Bus). This project includes visits to about 100 towns and villages (with a population of less than 130,000 inhabitants) where students rarely have the opportunity for hands-on science. Each EducoBus visit lasts two days during which the research stations are set up in schools and students work with experts for up to six hours a day.

dissemination of innovative practices; out of school hours provision; active learning; school-experts relationship.



26. <http://www.kopernik.org.pl/en/>

27. <http://www.nauka.gov.pl/aktualnosci-ministerstwo/w-polske-rusza-pierwszy-naukobus.html>

114. Computer at School conference/Czech Republic

The “Computer at School”²⁸ conference is organised every year and is focuses on the most challenging issues of digital education. During its history, the conference has addressed topics like digital literacy and computational thinking, gamification and augmented reality, digital technology and laboratory exercises as well as the use of digital technologies in social science education.

The 15th edition of the Computer at School conference is planned for March 2018 with the support of the Ministry of Education, Youth and Sports, the Vysočina Region and Nové Město na Moravě together with Microsoft Company as the strategic partner. More than 100 participants are expected to attend and discuss, during the course of two full days, the process, impact and nature of digitalisation in education.

Scientific articles, lectures, workshops and video presentations from the previous conference editions are available free of charge on the conference website. Webpages containing interesting news and further professional training opportunities in using digital technologies in education are also made available.

education-industry relationship; education-multiple partners relationship; school- local authorities relationship.



115. STEM and research open conference/Israel

How do different types of food affect the quality of camel milk? How does the concentration of carbon dioxide in the classroom affect students’ performance? How can sewage produce energy? How to collect morning dew to save rare desert trees?

Answers to these research questions and many others were presented in the 6th Israeli national fair for research and scientific problem solving that took place in May 2017. The fair is a result of collaboration between Science Division in the Pedagogic Secretariat in the Ministry of Education, the Hebrew university in Jerusalem,

28. <http://www.pocitacveskole.cz/>

the municipality of Jerusalem, the Bloomfield Science museum and Broadcom foundation.



In Israel, all 6th grade students (aged 11-12, in their last year of primary school) and 9th graders (aged 14-15, in their last year of secondary school) are requested as part of the curricula to conduct a piece of research and write a research paper or solve engineering problems. 60 percent of all schools organise fairs at region or city level; the most innovative researchers are chosen by experts in academia and industry to represent their regions and cities and are invited to this scientific conference. It brings together 250 pupils and representatives of 51 schools from all around the country. These young researchers present their research to the wider public, presenting it to teachers, researchers and industry in the Hebrew University, followed by an academic lecture on stem cells and finishing with a closing ceremony. Aiming to disseminate knowledge and promote excellence in a non-judgmental and celebratory way, rather than competition between the researchers, all projects are presented in a scientific spirit of sharing knowledge and learning collaboratively from each other.

STEM; project-based learning; problem solving; inquiry based learning; school-industry relationship; school-experts relationship.





5 GLOSSARY

(The definitions not mentioning one single source have been build summarising different sources cited in the Bibliography section VI)

Active learning

Any instructional method that engages students in the learning process. Its core elements are student activity and engagement in the learning process (Prince, 2004).

Blended learning

The integrated combination of traditional learning (mainly face to face) with web and technology based on-line approaches.

Collaborative learning

Collaborative learning can refer to any instructional method in which students work together in small groups toward a common goal (Prince, 2004).

Continuous professional development (for teachers)

Activities that develop an individual's skills, knowledge, expertise and other characteristics as a teacher. The definition recognises that development can be provided in many ways, ranging from the formal to the informal. It can be made available through external expertise in the form of courses, workshops or formal qualification programmes, through collaboration between schools or teachers across schools (e.g. observational visits to other schools or teacher networks) or within the schools in which teachers work (OECD, TALIS, 2009).

Creative thinking

Creative thinking encourages different perceptions, different concepts, and different points of view through exploration in learning. By using creative thinking approach, students can use various methods to solve the problems. They are encouraged to provide new and different views that are not derived each from the other but are independently produced.

Entrepreneurship education

Is about learners developing the skills and mindset to be able to turn creative ideas into entrepreneurial action. This is a key competence for all learners, supporting personal development, active citizenship, social inclusion and employability (European Commission, Thematic Working Group on Entrepreneurship Education Final Report, 2014).

Entrepreneurship (competence)

EntreComp defines entrepreneurship as a transversal competence, which applies to all spheres of life: from nurturing personal development, to actively participating in society, to (re)entering the job market as an employee or as a self-employed person, and also to starting up ventures (cultural, social or commercial)...entrepreneurship is understood as a transversal key competence applicable by individuals and groups, including existing organisations, across all spheres of life (Bacigalupo et al. 2016).

Evidence-based teaching

Teaching that benefits both from existing educational research and from evidence collected as teaching unfolds. It is undertaken in the spirit of inquiry, with the enrichment of the learning experience as its goal (Northeastern.edu).

Flipped learning

Flipped learning is a pedagogical strategy that reverses the traditional classroom process by delivering the instructional content usually, but not always, online before class and then engaging learners in interactive group learning and/or critical problem solving activities that are carried out under the teacher's guidance during class (Kim, Jeong-Eun et al., 2017).

Formative assessment

Assessment carried out during the instructional process for the purpose of improving teaching or learning.

Game based learning

The use of video and computer games with an interactive user interface and visual feedback games that are intended to serve an instructional function (Tobias et al. 2014).

Initial teacher education (ITE)

A program leading to a qualification as a teacher. It usually includes a general and a professional component. The general component refers to general education courses and mastery of the subject(s) that candidates will teach when qualified. The professional part provides prospective teachers with both the theory and practical skills needed for teaching and includes in-class placements (OECD, TALIS, 2009).

Inquiry based learning

Inquiry-based learning is an approach to teaching and learning that places students' questions, ideas and observations at the centre of the learning experience. Educators play an active role throughout the process by establishing a culture where ideas are respectfully challenged, tested, redefined and viewed as improvable, moving children from a position of wondering to a position of enacted understanding and further questioning. Underlying this approach is the idea that both educators and students share responsibility for learning (Ontario, Student Achievement Division to support leadership and instructional effectiveness in Ontario schools, 2013).

Learning community

Leadership involves social influence process whereby intentional influence is exerted by one person [or group] over other people [or groups] to structure the activities and relationships. Leadership is based on articulated goals or outcomes to which the process of influence is expected to lead.

Maker's approach in education

Set of activities designed with a variety of learning goals in mind. Making can happen in formal and non-formal education. This approach focuses on engaging participants in learning content and

process by creating an artefact, project or problem solving which relates to real world tasks. Work from this perspective engages the intersection of computer science, design, art, and engineering (Halverson and Sheridan, 2014).

Media literacy

Refers to all the technical, cognitive, social, civic and creative capacities that allow us to access and have a critical understanding of and interact with different media such as: broadcasting, radio, press, through various channels: traditional, internet, social media and addresses the needs of all ages (Media Literacy, European Commission, 2015).

Open badges

Open Badges are visual tokens of achievement, affiliation, authorisation, or other trust relationship sharable across the web. Open Badges represent a more detailed picture than a CV or résumé as they can be presented in ever-changing combinations, creating a constantly evolving picture of a person's lifelong learning.

Peer assessment

Set of activities through which individuals make judgments about the work of others (Reinholz, 2016).

Problem-based learning

(PBL) is an instructional method where solution strategies are introduced. In problem-based learning, students work in small groups to investigate meaningful problems, identify what they need to learn in order to solve a problem, and generate strategies for solution (Prince, 2004).

Professional learning community

Professional learning communities are physical or online space where educational staff and develops, discusses and/or creates common visions, strategies allowing teachers to collaborate on their professional work, analyse student data, and assess student learning outcomes. Moreover, professional learning communities allow educators to learn from each other through collaborative study, expertise exchange, and professional dialogue, improving the educational aspirations, achievement, and attainment of students through stronger leadership and teaching.

Programming/coding

Computer programming (covers also coding) is the process of developing and implementing various sets of instructions to enable a computer to perform a certain task, solve problems, and provide human interactivity. These instructions (source codes which are written in a programming language) are considered computer programs and help the computer to operate smoothly (European Schoolnet, 2014).

Project-based learning

Learning method that involves the completion of complex tasks that typically result in a realistic product, event, or presentation to an audience. It is central to the curriculum, organised around driving questions, focused on a constructive investigation that involves inquiry and knowledge building, student-driven and authentic, by posing problems that occur in the real world and that people care about (Darling-Hammond et al. 2015).

Reflexive teaching approach

Involves the use of Experience Based Learning (EBL) techniques, which engage the whole person and stimulate reflection on experience, whilst opening up the learner to new experiences.

School leadership

School leadership can encompass people occupying various roles and functions such as principals, deputy and assistant principals, leadership teams, school governing boards and school-level staff involved in leadership tasks. Key tasks for school leadership are: to improve teaching and learning within their schools: supporting and developing teacher quality, defining goals and measuring progress, strategic resource management and collaboration with external partners and dialogue.

Self-assessment

A process where students are directed to assess their performance against pre-determined criteria. The process involves students in goal setting and more informal, dynamic self-regulation and self-reflection.

Self-regulated learning

Students' attempts to attain personal goals by systematically generating thoughts, actions, and feelings at the point of use, taking account of the local conditions (Boekaerts, 2002).

Situated learning

According to this approach learning is enacted essentially in interaction with, and especially through participation in, the social and cultural context.

Students centered learning

Teaching method that shifts the focus of instruction from the teacher to the learner in order to ensure that learners' needs are diagnosed and addressed, individual motivations, interests and goals are incorporated into teaching and are put first (International Conference, OECD-CERI, 2008).

Teaching and learning scenarios

Narrative description of learning and teaching that provides a vision for various different pedagogical practices. The aim is to inspire teachers to change their own practices (through adaptation of the ideas presented) rather than providing a lesson script.



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- Providing concrete evidence and data in the area of innovation in education on which to base policy recommendations;
- Supporting schools and teachers in their teaching practices;
- Developing and sustaining a network of schools engaged in innovative teaching and learning approaches.



