DECODE

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"Guidelines for Teachers and Education Agencies"

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Preamble

Antonio Cocozza [1]

The world of education is increasingly subject to strong and frequent changes that affect the culture, objectives, organisation, technology and individual relationships within educational institutions. This is supported by the results of the DECODE research which examined the impacts of the 'digital revolution' on education and learning. These changes concern the role and skills of teachers, but also those of the head teacher, which represent the fundamental actor for the achievement of the targets of the new strategies expected by school system's reform and the one of the main one of OECD Countries.

In fact, on the future of the educational systems transformation and the evolution of learning processes, as Prensky recalls (Prensky, 2001), a fundamental challenge is represented by the spread of young "digital natives" students, i.e. by the generation of those who were born and grew up in an era of maximum dissemination of new information and communication technologies. At the same time, in a logic of lifelong learning, this transformation is increasingly also to "Digital immigrants", i.e. those that when these new technologies are widespread were already adults, and have had greater difficulty toward this type of learning, or even are not able to learn the use of these new means.

In the current scenario, in which the digitalization of processes is extremely widespread, interactivity and connectivity contribute to defining new languages and new ways of communicating.

In fact, with regard to the role of the new languages and the low degree of pervasiveness in the use of technologies, effective integration of ICT in teaching and learning processes has not yet been affirmed, since they are still relegated to the laboratories of computer science or decidedly traditional administrative practices (Cocozza, 2012) .

Many international experiences suggest that the integration of ICT in practice and in school life, although not resolutive of all the problems of the school, appears to be a useful best practice to foster the personalized teaching and a good socialization to a behavior-oriented towards a logic of lifelong learning, in line with the Europe 2020 strategy.

In fact, with regard to the increasingly clear influence of ICT on the educational system, as clarified by various research (Prensky, 2008) it is necessary to develop a different strategy for teaching/learning and conducting the same lessons in the classroom, since the interaction between digital media (e-book) and interactive communication (smartphone, iPad, Tablet, PC), which represent the most striking phenomena of social change and cultural industry at the beginning of this millennium, are revolutionizing the world of reading and study.

The new media undermines the realm of the Gutenberg print media and brings out a new digital culture that is affirmed through a communicative style oriented to interaction, to the autonomous production of contents and to the elaboration in team (Drop box) and sharing (blogs and social networks).

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On the scope of these changes in the field of educational processes, as suggested by Ferri (2011) it is necessary to begin to examine the generation of those who today are around six years of age, identifiable as a digital generation, who have lived and live a learning path that leads them chronologically first to confront the screens, to interact with reference adults who use computers and surf the Internet.

These digital students, which are fitted at an early stage of smartphones and tablet, when they begin to go to school, meet a mode of socialization and learning very different, far from their technological know ever more practical and by their culture of self-learning.

The data collected in this research can help to observe that investments in technologies promoted in recent years have not yet managed to promote the fallout expectations, therefore, it is necessary to ensure a more strategic vision and a more reliable continuity, accompanied by a continuous monitoring. The data collected in this research makes it possible to observe that beyond investments in technology, it is increasingly necessary to guarantee greater strategic vision and more reliable continuity, accompanied by continuous monitoring.

In this scenario, the most significant criticality is most likely the lack of information that characterizes this aspect and prevents an adequate analysis of the system able to inform any educational policy intervention with respect to the strategic choices to be made in terms of digitization. The informative void that also concerns e-leadership skills and practices that certainly cannot be considered secondary in the promotion of digital socio-educational culture.

It is essential to consider the transformation of organizational, professional and educational models and that radically alter rules, boundaries and autonomy of those who work daily in educational contexts.

This should suggest a global rethinking of the 'education' model and the idea of digital innovation that is to be pursued, nailing to their responsibility political decision-makers, policymakers and educators, called to outline the ideal digital school. We need to rethink the engagement rules of the different and multiple actors involved (management figures, teachers, innovators/trainers, students, families, companies, etc.).

In the same way, the processes and organizational systems in their internal configurations (processes, procedures, internal and external communication systems, learning paths and environments, educational interventions, etc.) need to be rationalized and re-centered, in order to integrate and enhance digital technologies, with the aim of making them more flexible and effective.

For this reason, it is necessary to create a community open to share, experiment and learning by doing. From this, it is evident the importance of leadership in tracing the path of a system that wants to make of digital innovation a cornerstone of the development of their own educational model. In the framework of the powers granted to this figure fits that of designing the organizational model, the loads, flow, work's internal processes and the teaching model-pedagogical that distinguishes the school. In such a system, the spectrum of skills required to the school manager extends further because it asks who has managerial roles to be able to draw a new horizon of meaning and new organizational processes, to exert an e-strategic leadership and a vision of the digital-to-educational use that is capable of directing and guiding the staff toward a new model of school.

In this new scenario, with the evolution of the management culture and of organizational models, the manager tends to be a leader and in this evolution the headmaster of the institute, assumes a critical function, because their knowledge of the processes is crucial and their credibility is increasingly based on professionalism and less on the hierarchy, so must strive to be an educational leader (Sergiovanni 1992).

The effectiveness of diffuse leadership, which involves teachers in staff function and school managers, relies on the ability to communicate within and outside of the school of motivating employees and to be able to spread to all levels of the organization of the school a "strategic vision" of the change. In fact, in a school system decentralized, based on a "network system of autonomous schools", the full and effective recognition of the leader role is the essential element for the achievement of a new culture and is necessary for attainment of the didactic autonomy, both for the management of the organization and of the structures, as well as human resources and instrumental in a perspective of achievement of planned outcomes and expected.

This may be accomplished not by transforming the head of the institute in a business manager, thus reproducing mechanically in the scholastic improper organizational business models type, but rather by introducing or strengthening in the culture of the Headmaster of the school, which is and remains a "person coming from the world of school", those professional skills needed to exert autonomous and effective management responsibilities connected with the new role (Cocozza, 2000).

In this evolutionary logic of tasks, activities and professional skills especially, the new role of the school Director can be better defined as educational leaders. The educational leader is someone who does not believe that force is required to be able to direct their collaborators, but that Focus is needed to remove obstacles, to provide material and support, to take care of the details that make the journey easier to share the participation to the gear and satisfaction at the end of the journey, to identify a significant destination for your next trip"(Sergiovanni,1992).

In line with this paradigmatic approach, the school, therefore, could represent a privileged field of learning and experimentation of digital technologies, in which the collaborative climate and the tension towards new knowledge create the optimal conditions for success.

In this direction, a correct digitalization of the Italian educational and training system could help to respond to the following challenges of the new international scenario:

- the globalization of markets and the continuous evolution of economic, social and cultural scenarios;
- the extreme pervasiveness of technological (ICT) and organizational innovation (from centralized bureaucratic structures to the network system);
- the need to adapt knowledge and skills to increase the competitiveness of the system in the learning society.

It is increasingly necessary to give a new "systemic vision" to the role assumed by the school in post-Fordist society, which cannot be assimilated simplistically to a traditional business model structurally oriented towards an efficiency dimension, but an institution. A cohesive and ethically responsible educating community, which presents itself as a much more complex cultural organization, which aims at effectiveness, in which values and behaviors are created, learned, transferred and shared, as well as knowledge and skills.

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In conclusion, in the digital age the evolution of the organizational culture of the scholastic institution, even more so in a society perennially connected and open to participation, cannot do without a conscious and responsible involvement of all the different actors present in the school and by a significant contribution from teachers and the head teacher, as an effective educational leader in a responsible educating community.

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[1] Antonio Cocozza, Full Professor Università "Roma Tre", Director of the CRES-IELPO Research Center

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Introduction

Stefania Capogna [1]

1. Theoretical framework of research

Eurydice's report (2011), *Key Data on Learning and Innovation through ICT at school in Europe,* recommends the promotion of innovative pedagogical approaches, to allow students to learn through adequate modalities based on personal experiences and interests. The report confirms that ICT is widely promoted by central authorities as a tool for teaching and learning, however significant disparities with regard to their implementation persist. Member states of the European Union have recognized the importance of teacher training and have committed, with the 2007 European Council, to developing digital skills in the initial training of teachers, and to keep promoting them through support at the beginning of the career and the continuous professional development. Anyway, the report clarifies that, generally, their motivation to use ICT remains problematic. An analysis of the experiences of applying *Web 2.0* tools to the educational context shows the increasing influence of participatory culture and informal learning[2]. This confirms not only the potential but also the criticalities of a transition that questions both the traditional educational *setting* and the role of the teacher. Moreover, it questions also the way of thinking, planning and implementing the overall educational offer, and the educational and professional environments in which the teacher's professionalism, in its complexity, is expressed. In the past, updating and training activities of ICT structures and staff have had typically "technologizing" and "incorporating" approaches, with the result that teachers often appreciate and use technology, but rarely use it in class (OECD, 2013/a; 2013/b; 2015); in more recent years there has been a clearer rupture from traditional didactic schemes but with small-scale interventions. What emerges is that even in the face of small signs of change there is a significant difficulty to move from the experimental and episodic level to systematization and enhancement of practices and experiences that remain local and embedded. To comprehend how professionalism teachers have changed, we refer to the classical definition of professions (Freidson, 1994), which denote specific domains: a common orientation towards the promotion of human wellbeing; high specialized knowledge and skills, working in relationships of authority and trust. These aspects contribute to defining the profession (Abbott, 1988; Sarfatti Larson, 1994), giving a justification for why they need to regulate themselves. A very interesting debate has developed over the last few years to understand the evolution of the teaching profession through the affirmation of liberal and democratic models (Biesta, 2016) that have contributed to eroding the spaces of autonomy of teachers, leaving the need to emerge of new paths of recognition and legitimation (Stevenson, Gilliland, 2016).

The starting point of the reflection is the willingness to study the immaterial dimensions of the educational organization for exploring the building process of the professional habitus of the "digital teacher".

The hypothesis is that the availability of the technological infrastructure is not per se sufficient enough to guarantee correct use of learning and knowledge technologies among colleagues, *in* class and *with* the class. Reason for which the research has focused on the immaterial organizational aspects in the background.

The aim is that of understanding if, and how, the European Digital Pattern has been 'translated in practice" (Latour, 1999) from examined countries, and how the digital innovation is sedimented in didactical practices that take part in the construction of an "organizational texture".

One of the most important issues affecting the development of the old and new media in education is the lack of a systemic vision of the different levels of education, and the lack of clear empirical data on the use both of these tools in teaching practices and in the definition of digital competences for teachers, headmasters and school staff.

The ERASMUS + project, DECODE - DEvelop COmpetences in Digital Era. Skills, good practices and teaching in the 21st century [3], which is given in this publication is born from the need to fill this void of information through the implementation of an exploratory-research[1] that has as main objective to promote the integration of ICT in teaching practices through the enhancement and set up of a system of innovative pedagogical educational methodologies, and the spread of best practices at European level, so as to:

1) provide decision-makers and institutions with useful data for the definition of intervention strategies;

2) contribute to the European debate on rethinking education in the digital age;

3) promote a digital culture, through a multi-stakeholder approach that takes account of the systemic complexity introduced by ICT which involved, transforming them, all social and organizational practices, contexts and learning models;

4) planning improvement actions targeted to the introduction of training models and successful methodologies to integrate into the school staff (teachers, headmaster, administrative etc.) digital, methodological and socio-relational skills requested by the digital era;

5) establishing cooperation networks and partnership among different educational institutions (universities, research centers, training institutions, schools, digital publisher and developers);

6) offer a replicable model of research-intervention in the area of ICT-based educational research.

[1] For more information on the themes of action research, see, among others, Kurt Lewin, 1940; Argyris, Chris (1983) Action science and intervention. Journal of Applied Behavioural Science, 19, 115-140; Argyris, Chris; Putnam, Robert and Smith, Diana McLain (1985) Action science: concepts, methods and skills for research and intervention, San Francisco, Ca.: Jossey-Bass; Beer, Michael; and Walton, Anna Elise (1987) Organisation change and development. Annual Review of Psychology, 38, 339-367; Linda Neavel Dickens

Karen E. Watkins Action Research: Rethinking Lewin, June 1999, Management Learning 30(2):127-140.

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In this passage from the macro to micro of this process of 'enacting' European recommendations and guidelines on digital policy for education, the study proved to be particularly rich in theoretical suggestions, and this led to a complexification of the interpretative system.

The first phase of the research took place in the field of public policy analysis, with the aim of reading, in a descriptive-interpretative key, the parabola of this translation path that revolves around the digital challenge for the third-millennium school. To this end, the contributions provided by the translation theory (Latour, 1999, Gherardi, Lippi, 2000; Wei, 2014; Zheng, 2017; Berneking, 2017) to examine the different solutions activated by five engaged Countries. The theory of translation, in fact, allows us to focus attention on the way in which the processes materialize locally in the transition from macro to micro. This has allowed us to reconstruct the way in which the European Digital Pattern has been reinterpreted at a national level, identifying both the salient passages of the implementation efforts and the strengths, critical points, opportunities and threats that are the object of attention, with the goal of intercepting similarities and differences attributable to the implementation results between the different countries. The theory of translation, in fact, explains that in the process of adaptation a sort of "localization" takes place, a term by which in the cinematographic field we indicate not only the linguistic translation action typical of the dubbing but also the cultural, symbolic, sign, spatial, rhythmic, etc. that allows a better penetration of the message to the context/community to which it is addressed.

In the sociological and organizational literature, there is no unitary picture in the study of the impact of digital technologies on organizations, particularly in the educational field. Moreover it is very complicated to isolate the technological variable from the other internal and external context variables. Moreover, digital technologies have become widespread in educational contexts quickly over the last fifteen years and their development is so rapid that it is difficult to attempt any systematization.

Among the various study perspectives to which it is possible to draw to investigate the relationship between digital technologies and educational contexts/practices, the sociological approach has been privileged, which offers interesting contributions that come from the curriculum of Science, Technology and Society (STS); from that relating to cultural and organizational processes.

Specifically, the reflections gained in the field of cultural and organizational studies were very stimulating. For this reason, a second focus of investigation was represented from the attempt to examine the immaterial dimension of change investigated at an organizational and professional level. The concept of “organizational texture” (Cooper, Fox, 1990; Gherardi, 2006) proved to be essential in the second phase of the investigation focused on the meso-level through which the organization acts. The “organizational texture” is identifiable with the group of people, practices, objects, technologies, emotions, rituals, through which actors create, reveal and share knowledge daily; and like so learn, they interpret and give meaning to their action, assuming that teachers’ personal beliefs and motivations, with respect to the uses and usefulness of said tools, are decisive for continuous learning paths and the type of activated didactic practices, which pass through the socio-material aspect of processes (Orlikowski, 2007; Landri & Viteritti 2010) and the continuous redefinition of the small things of everyday life (Norman 1988). Here, then the basic assumptions that act as a background for the research are the concepts of practice, artifacts, beliefs, emotions that animate the daily action in the

confrontation with the digital for educational purposes. A conceptual apparatus that aids us in seeing the complexity of said processes under an organizational point of view, referring to the more immaterial and fluid aspects that constitute the social reality of the organization. A reality made of values, multiple objectives and belongings, within which actors share objects, values, visions, practices, emotions (Gherardi e Strati, 1997; Ernst, 2013; Yousefikhah, 2017). Refusing all technological determinism, attention was focused on the organizational and social processes that guide and influence every innovation path, including the introduction of digital technology in educational organization.

Following this theoretical framework, the third focus has been those related to the idea of transformative learning (Mezirow, 1990) for leading the training teachers pilot. In keeping with the research-action perspective, we have continued on the path of training-intervention[2]. For this reason, at the micro level, an approach has been adopted aimed at enhancing transformative learning as a tool to promote adherence to the practice of reflexivity and self-evaluation. Following the transformative learning principles, over the years, adults acquire their own coherent body of experiences, associations, concepts, values, feelings, conditioning and identifiable answers within what is their frame of reference. This system constitutes and delimits expectations, perceptions, knowledge and feelings by orienting the adult in the response to events. In this way, everything that is not contained within the frame of reference is not considered and understood, even going so far as to deny or delegitimize meaning. In the course of life, the person makes changes that lead them to reshape, renew, re-learn and re-work their knowledge, redefining their reference frames and developing those skills that lead them to be able to effectively manage the change caused from the situation of uncertainty in which they find themselves living. In this way, a conscious decision is made by the adult to get back into learning, to change their vision of the world by opening up to stimuli that are perceived as new. The central idea is that transformative learning can contribute to social change by the potential in addressing, framing, and communicating learning as one of the many important social impacts that occurs in Design Social Initiative (Yoshida et. al; 2017; Yee, 2019) for organizational change and innovation.

2. The immaterial dimension of the organization

The concept of practice represents a stronghold in organizational studies and it is possible to bring together different perspectives that concur in defining its complexity. This paper takes into consideration the interpretation provided by Bourdieu (2005), which considers practice like an adaptation to conjunctural pressure in which the subject moves. The practice represents a cornerstone of the social living, and for this reason, is a privileged vantage point for sociological research. Through practice, one learns, reproduces, modifies and reconstructs incessantly the social world. In this sense, the practice represents the architrave and lifeblood of organizational culture. Through practices once can express the set of strategies, styles, behaviour modalities, so deeply sedimented to be unknown to those who act them. Practice communicates the *habitus**[4]*** through which every subjectivity manifests itself, within a specific *field* characterized by a reciprocal "conditioning", in which the field structures the *habitus* through a relationship "of knowledge or cognitive

[2] There is a vast scientific literature on intervention training, for example, on this issue, see: Di Gregorio (2007); Casey, D., (1993), *Managing Learning in Organisations*, Open University Press, London.

construction"; while the *habitus*, in turn, conditions the *field*[3]. Bourdieu distinguishes between a *primary habitus*, learnt during the socialization of childhood, which develops in the family nucleus, and a *secondary habitus*, which adds to it through the process of secondary socialization that, in modern societies, is guaranteed by the school. The *habitus* is defined as the set of durable interiorized dispositions that guide the subject in action, relying on experimented practices and, at the same time, capable of inspiring new practices. The totality of practices conveys the personal style that constitutes a perception and evaluation scheme through which systems of belonging can be understood. The practice is always one of knowledge and is the result of the use and ideation of new knowledge by social actors that interact in a given context. In the Actor Network Theory the concept of practice always refers to human and non-human actors (Callon 1975; 1984; Latour 1987; 1999) since every observable organizational field could be understood as the consequence of a mixture of objects and subjects that influence one another. Practices are never detached from the context. They are situated (Suchman 1987), *embedded*, and are always acted by a more or less extended set of practitioners who participate and recognize each other as belonging to a socially identified context. For this reason, every practice can be considered as a social practice. The combination that characterizes each practice in its being, through the meeting between people, objects and reference environment, constitutes the distributed knowledge that characterizes the organizational environment, in this case, the school. Various schools of thought juxtapose the concept of practice to that of the community (Lave e Wenger 1991; Wenger 2000), understood as a multitude of actors, or reticular actor, who acts the practice. A juxtaposition that is well suited to represent the context in which the educational practice acts, within communities with indefinite boundaries, where actors participate and interact according to the mutually agreed relevance. Actors can participate in different communities within which develop trajectories of personal and professional growth that contribute to changing their role and positioning over time. In this sense, practices refer to more or less complex networks, with a variable configuration, within which subjects, participating in different practices, contexts and worlds, can transfer knowledge from one system to the other. Practical knowledge comes from daily experience, from empirical observation, from the exercise of one's functions within specific contexts/situations through which subjects mature their capabilities, their action within dialectical relations that always keep a certain degree of unpredictability.

The second key concept is that of the artefact that includes any work that derives from an intentional process of transformation by man. A technological artefact is a tool that allows the subject to extend and enhance his ability, through the creation both of tools and furnishings and signs to act in the immaterial world. The value of an artefact is defined not only for its usability but also concerning the meaning attributed to it. For this reason, every interaction about an artefact always involves both the physical-perceptive faculty and the sensory-interpretative faculty.

As Zuboff (1988) points out, ICT overcomes the automation technologies used to reproduce, expand and improve the work process, replacing human action. ICT produces a constant stream of data that can be used

[3] The refusal to distinguish between human subjects and non-human resources differentiates the cartography of controversies from the field theory of Pierre Bourdieu (which also resembles it in other respects such as the conflictual tension of the action and the strategic orientation of the actors). Local controversies are battles in which the same battle-field is one of the parties involved.

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to process valuable information. In this sense, digital technologies are not limited to producing an action but act at a deeper level, transposing events, objects and processes symbolically, making them visible, knowable and communicable in a new node. Digital technologies are technological artefacts that require the organization, especially the educational system, to redefine rules, culture, strategic choices to keep up with an innovation that seems to progress faster than our capability of comprehension, appropriation and co-evolution. Technologies (including digital ones) are never neutral, they mediate social actions, prescribing behaviours, define relationship and interaction systems, act as tools of power, boundary and control (Capogna 2014; 2016/a). Interaction between technology, social actor and context determine a continuous and complex process of meanings' negotiation, through which technological innovation is metabolized, contextualized and progressively integrated into the system. Every technological innovation is, thus, subject to a slow process of appropriation by the subject (Jedlowski, 2007). During this process, the technological artefact becomes a tool that allows the extension of one's own abilities to act in the material world (using tools) and in the immaterial one (using signs). In this way, a triad between the subject, the tool and the object within which tools act as mediators, or rather, as an interface between the subject and the object, is outlined. This mediation activity can acquire different characteristics in relation to the functions of use assigned to digital technologies (Pinch, Bijker, 2003), and through this perspective, the educational practices described by the teachers during the survey were analyzed in a deductive manner.

The first difference concerns the different types of orientations that may affect:

1. the object of the activity, for which knowledge will be mediated;

2. other subjects, for which interaction will be mediated;

3. and oneself, through a thoughtful mediation, as in the case of selfies.

The second difference concerns the kind of attributions assigned to the technological artefact that are distinguished in:

1. *epistemic mediation* when referring to the object or subject that acts the tool. In this case, the tool represents the means that allows the user to know the object or another subject. In this case, the artefact is a knowledge tool which can express different modality: logical-scientific, argumentative or speculative.

2. *pragmatic mediation* when referring to the object or subject that undergoes the tool. The tool establishes itself as the means that allows the user to act in the object or another subject [5]. In this case, the artefact appears as an active instrument which can assume:

    - a positive meaning in view of a common purpose/good (achievement of a goal/resolution of a problem; respect for the situation/problem/person; shared/common solution search);

    - or a negative meaning in the case of a personal goal/aim (exploitation/exploration of the situation/person; lack of respect for the situation/problem/person; research of personal/instrumental interest for his purposes).

The technological artefact, therefore, embodies an internal sociality composed of multiple declinations and uses related to the frame of reference that defines the system of relationships of the actors involved[6].

The introduction of a technological artefact in an organization (in the school too) is the result of complex interactions and brings a whole set of values, beliefs and visions of the world with which actors involved confront during their actions within a system of normalized and situated social actions. The use of a technological device is not only due to its physical and technical peculiarities, but also, and above all, to the courses of actions that it is able to activate, compatibly with the set of social practices created by the actors involved through the construction of collective beliefs and the gathering of shared experiences. In this perspective, technology, including digital, reveals the complexity of mutual interdependencies between social actors, context of action, and cultural references, which are comprised of four elements that can be distinguished only for heuristic purposes (Peterson, 1979): norms, values, beliefs, and symbols, which represent the fundamental conceptual armament of culturalist (Bateson, 1976; Schön, 1978; Schein, 2000;) and cognitivist approaches (Weick, 1988, 1997). In other terms, the more or less conscient vision that we have of digital technologies adapts the type of approach, use and relation with which said technologies are incorporated in didactical and professional practices from single teachers and the school community.

The emotional dimension[7] plays a solicited role by the fact that digital technologies perform, as we said, a triple role:

1. as devices of use, they question our self-efficacy;
2. as objects of interactional mediation, they open to intersubjective relation;
3. and finally, as objects of reflexive mediation, they fully enter the processes of identity construction and in the resolution of frustration towards the unknown and failure.

As a result, they determine the attitude towards learning and/or innovation in professional practices with strong or constructive results (Illeris 2003; Kort *et. al.* 2001).

Without the activation of intrinsic emotional resources, which allow the subject to discover the unknown, no learning process is possible either within the virtual class or in the presence of it. Following this reflection, the process by which people become expert in the use of artefact is a progressive path that crossing four phases (phase of extraneousness; phase of cognitive apprenticeship, phase of affiliation, phase of planning) lead people to acquire an artefact full mastery (Capogna, 2013: 137-138). These elements converge in that socio-material learning process (Orlikowski, 2007; Viteritti, 2012) that develops in educational and organization contexts (Fenwick, Ewards, 2010; Sorensen, 2009; Lave, Wenger, 1991), through the inextricable interconnection between subjects and symbolic, technical and material objects in the space-temporal flow of the action, giving birth to the hidden curriculum through which the educational action develops.

The online Dictionary of Social Sciences, edited by the *Athabasca Open University of Canada* defines hidden curriculum as "*the norms, values and social expectations indirectly conveyed to students by the styles of teaching, unarticulated assumptions in teaching materials and the organizational characteristics of educational institutions*". Elements that act particularly on the structure of teaching, organization and culture that permeate

the scholastic context, and is expressed through the complex analysis of the structural, procedural and relational dimension of the "school system". The hidden curriculum includes all the behaviours, expectations and values that implicitly emerge in school practices (rules, time and spaces management, the system of merits and detentions, the incorporation of mediators, the use of technologies, etc.). Generally, in the collective mind, the knowledge and use of ICT are considered to be separate realities. In the hidden curriculum of teachers, the dialogue between culture and digital is difficult, ambiguous, uncomfortable and, often, contrasting. Technology is often perceived as a factor of alienation, dehumanization, that hinders relationships and study, while the class, the book and the formal curriculum of disciplines remain the apparently neutral guards of the cultural heritage (Søby 2014:240), within which to operate the comfort-zone of an acquired professionality. But digital technologies rewrite the hidden curriculum, changing the didactic, the teaching and learning styles of teachers and students, the system of relations, internal and external communicative processes, opening a way to unexplored and, at times, ambiguous paths, and to spaces of mediation with an intense and always tense socio-materiality. The new techno-social space allows for the coexistence of more "spaces for learning", through which to transit and move continuously (Edwards, Biesta, Thorpe, 2009), without ever having full control over it.

3. Project description

3.1 Objectives

The digital revolution is not confined exclusively to the development of ICT skills but first of all concerns the formation of citizens capability of exercising ethical and responsible behaviour. For this, the digital revolution goes to school and is leading together with the school. To introduce new technologies in teaching; therefore, it is not enough to strengthen the technological infrastructures or focus exclusively on teachers' digital skills. We have to support even more the spectrum of emerging skills requested by the digital revolution. These relevant emerging skills in the digital era are divided into three different areas (Capogna, 2015; WEF, 2016):

- social and emotional ones (interpersonal communication, educational leadership, problem-solving, problem setting, conflict management, decision making, emotional intelligence);
- communicative one (media literacy, digital literacy, media competence, communicative competences);
- methodological ones (analysis, management of complex processes, planning and evaluation etc.).

According to this perspective, DECODE project aimed to raise awareness about the state of the whole education system in the comparison, testing and incorporation of ICT in teaching and educational practices and systems. To develop innovative thinking about the use of digital opportunities in school, we need to confront seriously and critically, with the meaning and the value of new technologies in the integral formation of man and for the renewal of the organization and production processes.

In line with the vision of development supported by the European Commission through the *Higher Education Modernization* documents and *The Digital Agenda for Europe*, DECODE aimed to be a knowledge and accompanying instrument towards the desired change that recognizes a strategic importance to the training of

different professionals school (teachers, headmaster, administrative, teaching staff, facilitators, tutors, etc.). With the advent of the Internet, the way to produce and manage knowledge has changed profoundly, thanks to extraordinary technological development. The Eurydice report (2011), K*ey Data on Learning and Innovation through ICT at school in Europe*, recommended the promotion of innovative pedagogical approaches, to enable students to learn in appropriate ways. The report confirms that ICT is widely promoted by the central authorities as a tool for teaching and learning but there are still major disparities regarding their implementation. At the level of primary and secondary school, most countries recommend, or suggest, a wide range of innovative teaching methods based on active and experiential learning, to increase student engagement and help to enhance their results. There are few countries that have already implemented e-portfolios as an approach for the evaluation. Moreover, there are not widespread training courses or updating and validation of digital skills in school. There are few countries where there is the dissemination of guidelines for integration and enhancement ICT in educational settings and teaching processes. Few countries recommend, at the central level, the use of ICT to assess students in compulsory education. The EU member states have recognized the importance of teacher training and they are committed, with the European Council (2007), to develop digital skills in the initial training of teachers, and to continue to promote them through the top of the support career and continuing professional development (OCSE, 2015).

The literature on education assisted by computers shows that the best results are obtained when the learning technology is used to integrate traditional teaching and not as an alternative. The use of computers is particularly effective when it is used to extend the time of study and practice, to enable students to take control of the learning situation and to support collaborative learning. Learning is not depleted by the technology, but it is enriched by all those aspects that characterize the social and shared practices.

3.2 The methodological approach: exchange of practice and shared approach to policies

DECODE moved in the methodological frame indicated by the *European Employment Strategy* (EES), an integral part of the Europe 2020 growth strategy, and by the open method of coordination approach to policies. The exchange of practices is the centre of the reciprocal learning concept and it is the essential methodology. Thus, good practices can provide a point of reference for policies mainstreaming, since the offer some cues in order to work out new policies.

DECODE is an action research project (Lewin, 1946) that aimed to create the best conditions of exchange and learning, combining the wide availability of cases analyzed and made available through a system of organized knowledge, the promotion of opportunities for exchange and comparison (virtual or direct between the stakeholders), through the creation and development of communities of practice, focus groups, seminars, mentoring, peer review, etc. A methodological framework that guarantees results and benefits to the educational community as they build frameworks for collective and organizational learning, intentional, conscious and systematic, based on knowledge management.

For this reason, DECODE promoted the use of Action Learning Methodology (Boshyk et all., 2010; Hale, Richard, 2014), a methodology based on the personal and social capital enhancement of each partner and all stakeholders involved in the process, focused on problem solving technique, as a means to the individual and

organization change, and the creation of appropriate contexts to the comparison, the reflection and the analysis of practices.

DECODE is inspired by the theoretical and methodological Action Research framework (Kemmis, Easen, 1985), which aims to study, systematically, the solutions explored by countries partners to improve educational practice, through both practical experimentation and reflection on the effects of these actions, turning, for this way, the research into an agent of change.

For this reason, DECODE promoted the recognition and the reflection on real experiences, practices and needs expressed by the entire educational system (headmasters, teachers, operators, decision makers etc.). Studying their actions and experiences can offer useful information to orient choice and decisions that can improve digital micro and macro policies.

The main objective of DECODE has been to contribute, by action research, to the improvement of the school digitization processes by:

- the understanding of the real organizational and educational processes, useful in providing important sources of information to policy and decision-makers;
- the improvement of teachers' strategic skills in the use of ICT in education and didactical activities;
- the spread of best practices at the European level, and the improvement of media and digital literacy;
- the experiment a new training model for teachers, which aims at contributing to the creation of digital competences to respond to the new demands of knowledge and information society to the education system.

To reach these goals, DECODE provided an articulated set of five actions which used a multilevel and a multidimensional approach (with documentary, quantitative and qualitative methodology) to indagate the observed phenomena at macro, meso and micro level (as illustrated in each chapter relative to the different research phases). Thanks to the partnership between Higher Education Institutions, research centers, training institutions, schools, associations, and according to a logic of co-construction and co-evaluation, DECODE involved different target groups in research and experimentation activities run (headmasters; key actors from national and local educational institutions; teachers school; policy-makers, ecc.). Participation in these activities has been on a voluntary basis, after communication and promotion actions carried out by partners towards their affiliates and social media.

4. Volume structure

The results of the research aim to illustrate the complexity and interdependence of the elements of influence in the reconstruction of the ongoing change. The publication, therefore, presents the restitution of the whole research process through the re-elaboration of the entire analysis path, to offer useful interpretative keys concerning the complexity investigated. For this purpose, the publication is structured in the following way.

Chapter 1 related to *Digital competence. European policy, research and frameworks* provides a brief overview of the way in which policy and research at European level have been transposed into practical frameworks for the use of educators, school managers, researchers and training providers. The first part highlights some of

the research behind current and emergent issues related to digital education, the second part reviews some important policy documents, with special focus on the *Digital Education Action Plan* (2018), while the last part details conceptual frameworks for digital skills. The reconstruction of the European framework about digital technologies in education represented the first phase of the research to establish the starting point of the translation process activated by each country.

Chapter 2 about Learning and teaching processes: policies, digital skills and good practices at school in the XXI century shows the results of the second research phase focused on national education policies, training models and successful methodologies to develop school staff`(teachers, headmasters, administrators, etc.) digital, methodological and socio-relational skills requested by digital era. By the reinterpretation of *National Researches Report* this contribution tries to assess the current needs of schools, to identify the key digital opportunities and risks from a procedural and organizational perspective in the project countries.

Chapter 3, *Integration of digital technology in the teaching-learning process (IO3),* takes a look at the current landscape in terms of efforts to make digital technology a useful tool for teachers in their day to day activities. The first part is a synthesis of the transnational report regarding national approaches in partner countries (ES, FI, IT, RO, UK) in bringing digital technology to the classroom. In the second part, we will take a look at some practical steps which school leaders might take to facilitate this process.

Chapter 4, *Practices, training and skills needs of the digital teachers* (IO4) illustrates the results of the cluster analysis carried out starting from the data collected during the comparative survey which involved more than 2000 teachers coming from the five project partner countries. The survey detected experiences, skills and training needs of teachers involved to identify strengths, areas for improvement and development prospects, through a multi-dimensional and multi-perspective approach. Then, the cluster analysis has identified in each country-specific profiles that define practices and uses of the technological artefact in teaching practices.

Chapter 5 illustrates the results of the *Online training model on Digital Competence for in-service teachers*. This model aims to train in-service teachers in the integration of teachers' digital competence in their professional practice. Although this model considers the instrumental part, it focuses on the Methodological Teachers' Digital Competence. This model was designed to be implemented fully online ant to participants to collaboratively design, a learning situation in which students acquire digital competence through the use of ICT. Subsequently, the implementation of the Model in 5 different pilot experiences is explained with their general results, pointing out their limitations and points of improvement. Finally, the impact of this training model through a training experience applied to other context is explained.

Chapter 6 offers *A proposal of Guidelines for Educational Agencies* a sort of policy paper for national and supranational institutions. This guideline aims to be an agile one aimed at policy and decision-makers and national or local institutional and representative actors aimed at summarizing the major contributions of the research carried out. This Guideline intends to offer a series of possible and feasible ideas and proposals, to be disseminated and adapted to raise the level of digital awareness and digital maturity, concerning the importance and complexity connected to the introduction of technologies in educational practices and contexts.

An Annex with best practices emerged by training teachers pilot and the DECODE online survey complete the research publication.

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[2] By formal learning we intend training typically provided by an education or training institution and leading to certification. Formal learning is intentional from the learner's perspective; non-formal learning takes place outside the formal system informal learning is the result of daily life activities related to work, family or leisure.

[3] The DECODE action research project was carried out thanks to a partnership between universities, research centers, training institutes, schools and professional associations. The project partners were: from Italy: Link Campus University Foundation (FLCU); CRES-IELPO Research Center, Department of Education - Roma Tre University; ANP National Association of Public Executives and High Professionalism of the School; from Spain: UOC, Universitat Oberta de Catalunya; from Finland: Omnia, the Joint Authority of Education and Regional Center of Espoo; from Romania: ISE, Institutul de Ştiinţe ale Educaţiei; from the United Kingdom: Aspire International.

[4] Regarding the concept of professional habitus see, among others Bernstein (1971).

[5] For further information on this topic see Pinch e Bijker (2003, 221-232).

[6] The Science Technologies Studies (STS) research has highlighted, since the end of the '70s, the complex interdependencies that exist aiming social, political and cultural values. These studies develop around two main directions of study: the relations between scientific innovations and technologies, starting from the assumption that both are socially built and that society itself can be considered a socio-technical aggregate; the exam of the effects produced by these innovations, of correlated risks and the consequent redefinition of the social parameters they produce. Among the most influential researchers of the subject, to mention a few, are Callon (1975; 1984); Latour (1987, 1999) and Latour and Woolgar (1979).

[7] Regarding the role of emotions in the organizations sees, among others, Hochschild (1983); Ashkanasy e Humphrey (2011).

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1. Digital competence. European research, policy and frameworks[4]

Mihai Iacob [1]

Emanuela Proietti [2]

1.1. European research into digital education

When setting up the scaffolding for making digital technology a relevant tool in educational settings, there is a pressing need for research, which offers context specific intelligence. This chapter aims to underline some of the research which has informed the DECODE partnership.

Technology is expected to shape the labour market in the coming decades with "a shift towards more autonomy, less routine, more information and communication technology (ICT), fewer physical tasks, and more social and intellectual tasks over the forecast period to 2030" (Skills forecast. Trends and challenges to 2030[5], Cedefop, 2018:11), but adjusting to these changes will not be effortless. As pointed out by a group of European experts, "reaping the benefits of technology is conditional on a shift in learning as well as fundamental adjustments to education and training systems in the EU" (European Education and Training Expert Panel[6], 2019:85).

On a global level, there is a downward trend in equipping classrooms with digital technology, but more students use technology at school and in their work, as pointed out by a recent study[7] (Vincent-Lancrin et al., 2019:29). For the European context, starting in 2005, the Joint Research Centre of the European Commission (JRC) has promoted several research areas, studies and projects to analyse and propose how to make better use of digital technology for rethinking learning, for innovating education and training and for addressing new skills requirements (e.g. digital competence) to generate growth, employment and social inclusion.

JRC's Learning and Skills projects cover a wide range of studies: on citizens and learners (micro), on teachers and educators (professionals), and on educational organisations (meso) and societies (macro). As indicated in the image below, projects are developed in collaboration with sister Commission services (Education and Culture, Employment, Justice). Together with other pan-European research initiatives, it has offered insights and guidance into the use of digital technology in educational contexts.

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[4] The study is the result of a joint work, only for the award, it can be considered the following paragraph division: Mihai §1, §2; Proietti §3.

5 https://www.cedefop.europa.eu/files/3077_en.pdf

6https://publications.europa.eu/en/publication-detail/-/publication/b976dfa7-a6a9-11e9-9d01-01aa75ed71a1/language-en

7https://www.oecd.org/publications/measuring-innovation-in-education-2019-9789264311671-en.htm

In regard to the quality of school connectivity and estimating the costs of classroom-level digital technology, the 2nd Survey of Schools, ICT in education[8] (2019) - which followed in the footsteps of its 2013 iteration and covered 31 countries (EU28, Iceland, Norway and Turkey) - has pointed out weak spots in the access to broadband internet connections and was able to model three scenarios (entry level, advanced and cutting edge) of access to technology. In the advanced scenario, the per student cost in the average EU classroom for equipment, the training of professionals and accessing content ranges from 224 to 536 euros. Another key finding of the survey was related to the gender gap, with a disproportionate number of girls not being engaged in coding in school.

Digital technology has transformed the way in which pupils interact with information in educational settings. An attempt to take into consideration these changes can be found in the Methodological guide for implementation and evaluation of open e-textbook programs[9] (Tarkowski, Sitek, Strycharz, Vuorikari & Castaño Muñoz, 2019). The aim of the guide is to offer support in evaluating the cost effectiveness of digital textbooks, by taking into account the regulatory framework, the publishing market, student demographics, penetration and use of the new materials, economic impact and outcomes of the education system.

During the past few years, a consortium led by the London School of Economics and Political Science has taken repeated looks at the behaviour of children in the online environment, through the EU Kids online[10] survey. This data is key to informing educational institutions regarding the acquisition of digital skills among children and taking steps to bridge gaps. For example, one Norwegian report[11] (Ní Bhroin & Rehder, 2018:3) suggests that children are naïve experts, rather than digital experts, with a gap between the extent to which children are familiar with concepts that relate to the Internet, and their ability to implement the practical skills these concepts refer to".

Looking forward, towards emerging technologies, we should take a look at what artificial intelligence and blockchain promise to offer. Three reports on these issues - Blockchain in education[12] (Grech & Camilleri, 2017), Artificial Intelligence. A European perspective[13] (Craglia et al., 2018), and the impact of Artificial Intelligence on Learning, Teaching and Education[14] (Ilka, 2018) - have pointed out the expectations and possible pitfalls of these technologies.

8 https://ec.europa.eu/digital-single-market/en/news/2nd-survey-schools-ict-education

9 http://publications.jrc.ec.europa.eu/repository/bitstream/JRC115866/jrc115866_methodological_guide_final.pdf

10 http://www.lse.ac.uk/media-and-communications/research/research-projects/eu-kids-online

11http://www.lse.ac.uk/media-and-communications/assets/documents/research/eu-kids-online/reports/norway-report.pdf

12 http://publications.jrc.ec.europa.eu/repository/bitstream/JRC108255/jrc108255_blockchain_in_education(1).pdf

13 http://publications.jrc.ec.europa.eu/repository/bitstream/JRC113826/ai-flagship-report-online.pdf

14http://publications.jrc.ec.europa.eu/repository/bitstream/JRC113226/jrc113226_jrcb4_the_impact_of_artificial_intelligence_on_learning_final_2.pdf

In regard to blockchain technology in education (Grech & Camilleri, 2017:8-9), four potential uses have been identified, but they are still in the developmental stage:

1. it could accelerate the end of a paper-based system for certificates;
2. it could allow users to be able to automatically verify the validity of certificates directly against the blockchain;
3. it could allow the creation of data management structures where users have increased ownership and control over their own data, which could significantly reduce data management costs for educational organisations;
4. in some cases, blockchain-based cryptocurrencies are likely to be used to facilitate payments.

Cutting edge technology also comes with attached risks and artificial intelligence in no exception: "the black box characteristics of most leading AI techniques make them opaque even to specialists. AI systems are currently limited to narrow and well-defined tasks, and their technologies inherit imperfections from their human creators" (Craglia et al., 2018:121). This is often seen either in the bias of the search engines or that of recognition software. Steps are being taken to prepare more professionals in the field of artificial intelligence. However, the *Academic offer and demand for advanced profiles in the EU*[15] (2019) report shows that there is an unequal distribution of training opportunities across the member states. In the near future, this could translate into gaps between the different countries, in terms of preparedness to take on board innovation.

1.2 EU policy on digital skills and education

Learning and skills are key contributors to society and the economy. As modern societies and economies are changing due to, amongst others, globalisation and technological progress, a fundamental transformation of education and training throughout Europe is required to deliver the knowledge and skills needed for growth, employment and participation in society.

Digital skills have been on the agenda of the European and national policy makers for the past few decades, with ever increasing efforts being dedicated to creating a framework which would support their acquisition and development. The objective of the chapter is to highlight the EU's policy towards the development of digital skills in education and training.

The Conclusions of the European Council of 26/27 June 2014[16] emphasized the need to achieve a digital single market by 2015, while anticipating and adapting to the skills needs of the digital age. The Conclusions of the European Council 19/20 October 2017[17] reiterated the need for training and education systems to be fit for the digital age. Several other policy initiatives have taken shape during the past few years, among them:

15http://publications.jrc.ec.europa.eu/repository/bitstream/JRC113966/jrc113966_jrc113966_academic_offer_and_demand_for_advanced_profiles_in_the_eu_ai-hpc-cs.pdf

16 https://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/143477.pdf

17 https://www.consilium.europa.eu/media/21620/19-euco-final-conclusions-en.pdf

- New Skills Agenda for Europe18;
- the revised Key Competences for Lifelong Learning[19] (2019);
- Opening up Education: Innovative teaching and learning for all through new Technologies and Open Educational Resources[20] (2013);
- the Bologna Process Implementation (2015) and Modernization of Higher Education (2013);
- the Digital Education Action Plan[21] (2018);
- the Education and Training Framework 2020[22];
- the European Digital Agenda (Europe 2020)[23].

As set out by the Communication from the Commission […] on the Digital Education Action Plan (COM/2018/022)[24], the EU and the member states should undertake concrete actions in order to harness the educational and economic potential of digital technology. The Digital Education Action Plan is divided into 11 specific actions, which are grouped in three clusters:

I. Making better use of digital technology for teaching and learning

- Action 1 - Connectivity in Schools

A key finding of the 2nd Survey of Schools: ICT in education (2019) was that a significant number of schools across the EU was without access to broadband Internet. This action aims to raise awareness towards the benefits of such access and to provide funding for improving connectivity.

- Action 2 - SELFIE self-reflection tool & mentoring scheme for schools

This tool capitalizes on a wider movement to promote self-school evaluation (Capogna, 2019) and empower educational organizations. The SELFIE[25] tool was developed by the Joint Research Centre with the aim to help "schools assess, though a series of questions to teachers, students and school leaders, where they stand with the use of digital technologies for teaching and learning." As of August 2019, it is available in 30 languages.

- Action 3 - Digitally-Signed Qualifications

18 https://ec.europa.eu/social/main.jsp?catId=1223

19 https://publications.europa.eu/en/publication-detail/-/publication/297a33c8-a1f3-11e9-9d01-01aa75ed71a1/language-en

20 https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1389115469384&uri=CELEX:52013DC0654

21 https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en

22 https://ec.europa.eu/education/policies/european-policy-cooperation/et2020-framework_en

23 https://ec.europa.eu/digital-single-market/en/europe-2020-strategy

24 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2018:22:FIN

25 https://ec.europa.eu/jrc/en/digcomporg/selfie-tool

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In order to capitalize on the emerging technology of blockchain (Grech & Camilleri, 2017) the EU would like to support institutions that award qualifications to issue digitally-signed certificates. The new Europass platform, which should be available before the end of 2019, will support the storing and sharing of such documents.

II. Developing digital competences and skills

- Action 4 - Higher Education Hub

The platform is meant to "act as a hub for existing European, national and regional platforms dealing with online learning, blended/virtual mobility, online campuses and exchange of best practice". It aims to provide training for academic staff, enable the sharing of resources and practices, offer blended and digital learning, and support collaboration between higher education institutions and employers.

- Action 5 - Open Science Skills

The aim of the action is to "foster digital competences and open science skills in higher education". This should be done by developing training courses and curricula for undergraduates on topics such as: open data, open science, citizen science, collection, analysis and communication of scientific data, etc.

- Action 6 - EU Code Week in schools

EU Code Week in a grassroots initiative, driven by volunteer support, to promote the acquisition of coding skills and computational thinking across primary, secondary and VET schools. It aims to reach 50% of schools in Europe by 2020.

- Action 7 - Cybersecurity in Education

This action is focused mainly on awareness raising and capacity building regarding online safety. The target group is made up of primary and secondary school teachers, which will develop relevant skills on cyber-security. In addition, EU wide awareness campaigns will be run.

- Action 8 - Training in digital and entrepreneurial skills for girls

Another key finding of the 2nd Survey of Schools: ICT in education (2019) was the gender gap in digital skills across Europe. In order to tackle this issue, a series of workshops will be developed and delivered to primary and secondary school girls.

III. Improving education through better data analysis and foresight

- Action 9 - Studies on ICT in education

Reliable and comprehensive data are required in order to support policy making. Alongside the two ICT in education Surveys (2013, 2019), data on the use of ICT in education has been collected during the PISA tests.

- Action 10 - Artificial Intelligence and analytics

The labour market is being shaped by digital technology and it is of utmost importance to be able to predict future trends and skill needs. Th Horizon 2020 Programme will be at the forefront of this action, accompanied by policy measures aimed at streamlining the flow of non-personal data, promoting better connectivity and stronger cybersecurity.

- Action 11 - Strategic foresight

The EU aims to regularly publish policy, research and guidance papers on digital issues affecting education and the labour market. Also, a more practical approach, will see a EU-wide hackathon will try to identify innovative solutions to current challenges.

Within the Education and Training 2020 Framework, a working group[26] has been established (Digital Education: Learning, Teaching and Assessment) to support the exchange of information and practices among member states. Digital skills will probably continue to feature high on the agenda of EU governments and policy makers, as attested by the High-level Group Meeting of the representatives of Ministries of Education across the EU[27], in Bucharest in February 2019, which had digital education as one of its three main topics, alongside the European Education Area and transitions from one educational stage to another.

1.3 Being digitally competent: a task for the 21st century citizen. From DigComp to DigCompEdu

Creativity, entrepreneurship, learning-to-learn, digital competence and other 21st century skills and competences are emerging as more and more important for innovation, growth and participation in a digital society and economy. The key challenge for research and policy is to make sure that supply and demand for new skills and competences are matched and the key question is how can or should these new skills and competences be defined, described, thought, acquired and recognized. Innovating and modernising education and training are key priorities in several flagship initiatives of the Europe 2020 strategy, in particular Agenda for New Skills and Jobs, Youth on the Move, the Digital Agenda and the Innovation Union. Finally, Open education has the potential to make educational systems more innovative and efficient. In addition, Open Education allows individuals to engage in new and more flexible ways of lifelong learning.

The Digital Competence Framework for Citizens (also known as DigComp[3]) was developed by EC JRC IPTS (European Commission - Joint Research Centre[4] - Institute for Prospective Technological Studies) on behalf of Directorate General Education and Culture and, more recently, on behalf of the Directorate General for Employment, Social Affairs and Inclusion (DG EMPL).

In 2016-2017, JRC research was structured around three main strands: 21st century skills and competences; innovating and modernising education and training and open education. JRC's Learning and Skills projects cover a wide range of studies on different levels: micro (on citizens and learners), meso (on educational organisations) macro (on societies) and on professionals (on teachers and educators). Projects are developed in collaboration with different Commission services (Education and Culture, Employment, Justice) (Fig. 1).

DigComp and DigCompEdu are part of a wider package of projects, which together can contribute to train more competent digital citizens.

26 https://ec.europa.eu/education/policies/european-policy-cooperation/et2020-working-groups_en

27 https://www.romania2019.eu/event/high-level-group-on-education-and-training/

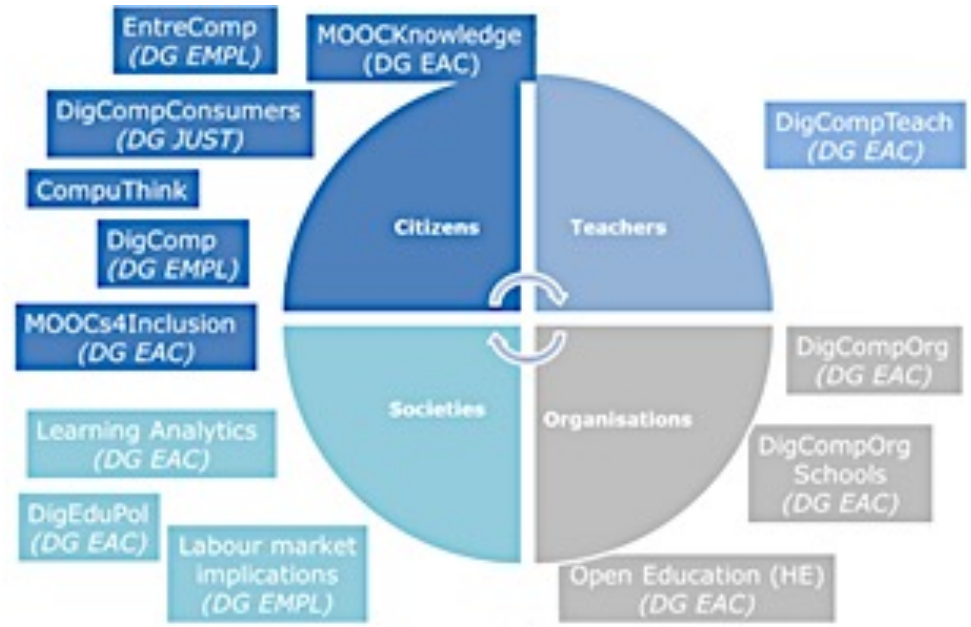

Figure 1 JRC's Learning and Skills projects. Source: EU Science Hub. The European Commission's science and knowledge service (https://ec.europa.eu/jrc/en/research-topic/learning-and-skills)

In order to produce the framework, an extensive literature review, case study research and stakeholder consultation process were carried out. More than 200 experts and a variety of stakeholders from EU Member States have been involved in developing DigComp.

Since the publication of the first DigComp Framework in 2013, two new versions have been released, the latest one in spring 2017.

"DigComp was designed to be a reference frame-work for digital competence. This means that the framework is descriptive rather than prescriptive, highlighting the importance of all competences. Further elaboration of the content and the level of competences can be done by the users, should they wish to do so. This makes the framework flex-ible and adaptable. Some effort may be required however to adapt DigComp content to local goals and specific circumstances" (Kluzer, Pujol Priego, 2018, pag. 8).

Whereas DigComp helps to define "what" (which competences) to address, stakeholders face challenges about "how" (which method) to perform effective digital competence development (Kluzer, Pujol Priego, 2018, pag. 8).

DigComp was first published as a reference framework to support the development of digital competence of individuals in Europe. DigComp describes which competences are needed today to use digital technologies in

a confident, critical, collaborative and creative way to achieve goals related to work, learning, leisure, inclusion and participation in our digital society.

The framework is structured in five dimensions. They outline the underlying data model and organise all elements showing how they relate to one another. They are:

1. competence areas identified to be part of digital competence;
2. competence descriptors and titles that are pertinent to each area;
3. proficiency levels for each competence;
4. knowledge, skills and attitudes applicable to each competence;
5. examples of use, on the applicability of the competence to different purposes.

Two of the dimensions in the earliest version of the Framework (DigComp 1.0 published in 2013) were updated in 2016, namely Dimension 1 (the competence areas) and Dimension 2 (the descriptors and titles). The updated version became DigComp 2.03. The latest version of the Framework – DigComp 2.1 – includes further updates: Dimension 3 now has eight proficiency levels and Dimension 5 has new examples of use. DigComp 2.1 does not include an update of Dimension 4; the research team prefered focusing on proving examples of use applied to the field of employment and learning due to their policy relevance (Carretero, Vuorikari, Punie, 2017).

In DigComp, there are 5 competence areas which outline the key components of the digital competence (Tab. 1).

T.1 DigComp competence areas and competences

COMPETENCE AREAS	COMPETENCES
1. **Information and data literacy**	1.1 Browsing, searching and filtering data, information and digital content 1.2 Evaluating data, information and digital content 1.3 Managing data, information and digital content
2. **Communication and collaboration**	2.1 Interacting through digital technologies 2.2 Sharing through digital technologies 2.3 Engaging in citizenship through digital technologies 2.4 Collaborating through digital technologies 2.5 Netiquette 2.6 Managing digital identity
3. **Digital content creation**	3.1 Developing digital content 3.2 Integrating and re-elaborating digital content 3.3 Copyright and licences 3.4 Programming
4. **Safety**	4.1 Protecting devices 4.2 Protecting personal data and privacy 4.3 Protecting health and well-being 4.4 Protecting the environment
5. **Problem solving**	5.1 Solving technical problems 5.2 Identifying needs and technological responses 5.3 Creatively using digital technologies 5.4 Identifying digital competence gaps

Table 1: DigComp competence areas and competences

The competence areas 1, 2 and 3 deal with competences that can be re-traced in terms of specific activities and uses. Competence areas 4 and 5 are “transversal”, as they apply to any type of activity carried out through digital means. Problem solving elements, in particular, are present in all competence areas, but a specific area was defined to highlight the importance of this aspect for the appropriation of technology and digital practices.

In each competence areas, several competences are present.

DigComp maps out 4 broad proficiency levels: foundation, intermediate, advanced and highly-specialised. These levels can also be further elaborated across 8 levels offering a more detailed description of progression criteria. The 8 levels provide the granularity needed to develop learning materials, assess and recognise learning progression, and to describe tasks and competences in detail. Each of the 8 level descriptions represents a further step by the citizens in three domains:

- the acquisition of knowledge of the competence;
- the complexity of the tasks they can handle;
- their autonomy in completing the task.

Each description contains knowledge, skills and attitudes, described in one single descriptor for each level of each competence (8 x 21 learning outcomes). The proficiency levels were inspired by the structure and vocabulary of the European Qualification Framework (EQF) and were written as a combination of learning outcomes, using one action verb per learning outcome.

Asked about the value of using the DigComp framework, stakeholders gave four main reasons (Kluzer, Pujol Priego, 2018):

- its character as a European framework;
- its contribution to create a common language and understanding of digital competence;
- the quality and flexibility of the framework;
- its guiding function for education and training actions.

In a very useful Guide (published in 2018, by Kluzer and Pujol Priego), 38 examples of DigComp use are presented that reflect what can be done with the Framework. Based on these examples, some considerations are proposed by the authors.

DigComp is typically used for five main goals, which are also the five steps of a suitable DigComp implementation process (Fig. 2):

- adaptation and specification;
- competence assessment;
- training trainers;
- end-user learning;
- recognition and certification.

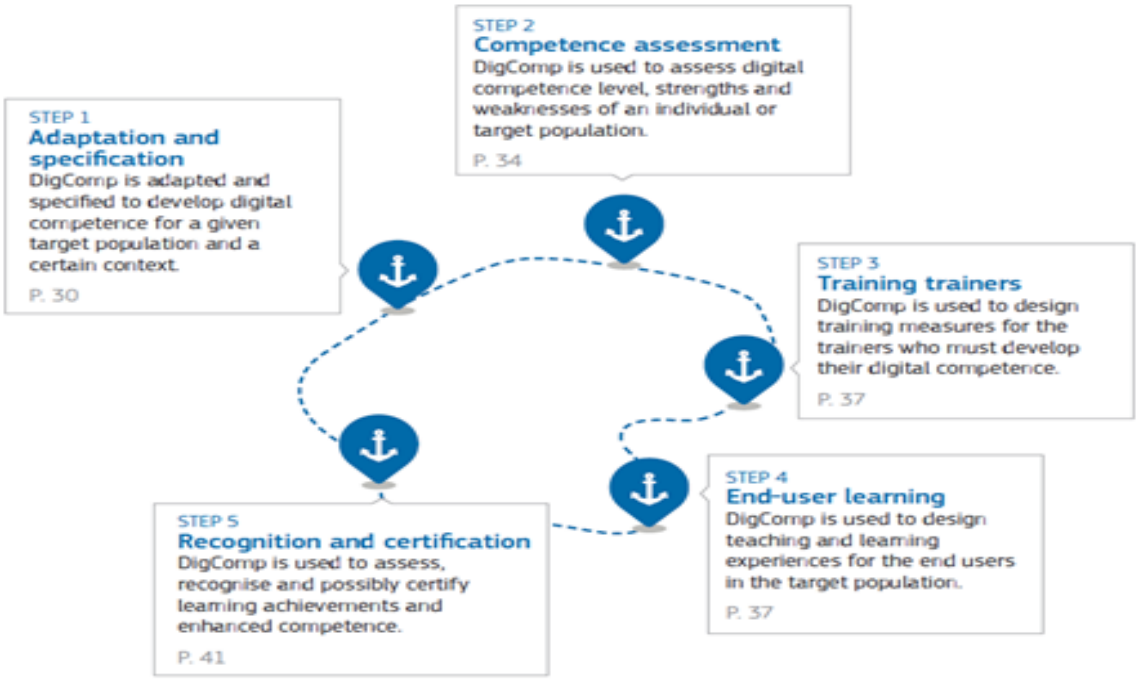

Figure 2 A suitable DigComp implementation process. Source: Kluzer, Pujol Priego, 2018

DigComp is being used in three main domains where digital competence is increasingly important:

- education and training: it is used in education at all levels starting at school, where it contributes to educational achievements and the wellbeing of children;
- life-long learning and inclusion: digital competence is important in everyday life and the lack of digital competence can exacerbate the condition of already disadvantaged people or contribute to socially exclude them;
- employment: digital competence is needed today for a wide variety of job profiles in the world of work.

The examples collected for the Guide show that DigComp is being used by the following main stakeholder categories:

- policy-makers: they are national or regional ministries or in-ternational organisations and their related research and support agencies, institutes and similar entities. They develop digital compe-tence initiatives in different policy areas: ed-ucation and training, employment, econom-ic development, public administration and digital agenda. In the case of education and training, they undertake digital development actions at all levels and they address the life-long learning perspective in adult education.
- Third sector and enterprise: they are foundations, associations and other non-profit organisations which run activ-ities and offer services in non-formal ed-ucation and training, including specialised digital competence centres. Non-profit organisations address vari-ous target users such as: young people to enhance their employability, children in a (non-formal) educational perspective and older people, unemployed people and adults in general in a life-long learning and inclusion perspective.

DigComp is also being used to develop digital competence for employees of companies and public organisations facing digital transformation challenges.

- Education and training: institutions develop digital competence initiatives acting independently, in nation-al networks (also in association with profes-sional and government bodies) or in European projects with different types of partners. They operate in the education and training and other domain, but with research and support functions. A few examples are implemented by schools, typically in the context of Europe-an projects.

In 2016, DigComp is updated by JRC in its conceptual reference model. It constitutes phase 1 of the update of the framework, which focuses on the conceptual reference model, new vocabulary and streamlined descriptors.

Published in 2017, DigComp 2.1 is a further development of the DigComp Framework for Citizens. Based on the reference conceptual model published in DigComp 2.0 (2016), it presents now 8 proficiency levels and examples of use applied to the learning and employment field.

The JRC will also continue to monitor the implementation of the DigComp framework at regional and national levels and ensure that it is up-to-date and policy relevant in the future.

The DigComp conceptual reference model has been used by the JRC to develop other related frameworks for the European Commission:

- DigCompOrg (2015): The European Framework for Digitally Competent Educational Organisations;
- DigCompConsumers (2016):The Digital Competence Framework for Consumers;
- DigCompEdu (2017): The European Framework for the Digital Competence of Educators.

“National and European policies acknowledge the need to equip all citizens with the necessary competences to use digital technologies critically and creatively. The European Digital Competence Framework (DigComp), which was updated in 2016/17, responds to this need, by providing a structure which allows European citizens to better understand what it means to be digitally competent and to assess and further develop their own digital competence” (Redecker, Punie, 2017, pag. 12).

As the teaching professions face rapidly changing demands, educators require an increasingly broad and more sophisticated set of competences than before. In particular, the ubiquity of digital devices and the duty to help students become digitally competent requires educators to develop their own digital competence. On international and national levels a number of frameworks, self-assessment tools and training programmes have been developed to describe the facets of digital competence for educators and to help them assess their competence, identify their training needs and offer targeted training. Analysing and clustering these instruments, Redecker and Punie (2017) present a common European Framework for the Digital Competence of Educators (DigCompEdu). It is defined by the authors, as a scientifically sound background framework which helps to guide policy and can be directly adapted to implement regional and national tools and training programmes. In addition, it provides a common language and approach that will help the dialogue and exchange of best practices across borders. The DigCompEdu is directed towards educators at all levels of education, from early childhood to higher and adult education, including general and vocational training,

special needs education, and non-formal learning contexts. It aims to provide a general reference frame for developers of Digital Competence models, i.e. Member States, regional governments, relevant national and regional agencies, educational organisations themselves, and public or private professional training providers (Redecker, Punie, 2017).

"The European Framework for the Digital Competence of Educators (DigCompEdu) responds to the growing awareness among many European Member States that educators need a set of digital competences specific to their profession in order to be able to seize the potential of digital technologies for enhancing and innovating education" (Redecker, Punie, 2017, pag. 8).

The Framework also proposes a progression model to help educators assess and develop their digital competence. It outlines six different stages through which an educator's digital competence typically develops, so as to help educators identify and decide on the specific steps to take to boost their competence at the stage they are currently at. For ease of reference, these competence stages are linked to the six proficiency levels used by the Common European Framework of Reference for Languages (CEFR), ranging from A1 to C2. At the first two stages, Newcomer (A1) and Explorer (A2), educators assimilate new information and develop basic digital practices; at the following two stages, Integrator (B1) and Expert (B2), they apply, further expand and structure on their digital practices; at the highest stages, Leader (C1) and Pioneer (C2), they pass on their knowledge, critique existing practice and develop new practices.

"The proposed progression model is intended to help educators understand their personal strengths and weaknesses, by describing different stages or levels of digital competence development" Redecker, Punie, 2017, pag. 28).

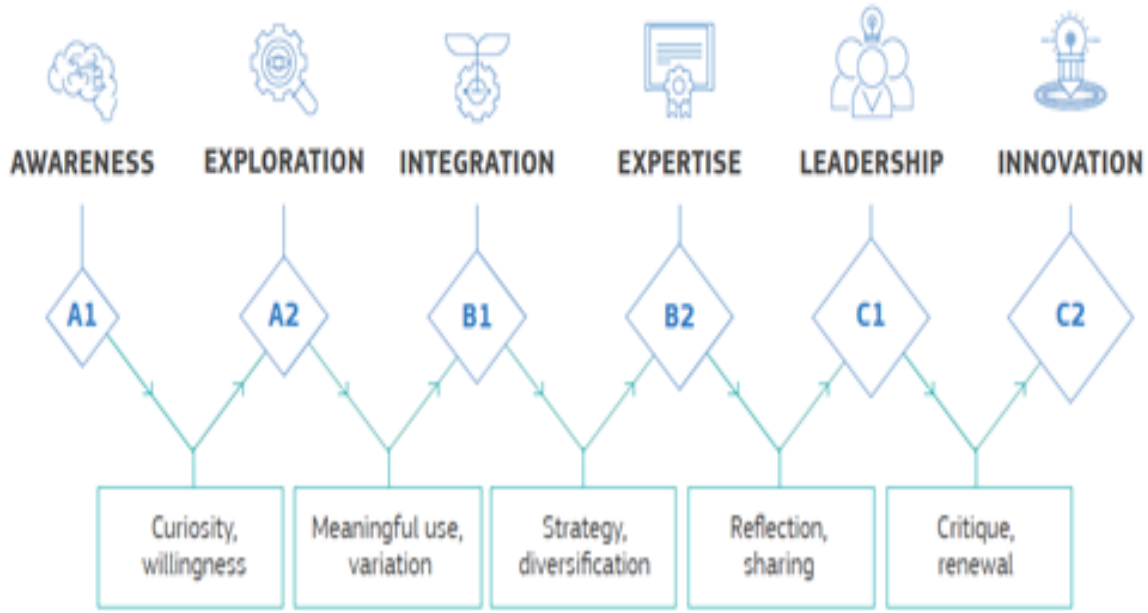

Figure 3 DigCompEdu progression model. Source: Redecker, Punie, 2017

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The objective of the DigCompEdu framework is to reflect on existing instruments for educators' digital competence and to synthesize these into a coherent model that would allow educators at all levels of education to comprehensively assess and develop their pedagogical digital competence.

The DigCompEdu framework is not intended to undermine national, regional and local efforts to capture educators' digital competence. On the contrary, the diversity of approaches in different Member States contributes to a productive and ongoing debate and is welcomed. The framework aims to provide a common ground for this debate, with a common language and logic as a starting point for developing, comparing and discussing different instruments for developing educators' digital competence, at national, regional or local levels.

Thus, the added value of the DigCompEdu framework is that it provides (Redecker, Punie, 2017):

- a sound background that can guide policy across all levels;
- a template that allows local stakeholders to move quickly on to developing a concrete instrument, suited to their needs, without having to develop a conceptual basis for this work;
- a common language and logic that can help the discussion and exchange of best practices across borders;
- a reference point for Member States and other stakeholders to validate the completeness and approach of their own existing and future tools and frameworks.

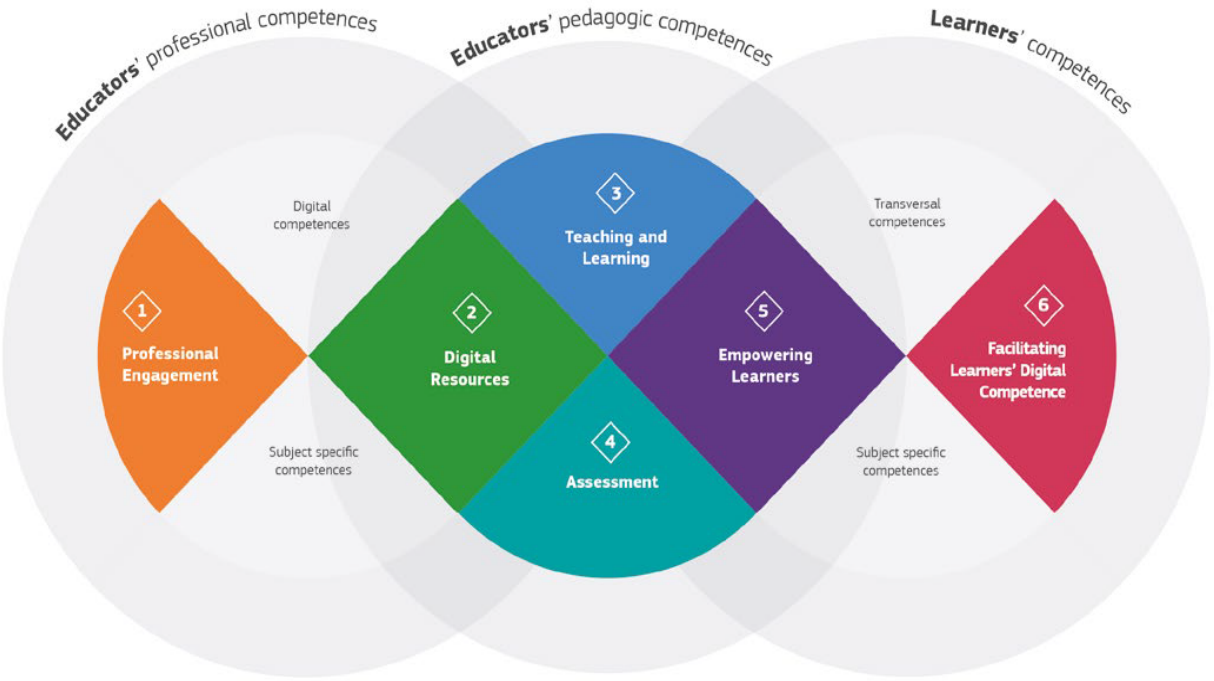

Figure 4 - DigCompEdu areas and scope. Source: Redecker, Punie, 2017

As Redecker and Punie (2017) write, educators are role models for the next generation. It is therefore vital for them to be equipped with the digital competence all citizens need to be able to actively participate in a digital society. The DigComp specifies these competences: it has become a widely accepted tool for measuring and certifying Digital Competence and has been used as a basis for teacher training and professional development across and beyond Europe. "As citizens, educators need to be equipped with these competences to participate in society, both personally and professionally. As role models, they need to be able to clearly demonstrate their digital competence to learners and to pass on their creative and critical use of digital technologies. However, educators are not just role models. They are first and foremost learning facilitators, or more plainly: teachers. As professionals dedicated to teaching, they need, in addition to the general digital competences for life and work, educator-specific digital competences to be able to effectively use digital technologies for teaching. The aim of the DigCompEdu framework is to capture and describe these educator-specific digital competences" (Redecker, Punie, 2017, pag 15).

The DigCompEdu framework distinguishes six different areas in which educators' Digital Competence is expressed with a total of 22 competences (Fig. 5).

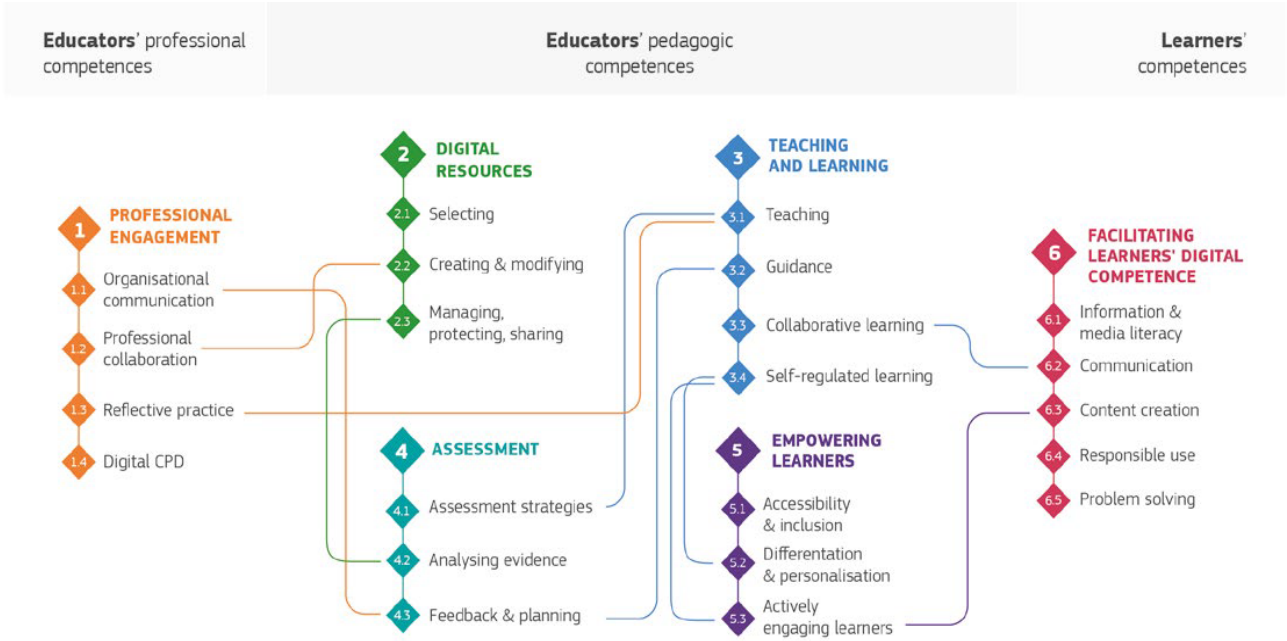

Figure 5: DigCompEdu competences and their connections. Source: Redecker, Punie, 2017

The DigCompEdu Framework aims to capture and describe these educator-specific digital competences by proposing 22 elementary competences organised in 6 areas and they focus on different aspects of educators' professional activities (Tab. 2):

Table 2: From DigCompEdu areas to educators' professional activities

DigCompEdu AREAS	Description	Educators' professional activities
Area 1 - Professional Engagement	directed at the broader professional environment, i.e. educators' use of digital technologies in professional interactions with colleagues, learners, parents and other interested parties, for their own individual professional development and for the collective good of the organisation.	using digital technologies for communication, collaboration and professional development.
Area 2 - Digital Resources	looks at the competences needed to effectively and responsibly use, create and share digital resources for learning.	sourcing, creating and sharing digital resources.
Area 3 - Assessment Teaching and Learning	dedicated to managing and orchestrating the use of digital technologies in teaching and learning.	managing and orchestrating the use of digital technologies in teaching and learning.
Area 4 - Assessment	addresses the use of digital strategies to enhance assessment.	using digital technologies and strategies to enhance assessment.
Area 5 - Empowering Learners	focuses on the potential of digital technologies for learner-centred teaching and learning strategies.	using digital technologies to enhance inclusion, personalisation and learners' active engagement.
Areas 6 - Facilitating Learners' Digital Competence	details the specific pedagogic competences required to facilitate students' digital competence. For each competence, a title and a short description are provided, which serve as the main point of reference	enabling learners to creatively and responsibly use digital technologies for information, communication, content creation, wellbeing and problem-solving.

The core of the DigCompEdu framework is defined by Areas 2-5. Together these areas explain educators' digital pedagogic competence, i.e. the digital competences educators need to foster efficient, inclusive and innovative teaching and learning strategies. Areas 1, 2 and 3 are anchored in the stages characteristic of any

teaching process, whether supported by technologies or not. The competences listed in these areas detail how to make efficient and innovative use of digital technologies when planning (Area 2), implementing (Area 3) and assessing (Area 4) teaching and learning. Area 5 acknowledges the potential of digital technologies for learner-centred teaching and learning strategies. This area is transversal to Areas 2, 3 and 4 in the sense that it contains a set of guiding principles relevant for and complementary to the competences specified in these areas.

"Both areas acknowledge that educators' digital competence goes beyond the concrete use of digital technologies within teaching and learning. Digitally competent educators must also consider the overall environment, in which teaching and learning encounters are embedded. Hence, it is part of educators' digital competence to enable learners to actively participate in life and work in a digital age. It is also part of their competence to reap the benefits of digital technologies for enhancing pedagogic practice and organisational strategies" (Redecker, Punie, 2017, pag 17).

Both the DigComp and the DigCompEdu represent a set of digital competences, which can offer a strategic source to understand in which direction to plan effective training courses for teachers on this in constant evolution subject, as well as self-analysis of training needs.

These frameworks have had the great merit of declining many digital competences and skills by grouping them into areas of reference, taking into account the increasing complexity of the use of ICT and the required mastery, not only from a purely technological point of view, but above all from a critical and responsible, coherent aimed at the proposed purposes use.

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[2] Emanuela , Ph.D., Research Fellow Università "Roma Tre", Collaborator of the CRES-IELPO Research Center

[3] DigComp can be used, reused and modified providing the original source is acknowledged. It is free of charge available at: EC.EUROPA.EU/JRC/EN/DIGCOMP. The three official DigComp Framework reports are the following:

- DigComp: A Framework for Developing and Understanding Digital Competence in Europe (2013) by Anusca Ferrari, Yves Punie and Barbara Brečko (Eds.). Available from: https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/digcomp-framework-developing-and-understanding-digital-competence-europe
- DigComp 2.0: The Digital Competence Framework for Citizens. Update Phase 1: The Conceptual Reference Model (2016), by Riina Vuorikari, Yves Punie, Stephanie Carretero, Lieve Van den Brande. Available from: https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/digcomp-20-digital-competence-framework-citizens-update-phase-1-conceptual-reference-model
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[4] As European Commission's science and knowledge service, the Joint Research Centre (JRC) supports EU policies with independent scientific evidence throughout the whole policy cycle. Its main objectives are to create, manage and make sense of knowledge and develop innovative tools and make them available to policy makers; to anticipate emerging issues that need to be addressed at EU level and understand policy environments; to collaborate with over a thousand organisations worldwide whose

scientists have access to many JRC facilities through various collaboration agreements. Its work has a direct impact on the lives of citizens by contributing with its research outcomes to a healthy and safe environment, secure energy supplies, sustainable mobility and consumer health and safety.

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[1] DigComp can be used, reused and modified providing the original source is acknowledged. It is free of charge available at: EC.EUROPA.EU/JRC/EN/DIGCOMP. The three official DigComp Framework reports are the following:

- DigComp: A Framework for Developing and Understanding Digital Competence in Europe (2013) by Anusca Ferrari, Yves Punie and Barbara Brečko (Eds.). Available from: https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/digcomp-framework-developing-and-understanding-digital-competence-europe
- DigComp 2.0: The Digital Competence Framework for Citizens. Update Phase 1: The Conceptual Reference Model (2016), by Riina Vuorikari, Yves Punie, Stephanie Carretero, Lieve Van den Brande. Available from: https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/digcomp-20-digital-competence-framework-citizens-update-phase-1-conceptual-reference-model
- DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use (2017), by Stephanie Carretero, Riina Vuorikari and Yves Punie. Available from: https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/digcomp-21-digital-competence-framework-citizens-eight-proficiency-levels-and-examples-use

[2] As the European Commission's science and knowledge service, the Joint Research Centre (JRC) supports EU policies with independent scientific evidence throughout the whole policy cycle. Its main objectives are to create, manage and make sense of knowledge and develop innovative tools and make them available to policy makers; to anticipate emerging issues that need to be addressed at EU level and understand policy environments; to collaborate with over a thousand organisations worldwide whose scientists have access to many JRC facilities through various collaboration agreements. Its work has a direct impact on the lives of

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citizens by contributing with its research outcomes to a healthy and safe environment, secure energy supplies, sustainable mobility and consumer health and safety.

2. Learning and teaching processes: national policies, digital skills and good practices at school in the XXI century[28]

Federica De Carlo [1]

Mario Pireddu [2]

Emanuela Proietti [3]

2.1 Introduction

The second action of the research activity aimed at reconstructing innovative training models, methods and tools for teachers in the digital age. It was realized on the bases of research methodological design, tools and outputs prepared by University Roma Tre team, in the first phase of the project.

National reports[29] had the goal to share significant information about national "translation in practice" process regarding the incorporation of ICT in scholastic systems and didactical practices.

They focused on national education policies, training models and successful methodologies to develop school staff (teachers, headmasters, administrators), digital, methodological and socio-relational skills requested by the digital era.

National reports explored the governance practices in order to understand:

- what innovative policies were implemented;
- significant experiences spread in the countries of the project (Italy, United Kingdom, Finland, Romania and Spain);
- classification of profiles and skills of educational professionals in the ICT field;
- best practices and educational successful methodologies, spread in the participating countries.

[28] The study is the result of a joint work, only for the award, it can be considered the following paragraph division: De Carlo § 2.5; Proietti §2.1, §2.2, §2.3; Pireddu, §2.4, §2.6.

[29] DECODE national research reports are available at: http://decode-net.eu/index.php/outputs/

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Through national reports "Innovative training models, methods and tools for teachers in the digital age", the research team tried to assess the current school needs, to identify the key digital opportunities and risks in a procedural and organizational perspective in the project countries.

To reach the objective, the national research presents:

- a new understanding of the national contexts: trends and policies activated at the national level in relation to the introduction of training models and successful methodologies to develop the school staff` digital competences;
- the national legal framework and the available funding programs;
- the framework of contractual rules and career perspective in relation to the educational digital challenges;
- the identification of local good practices.

The chapter provides a comparative analysis of the most significant results of national research, presenting them in terms of remarkable characteristics, common elements and notable differences.

The development of an innovative educational model requires taking into account a digital revolution, which involves the whole educational community at various levels: political, institutional, organisational, but also at a pedagogical level.

This chapter presents the emerging key elements of the national contexts and the main and the most relevant results of the national field research.

The first part offers a comparative analysis of the five national frameworks, with particular attention to: the national legislative framework for the adoption and the development of ICT in education (specific laws, decrees, acts, ministry orders etc.); institutional and organisational processes; the key institutional framework; financing programs supporting implementation of innovative didactic methods based on ICT; the contractual framework and career perspective for school leaders and professors, the professional profiles and competence, and the assessment and quality assurance systems; the main and most interesting experiences in the field of training teachers' digital skills

The second part presents the results of the research which try to explain how national education policies in the different countries can support the development of pedagogical and methodological innovation through ICT, thanks to programs aimed at developing and implementing digital tools and environments. Focus groups and interviews results highlight how nowadays the use of ICT technology is relevant and necessary, and thus the promotion of digital skills, but there are also nuances in how to define, focus and address this digital or technological competence; in how much digital challenges for national education systems mainly concern two different levels: the institutional level and the pedagogical one.

Results relating to opportunities in teacher training for the enhancement of digital skills are presented in the third part.

Transversally, main issues emerging from focus groups and interviews are presented.

Finally, a brief reflection about the most important results of the comparative analysis concludes the report. Results of this research action suggest that, at European level, the challenge is to adopt policies for lifelong and life wide learning that take into account the digital transformation of society as a whole.

The choice of the Participatory Action Research (PAR) methodology was connected to the main objectives of the research: to valorize and to share national policies and practices to develop innovative and more mature thinking about the meaning and the value of new technologies, of the digital culture. Goals cannot be only referred to improve the incorporation of ICT in teaching and educational practices and systems, but also to how to contribute to the formation of contemporary citizenship and of organisations.

Results tell us how, today, to innovate means knowing how to select digital devices, what and how to search, how to participate in communication virtual spaces and how to be aware of the civic dimension of the use of technology. So, practices are innovative when they amplify the possibilities and opportunities of learning for students, generating more enriched scenarios where students acquire a leading role. Students nowadays are generally considered to be digital natives, able to use technology effectively and easily; however, it is fundamental they learn how to become digital citizens. A digital citizen acts appropriately and ethically in an online environment; is able to resolve conflicts, source material ethically and interact with the wider world in a responsible manner. Strategic transversal competences become critical thinking, problem solving, effective communication, creativity skills, decision making.

Teacher training becomes a key element for the development of the educational system: if it is useful, appropriate, of high quality, it offers the concrete opportunity to go over differences in motivation, differences in knowledge, to develop the attitude to innovation.

2.2 The methodological approach: starting from stories and experiences

During the second phase of the research a qualitative approach has been used, through three main methods: desk analysis, focus groups and interviews.

The desk analysis has been carried out in order to reconstruct the political and the legal framework in the five countries, with particular attention to:

- national legislative frameworks for the adoption and the development of ICT in education;
- institutional and organisational processes;
- main institutional frameworks;
- financing programs supporting implementation of innovative didactic methods based on ICT;
- contractual frameworks and career perspective for school leaders and professors, the professional profiles and competence, and the assessment and quality assurance systems;
- some interesting experiences in the field of training teachers' digital skills, as well as the main and most interesting pedagogical adopted models in teachers' digital skills.

Information were obtained from: specific laws, decrees, acts and ministry orders; official national agencies websites and national research reports.

The choice of the Participatory Action Research (PAR) revealed itself appropriate.

This approach involves researchers and participants working together to understand problematic situations - in research objectives, that translation in practice (Latour, 1999) of European and national policy frameworks in different countries realty and characteristics of the settling of digital innovation in didactical practices, that take part in the construction of an "organizational texture" (Mezirow, 2016) - and change them for the better.

The researcher finds himself/herself immersed in a process of "doing work with", characterized by a common processing of knowledge (Barbier, 2007, pag. 8); for this reason action research remains the only way to conduct research, to produce knowledge, "with people and not people", (Barbier, 2007, p. 10).

PAR uses a range of different methods, both qualitative and quantitative: among them focus groups (Morgan, Kruger, 1993) and interviews (Bichi, 2007) are two extraordinary methods to listen by privileged witnesses' experiences and reflections and to elaborate, as said, with them, research pathways.

Due to the highlighted features – very briefly mentioned – of this approach and methods, it was felt that they were the most suitable to allow researchers to analyze the different issues implicated and to reflect on them with the panel of key actors. These methods allowed consulting with those in school who work every day, occupying different professional positions. They offered the opportunity to gather elements of the scenario, strengths - connected to the many successful experiences heard - and critical areas, with respect to both the organizational and educational dimensions.

Focus groups and interviews were organised, across a three month period (from March to May 2017), to reach a panel of key actors (policy makers, decision makers, institutional representatives, headmasters, school leaders). 133 key actors were met during the focus groups and 25 were interviewed[30].

The method of focus group is a particularly effective tool to analyze the needs of a context, an organization or an institution; to activate participatory processes; to facilitate learning processes and to assess the impact of a service or a project. The idea behind the design of this system is to allow the protagonists to develop, within

[30] Research activities realized in the five countries are:

England: 2 focus groups with school ICT staff and teachers (25 people); 5 interviews with school leaders with focus on digital leads;

Finland: 3 focus groups with head masters, ICT tutors, members of digital team, head of departments (20 people); 5 interviews with institutional key actors;

Italy: 4 focus groups with headmasters and "animatori digitali" (40 people); 5 interviews with institutional key actors;

Romania: 3 focus groups with head masters and ICT school leaders (24 people); 5 interviews with decision makers, school county inspectors;

Spain (Catalogna): 1 focus groups with ICT experts, school teachers, TAC coordinators, mainly of the autonomous community of Catalonia (24 people); 5 interviews with experts in the education ICT policy area.

the Focus space, a change, an update of the indications and conditions that can give effective answers to the research questions (Chiu, 2003; Morgan, 1997; Zammuner, 2003).

The general objective was to evaluate the steps taken for the integration of ICT in the education system and teaching practices.

Participants of the Focus Groups were chosen based on their profile as headmasters, school directors or managers, ICT experts with extensive professional experience in the ICT and education sector; with the aim of detecting best practice, accompanying needs and coordination for the integration of ICT in teaching practices.

Focus groups were about the integration of ICT and the competences linked to this integration.

Starting from a shared concept of digital competence - as a set of knowledge, skills and attitudes (thus including abilities, strategies, values and awareness) that are required when using ICT and digital media (Ferrari, 2012)[31] - participants discussed the following topics:

- the idea of school innovation and innovative practices;
- opinions about how digital revolution can modify learning and school practices/activities;
- the relationship between competences and best/effective practices;
- experiences on professional development on the integration of ICT in school practices;
- opinions about national policies for education to develop teaching and methodological innovation through ICT.

With some differences between countries, focus groups have shown similar problems and opportunities as far as innovation and change in education systems are concerned.

Interviews with key actors aimed to reconstruct the institutional process regarding the challenges that ICT puts into the school system.

The interview interrogation scheme has two key functions, not mutually exclusive: the first of conceptual framework of the final interpretative model; the other of interrogation device, related to the construction of concepts. This second function characterizes the interview as a complex of explicit interrogation acts, direct but not definitional, or as memory for the conduction (Bichi, 2007). This method allows the construction of information, accessing the world of the interlocutors involved, both linguistically and physically, through access to people's words, creating a contact with them and their history. The objective of the interview is to capture his mental categories, his interpretations, his perceptions and his feelings, the reasons for his actions (Corbetta, 2003).

[31] The set of knowledge, skills and attitudes are required to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socialising, consuming, and empowerment (Ferrari, 2012).

Semi-structured interviews were conducted using a template[32].

Topics addressed during the interview focus around seven central issues:

- most important challenges faced by the national education system;
- the theme of competences to teach in the digital age;
- the presence of good practices;
- education policies and areas of major investment;
- ICT European guidelines;
- most important problems encountered in digital development processes at school;
- most important changes detected.

Participants were involved by Project's Partners thanks to a communication campaign on some social networks (Facebook, LinkedIn), formal invitations sent to partners mailing lists of schools, headmasters and teachers.

The main results of this action were identified as starting points of the research pathway.

2.3 National policies and practices on ICT in Education: an overview

The national policies framework of ICT in education, in every country involved in the DECODE project, is polyhedric and much more different for national culture, that produces different kind of school's educational programs, training experiences and projects.

From the Finnish paradox – that has not a specific law about ICT learning, but the most interesting use of digital opportunity in their school – to the Romanian difficulty with having digital competencies as it results in the Digital Economy and Society Index 2017[33]: last one in EU. In the midst of these, there are some countries: the United Kingdom (England and Wales specified most in report), Spain (and Catalonia) and Italy (25th position).

[32] The template is available in the Report "Template for national research and tool" at: http://decode-net.eu/index.php/outputs/

[33] The Digital Economy and Society Index (DESI) is a composite index that summarises relevant indicators on Europe's digital performance and tracks the evolution of EU member states in digital competitiveness. Its five dimensions are:

- Connectivity - Broadband market developments in the EU;
- Human Capital - Digital Inclusion and Skills;
- Use of Internet Services;
- Integration of Digital Technology;
- Digital Public Services.

Further information are available on the European Commission's website at: https://ec.europa.eu/digital-single-market/en/desi

Over the past year, all EU countries improved their digital performance. In DESI 2019, Finland, Sweden, the Netherlands and Denmark scored the highest ratings and are among the global leaders in digitalisation. These countries are followed by the United Kingdom, Luxembourg, Ireland, Estonia, and Belgium. Spain is at the 11th place, Italy is stable at the 25th and Romania is today at the 28th place.

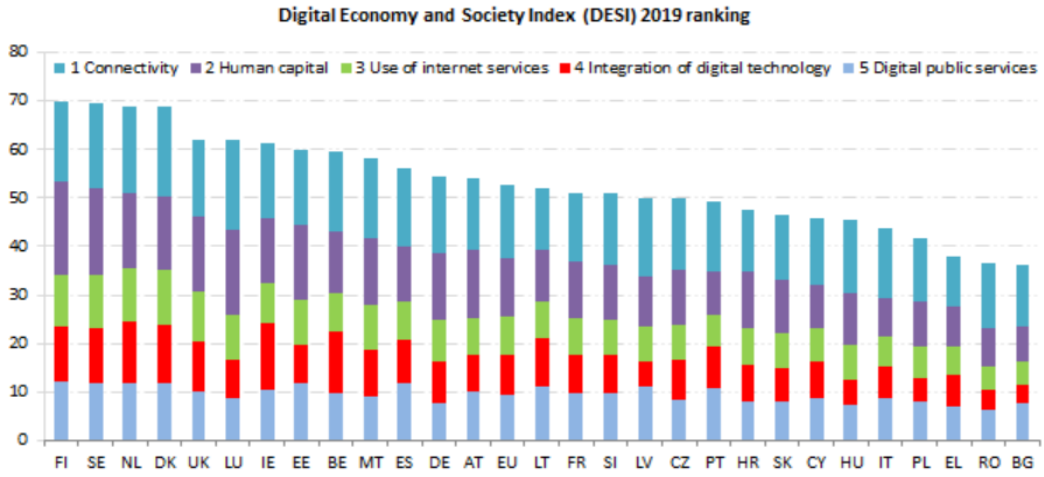

Figure 6: Digital Economy and Society Index (DESI) 2019 ranking. Source: https://ec.europa.eu/digital-single-market/en/desi

2.3.1 National legislative frameworks for ICT integration in education

In 2011, the Eurydice Report, "Key Data on Learning and Innovation through ICT at school in Europe"(Eurydice, 2011), recommended the promotion of innovative pedagogical approaches and teaching methods, to enable students to learn in appropriate ways: starting from research results, it is possible to see how country responses to this are different[34].

In Finland, there are no policy provisions on ICT in school education, but a major reform to improve mathematical and programming skills, even in lower grades of their schooling path. Compulsory school starts at 7 years. Each subject at school uses a variety of learning methods, giving the pupils a chance to learn different skills. The Government launched an action plan to revamp comprehensive schools in autumn 2016. "It serves to put the new curricula in practice and responds effectively to existing and imminent challenges in comprehensive school education. As outlined in the Government Programme, EUR 90 million will be used over three years to execute the plan. Of these resources, around EUR 8 million was made available in autumn 2016 through the Finnish National Board of Education for activities relating to experimenting, development and innovation, and roughly EUR 7.5 million will be disbursed for training and activities for tutor teachers" (National Board of Education, 2016, pag.2).

[34] More detailed information are available in the single national research reports, at the DECODE PROJECT website: https://decode-net.eu/

In the United Kingdom, there is no formal legislation. Instead, the Government's approach has been to hand responsibility to individual institutions to develop their own approaches and strategies towards the use of ICT in the classroom. Institutions/practices, which work particularly well, are monitored by the government, who then circulate and promote best practice examples. The Joint Information Systems Committee (JISC)[35] - sponsored within the Further Education Learning Technology Action Group (FELTAG)[36] report - gave impetus to ideas and developments around online and digital teaching. With no government support on actively pursuing a digital strategy, funding for these staff costs needs to be found from within existing budgets of singular schools.

In Italy, the introduction of ICT in school education starts with the National Plan for Information Technology (in Italian: PNI - Piano nazionale di Informatica), 1986/1987, which enriches the teaching of mathematics and physics with the use of IT tools. The experiment came to an end during the reordering of the school system following the 2010 decrees, known as Gelmini Reform (Education Minister, in that period), which gathers together all the legislative acts issued by the Berlusconi government to redesign the entire education sector in Italy.

In 1997, the introduction of school autonomy represents a restart for improvement of ICT in primary and secondary school. The beginning of this experiment coincided with a two-year Teacher Training Plan, initially only involving the two disciplines concerned and then extended to letters and languages.

From 1997 to 2000, the National Plan of Didactic Technologies (in Italian: PNSD - Piano Nazionale Scuola Digitale) was held, the most important initiative that for the first time introduces computer science and telematics in all classes and grades of the school and training for all teachers. It had three main objectives: education of students in multimedia and communication; improving the effectiveness of teaching and learning of the disciplines; improving the professionalism of teachers. It was the first great moment of transformation of the educational socio-material space (Orlikowski, 2007; Landri & Viteritti 2010): it aimed at redefining the setting of the encounter between "human and non-human actors" (Callon 1975; 1984; Latour 1987; 1999) by digital equipment provided to school. Guidelines, for the "translation in practice" of the PNTD 1997/2000, provide for the allocation of funds for the implementation of some pilot projects, engaging a limited number of schools.

The ForTic Plan (National Information and Communication Technologies Teacher Training Plan) is an important broader scope project which was launched at the end of 2002 and involved about 180,000 teachers, supported by approximately 8500 tutors. It aimed at intercepting and involving, at various levels of the

[35] It is a membership organisation, providing digital solutions for UK education and research. Further information are available at: https://www.jisc.ac.uk/

[36] The Further Education Learning Technology Action Group (FELTAG) was set up in January 2013 by Matthew Hancock, Minister of State for Skills and Enterprise in BIS, as a sector group to make practical recommendations aimed at ensuring the effective use of digital technology in learning, teaching and assessment in Further Education and Skills. Further information are available at: http://feltag.org.uk/

institutional system, allies and partners to be activated in the territories as promoters and catalysts of the expected process of change.

The 2002/2003 school year is to be considered the birth of the first online environment for systematically training teachers, called PUNTOEDU platform, an e-learning platform managed by INDIRE (National Institute of Documentation and Educational Research) for the implementation of compulsory training courses for the newly-to be trained teachers.

However, first attempts to introduce ICT in compulsory school was inaugurated into the Italian education system by Law 59/1997 - Art. 21[37], and it has been developing since then up to today with many experimental projects that involved thousands of schools patchy in the country. Projects with fewer recipients and less transformative capabilities were established, beginning with the idea that innovating a limited number of institutions in depth would then pave the way to cover the entire system, something which has not yet happened. Before the new National Digital School Plan, fundamental pillar of Law 107/2015, numerous additional initiatives were promoted[38] to activate and distribute germs of change in the territory.

Last significant school reform was introduced by Law 107/15[39] which starts a new PNTD with a specific allocation for 2015-2020 period. It represents a pillar of the Law, which proposes an operational vision: it places at the centre the innovation of the scholastic system and opportunities of digital education.

In Spain, at a general level, the inclusion of educational policies for the integration of ICT into the education system has been progressive. In reference to specific laws, decrees and acts, references in the "translation in practice" (Latour, 1999) of ICT integration in education can be found in successive Spanish laws. In this sense, this implementation finds space in the last three educational reforms. The LOGSE - Ley de Ordenación General del Sistema Educativo español (Law of General Management of the Spanish Educational System)[40]: an Organic Law adopted in 1990, in which there is no direct mention of the implementation of ICT in school, a concept popularised in the mid-1990s (Grau, 2013), but in which the concept of knowledge society was introduced. The LOE: Ley Orgánica de Educación (Organic Law of Education)[41]. An Organic Law adopted in

[37] LEGGE 15 marzo 1997, n. 59. Delega al Governo per il conferimento di funzioni e compiti alle regioni ed enti locali, per la riforma della pubblica amministrazione e per la semplificazione amministrativa. (GU Serie Generale n.63 del 17-03-1997 - Suppl. Ordinario n. 56). Entrata in vigore della legge: 1-4-1997. https://www.gazzettaufficiale.it/atto/stampa/serie_generale/originario

[38] MIUR provided on these initiatives a concise and effective report: "Action for Innovation in Teaching and ICT Prior to the PNSD", Report, MIUR Directorate General for Statistics Studies and Information Systems http://www.istruzione.it/scuola_digitale/allegati/2014_archivio/home03_140601_Piano%20Nazionale%20Scuola%20Digitale.pdf

[39] LEGGE 13 luglio 2015, n. 107. Riforma del sistema nazionale di istruzione e formazione e delega per il riordino delle disposizioni legislative vigenti. (15G00122) (GU Serie Generale n.162 del 15-07-2015). https://www.gazzettaufficiale.it/eli/id/2015/07/15/15G00122/sg

[40] https://www.boe.es/buscar/doc.php?id=BOE-A-1990-24172

[41] https://www.google.it/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&ved=2ahUKEwi2h4q0hpnkAhUIJVAKHRM8BMoQFjADegQIDRAC&url=https%3A%2F%2Fwww.boe.es%2Fbuscar%2Fpdf%2F2006%2FBOE-A-2006-7899-consolidado.pdf&usg=AOvVaw3gCKTfMvnlt1xa28Y_x6Gi

2006, in which references to ICT are increased: the use of ICT are promoted from early childhood education to post-compulsory education and are contemplated in the economic resources for the improvement of the learning and support to the teaching staff. The LOMCE: Ley orgánica para la mejora de la calidad educativa (Organic Law for the Improvement of Educational Quality). Approved in 2013, for the improvement of educational quality. ICT - one of the axis of the modernization of the education - are addressed in a more precise and concrete way, and are considered one of the areas most related to the transformation of the education system. Catalonia approve similar law in 2009, with the LEC (Llei d'Educació de Catalunya, in english: Education Law of Catalonia) and "rearranged" by Government of Catalonia in 2013.

In Spain, two frames of reference - the "Common Digital Competence Framework For Teachers"[42] (2012) and the Project of Digital Teaching Competence in Catalonia (2014) - emphasize the Digital Competences of teachers and their implementation in educational practice. During the last years, the figure of the ICT coordinator has appeared for the implementation and the correct use of digital technologies in education centres. In the different autonomous communities, the figure is considered differently. The central and regional governments define competences and skills that students must goal in primary and secondary schools. In Catalonia, the TAC Plan runs as a vector for introducing ICT in education and an assessment on implementation.

In Romania, the Ministry of Education launched in 2001 the national program Digital Education System, which lasted for 10 years. In 2011, a new National Education, the Law 1/2011, is issued (which states that the national pre-university curriculum pursues the development of the key competencies, including digital competence as defined by the European Framework of Key Competencies of the European Commission). Funds and goals are determined in the National Strategy on the Digital Agenda for Romania 2020, approved in 2014. According to the Order of the Ministry of Education for approving the curricular framework (OMENCS 3590/5.04.2016)[43] in the lower secondary school, starting with the 2017-2018 school year, a new subject was introduced regarding Programming and ICT, with 1 hour per week during the entire cycle.

In some of the countries examined, the legislative frameworks to support the integration of ICT in education have been more numerous and hefty: this is the case of Italy, Spain and Romania. In Finland and in the United Kingdom, national governments are less directly involved. In Finland, however, a National Plan was promoted and important funds dedicated to this goal. In the United Kingdom, on the other hand, the Government's approach has been to hand to responsibility for individual institutions to develop their own approaches and strategies; mentioned research centers give impetus to ideas and developments around online and digital teaching.

[42] It is part of the "Digital Culture Plan in Schools", whose set of projects are the result of a process of shared reflection that the Spanish Ministry of Education, Culture and Sport opened with the active participation of the Autonomous Communities and the constitution of a Conference in which external experts also take part. More detailed information are available at: https://intef.es/Noticias/common-digital-competence-framework-for-teachers/

[43] Available at: https://lege5.ro/Gratuit/gezdcmrugy2q/ordinul-nr-3590-2016-privind-aprobarea-planurilor-cadru-de-invatamant-pentru-invatamantul-gimnazial

In Spain, there is a considerable state of economic investment by the Government, with the Program Escuela 2.0 (School 2.0 Program), between 2009 and 2012; initiative included in the so-called E-Plan, which aimed at reactivating the Spanish economy, with a budget of 200 million euros financed between the central government and the Autonomous Communities (Alonso Cano et al., 2014).

The main actors of the process are schools and teachers. In the United Kingdom, schools must also find the funds to promote projects in this area; the Government, who then circulate and promote best practices, however, monitors institutions, which work particularly well.

In Finland, strong processes of personalization and individualization of teaching, with extensive use of ICT, witness the fundamental role of teachers.

In Italy, the numerous and substantial legislative interventions assume greater importance, which, over the years have indicated strategies, allocated funds, promoted many training activities for teachers.

In Romania, in 2001, the Ministry of Education launched the national program Digital Education System, which lasted for 10 years. Then, in 2011, in new National Education, the Law 1/2011, was issued. Funds and goals are determined in the National Strategy for the Digital Agenda for Romania 2020, approved in 2014. So a broad strategy that has looked far ahead.

The adoption of complex legislative frameworks is not in itself a guarantee of strong ICT integration processes in education; the disbursement of funds is certainly fundamental, but also in this case, if the basis of their use is not contextualised in a clear strategy, they give life to excellent projects, but patchy. Systemization is not guarantee.

2.3.2 Financing projects supporting innovative didactic approaches based on ICT

In Italy, by Ministerial Decree 851 of the 27th October 2015, the new National Digital School Plan (in italian: PNSD - Piano Nazionale Scuola Digitale) was launched, which provides over one billion euros of investment for the period 2015/2020. The overall challenge of the project, articulated in 35 operations, is of a cultural nature. The initiative is not complete and conclusions will soon be drawn and judgements made. A lack of governance by central administration discourages assessment during the course of the work.

In Finland, a Government programme provides 90 million euros to execute a three year plan. Of these resources, around 8 million euros were made available in autumn 2016 through the Finnish National Board of Education for activities relating to experimenting, development and innovation, and roughly 7.5 million euros will be disbursed for training and activities for tutoring teachers.

In Romania, funds for innovation come either from specific programs of international organizations (i.e. World Bank) as well as from specific contributions of companies (i.e. Orange, a telecom company).

Funds (Fs) / Legislative framework for ICT (LF)	**UK**		**Italy**		**Finland**		**Romania**		**Spain**	
	Fs	LF	Fs	LF	Fs	LF	Fs	LF	Fs	LF

European	X		X		X		X		X	
State			X	X	X		X	X	X	X
Regional or local									X	X
International institution							X			
Private	X						X			

Table 3: Financing projects and legislative frameworks supporting innovative didactic approaches based on ICT

In Spain, during the last decade of the XX and the first decade of the XXI, regional educational policies to integrate ICT in schools were raised and implemented without there being shared objectives or actions between regional governments; these were policies that followed European directives, but were partly funded by the European Union. Also, a drive for resources and guidelines for ICT learning, in Spain, is the National Program of Information and Communication Technologies (in spanish: PNTIC - Programa Nacional de Tecnologías de la Información y la Comunicación).

In the United Kingdom, as specified, there are no public funds for the adoption of ICT in schools.

2.3.3 Key figures, institutions and organisational processes

As previously mentioned, there are some differences in the organization of education among the countries of the DECODE Project. For example, Finland and the United Kingdom do not have a centralised system of skill's growth in ICT among teachers and all is delegated to a singular school budget and/or to the parents contribution (especially in the United Kingdom) or joint municipal boards (in Finland). In Italy, the Guidelines for the implementation of the PNTD 1997/2000 provide, in addition to the financing of general projects for the allocation of funds for the implementation of more than 11 pilot projects, engaging a limited number of schools, to have organizational methods and particular solutions and types of specific verification, starting with a series of ongoing or concomitant activation.

In Spain and Catalonia, the local and general Government introduces and implements ICT in the classroom through the definition of basic digital competences (LOMCE 2013), specific for primary and secondary compulsory school.

In Romania, the National Education Law defines the training profile of the graduate of compulsory education and explicitly target the development of digital skills. Furthermore, the Ministry of Education encourages schools and educational institutions to promote educational projects and partnerships with different companies.

Furthermore, in Finland, a national agency is responsible for the implementation of the policy aims. The Ministry of Education and Culture has competence on education policy, preparation of legislation and state funding; while competences of the Finnish National Agency for Education are: national development agency,

national core curricula & qualification requirements, support for evidence-based policy-making, services for learners.

Then, in the United Kingdom, the Department of Education is supported by 17 agencies and public bodies, including[44]:

- Ofsted: a non-ministerial department of the UK Government, with the responsibility for inspecting educational institutions in the United Kingdom;
- Ofqual: the Office of Qualifications and Examinations Regulation which deals with examinations, qualifications and assessment in the United Kingdom;
- Education and Skills Funding Agency: it deals with funding for education and training for children, young people and adults;
- Standards and Testing Agency: it sets the tests to assess children in education from early years to the end of Key Stage 2 (age 11);
- Higher Education Funding Council for England: this organisation is responsible for the distribution of funding to universities and colleges of Further Education in England (within the United Kingdom).

The Department has responsibility for primary, secondary and further education but, at the local level, the Local Education Authorities (LEAs) are responsible for setting in place educational policies. This is similar to Finland, in which local administration is the responsibility of local authorities.

The Italian key institutional figures framework is focus on training courses in order to encourage the use of ICT in the classroom: operative program of training is ForTic Plan (National Information and Communication Technologies Teacher Training Plan, 2002), the broader scope project launched at the end of 2002. ICT's training is often considered a collateral step than a core business of teachers preparation.

As for other aspects of school life, the contractual frameworks of the analyzed countries present many differences.

In Finland and Italy the Labor Unions have a specific role in definitions of work conditions in respective countries, the professional profile of the Italian teacher - for example - is described in the National Labour Contract for Teaching Staff and Constitutional Charts guarantee their duty.

In Italy, the Law 107/2015 states that the school leader can identify, within the scope of self-employment, up to 10% of teachers who support Headmaster in organizational and educational support activities of the school institution, as well as other teachers who will receive assignments from the school manager.

In Italy, access to the teaching profession in the school takes place through three rankings: merit rankings of public competitive examinations for qualified candidates (for permanent contracts); rankings to exhaustion (for

[44] https://www.gov.uk/government/organisations

open-ended contracts and for annual substitutions and up to the end of educational activities); institutional rankings (for short substitutions). The access to the competitive examinations it is possible only through teaching qualification (Master's degree is necessary to attend any school level and field of teaching). Law 208/2015 establishes the procedure for the recruitment of headmasters: a selective training course, announced by the Ministry of Education, after consulting the Ministry of Economy and Finance.

In Finland, class teachers have a Master's degree in education. Subject teachers have completed a Master's degree in the subject they teach as well as pedagogical studies. Teachers are required to participate in in-service training every year as part of their agreement on salaries and the teaching career is highly valued, selection is hard: 10% of applicants become a class teacher and between 10 and 50% subject teacher (depending by field).

In the United Kingdom there are differences in salary between different types of schools. In England and Wales, with a degree, it is possible to train through a postgraduate teacher training course. There are two main routes to take this achievement: school-led and university-led. Both provide practical skills and theoretical knowledge needed for teaching but are delivered differently. For those who have not a degree, they can qualify by taking a Higher Education course that awards qualified teacher status (QTS).

In Romania, the teacher training system includes initial and continuous pathways. Initial teacher training is done through either the Departments for teacher training from each university organizing the pedagogical module. The curriculum of the module includes six-semester courses, one of them being Computer-Assisted Instruction. Due to the university autonomy, there is no clear or uniform structure of the module, respectively, of the Computer Assisted Instruction course. The main topics covered on this course could include: the potential of ICT for learning approaches to ICT based learning, ICT based education tools and methods or through the Didactical Master programme.

Continuous teacher training runs through the Teacher Training County Centres. According to the official provisions each teacher is obliged to acquire a minimum number of 90 professional development credits within a period of five years. Failing to do this can hinder teachers the possibility of promotion, professional stimulants etc.

Concerning assessment and development of quality assurance systems, national practices are quite different.

In Italy, the Law 107/2015 introduces the valorisation of the profession, entrusting the School Manager with the choice of professors to be rewarded with a bonus on the basis of three dimensions to be rejected in criteria by a three-year evaluation committee, consisting of the chairman, who presides over it, three faculty members, two of whom are chosen by the college one by the board of directors, two parents or one student and one parent chosen by the board of directors, an external member identified by the Regional Scholastic Office (in Italian: USR - Ufficio Scolastico Regionale) among teachers, executives and inspectors. A budget for the merit of 200 millions of Euro was designated in 2016.

In Finland, the key to the evaluation of quality is self-evaluation. School inspections were abolished in the early 1990s and the education providers receive their own results to be used only for development purposes.

In the United Kingdom, checking quality in teaching and especially in ICT confidence is lead directly by single schools and ICT coordinators for digital competencies. At the start of every year, all staff were surveyed on their confidence in using ICT within the classroom. The goal of this survey is having 90a +% of staff responded that they now have good skills for using technology in education delivery.

In Romania, there are not currently any specific regulations for the Assessment and Quality Assurance of integration of ICT in Education. Within each school, there function several committees, one of the most important being the Quality Assurance and Evaluation Committee.

2.3.4 The results of the field research. The "translation in practice" of current national policies for ICT and innovating education in school practices

Interviews results

In Finland, on the local level, European processes are not well known. The objectives should meet on paper at least in the curricula. There are no national criteria, anyhow, for the digital competence of citizens or of teachers. Usually, EU recommendations are followed quite punctually, but in education, the situation is a bit different. For example, Finland joined the European Qualifications Framework (EQF) system only recently, in 2017[45].

In Romania, both policymakers and decision-makers from national and local institutions as well as school directors and coordinators working on ICT integration agree that the current national policies are in line with the European recommendations. The interviewees were aware of EU recommendations on the topic of key competencies (European Framework on Key Competencies for Lifelong Learning). The term opportunity, in accordance with European recommendations, to develop teacher competences in ICT, implies:

- adaptability to modern techniques;
- concern for learning and continuing professional performance;
- communicating on the principle of *knowledge*, *knowledge to do* and *knowledge to do with others*;
- be able to creatively use the scientific content at the class and boost creativity among students;
- has correct scientific knowledge;
- being able to teach the children to learn in the team;
- being able to make students learn and participate with pleasure in school activities;
- knowing how to handle the information;
- being able to communicate in a digital format;
- being able to create educational content in a digital format;
- managing the administrative system in digital content;
- managing systems on educational content;
- using digital equipment in education;
- observing the ethical and legal norms imposed by digital deontology.

[45] More detailed information are available at: https://www.cedefop.europa.eu/en/publications-and-resources/country-reports/finland-european-inventory-nqf-2018. FINLAND European inventory on NQF 2018.

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Policies related to the Digital Agenda, in Italy are in line with European programs. Among the most important intervention lines, which are also of interest to the school, are the National Broadband Plan and the Digital Growth Plan, which are two synergic strategies for pursuing the goals of the European Digital Agenda 2020. Another important objective, which the Italian PA is investing in, is in line with the European dictum: it refers to the definition of a framework of digital skills for orienting systems.

Focus groups results

Results of the national research highlights some "limitations" and some "requirements" in the design and "translation in practice" (Latour, 1999) of the national policies for ICT and innovating education in the partner countries.

Lack of national framework

In Romania, although the national legislative framework for the adoption and the development of ICT in education fulfills the necessary supporting role by acknowledging, affirming and encouraging the integration of digital skills, it still requires further improvement in certain respects and coverage of gaps. A focus on monitoring of the sustainability of various initiatives should be a priority.

Nonetheless, the lack of a national framework also acts as an opportunity in those schools and colleges where digital teaching and skills have been embraced. Rather than having to follow generic national policy or expectations, individual institutions are given the freedom to address the specific needs of their learners in an innovative way.

In the United Kingdom, this has led to a number of effective solutions being developed which are both cost and time-efficient. These innovative practices are beginning to spread from institution to institution organically, as each share their learning points and best practices. This greater collaboration (in particular throughout the growth of academy chains) offers a potential solution to the patchy adoption of digital technologies within schools, also from an economic point of view (whilst the costs involved in buying in specialist equipment, employing specialist staff, developing specific training etc. may be too great for individual schools to afford on their own, institutions which are part of academy chains (or equivalent associations) are able to pool resources and so share the investment burden).

Lack of clear educational policies

Policies too broadly focused on certain specific lines (such as the impulse to the integration of mobile technologies in "Mobile learning") (i.e., in Spain).

The need for a modern Education Law emerges - consensuated by the whole parliamentary arch, that necessarily contemplates the implementation of technology as a transversal tool throughout the educational process. Actions, initiatives or educational policies must be thought out setting medium and long term scenario, posing a process of continuous revision (Spain).

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The proposal for reaching an educational policy of excellence emerges. It has to take into account the voice of the protagonists, the key actors of the system: teachers, students, families and other social agents involved in the day to day of education. A country that is progressing is a country in which ICT is part of all walks of life, including politics and education. It is important to encourage good practices, not necessarily in an economic way, and encourage professional exchanges (Spain).

Lack of national coordination

A lack of national coordination can represent weakness and also an opportunity. A lack of coordination and policy on a national level means that it is left to individual schools to decide the level of digitalisation they adopt. Therefore, the uptake and integration of digital learning are reliant on the commitment and vision of individual school leaders. Furthermore, even when school leaders want to introduce digital tools, the lack of national promotion and support can limit their abilities to do this (United Kingdom).

Lack of investments

All national researches underline that the development of digital tools and skills needs an important investment of money and time.

The educational policies have suffered the economic cuts applied in Spanish and Catalan territory: these cuts and the lack of funding by the governments in the 1x1 programs, have paralyzed or provoked an irregular activity of the educational policies with ICT (Spain).

Lack of time

As well as cost, the development of digital tools and skills needs an investment of time. However, this is not always possible as staff have several other competing tasks and responsibilities to balance. Therefore, they sacrifice spending time on improving their own digital skills, resources used in their teaching etc. in favour of other tasks. Without any overriding national requirements or policy to compel staff to focus on digital teaching and skills, there is no incentive to prioritize this over other tasks (United Kingdom).

Lack of a firm commitment to turn technology into an ally of the new educational model

Erratic process, which has been improvised without having an integrated project, in which ICT forms part as transversal support throughout the teaching/learning process. Until recently, the focus was mainly on the availability of technology, mainly devices, in the classroom. Recently the focus has been on devices and has increased in other aspects, such as connectivity, teacher training, availability of digital educational resources, and finally the teaching/learning digital transformation of the educational centre (Spain).

Also, in Finland, among the interviewees the biggest problem seemed to be the lack of a national vision and strategy concerning the development of ICT competence. Curricula are good, but they are quite general and broad-based. Principles and education providers have a lot of power to specify them and teachers have pedagogical freedom in the classrooms, so the changes are often fragmented and personalized. The state level works as stated in the government program and the ministry of education is not aware of the everyday

life of the schools. The Finnish National Agency of Education point of view is often that when the guideline has been signed the matter is finished and should somehow be in force immediately, but of course, the implementation of the fine decisions takes some time and effort in the local level.

Lack of teacher training, adapted to new learning models

The main limitation is the formal structure and a totally outdated teacher promotion system that rewards seniority. Deep digital literacy is required to acquire a digital teacher composition, both instrumental and pedagogical. Working with ICT to do the same that is done with ICT is expensive, incongruent, inefficient and tires the teachers. There is a shared idea that there is a lack of a consistent and regular national or regional plan for forming ICT experts (Spain).

In Finland, there are investments in machinery, but not to in-service training. So far the digital competence in the schools has been based on the personal activity of some teachers. Many times attempts to develop the competence of the teachers has mainly consisted of putting pressure on or even bully teachers, which is wrong.

Also, to minimize discrepancies between schools in terms of human, financial and development resources and opportunities, free educational resources – training courses, platforms, educational software - must be provided periodically on a timely basis to teachers, because the work of selecting and purchasing them involves research work and funds which are not at hand for every school (Romania).

The requirement to build networks and "to make system"

In Italy, field results point out the most important challenge nowadays is the ability "to make system": build networks, so as to coordinate and promote mutually beneficial systems. Today the most important functions of public institutions involved in the digital innovation processes are: the design of system actions; the revision of administrative logic capable of overcoming sectoral perspectives; the definition of the necessary digital framework to which the evaluation topic and the related certifications are to be followed; the promotion of a diffused digital identity/culture capable of expressing a conscious and responsible citizenship. Talking about designing system actions means that public institutions are able to define and to implement addressing and coordinating actions which are capable of creating territorial and transversal synergies, so as not to disperse human, professional and economic resources in the field.

A stronger vision and criteria for the development of ICT in education would facilitate better cooperation. Dialogue between different actors should be increased and build an ecosystem of co-ordinated networks to ensure a minimum level of competences. In Finland, a good example is the network model that the National Agency of Education created in a very short time for the training of immigrants.

The requirement to involve the public administration

The challenge overlaps the educational policy system to invest the whole public administration. Reviewing the administrative logic with regard to the idea of accompanying means overcoming a typically bureaucratic vision based on a policy and sector policy intervention that concludes with the promulgation of the law to understand

the strategic importance of accompanying actions and technical assistance for the practical translation of the norm. This means re-orienting the public administration model, to be able to overcome the stiff division of departments and territories to foster integrated, multi-level, multi-dimensional policies. This is a radical innovation which invests the way in which programming is planned, with the aim of building alliances with other actors who, in different respects, co-operate on the same goal as the territories, to converge on common goals and priorities. This problem concerns the way of conceiving and writing the calls: the writing of the calls never allows for the provision of accompanying functions and actions; while innovation develops within fertile and reciprocal cultural spaces, it is very important to find the right ways to "cultivate practice communities" (Italy).

The requirement to recognize the value of the capital which students possess

In addition, institutions are recognising the capital, which students possess when it comes to digital skills. They often are far more digitally competent than staff, whilst they are also usually far more aware of the latest developments and trends in terms of apps, devices, etc. Thus, some schools are beginning to successfully harness this knowledge as part of their digital strategies (this includes involving digital student councils in decisions on technology procurement, as well as appointing particularly knowledgeable students as digital leaders, to help both staff and their fellow students understand how to make the most of the technology available to them) (United Kingdom).

But, on the other hand - as the Finnish field research highlights - it is an illusion that pupils could teach teachers. Innovative principals and teachers have developed learning environments a lot, but a firm connection between innovators and other employees is needed. Teachers education, more effective in-service training, and especially updating training of the older teachers, still need investment.

The requirement to improve accessibility and reliability of the ICT tools

There is still a need to upgrade the capacity of the data transfer networks and to improve accessibility and reliability of the ICT tools. If teachers are supposed to use ICT fluently in education, they should have personal laptops or tablets paid by the employer. Then teachers could play - and learn - with the machines at free time, too. Large contracts demanded by education providers limit the use of open software and can make urge for development awkward and controversial (Finland).

2.3.5 National practices for ICT and innovating education

The DECODE partners presented in the national reports some main and most interesting experiences in the field of training teachers' digital skills. They refer to strategic partnership, research experiences, awards, conferences, projects.

The UK research presented four projects.

Regarding digital capabilities, JISC (Building Digital Capability. Building capability for new digital leadership, pedagogy and efficiency)[46] developed a framework, which is now often used by digital leaders in their work.

[46] https://www.jisc.ac.uk/rd/projects/building-digital-capability

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The framework describes the skills needed by staff from a wide range of academic settings to perform well in a digital environment. The project deals with the use of digital technology in the field of learning. It has developed a set of elements, which enable staff to provide a better learning environment for students, which in turn can lead to a better return on the investment put into digital technology by the university or college. The framework has 6 elements: ICT Proficiency/ICT Productivity (Functional Skills); Information, data and media literacies (Critical Use); Digital creation, problem solving and innovation (Creative Production); Digital communication, collaboration and participation (Participation); Digital learning and development (Development); Digital identity and wellbeing (Self-actualising). It is used to support discussions around the capabilities required in a digital organisation and to plan staff development and review the curriculum using the above elements; it also offers a facility to highlight skills gaps among staff and to plan development accordingly.

The project NAACE ICT Mark is an award for schools with good use of technology to support teaching, learning and school administration. This accreditation is awarded to schools for the best use of technology and learning and in the day to day running of the school. The Award is valid for 3 years from the date of receipt. Schools who achieve this award have demonstrated that they are committed to the use of technology for the overall benefit of the school. Among the benefits of a school having the ICT Mark are that parents and the whole school community will understand the commitment of the school towards technology and showcases the school as a go-to hub for technology among its peers. The NAACE ICT Mark is a way for teachers who use ICT in their day to day teaching across many subject areas to receive the recognition for this. As schools invest more in technology, the ICT Mark allows them to show that they are getting the best value from this investment and the best commitment from school staff.

The Education ICT Conference[47] is an annual conference which brings together schools and colleges to learn about the skills needed to make the best use of technology in their institutions. Delegates explore the application of new technologies and how they can buy the best technology to suit their needs. The Conference addresses the innovative use of technology-enhanced learning in the classroom setting and how teachers can make the best use of this knowledge. Exhibitors meet an audience of over 200, including head teachers, heads of digital learning, heads of IT, directors of blended learning from organisations such as primary and secondary schools, the Department for Education, Local Education Authorities.

The Blended Learning Consortium[48] was launched in 2015 by the Heart of Worcestershire College to support Further Education Colleges to meet accredited guidelines and to share quality digital/online learning resources for further education. The Heart of Worcestershire College recognised how it was hard to find high-quality digital resources targeted to the needs of the further education sector and therefore decided to solve this themselves. Blended Learning is a mixture of traditional classroom methods and online digital methods. The Consortium produces learning resources, which cover different learning levels and subjects. Colleges in the Consortium can share good practice by contacting other members through discussion forums or by using the

[47] https://enhancingeducationtech.co.uk/

[48] http://www.blc-fe.org/

blog which has been set up by the project team at the Heart of Worcestershire College. The Consortium was set up to offer a solution to providing face to face contact time for 100% of a course which was proving difficult due to budget reductions. It focuses on the effective use of digital technology in further education institutions and the sharing of knowledge between staff members. The result of this collaboration is high-quality digital resources, which are developed for the further education curriculum. Quality support is provided for the development of staff members' digital capabilities; they can develop their skills to produce content, which can be cascaded across the Blending Learning Consortium network.

The Romanian research team presents several good practices that were highlighted by participants during the interviews and focus groups. They are local, national and transnational initiatives or online resource hubs. With particular reference to the development of teachers' competences, the aims of these practices are different:

- to improve access to broadband Internet and the ICT infrastructure in rural and small urban areas, as well as the acquisition of ICT skills;
- to improve access and participation to initial and continuous training opportunities for teachers;
- to develop the abilities of teachers to use interactive teaching methods and ICT;
- to expand the skills of primary school teachers in order to match the requirements of the new curriculum;
- to develop digital resources for teaching;
- to equip maths teachers to develop and implement curricular activities while using ICT resources;
- to train teaching staff to acquire the digital competencies that make up the e-skills for the 21st century and enabling them to implement modern teaching methods and strategies that make use of tablets;
- to promote the use of mobile devices in teaching;
- to promote the teaching/learning of elements related to ICT, technology, maths, programming and engineering;
- to create and promote the implementation of a curriculum on programming for the lower secondary cycle at the county level;
- to improve the quality of education by developing the capacity of schools to build key competencies in the areas of maths, sciences and technologies;
- to develop and implement digital tools for improving the evaluation and self-evaluation in upper-secondary education;
- to create an e-learning platform for a wide range of subjects within the national curriculum;
- to create an online community for sharing tools and experiences related to K-12 education;
- to promote and support a Europe-wide collaboration among STEM (science, technology, engineering and maths) teachers, education researchers, policymakers and other STEM education professionals.

The Spanish research team presented the *Common Framework* for *Digital Competence* of *Teachers*. An Institute of the Ministry of Education, the INTEF (Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado), created in 2012 this common framework, based on DigComp. It is used as a base for planning teacher Professional Development programmes, such as MOOC, NOOCS and other digital resources (European Commission, 2017). In 2013, the draft version v1.0 was published and, in 2017, the Framework has been updated to its current version. It is a standardized proposal that specifies the digital competence through

competency descriptors of 21 sub-competencies organized in 6 levels and 5 areas of competence[49] (INTEF, 2017).

In 2015, the Region of Extremadura implemented the Teachers Digital Competence Portfolio, a document that details and organizes in levels the digital competencies necessary for the exercise of teaching in the context of the current society (DOE 112, General Secretariat of Extremadura, 2015).

The Spanish team presents also the *Project Interdepartamental de Competència Digital Docent* (PICDD) (Project of Digital Teaching Competence). It was launched in 2014, with the objective of identifying the digital competences of non-university teachers and establishing the framework and design of the ways for acquiring and accrediting these competencies, both in initial training and in in-service teachers (ENS/1356/2016 resolution, DOGC, 2016). In this project, the initial and continuous training of ICT teachers was analysed in order to make proposals. In this sense, the project defined five areas or dimensions of digital teacher competences:

1. Design, planning and didactic implementation.
2. Organization and management of educational spaces and resources.
3. Communication and collaboration.
4. Ethics and digital citizenship.
5. Professional development.

In Italy, like in the other countries, continuing education is an integral part of the teaching function, but today the Italian Law 107/2015 (The Good School) recognizes and strengthens this principle, corroborates some rules of operation and gives it financial resources. Three tools have strengthened the awareness that professional development of teachers is crucial for the growth of a quality school: the Triennial Plan for the Training Offer, the School Improvement Plan and the Self-Assessment Report (in Italian: RAV - Rapporto di Autovalutazione).

First, it is the same Law 107/2015, which recognizes that participation in training, with a variety of possible choices, must refer to the school community, specifically in the Triennial Plan of the Training Offer. It should include within it the anticipation of the training actions that the institute undertakes to design and implement for its teachers (and for all staff), in a differentiated form in relation to the needs detected. Secondly, there are tools for linking the systematic design to the training operations within the school to the priorities and the improvement goals of each institute. The Self-Assessment Report (RAV), which each school has created and updated, identifies the goals of improvement that, accordingly, each school community intends to achieve in the next three years. The RAV internal analyses are the starting point for the Improvement Plan and RAV identifies training as one of the 7 process areas on which a judgment is made about the institution and one of

[49] https://www.slideshare.net/educacionlab/marco-comn-de-competencia-digital-docente-versin-en-ingls

the project goals that the school can point and define to achieve the results. The plan of each school must consider staff training as a lever to successfully pursue the Institute's development and improvement strategy.

Mandatory, permanent and structural, three "heavy" adjectives that change the relationship between teachers and the profession, seen here as a constantly evolving process, to be treated according to needs that intertwine, among those of the person who carries out a profession and those who come from the environment.

The Personnel Training Plan, as an act adopted by decree of the Minister of Education, University and Research, defines the priorities and the financial resources for the three-year period 2016-2019 and outlines, starting from the school year 2016-2017 (also taking into account the training initiatives launched in 2015-2016), a strategic framework to support in a transparent, innovative and effective way a concrete policy for the growth of human and professional capital of the school. Between the different objectives of the plan, in the training area, we can find: a. Personal and professional growth goals of the individual teacher; b. School improvement goals; c. Strategy for the development of the entire country.

The Plan is an informative and strategic prerequisite for addressing the theme of career enhancement of teachers. A professional development system allows documenting, through devices such as the professional portfolio - as in the Spanish context - and the professional development plan, the gradual refinement of skills, attitudes and expertise of the faculty to give an overall representation of the teaching function.

According to digitalization in EU, Finnish government made an action plan and followed the general lines. One of the strategic priorities is Digitalisation, experimentation and deregulation (procedures). These priorities are materialized in the 26 different key projects. Digitalisation mentioned in followed key projects: public services will be digitized; a growth environment will be created for digital business operations.

In the educational sector, one active key project is: *New learning environments and digital materials to comprehensive schools* (2015 – 2019). Teacher's ICT skills were developed and supported during projects Ope.fi 1, Ope.fi 2 and Ope.fi 3. Oppiminen online is a part of the *OsaOppi III – Osaamispisteet pelissä* and *OsaOppi IV* project in which the requisite skill sets, as defined by the Ope.fi standards (in Finnish), are provided over 3 levels and 3 locations around Finland: Espoo, Hämeenlinna and Oulu.

Teachers ICT skills are followed during the years 2012 – 2017 by an e-platform[50]. Teachers from basic and general upper secondary schools can give feedback about their skills and competences of ICT using on this self-assessment platform.

The answers have identified skills and competences on the five different groups:

1. technological capabilities ('teknologiset valmiudet'),
2. methods/mode of operation ('toimintatavat'),

[50] http://opeka.fi/fi

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3. attitude (‘asennoituminen’),
4. using in the teaching process (‘opetuskäyttö’),
5. competences (‘osaaminen’)

Teachers have progress in some sectors (answers are more positive compared to the earlier years). They concern the good use of devices, software and a wireless network in the school - students and visitors can use the Wifi with their own devices too -; of social media networks to learn new; ICT skills as one topic during development discussions with the school leader; new didactic activities with students about graphic and other types of programming with students; better general level of ICT skills; sufficient technical support to ICT in the school; the use of own devices (eg laptops, smartphones, tablets) by students in classes;

Some other answers are less positive compared to the earlier years: scope of new technology into teaching is a burden; level of using information and communication technology during lessons; the possibility to influence the school to the procurement of ICT; to find good ways to utilize information and communication technologies in different learning situations; the opportunity to jointly agreed with goals for using ICT in teaching in the school; the desire to use information and communication technology more in my teaching; the enhanced use of information and communication technology during lessons by students; the enhances use of digital materials in teaching; the improved working atmosphere, more positive to experimenting with new things in teaching.

School leaders have an other e-platform for following the digital environments and development needs in their schools (self-assessment tool[51]). Answers will identify followed sectors: strategy, commitment to the change, developing of the new working culture; developing of competence.

The framework and practices presented highlight how much is important the creation of a continuous professional development system, a "diffused" learning environment qualified by a variety of cultural opportunities for training, throughout different tools: courses, community practices, journals, publications, associative experiences, research proposals and academic activities, national and international projects.

To achieve the goals associated with an effective decline in training in the field of teaching, the starting point is the adoption of "professional standards". As is the case in many educational systems around the world, it is necessary to link teacher's continuous professional development goals to clear and defined professional standards. The attainment of adequate standards makes it indispensable to introduce tools that can accompany the career path, as the eportfolio.

Some priority objectives remain at the centre of the educational political action:

- the methodological innovation in all its forms and connects to the new environments for the learning and use of teaching technology;
- opportunities for curricular, organizational and didactic development;

[51] http://ropeka.fi/fi

- acceptance, aimed at inclusion, as a "daily" way of managing classes;
- the growth of a culture of evaluation and improvement;
- the development of fruitful relationships with the world of work.

2.4 Digital challenges for national education systems

2.4.1 Innovation and digital revolution

The world is changing, and learning tools and digital environments are also constantly changing. There are new ways and methods of working and learning: it is important to involve all students with personal training and guidance, and instructors must be able to support them. Online guidance and shared teaching require high levels of cooperation and networking. The adoption of digitalisation requires motivation and a change of mind. It also requires the manager's intent and peer support.

It is crucial to change perspective on innovation. Didactic approach has to be modified, for example in the organisation of classroom's space and in choosing didactic methods (face to face lesson can not be the only way). ICTs are useful in order to help working in different ways (coding, flipping, etc.); a pedagogical shift has to be encouraged: the new approach has to be learner-centered and not discipline-centered; a different mental and cognitive approach is thus necessary. Teachers have not to entirely change their didactics, but they must learn to use ICTs as a helpful tool. From an administrative point of view, also, using digital tools can help in reviewing traditional procedures.

The management of innovation processes requires constant training for teachers: if the quality of the training paths is poor, teachers move away from the very idea of innovation. Innovation sometimes is perceived when something is no longer working, and for some teachers there is no need at all for innovation. The paradigm shift occurs through tools: there is no shortage of information as before. Learning is in itself innovation, we are always in a process of constant change and lifelong learning. This process does involve not only students, but also teachers. If school can promote these attitudes, it will be easier to promote innovation.

It is necessary to be open to innovation, but it is also necessary to active a "pedagogical filter": the use of new communication devices is widespread and there is the need to develop critical skills in order to better know and discern. It is crucial to deal with communication, both from the user's and from the producer's points of view. Among the opportunities for ICT innovation, there is the possibility to facilitate teachers' networks and communities of practice. It is crucial to oppose the isolation of teachers and adopt a systematic approach.

National education policies in the different countries support the development of pedagogical and methodological innovation through ICT with programs aimed at developing and implementing digital tools and environments.

The majority of participants shared the idea that nowadays the use of ICT technology is relevant and necessary, and thus the promotion of digital skills, but there are also nuances in how to define, focus and address this digital or technological competence.

Many participants of the focus group have cited digital competence, and have considered it a competence with its own specificities, and - on the other hand - many of them consider it a transversal competence, because it relates to critical thinking in the global world, citizenship, interaction and communication.

To innovate means knowing how to select, configure and program digital devices according to the tasks to be performed; to critically differentiate which digital devices have to be used according to the needs of the task, moment and situation, so people must be digitally literate; to know how to use different software and applications, configure cloud computing spaces, elaborate and manage digital documents, or image and sound editing.

To innovate means knowing how to search, contrast and select digital information suitable for the work to be done, all considering different sources and digital media; to be able to define and apply accurate search criteria, and knowing how to use search engines; to have a critical vision of the information found and discriminate useful information and contrast it with several sources in order to verificate its pertinence; to organise and use a personal working and learning environment with digital tools to become an active member of the knowledge society.

To innovate means knowing how to participate in interpersonal communication environments and virtual spaces; to acquire communication skills and strategies to interact online with others and to develop criteria that allow them to share adequate information considering the space in which will be published such as social media and social networks.

To innovate means knowing how to be aware of the civic dimension of the use of technology; to respect a code of conduct in being active online; to use responsibly and ethically the digital resources; to be aware of the benefits and the risks of using ICT for personal development.

It is needed to integrate technology in all aspects of life, but this integration, as can be seen in the description of the digital competence, is not enough by itself and has to be accompanied by critical thinking.

Regarding the role of schools in the promotion of the emerging teacher skills in a digital era, many participants said that despite the fact that society is increasingly aware of the need for change and educational transformation to respond to the current demands and needs, the school continues to be linked to obsolete and decontextualized practices that are distant from the development of the cited competences.

2.4.2 Pedagogical issues

The 21st-century key competences are mostly described by participants on a general level: the difference among ICT skills and digital skills is not very clear for users. Participants recognize that young generations have access to different devices (smartphone, tablet etc.) and that these devices are not used for training purposes nor for the improvement of working life basic skills. The general opinion was that the identification of the 21st-century competences for citizens was described or understood on a general level.

School directors pointed out the need for ICT user skills on the general level. Nurseries and primary schools should offer and guarantee these skills. All citizens will need basic skills to manage e-documents, and the

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digitalisation of the whole society will influence the ways people study, work, experience leisure and communicate. People will need new skills to confidentially and ethically manage information.

The competences of 21st century citizens that schools can help develop through the integration of ICT named during focus group were the following: all key competences connected to Lifelong Learning (both written and oral), problem solving, team working, reading skills and digital literacy, text and image literacy, critical evaluation of data sources, interpreting images and videos, operating methods for sustainable development, integration of and enhancement by ICT in educational settings and teaching processes, basic skills in the use of ICT.

Participants mentioned other soft skills that will support digital competences and are connected to 21st century skills. A primary skill would be learning how to learn a wider variety of information in more depth, also in the ICT field. Schools can teach and advise practically all key competences (working life skills, safety use of digital resources etc.).

Digital competences can support soft skills such as networking, project and structured working, and can help students in managing their own skills. This will increase students' self-awareness and self-assessment. Networking and team working skills are mentioned often as working life new needs to be taught and trained in schools. Young people become accustomed with new equipment and programs much faster compared to adult population and we require them to adapt with new challenges (networking and sharing information by legal principles and ethical rules). These skills need to be taught and trained also for the creation and a better management of public images and profiles.

There is a consensus on the fact that teachers should put all competences into play in educational practice and that they should be able to learn constantly in order to improve their professional activity also according to social needs. The following key competences are needed for citizenship and for the labor market: information retrieval and processing, digital literacy (critical thinking and problem solving, self-expression, online publication, digital portfolio), digital skills and creativity (images, videos, visual presentations).

Governments in different countries pointed out the integration as one of the successful methods to benefit digitalization in schools. This is understood as a way to answer to skills demanded in the labor market and described in the requirements of curricula and qualifications (digital literacy, critical evaluation of data sources, interpreting images, photos and videos, legal and ethical decisions). Digitalisation would also support the development of language skills, benefit and integrate language through gamification.

Not all experts agree on the use of digital environments, some rely on more traditional ways of studying. Fast development of information technology and rapid changes can be confusing. There is a need for guidance where it is worth accompanying. New devices and methods (eg. online publications) can cause fear and require re-learning from the old methods.

The understanding of digital skills can connect to lifelong learning skills and support distance learning as well. The computer belongs to the everyday life in every school. In general education, mobile devices have been used, for example, in information retrieval, in connection with a task (eg. mind maps). The hardware is

generally not so good, and that is true for all the countries involved. It is crucial to focus on the pedagogical perspective: changing methods and choosing new tools and materials (BYOD, etc.).

The new reality and the (new) hardware lead to many questions and new challenges in schools. Nowadays all teachers and students are going from computers (static working place) to laptops (taking with) and mobile technology. The ideal situation will be the accessibility of a platform that is not dependent on the equipment. Participants pointed out that learning comes first, and technology is just a set of tools for learning.

The following pedagogical aspects have been cited during the interviews: accessibility of teaching and guiding; support to distance learning, more material, videos; developing of lifelong learning (free digital lectures and lessons); developing user friendly platforms focused on aims and tasks; integration of digital methods and materials in learning processes; e-learning; cooperation and networking between teachers; international projects and learning from each other.

Digitalisation offers also new opportunities against exclusion. Many of the participants are worried about inequality among students in regards to differences in the use of technologies: there are many differences between students, and the challenge will be to get all learners involved. The most important aspect of digitalisation would be to have free resources, available and shared with everyone.

All participants mentioned problems with network errors and updating of equipment. Differences in master levels using digital devices and methods depend on: equipment, users skills, working possibilities (updating of equipment and programs/platforms, network's functioning); software (which programs, platforms, games etc will be used); tasks (why teachers choose different kinds of methods, platforms and equipment). The level of transfer of these good practices is different from one country to another, but in all countries there are different possibilities between different schools and regions.

The main competences that teachers should have in order to carry on effective practices are deeply connected to attitude and motivation, genuine desire to develop and share knowledge and materials. The best and effective practices in integration of ICT require time, examples, peer support, learning and experimentation, planned training, equipment and software. Teachers in all countries have mostly basic user level skill of ICT. Compared to the number of existing learning platform there is too little training.

Skills in the digital age should include those related to attitudes in the use of technology: technologies must be used responsibly and efficiently as means of communication and interaction and a proactive attitude towards networking is needed. Regarding the digital educational environment, instrumental competences can be separated from methodological ones. The aim is to promote meaningful student learning through student-centered strategies, and to give support to students' learning needs also by respecting the different rhythms in focusing on digital content.

Preparing students for these competences implies changes at different levels: organizational, spatial, architectural, methodological and technological.

It would be useful to plan gradual changes that do not involve many risks, that will expand the comfort zones of the teaching staff, that lead to good results, that give confidence and that motivate them to continue working

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also online. It is necessary to separate the ICT coordinators from the ones responsible for maintenance. It is necessary to consolidate the relevance of the ICT coordinator as a catalyst for innovation and the necessary commitment to a methodological change of teaching staff, as well as the renewal of educational methodologies to strengthen the didactic use of ICT. The leadership of the management teams is also fundamental so that schools can improve the digital competence of teachers and consequently increase their use in schools and better reach students' motivation.

2.4.3 Digital transformation as an opportunity for European education systems

Highlighted digital challenges for national education systems by national research mainly concern two different levels: the institutional level and the pedagogical one.

The Spanish research team identifies very clearly the relationship between these levels, specifying some needs:

- to update the educational institutions for the new needs of society in the 21st century;

- to overcome (by all agents) completely outdated structures and dynamics;

- to transform educational processes taking advantage of the possibilities offered by technology.

ICT is indispensable in any educational process, although it is important to know how to integrate them; they have to be facilitators of this change and must be integrated into learning activities by providing equal added value as they do in other aspects of everyday life. However, it is clear that they by themselves do not provide solutions, but it cannot be ignored that without this technology education cannot achieve its goals in present and future times.

Some challenges highlighted by Spanish report:

- the change of educational paradigm "from the industrial society to the network society":

fostering competences increasingly needed, such as: critical thinking, problem solving, learning to learn, communication and collaboration, digital and information literacy, local and global digital citizenship;

- the need to move from a teacher-centered pedagogical approach to a student-centered one:

moving from content to knowledge creation, as technology is the basis in the educational innovation process;

- focusing on dynamic, participatory, collaborative methodologies to take advantage of technology in the classroom in a productive way to improve education;

- to educate the technology, rather than to technify the classroom, because society is already digitalised, everyone is connected and needs ICT and ICT skills.

The research team of Romania stresses that the challenge for teachers is to learn to transfer what they have learned, rather than learning to use modern media. The education and career systems need deep changes to

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prepare teachers for digital globalization. One of the conclusions drawn from interviews is to improve access and participation of teachers in pre-university education, in order to have continuous training opportunities, by developing the capacity to use interactive teaching and learning methods using ICT. Also, it is crucial to create the opportunity to develop better education through innovative multi-regional training programs, based on priority areas in education and digital resources. In Romania, teachers have had the opportunity to participate in projects with multi-regional implementation with a transnational approach, and the territorial dimension has covered both urban and rural areas.

About this topic, the Italian report explains that, with the challenges the education system is facing and despite the diversity of perspectives, the interviewees broadly agree on the essential issues that characterize this time of transition and which can be summarized into three main categories which are closely interdependent:

- the first element of attention concerns infrastructures. All national and international research, as the witnesses recall, underline the Italian gap on this point. A delay that in recent years, with the various interventions implemented in this field, has been attempted to overcome;

- closely related to this issue is the question of technology equipment and its investments, because -as one of the institutional referrals highlights - the ministry has only resources for ordinary management;

- it is evident therefore that the topic of technologies and infrastructures is closely related to the political one, because it calls for the need to mediate between different interests, needs and visions where perhaps the most weight gains the ability to reconcile logic, rationality, different priority as those that may be of interest to the Ministry of Education and the Ministry of Economy, but also regional calls will promote and invest in local development.

From ministerial funds to educational choices, it is evident that the ability to define the school model, underlying the introduction of digital technologies in the classroom, is very important. The most daring challenge is to define how to help schools to exploit digital technologies for the benefit of training that is capable of forming citizens able to move into global and hyper-technology society. The problem goes far beyond funds, but invests in the crisis of the school-society integration model that requires a deep rethinking. Choosing to invest in technology, rather than another issue, raises a process that invests every dimension of the educational process, requiring a radical re-design of architectural structures, spaces, classroom, etc. It's not only an economic issue, but it recalls the need to renegotiate priorities, disciplines, contents, rules of engagement and, consequently, the type of training that must accompany teachers and students, the skills they deem useful and necessary to form, the way they must and can be constituted and related valuation systems etc.

In this framework a more complex issue is the need to create a system of certifications capable of recognizing and harmonizing the competence profiles that characterize the digital world. However, the issue of competence certification is an ambiguous and slippery subject, as there is always a risk of stiffening behind the necessary structuring, which leads to the reduction of the margins of flexibility and experimentation by depriving the autonomy of the school, of teachers and the student's freedom of learning (Italy).

Across the United Kingdom's national research, a common message was that time and financial constraints are the biggest challenges for teachers, when it comes to adopting and developing ICT and digital resources. In recent years school budgets have come under increasing pressure, which means that there is not always capacity or commitment to promote digitisation.

Overall, it became clear that senior management's buy-in was the main driver of whether a school was ready to free up time and money to invest.

In conclusion, few people mentioned infrastructure as a real issue: high-speed broadband which can support large volumes of users at once is needed but this seems to be an accepted part of modern school life (at least in institutions willing to invest in ICT), and so is something easily rolled out across school sites. Equally, training was not perceived as an insurmountable challenge. Some staff may still require support to improve their digital skills, but CPD opportunities and support do exist. This is largely due to the established commitment to staff development embedded within British education, as digital skills training can be seamlessly slotted into wider training programmes throughout the school year (United Kingdom).

2.4.4 Problems in implementation process

The United Kingdom's research report identifies funding issues as principal problems in implementation process. In the United Kingdom, there is no dedicated national funding for the roll-out of digital tools, resources and infrastructure in schools. This produces two main effects:

- each school has to find the money within their own budgets to cover any expenditure of ICT. For many schools, the solution to this has been to pass on some of the cost to parents and pupils. For some this cost is unworkable, whilst the lack of a national campaign around the benefits of digital learning means other parents resent being asked to pay;

- concerning teachers training, in contexts where money is less of an issue dedicated trainers are being appointed to oversee schools' digital strategies and Continuing Professional Development - CPD for staff; even in schools where budget is more limited, the principle of offering staff CPD is a core principle (both through dedicated training days at the start of school terms and shorter sessions throughout the year). This means that training specifically focused on digital skills can be integrated into established training programmes, helping to maximize their impact.

Connected to funding problems also some pedagogical issues emerges. There is the risk of a "digital inequality", which can exacerbate social segregation and limiting social mobility. A multi-stream approach is developing: some schools are leading the adoption of digital tools (including staff training), whilst others keep faith with traditional methods. As digital aspects become a more integrated part of both education and the world of work, this risks impact on students' performance and prospects – especially when it comes to the need for well-developed digital literacy skills when they enter the labour market.

For the appropriate integration of ICT in schools, the Romanian research report identifies the following main issues:

- using ICT resources in education improves the management of school, communication between all actors: policy makers, decisions factors, teachers, students, parents and society. It is also noted a growth of education quality, due to motivation for learning.

- using ICT in teaching is an appropriate and natural form in which students are trained to fit into a digital society, providing a major advantage for both teachers and students.

- using ICT in education supposes several other advantages, both for teachers and students.

In the Italian report, the most important implementation problems related to digital enhancement in educational systems and teaching practices are identified as a reflection of the challenges connected with the national context. They can be summarized in two essential dimensions: the ability to innovate and the limits of the implementation process. For this reason, it is necessary to promote appropriate monitoring, evaluation and follow-up of investment in digital innovation.

Among the problems associated with the implementation, it is also emphasized the role of the communication management that characterizes the administrative processes. There is a problem of language that very often appears distant from immediate comprehension and applicability to real contexts; the limitation of an informational system - which is connatural to the linear and transmissible logic of the public administration - emerge as a real issue. The information can not penetrate and reach the potential interested and concerned recipients, as evidenced by this testimony. There is the need to establish a system of information capable of acting as an accompaniment and as an action of empowerment for citizens, organizations and territories.

National specificity that is considered useful to enhance

In the Romanian report other aspects, which constrain the acquisition and effective use of ICT competences, are identified as systemic factors, and they affect other areas: bureaucracy, logistics, time resources. Throughout the interviews and focus groups, the following problems occurred: overloading teachers and lack of time; excessive bureaucracy; formative training attended only because of credits need to be accumulated; teacher payment being problematic.

Is regard to the level of transfer of good practices and the factors that favor and constrain, financial shortages have been mentioned first. The level of transfer of good practice is satisfactory. Training is promoted through use and enforcement of information protection legislation. Romanian Ministry of Education creates the opportunity for teachers to improve digital skills and communication skills, both in mother tongue and in a foreign language (mostly in English).

In the Italian context, as pointed out in all the interviews carried out, there are some national prerogatives:

- territorial diversity: the degree of digital penetration and innovation is very diverse, characterized by a not homogeneous distribution. The local component identified by the capacity of the implementation structures to play an institutional leadership role and addressing-coordinating territorial actors is very important. The open spaces of autonomy with the processes of decentralization to the regions (L. 59/1999) have contributed to highlighting these territorial disparities. The effort thus made through L. 107/2015 - which marks the last step in

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the ministry's intervention to introduce and enhance digital education within educational systems - has tried to intervene precisely on this disparity in order to standardize opportunities in a widespread and pervasive way;

- polarization of practices: two quite widespread dynamics are observed: on one hand there are some very innovative teachers and on the other side a large number of teachers not prepared for a full adoption of ICT. To counter this phenomenon, one of the most important actions introduced by L. 107/2015 was the creation of the key role of “Animatore Digitale”, joined by the “innovation team”;

- rules: as far as the ordinance dimension is concerned, the most serious issue that is currently under discussion, and on which the government has worked, is the review of the curricula, as it has been done in other countries, in order to clearly integrate teaching of “culture and digital citizenship”;

- the “restart” in innovation processes: finally, regarding the need for a boost to the innovation processes, interviews show that the driving force that could be carried out with investment in infrastructure, equipment, training, etc, has lost his strength. It is now necessary for renewal to be welcomed by the schools, in all their components, in synergy with the territories and with specific educative communities, in order to rethink a space and a model of school that are adherent also to the needs of local realities.

2.5 Opportunities in teacher training for the enhancement of digital skills

It is opportune to outline the picture of the overall school organization, so that could emerges what the individual teachers' operational, didactic and non-didactic commitments are.

On the basis of this organizational framework, individual teachers had the opportunity to proceed to the analysis of their competences, their attitudes and their propensities.

If, on the one hand, it is important to know which are the skills already possessed, on the other, it is much more important to know which are the attitudes, the propensities, predilections, the interests, the motivations of the single teachers, even disregarding the specific professional roles ascribed, because the school of autonomy is the school in which the teachers work normally also from the specific disciplines assigned to them, assigned by a flexibility that can integrate the more varied aggregation of the disciplines, the modularity of the groupings of the students also to open classes, the modularity of the calendar and schedules. Therefore, the analysis of current and requested competences of teachers and is associated with the whole field, regardless of the professional roles, ascribed and bearing in mind the organizational possibilities that the school can use.

As mentioned in the previous paragraphs, the analysis (self-analysis) could concern the training needs. The didactic competences concern the didactic methodologies (lesson, research, rediscovery, reconstruction, reinvention, Problem solving), educational technologies (structured and unstructured materials, audiovisuals, multimedia technologies). In particular, competence in the use of educational and didactic technologies, with particular reference to multimedia technologies, assumes significant importance today. Teaching skills are based on pedagogical, methodological-didactic, psychological, sociological, anthropological knowledge etc.

Moreover, the didactic competences involve the mastery of the problems related to the evaluation, above all to the formative evaluation (to evaluate to educate) and to its instruments.

About the new competences required for the ICT teacher, good practices are facilitated by followed arguments: good cloud services, sharing between teachers, presence of digital tutors, program for digi-tutor, organizing e-tests, development of technique; communicate and share information.

The common limits are reinforced by following factors: attitude, social media not involved in the teaching process (not appreciated as teaching method), age limit (primary school), not enough equipment, poor digital teaching material, poor sharing; not enough equipment (have to organize paper test), problem in networking, pupil's equipment, changes in study programs, limited skills of pupils, limited skills of teachers, programming skills, licenses from parents, limited financial resources (big difference between towns and countryside, and between different areas), limited time for training; strictly theoretical, not related to actual needs or poor quality training courses (there is a need for several such courses of methodical training with embedded practice).

The management of school have an important role by trying to remove restraining and limiting factors. Some bureaucracy such as teaching obligation, pay system can limit to real motivation: it would be good to get more relaxed hands for those who want to do more.

The followed soft and hard skills was named during interviews, in continuity with the emerging framework of competences outlined by some scholars (Capogna, 2016): socio-relational skills, sharing skills, networking skills, interactive skills, curious and entrepreneurial attitude; digital skills such as basic ICT skills, user skills for digital devices, skills for digital conversation, digital literacy, skills in data sources, making visual presentations, digital portfolios etc; methodological skills such as to develop digital material (not only copy the books to the e-platform), manage copyright, ownership of digital material (ownership), permissions, skills to use existing digital material.

It is interesting to note that when innovative practices are mentioned it have been cited projects, as well as Apps or initiatives. Practices are innovative when they amplify the possibilities and opportunities of learning of the students, generating more enriched scenarios where the students acquire a leading role. Many participants mentioned spaces of interaction and collaborative construction of knowledge; learning as a social fact, real and contextualized. In these practices the evaluation goes beyond the simple qualification and it is part of the student's learning process, becoming authentic and formative. Innovative practices are all those methodologies that place the student in a network as subject and object of the teaching and learning process. ICT play an important role in these innovative practices as they break the space-time barriers; bring people closer together and boost their collaboration; allow people to go beyond the walls of the classroom and connect with students' real life experiences, and act as facilitators of learning and as enablers of knowledge creation.

In many schools, the use of mobile phones is totally prohibited, although there are national documents that recommend its use. Participants complain about the lack of connectivity, lack of devices, malfunctioning devices, and banning of personal devices when there are examples that the BYOD model can be a valid model at certain times.

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School can be seen as a complex and resilient organization and it is necessary to consider ICTs in education practice. School prevents this kind of changes. Some tools or practices are temporary and school cannot change constantly on their basis. Needs have to be oriented: it does exist a necessity to give answer to needs, but it is important to solicit needs, too.

There is the need to systematize practices and disseminate more about what is done. The danger is that there is no recognition of an innovative potential in these practices, if they are not seen in a systematic approach.

The Spanish research report efficaciously summarize some relevant issues on the centrality of teachers training for the enhancement of their digital skills, which recalls a change of paradigm.

There is a complete consensus that teachers have to be competent in the instrumental and methodological use of ICTs. The main competencies that teachers have to have in the digital age related directly to ICT are these ones related to encourage students to become producers of their own contents and not passive agents, become digital competent and integrate technology in the active methodologies, promote teamwork, encourage respect and tolerance towards others, be in continuous training.

So, the reference perspective becomes a lifelong and lifewide learning centered approach.

Some lines of competence training that teachers would have to focus on: instrumental use and methodological use of ICT, promote its active role in the production of teaching contents, new active methodologies that enhance student learning in collaboration and projects, be able to actively involve students in their training, empowering the participation of families, to give the bases to be formed throughout the life of autonomous form.

A problem in relation to accreditation procedures emerges: several of the interviewees point to the lack of a clear accreditation system, noting that it's necessary to create mechanisms for the accreditation of these competences that allow the teacher to demonstrate that they have reached a set of established levels, appropriate to each task and that for this reason they are used and valued in the processes of selection and promotion for educational tasks to be performed.

The results of the Italian research confirm that training of teachers and school leaders is considered transversally the central problem of promoting digital innovation in schools.

For this reason, in Italy, one of the central axes of the "Good School" Reform, insists on teacher training and the enhancement of digital skills. To do this, the Ministry is investing in two special actions: the Schoollkilt tool (format of training, self-production and circulation of good practices agreed through different focus groups) and the sharing of good practices through community building that can continually interact with each other on these issues.

2.5.1 Needs and perspective of improvement

How teachers can improve their technologies competences to enhance their learning outcomes? Which are their professional targets? Have they some professional development targets? The aim of present project was,

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in different ways, stimulate in teachers indeep reflections by their engagement in the learning, attending the online course, starting by the analysis provided by the self-assessment of the current status on teachers ITC. One of the principal aims was to provide a digital environment, where the delegates could learn, share, made suggestions to colleagues, works together and collaborate to obtain one shared goal (as the final project work), and also to improve their knowledge in different fields (team working, soft and social skills, relations with students and colleagues). The main objects are represented by kind of questions posed by the survey about ICT competences, in which competence areas they wanted to improve as professional development, ICT, assessment, teaching methods. But the most important goal was to detect the training needs and the relative resources about it.

It is now a widely shared opinion in scientific literature that teachers today must constantly be the main promoters of innovation in schools. Although, in any case, with regard to digital skills, and the integration of ICT, many of them have not yet reached those levels that allow a constant pedagogical use both for their own professional development and for the didactic methodology. This also emerged from the results of the survey: data in fact, demonstrate how in most of countries teachers do not yet obtain the mastery of some tools, and these consequently are not used in teaching.

Through the online path designed for multimedial teachers, it is intended to support them in improving their knowledge, especially at the operational level. However, considering also the relational part, thus creating a multimedia habitat where they can confront, work in teams and implement their soft skills, community of practice (Wenger, 2009)[52]. But not only, because being part of a community, through the creation of a visible personal profile online, gives the opportunity to all participants to know not only different professional realities, but also good practices, initiatives in terms of teaching, through the experiences and testimonies of their peers, also in creating connections in interdisciplinary fields. Also the acceptance of some challenges that have been launched through the team design of some project-work, has led the participants to collaborate and get involved with their peers.

Participants have cited a multitude of ways of teachers' professional development. Teachers can update permanently, by carrying out innovative methods and tools in the workplace, participating in professional networking groups, attending courses and conferences, reading the news of the areas of interest, collaborating with colleagues and peers, learning from the students, incorporating new resources of teaching practice, designing training actions. Another way to update professionally mostly recognized by the participants is through being active online and in virtual groups, seen as valuable for professional updating.

Most of the participants share the idea that the training is consisted basically of formal courses and that today the use of ICT expands these possibilities, because nowadays there is a set of context configurations composed of activities, materials, resources and relationships that are generated in physical or virtual spaces (as MOOC) and that provide learning opportunities and allow us to study the mechanisms of development and professional updating of different types of professions. Many participants cited interesting spaces for

[52] Wenger, E., White, N., & Smith, J. D. (2009). *Digital habitats: Stewarding technology for communities*. CPsquare.

professional teacher development outside the classroom such as conferences, face-to-face courses, online, meetings or associations. Several participants cited the MOOC courses offered by prestigious institutions from around the world. There are often important limitations depending on the context: teachers will have more or less possibilities to teach by intensive using of ICT, there are centers that have integrated ICT in their educational project and have an adequate infrastructure and, instead, there are other centers that do not have Internet connection, wifi, digital whiteboards etc. Even for schools where budget is more limited, the principle of offering staff Continuing Professional Development (CPD) is a principle core. Training specifically focused on digital skills can be integrated into established training programmes, helping to maximize reach and impact. A lack of coordination and policy on a national level means that it is left to individual schools to decide the level of digitalization they adopt. Therefore, the uptake and integration of digital learning is reliant on the commitment and vision of individual school leaders.

Individual institutions are given the opportunity to address the specific needs of their learners in an innovative way. This has led to a number of effective solutions being developed which are both cost and time efficient. But whilst many schools now encourage students to use tablets in the classroom, these tablets have to be rented from the school at a cost to their parents (as in UK). For some this cost is unworkable, whilst the lack of a national campaign around the benefits of digital learning mean other parents resent being asked to pay. Schools recognize the benefits and savings which can be made by sharing insights and learning from each other. Therefore, these innovative practices are beginning to spread from institution to institution organically, as each shares their learning points and best practices. Some schools are leading the adoption of digital tools (including staff training), whilst others keep faith with traditional methods.

Another risk is the unwillingness of some staff to learn the new skills needed to fully exploit the potential of digital learning. Across the national survey it was clear that it was individual staff attitudes, rather than age, subject area etc. which influenced this.

Teachers want to be trained to work with actual digital resource databases and integrate those things and see examples of good practice. Training courses offered are of variable quality and their lessons are less attractive. Courses should be more interactive.

According to several participants, the training and accreditation of digital competences must also be transversal to teaching pedagogical competences. The teachers must be able to use ICT appropriately in all areas of their knowledge.

Most of the participants pointed out that it is crucial to obtain fundings. International programs facilitating the exchange of experience for teachers are considered very important for acquiring the necessary skills and represent a way to import good practices in the field of ICT integration. Training in projects such as Erasmus, are not always accessible to all the people involved and they really would facilitate a change of mentality.

The EU has an impact on the level of planning. Education policy has helped. Funding from projects to acquire tools for schools has been a fierce development over the last three years. Distance learning and the use of video tutorials (self-made & network-ready videos) has also been added. This has also increased the networking of teachers during the developing process sharing between teachers.

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The key projects of different government give opportunity to apply projects and financing for further developing and updating digital competences. There are many processes going (new curriculas), and teachers understand the need of further training and updating their skills. Projects give possibilities to organize further training of teachers and up-to-date some hardware.

Digitalization is one of the strategic priorities in all the countries involved. This means opportunity to apply different project and funding for developing digitalization. In education sector, Governments have also many programs for reforming education and developing new learning environments and digital materials to different level of schools. The aim is to modernize learning, organize more personal pathways for students, make deeper cooperation with labor market, build connections between different levels of education.

The comparison of all Countries data shows that in UK England there is the risk of unwillingness of some staff to learn the new skills needed to fully exploit the potential of digital learning. Across the national survey it was clear that it was individual staff attitudes, rather than age, subject area etc. which influenced this. It was also evident that the solution for this lay is a more well-rounded training approach, which combined support to improve digital skills with information and evidence on the impact and benefits of digital learning for both staff and students

The Spanish research highlights how ICTs allow for the extension and diffusion of some of the objectives of education in the field of personalization of learning, the carrying out of student-centered educational activities, learning based on challenges, and above all collaborative work, which can benefit greatly from the application of technology. ICTs play a fundamental role in bringing education closer to the real world, extending education beyond the classroom and including other areas of the student's life such as his family or personal interests or social circles.

The Romanian report identifies some main skills needed by teachers: creating digital educational content; implementing school management applications; Managing educational content, and not least the pleasure of teaching, of being a teacher; motivation; scientific knowledge; spirit of research, psycho-pedagogical competencies.

The most important areas of skills development are (Capogna, 2015):

- the socio-emotional area (interpersonal communication, educational leadership, problem solving, decision making, Compliance with ethical and legal norms in digital space);
- communicative skills (communication - modern language learning/Digital; Internet browsing; Information/ content management; Adaptation to various facilities offered to the modern society: on-line purchase, filling in online forms);
- methodological skills (management of complex processes, planning and evaluation: Creating digital content needed in the knowledge society; Implementing management applications across all domains).

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A common trait for most respondents is the need of more focus on digital skills gaps. The advanced age present in almost all the countries involved in the project represents a critical data, as life-long training is not always punctual, considering the multiplicity of personal and professional commitments of the teachers, and also the large number of professional updates on other fronts and other disciplines to which they must make up.

Nonetheless, it is clear that there is a great deal of interest and intent to fully engage in training, with the aim not only of obtaining the appropriate certifications, but on dedicating time to one's own professional development. Another very interesting fact that has been noted, is the use of digital methodologies in daily teaching, a practice that also improves relations with the students themselves, always very active on digital devices. For this reason, it is assumed that a further development of digital skills such as mastering on use of platforms in the classroom, and exercises carried out also in teams, can effectively improve the teacher-student relationship and the development of a spirit of collaboration between peers. It should also be emphasized that in the implementation of some practices there are limits in the use of some methodologies in their use for the activities planning or learning situations. About the teaching methodology, more than half of respondents claim to have knowledge on it at a medium level. Similar percentages appear in the use, always at a medium level, of innovative teaching methods for strategies, monitoring and evaluation of students in the teaching-learning process.

The research and critical selection of appropriate digital resources to the learning context are well receipted, as most state that they possess a medium-high level.

From the ethical point of view, on the other hand, we can consider the levels of appropriate application of the rules provided in digital environments and spaces in most respondents to be high. Furthermore, the respect of licenses in the use of digital resources is also met in an average percentage. Concerning teacher professional development in ICT, the Romanian report describes:

some strengths: as availability of high quality practical and applied training courses. The methodical skills needed to integrate ICT into lessons can be developed through teacher training courses. Experience exchanges in other countries: international programs facilitating the exchange of experience for teachers are considered very important for acquiring the necessary skills and represent a way to import good practices in the field of ICT integration. Good practice models within the methodical circles.

Some weaknesses highlighted: as strictly theoretical, not related to actual needs or low quality training courses. Even all interviewed teachers have been trained on AEL (Educational Assistant for Schools) platform, the use of AEL system is difficult, not all of computers can be synchronized and isn't functioning properly. It is necessary to train teachers of other disciplines in using ICT techniques and developing digital competences. Poor offer of methodological courses on ICT integration. Also considered a very stringent need, is the training on didactic methodology in applying TIC in teaching. There is a need for several such courses of methodical training with embedded practice. Difficult access to ERASMUS projects. Lack of schools' equipment, there is a need for acquisition of material resources (tablets, laptops and video projectors, digital board - for class.

2.6 Concluding remarks

It considers all common emerging elements and interesting issues, which can have relevance at the national level for all the countries.

Some recommendations emerge from the first phase of the project, the field research:

- the need of national visions for education development, in line with European recommendations;
- the need of a legislative framework, as a general national education law, about education system development in a lifelong and lifewide learning perspective, with a specific focus on the integration of ICTs in the system;
- the requirement of economic investment, which can guarantee equal opportunities in ICTs access and training for students and teachers;
- the financing of Continuing Professional Development to spread innovative practices.

All these issues required to be:

- designed and managed in the long term and in a European perspective;
- managed at national level, with differentiated margins of intervention for each local initiative.

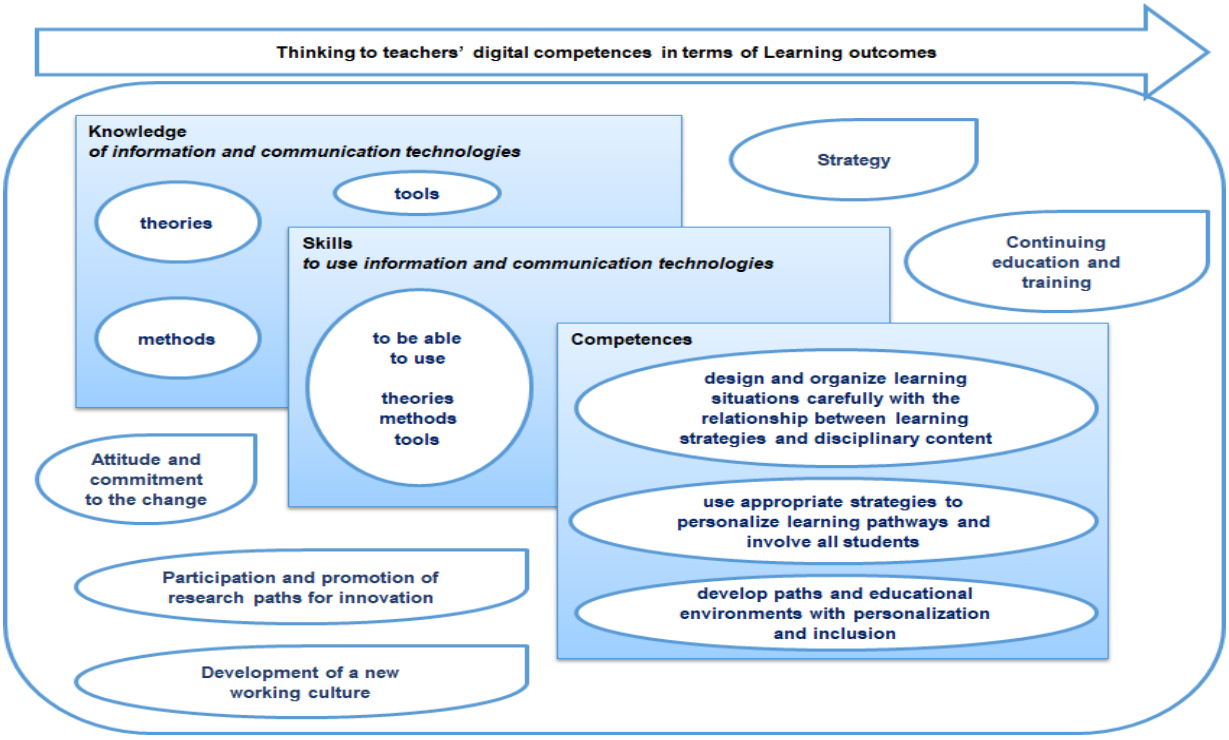

Figure 7: Thinking to teachers' digital competences in terms of Learning outcomes. Our elaboration

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From the analysis of the European and the different national digital competences frameworks, a possible common framework is proposed. It is certainly not exhaustive, but it represents the common elements of these frameworks, consequent from the results of the national research. From the results of the focus group and the interviews and during the progress of the project, the research team worked on some areas of development of teachers' digital competences. They can be identified as follows.

It is crucial for teachers to know how to organize and design different learning situations according to specific disciplinary content, and how to better develop personalized learning path by including all students in the process. What emerged from the analysis is also consistent with what is stated in the Digital Education at School in Europe, the Eurydice Report published in august 2019[53]. In about two thirds of the European education systems, teacher competence frameworks include digital competences among those considered essential for all teachers: some countries have developed specific frameworks referring to teacher-specific digital competences, and in other countries the existing teacher competence frameworks do not acknowledge digital competences, with seven education systems that do not have teacher competence frameworks at all.

The challenge, also in light of the results of this research, is to push all European countries to adopt policies for lifelong learning that take into account the digital transformation of society as a whole. With "development of a new working culture" we intend to support precisely this: DECODE project aimed to raise awareness about the incorporation of ICT in teaching and educational practices and systems, in order to develop innovative thinking about the meaning and the value of new technologies in the integral formation of man and for the renewal of the organization and production processes. The project was dedicated to promote strong ways of thinking, planning and implementing the overall educational offer, and the educational and professional environments in which the teacher's professionalism is expressed.

With digital skills being on the agenda of the European and national policy makers in the past decades, the results suggest that now it's the time to strongly encourage and promote actions capable of governing the most extensive processes of digital transformation. Crucial processes for the present and the near future - such as automation, digitization, dematerialization, virtualization, cloud and mobile computing, and the general shift towards a platform society and a culture that is based on algorithms - cannot remain on the margins of educational systems and distant from the professionalism of the teacher. The goal is to succeed in integrating the most effective theories, methods and tools to train teachers so that they are able to understand and manage continuous change, and the immaterial and socio-material dimensions of change here investigated at an organizational and professional level. As the teaching professions face rapidly changing demands, educators require an increasingly broader and more effective set of competences than ever. Teachers are expected to be able to create a learning environment that integrates digital technologies into their pedagogical practices not only to update and adapt the educational system, but to achieve a full digital citizenship for all. As the Council of Europe pointed out[54], it is pivotal for European citizens to reach empowerment through education or the acquisition of competences for actively participating in digital society. Digital Citizenship

[53] https://eacea.ec.europa.eu/national-policies/eurydice/content/digital-education-school-europe_en

[54] https://www.coe.int/en/web/digital-citizenship-education/

represents a new dimension of citizenship education that focuses on teaching students to work, live and share in digital environments in a positive way. It refers to the ability to engage positively, critically and competently in the digital environment, drawing on the skills of effective communication and creation, to practice forms of social participation that are respectful of human rights and dignity through the responsible use of technology. Supporting young people to participate safely, effectively, critically and responsibly in a world filled with social media and digital technologies has emerged as priority for educators. To address this issue the Steering Committee for Educational Policy and Practice (CDPPE) of the Council of Europe launched a new intergovernmental project entitled "Digital Citizenship Education" in 2016. The aim of this project of the Education Department (DG Democracy) is to concur to reshaping the role that education plays in enabling all students to acquire the competences they need as digital citizens to participate actively and responsibly in democratic society, whether offline or online. This is only possible - according to the main goals of DECODE - through the training of highly professional teachers, a professional and personal training that must be intended as continuous and for life.

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3. Integration of digital technology in the teaching learning process

Mihai Iacob [1]

3.1 How educational systems are supporting digitalisation

3.1.1 Approaches to the integration of digital technology in education

In each of the five countries represented within the DECODE partnership desk research and interviews have been conducted by local teams in order to determine how digital technology is embedded into the educational system. It should be noted that in the case of the United Kingdom and Spain, the information gathered tends to reflect a regional context (England and Catalonia, respectively), rather than the whole national context.

Integrating ICT into **Italian** schools is an ongoing gradual process that it's not yet fully incorporated and applied effectively. The national context regarding school digitalisation and ICT integration is framed and supported by national legislation and programmes. One of the most important pillars is The Digital School National Plan promoted by the Italian government in 2015. The Digital School National Plan underlines practices for the development of students' skills and specific roles for the Headmaster and the Administrative Director, not as mere executors of administrative procedures but as protagonists of the "digital school". Another important role is played by the Digital Animator.

In the United Kingdom, there is no national framework for the digitalization of schools and the integration of ICT, but rather a tradition of a 'bottom up' approach in education and this means that the implementation of digital learning and ICT depends on the philosophy of individual schools. In the case of schools that choose a more committed digital strategy, a digital leader is appointed and his role is to develop, implement and monitor the institution's digitalisation. Because lack of national framework also implies no national funding for ICT integration and digital tools, the money to cover staff costs for these positions has to be found from schools budgets. This means that only the schools with enough resources can afford to have full-time positions of digital leaders. In most other cases, a teacher or IT support staff member has the responsibilities associated with ICT innovation and digitalisation included within their daily tasks. Although ICT/digital tools are also not provided by national funding, for most schools, IT infrastructure it's not an issue (only the acquisition of tools that are more expensive, like cutting-edge hardware - tablets, VR headsets etc. is problematic).

In **Finland**, also, there are no specific laws regarding ICT in education, but this situation is compensated by some important reforms and key projects in the field of education that include the integration and development of ICT. A new comprehensive school program aims to reorganize the working culture of schools through a system of tutor teachers and networks. The role of a tutor, who is a member of the teaching staff, is to direct other teachers to digital appropriate exploitation, to disseminate and implement ICT and digital knowledge and to be part of the basic activities of schools. Tutor teachers will network and collaborate with each other and will work accompanied by students.

In the **Spanish** context, ICT education is regulated by legislation, with specific mentions about fostering digital competence and the ways and means in which technologies may be integrated in the classroom. Although, the perception is that policies related to integrate ICT in education are mostly limited to legislation and are not transposed into practical initiatives, there were a number of programs implemented that aimed to train teachers, equip both students and schools with digital tools and promote the development of digital skills.

In **Catalonia**, the administration adopted the TAC plan, with the main objective to offer an integrated vision on ICT in education, to promote the development of digital competences among students and to facilitate the integration of ICT. The philosophy behind the TAC Plan is based on shared responsibility and the involvement of the whole educational community in the process of decision-making: management team, pedagogical coordination, TAC coordination or TAC commission, department heads in the case of secondary education, school council or the Association of Students' Mothers and Parents.

In Romania the integration of ICT in education is framed by national legislation and was supported by a number of dedicated programs that aimed to foster students digital competences, train teachers and equip schools with the needed digital infrastructure, but the biggest problem in the process of implementation of the so called digital agenda is the absence of a coherent strategy and of a much needed unified vision. One of the consequences of this shortcoming is the lack of a clear image about the current situation of the ICT integration in schools in terms of human and material resources, students and teachers skills, methodological approaches, best practices and so on.

3.1.2 Good practices in the use of digital technology

When collecting good practices, the partners have used a framework of six types of digital tools (communication tools, virtual labs, virtual environments, virtual reality, apps and networks), with each country trying to identify examples within their national or regional context. For this publication we have selected only one example for each type of tool, but the five national reports include more such practices.

Communication and literacy learning with ICT

Bradford was the world's first UNESCO City of Film. In an effort to create a meaningful legacy from this status, a film literacy project[55] was created which aimed to have a positive effect on learning amongst primary age children in the city. The idea behind the project was that film could act as a useful gateway into wider literacy learning (reading and writing) as young people are a generation who have grown up surrounded by the moving image. Therefore, by using a variety of short and long-form films, students could learn how image, sound etc. are used to build meaning and fashion a narrative. Students themselves were also encouraged to develop a short film, using handheld devices (tablets, mobile phones etc.) to capture and edit content. To guide this work tasks were set around literacy points; for example, including a scene in the film which demonstrated the use of an adverb. Hence, the project transcended the traditional use of (pre-recorded) video in the classroom. Instead it harnessed the potential of modern devices to become interactive parts of the learning experience, with

[55] http://bradfordfilmliteracy.com/

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learning driven by the young people. Alongside some in-school support, experts delivered CPD for teachers around the basics of film literacy, editing content etc.

Virtual labs

The Mobilitzem la Informàtica[56] (Mobilise computing) experience is an optional subject in Informatics of the 4th year of ESO. The project consists of designing and programming an app for mobile devices. Students work in groups of 5 and the use of different tools and applications is considered throughout the course. The course is structured along the following lines: multimedia creations, publication and dissemination of content, and tools for communication. The didactic proposal is approaching a project through group work, focused on the design and programming of an app for mobile devices. While the development activities follow a linear process, sometimes students will have to replan or revise their previous decisions. The app should be meaningful for the students, i.e. it should provide a solution to a problem identified by the group. The definition of this problem and the tried solution are the base for all the activity. Students are asked to make a characterization of possible users, which is then a fundamental factor to consider in interface design and in the development of the provided services. Finally, it also integrates a commercial and entrepreneurial component. Different tools and applications are used throughout the process, in a contextualized and guided way, until the final product is created.

Scientific exploration through virtual environments

Operation World Heritage[57] is a free web game opened on the International World Day of Independence on 18 April 2016. It is a web game for lower secondary students, where pupils get to know Finland's World Heritage Sites. The game takes approximately one lesson and can also be played individually. The game begins with the arrival of aliens in the Earth orbit. Military superhuman aliens want to dismantle Earth and move people to other planets. As the military power does not help, players try to save Earth by justifying the aliens how unique the sphere is. The right arguments change in each game so players have to think about the world heritage and its importance from many different perspectives. Also, the leader of the game (eg a teacher) has a versatile opportunity to participate in the game. To overcome the game - and to save the world heritage - players must act together as active players. The organisation implementing the method is the Finnish Society for Cultural Heritage Education.

Virtual Reality in the classroom

Sevenoaks School in Kent is a (private) co-education boarding/day school for 11-18-year olds and in recent years the school has been able to establish a dedicated department focussed on innovation. As part of this, the school has been closely monitoring the growing affordability of virtual reality headsets and exploring the potential use of this technology in the classroom. By the start of the 2016/17 academic year, the school felt that VR had now become affordable enough to warrant investment and so began to roll out the technology into

[56] http://alexandria.xtec.cat/mod/data/view.php?d=2&rid=1773

[57] http://www.operaatiomp.fi

the classroom. The impact has been massive, with a range of subjects reporting an increase in student engagement and improved learning through the use of VR to explore topics. For example, the technology has been used in art and design to explore famous pictures in more detail. Students are able to render a 3D virtual mock-up of the picture and then fully immerse themselves into the scene using VR. This allows them to investigate the nuances of the image and so develop a greater understanding of meaning and technique.

Posing and solving problems in the App-Era

On the Careers Wales website, there is an app called the Job Interview Game[58], which can be used in sessions with young people preparing to enter the world of work (either part-time or full-time). Players role play through the stages needed to prepare for an interview; from what clothes to wear, to the sort of places to look for information on prospective employers. The game then takes players through the interview process, encouraging them to think about issues such as body language and how to answer interview questions. For young people, facing their first interview can be a daunting prospect. Equally, the skills needed to successfully complete an interview are not always the ones which they will have learnt through education. Therefore, the game allows young people to practise what having an interview may be like in a safe environment, whilst for schools there is no extra cost as the game can be accessed for free from any computer. Crucially, whilst traditionally such simulations may have been carried out face-to-face, the game has proved an effective way of disseminating information. This is because young people associate online games with fun rather than learning and so are more receptive to the learning points in the interview game.

Virtual communities

eTwinning promotes school collaboration in Europe through the use of Information and Communication Technologies (ICT) by providing support, tools and services for schools. eTwinning also offers opportunities for free and continuing online Professional Development for educators. Launched in 2005 as the main action of the European Commission's eLearning Programme, eTwinning is co-funded by the Erasmus+, the European programme for Education, Training, Youth and Sport, since 2014.

The eTwinning program has facilitated cooperation on science and technology between teachers and student classes in many transnational collaborative projects. "Open the gates to the Universe"[59] was such an initiative that brought together the efforts of participants from five countries (Romania, Cyprus, Portugal, Poland and the Republic of Moldova) to encourage primary school pupils to explore concepts related to astronomy through joint activities with colleagues from other countries. Nine-year-old groups of the five schools involved have worked together on tasks regarding astronomy, ending in an electronic journal that documented the process they have gone through.

[58] https://www.careerswales.com/en/tools-and-resources/games-and-activities/job-interview-game/

[59] http://isjvn.vn.edu.ro/utile/informatica.php

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3.1.3 Teacher training

Acquisition of ICT competences for teachers can refer to: a) the acquisition of competences related to the use of ICT by teachers for their own use and b) the acquisition of competences related to the use of ICT in creating an educational environment for students. The emphasis of the data collected through the national reports was on the second type of competences.

In **Catalonia**, the training and accreditation of digital competences must be an overarching component in the teaching of broader pedagogical competences, and the teacher needs to be able to use ICT appropriately in all areas of their knowledge. The Catalan PICDD project analysed the initial and continuous training teachers in ICT with the goal of proposing improvements. In addition, the project defined five areas or dimensions of digital teacher competences that should be considered in any teacher training in ICT (Generalitat de Catalunya, 2015).

The principle of allowing teachers time to carry out Continuous Professional Development (CPD) is well embedded in the UK's **education systems**. However, the content and format for this training varies from institution to institution and depending on individual teachers' needs. In an ideal world, all teachers would be able to take time out of class to learn about the latest developments in technology but there are budgetary issues to consider before releasing teachers for any CPD.

In **Finland**, while it has taken a long time to develop teacher training on information and communication technology, a number of studies have demonstrated that it has not become a natural daily activity in the teaching process in schools. Therefore, further development of basic and continuing teacher training remains challenging. There is a wide range between schools in the practical application and teaching of information and communication technologies. The National Board of Education has also funded teacher further training in ICT.

In **Italy**, the National Digital School Plan (2015) was probably the first important moment of reflection about digital didactical practices at school in the institutional world. It constituted the first moment of reflection on the educational processes, but also on the type of organization, school environment, spaces, training of teachers and real connection between schools and the world of work. However, like all reforms, it has clashed with an organizational and educational context, often not ready to absorb and welcome the changes, resulting in "*a series of problems that clash, both with a very cumbersome and demanding organization of the ministry and, with the organization of schools*" (policy-maker), hindering the pervasive relapse of initiatives that remain occasional experiences, difficult to capitalize.

In **Romania**, the methodical skills needed to integrate ICT into lessons can be developed through teacher training courses during initial training, but there is also a significant informal component to the acquisition of this type of skills, which should not be overlooked. In terms of initial training, the teacher training curriculum includes a compulsory course called *computer assisted instruction*, as part of the pedagogical module during the third year of study. This course should develop, in addition to the needed technical skills to use the computer for training purposes, those abilities related to the use of pedagogical methods that integrate technology into teaching, learning and evaluation. For this purpose, practical applications of the use of digital

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technologies in the teaching of any discipline should be included in the course format. Another proposal aims at setting up a didactic MA degree, with the recommendation that relevant training expressly seeks the successful use of new technologies in the classroom activity, regardless of the given teaching-discipline.

3.1.4 Approaches to the evaluation of ICT integration in schools

Variations within the systems of the five countries under analysis, in regard to quality assurance and evaluation of ICT integration in education, are considerable. This reflects the centralisation of different functions within these systems: the UK, Finland and Italy have a decentralised approach, while Spain and Romania have a more centralised approach.

In the **United Kingdom**, although there is no standalone evaluation or quality assurance tool issued from a governmental level to assess the implementation of ICT and digital resources in classrooms across the country, the use of technology is a factor which informs Ofsted inspections. In particular, the extent to which a school is using cutting-edge and impactful new technology forms part of the assessment of the quality of an institution's teaching during visits. Ofsted inspectors only visit most schools every two to three years (depending on how successful their previous inspection was). The problem with this is that these are more subjective, individual checks, which means that there is a lack of common criteria on a formal level to help decision-makers, practitioners etc. benchmark schools across the country against one another.

The external evaluation of schools in **Spain** is the responsibility of the Autonomous Communities and the Ministry of Education, Culture and Sport (in the case of the Autonomous Cities Ceuta and Melilla, and of Spanish schools abroad). The main body of external evaluation is the Education Inspectorate, dependent on the associated regional ministry/department of education (although some regions are divided territorial delegations), staffed by civil servants who act as school inspectors. The Inspectorate controls and supervises educational institutions and their programmes, teaching and school management, continuous improvement of schools, and the compliance with legislation, regulations and official guidelines.

In **Finland**, the earlier quality assurance was largely based on norms and inspections until the 1990s. The education administration was decentralised early 1990s in Finland after the abolishment of school and textbook inspections. The current quality assurance system in Finland comprises the quality management of education providers, the national steering of VET and external evaluation. There is a strong focus on both self-evaluation and peer evaluation of schools and education providers and national evaluations of learning outcomes. Digitalisation is one of the evaluation themes of the National Evaluation Centre for Education KARVI.

In **Italy**, at the national level, there are still no clear guidelines and procedures that accompany the education system to integrate digital innovations in educational processes and practices. In 2016, the Ministry created the School Single Data Portal for free access to data about schools, students, school staff, school buildings, national assessment system and national operational program (PON). In the same way, there is still no public monitoring and evaluation results regarding the efforts made through the PNSD.

In **Romania**, new technologies have been included in the first evaluation standards, which were elaborated in 2005. They have recently been reorganized and reduced in number: for accreditation, the descriptors were brought down to 133 from the original 611, while for reference standards the descriptors went down 450 to 403. In 2017 the National Quality Assurance Agency[60] (ARACIP) launched a public debate on these updated standards for authorization, accreditation and periodical evaluation. The new standards make explicit reference to "Availability of ICT equipment". When a school receives its authorization, the standards are in terms of projection (e.g. "Is there an allocated budget?"), while when it receives its accreditation they are referenced in terms of availability and functionality. For each category of standards there are compulsory minimal requirements, for both authorization and accreditation, and requirements leading to an optimal functioning level. Some indicators specifically reference the way ICT tools are integrated in educational practices.

3.1.5 Moving forward

Based on the desk-research and interviews conducted, within each of the five national reports, the authors have put forward a series of recommendations in order to map a way forward. While they were designed for each specific context, some underlying themes could be identified. The following considerations are based on those recommendations for changes at classroom, school and policy level .

As mediators of the use of digital technology within the educational process, teachers should be supported and empowered to offer to pupils meaningful experiences. The first steps in this direction are to strengthen their sense of agency and to offer validation for the skills they might have acquired in informal and non-formal settings. DigCompEdu (see Chapter 1) offers one such way of validating competences and planning a personalized training path.

In terms of classroom use, emphasis should be put on the real-life applications of digital technologies and the development of competences such as critical thinking, problem-solving, learning to learn, communication and collaboration in order to foster the acquisition of what is generally defined as digital citizenship. The revised Key Competences for Lifelong Learning[61] (2019) represent a conceptual model which could underpin such a process.

Because of professional, ethical and financial considerations, using open source software and open educational resources should be a priority, whenever they are available. In time, this is expected to lead to the creation of professional communities which transcend physical and administrative boundaries, while increasing the engagement of educational professionals, by recasting them from users to creators. The economic implications of the use of open educational resources are also significant, with a potential for long term

[60] www.aracip.eu

[61] https://publications.europa.eu/en/publication-detail/-/publication/297a33c8-a1f3-11e9-9d01-01aa75ed71a1/language-en

reduction in costs. Recent approaches to open educational resources, like the X5GON[62], have taken steps to break down previously hard to overcome barriers (e.g. linguistic, cultural).

The research presented above has shown that headmasters and school leaders are tasked with adapting digital technologies to the local context, even in educational systems with a more centralized approach. Their agency is paramount in the successful harnessing of the potential of these technologies, while recognizing that ICT equipment is only a prerequisite for contemporary education, not a guarantee of success (Vincent-Lancrin et al., 2019).

School leaders across Europe are interested in having a framework for schools to aim for and benchmark themselves against. By and large this is a positive development, in that it would create an environment for dialogue and the exchange of practices, but it is not without potential pitfalls. it is not difficult to anticipate ways in which such a tool would be used to create hierarchies and entrench divisions among schools.

There is a growing trend of involving pupils in the integration of ICT and the subsequent evaluation of the process, as attested by the creation of the SELFIE[63] tool. The underlying message is that pupils are instrumental in their own development and in the services provided by schools, rather than passive objects which are to be molded according to preset criteria. Ownership of the process of integrating ICT in education processes is key in assuring that benefits and responsibilities are shared in a fair manner. We think that an open management approach is best suited to achieving this goal.

In terms of policy, there is an often expressed feeling among experts that the updating of legislation to account for the development of digital technologies is lagging behind what is happening in practice. From privacy issues, to the reliability of the information circulated through digital means or the ownership of digital objects, there are many issues on the agenda of the legislators which need to be addressed. Recent developments, such as the adoption of the General Data Protection Regulation[64], have raised awareness among education stakeholders towards these issues, while at the same time providing enforceable legislation.

Finally, the investment strategy in connectivity and equipment does not always have clear and predictable updating mechanisms. This has meant that some contexts have not been able to keep up with the costs of connecting[65] and replacing equipment. Mitigating the negative effects is a medium and long term goal for the EU, as outlined in the Connectivity for a Competitive Digital Single Market Communication[66] (2016:2).

[62] https://www.x5gon.org/science/overview/

[63] https://ec.europa.eu/education/schools-go-digital/about-selfie_en

[64] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32016R0679&from=EN

[65] See *2nd Survey of Schools: ICT in Education*: https://ec.europa.eu/digital-single-market/en/news/2nd-survey-schools-ict-education

[66] https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=17182

3.2 Suggestions for developing a practical approach

3.2.1 Developing an ICT based education model

The education systems of the partner countries of the DECODE Project use various school management mechanisms, with regional differences within the same education system, in some cases. An ICT integration school action plan is a model instrument that is adapted to local contexts in order to support teachers in easily and realistically integrating ICT in their school/ classroom practice. The structure, contents, specific methods should take into account the specific requirements at the local level.

Based on expert advice, Kettunen and Sampson (2019), have mapped the challenges faced by career guidance services in integrating ICT, with four major issues being identified: a) inadequate access to ICT, b) inadequate access to information, c) inadequate skills and competencies, d) inadequate integration. We think that, to a large extent, this should be applicable to the wider educational system.

An ICT-based education model is a representation of the relationships among the education system components that derive from the general view on an ICT-based quality education process, and the inherent values and main features of good practice.

A model selectively highlights the components and the relationships that are considered the most important for reaching the objectives. It should have abstract characteristics and show the main approaches and assumptions to develop a quality process. It has a higher level of generality compared to specific methods and techniques and a lower one compared to the paradigms of the domain of knowledge.

A model can take various shapes and can be presented in an abridged manner that does not necessarily mirror the complexity of the world, yet it can play the role of facilitating the understanding of certain relationships/factors. Possible dimensions to highlight within the ICT-based education model should include:

1. Level of ICT integration (activities with/ through /by ICT);
2. Structural/ process dimension;
3. Quality of ICT use:
    a) full – in all the activities/ actions/ operations where ICT use is beneficial to fulfil the set goals;
    b) optimal – there is a balance between the ICT tasks and the rest of the activities from the perspective of the intended outcomes; ICT integration is not a goal in itself and should not be implemented uncritically, discarding other relevant activities;
    c) natural/relevant – ICT use is naturally integrated into the activities flow which requires a higher level in both domain related and digital expertise;
    d) efficient – there is optimal use of resources in order to reach the goals;

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e) effective – the ICT instruments facilitate the processes regulation in order to obtain the most of the expected outcomes;

4. Quality of the results at the level of:

   a) students' expected learning outcomes;

   b) satisfaction of the involved actors: teachers, students, managers etc.

Digital technologies provide the teacher with relevant resources for all of his/her activities, from designing complex situations for learning/assessment of the targeted competences, to preparing students for engaging with the learning situations, as well as the verification and analysis of the results.

3.2.3 Evaluating the integration of ICT in education

As highlighted in the first part of this chapter (see *Approaches to the evaluation of ICT integration in schools*) educational systems across Europe use both top-down and bottom-up approaches when offering guidance and evaluating the use of digital technologies. While both are efficient ways of supporting the educational process, with intrinsic benefits, we would like to emphasize the importance of using evaluation as a tool for empowering the whole school to assume ownership of the process.

Capogna (2019) sees evaluation as a tool for empowering school organization and teachers to:

- plan integration of digital resources at school;
- valorize digital technologies in teaching practices;
- support improving teachers' digital skills for teaching and their career development;
- self-evaluate the state of the art concerning the use of digital resources at school.

This creates the need for standards for self-evaluation and planning, in order to support the reflection process of school community. There is debate as to how to define the actors which constitute the network. For example, do parents have enough information to participate in a debate on the integration of ICT in their school, or do they only mirror their children's opinion?

On the side of top-down approaches, there are some commonly occurring criteria used by external evaluators, such as:

- The availability of resources;
- The existence of a school development strategy;
- Openness towards the community;
- The recognition offered for the use of ICT ;
- Continuous professional development;
- Integration of ICT throughout the teaching process;
- Promoting safety and security in the use of ICT.

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The indicators attached to such criteria are usually focused on externally observable aspects, as they are more readily measurable, while more subjective aspects are only touched upon through proxy measures. The inherent risk of using this kind of approach on its own is that of organisations learning what is expected of them in order to tick the boxes on the evaluators chart, rather than engaging with its members in a meaningful manner.

In regard to the evaluation of the level of competence development, as an extremely complex activity, it also requires the creation of mechanisms for collecting pieces of evidence and processing through digital systems. Some e-learning platforms of training institutions have developed advanced methodologies for assessing progress in learning. The ways in which information can be collected can vary depending on the information collected, how they are organized and in which form.

3.2.3 Meaningful teaching and learning

The focus on competence-based education represents an opportunity for every school to revisit their effective curricula, mainly teaching-learning-assessing practices that still centre *subjects matters* instead of the real *subjects* of education. In many places (and situations) teachers continue to teach the "school disciplines" instead of teaching students according to the latter's needs and interests.

The digital competence is not the result of a *per se* intensive study, a number of periods/ week for a number of weeks per term/school year. It actually becomes an opportunity for:

- a more meaningful school, i.e. better learning (since it involves "goals" that are worth striving for in the real world from a personal perspective);
- a friendlier school, i.e. more motivation for learning (since creativity, curiosity, open-mindedness are explicit key attitudes);
- use of acquisition in informal/non-formal contexts, i.e. learning and school open towards broader experiences that help integration and inclusion.

The way in which digital tools can be used to create a learning environment can take many forms, of which we would like to highlight five of them:

- **Documentation**: in an educational perspective, the act of "documenting" will be a shift from listening to the teacher's lecture towards exploring a variety of sources for a variety of topics in a variety of school subjects and learning how to "document" your search and results, i.e. to substantiate your findings with evidence. A very important component of learning to learn, and a valuable source of knowledge and discovery learning in all subject matters, documentation is well supported by the digital competence. It helps students to look for sources and specific info. Support is needed with novices for filtering, selecting relevant information and processing it according to a learning goal.
- **Interaction**: pupils use social networks extensively and they love it. From an educational perspective, far from being a mere distraction from serious study, social networks can become a good foundation

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for collaborative learning with all its benefits! Again, like with documentation, interaction on social media can apply to any subject matter for a variety of learning topics. The profit is two-fold: the digital competence sustains the interaction and collaborative learning; new contexts of putting the digital competence at work expand, differentiate, consolidate and multiply the transfer opportunities of the competence for later use.

- **Presentation**: Whether students present their results orally or in a written form, ICT is paramount! Digital channels are great to help with a good (even impressive!) presentation of good work. A digitally supported presentation sustains the promotion of results and by thus brings about more responsibility on behalf of the learner/presenter in neatly organizing ideas, expressing them in verbal (written/oral) or non-verbal forms.

- **Databases**: Operating with databases seems complicated and specialized and probably more appropriate for Maths classes at high levels, but with digital support, even primary school kids can effectively work with a database and profit in their learning .

- **Virtual tours**: One of the most spectacular educational uses of new technologies is the virtual tour of an otherwise difficult to access aspect of reality. Commonly perceived as purely in the sphere of games and entertainment, virtual reality can support students to better understand a variety of topics. Whether it is about exploring science, technology, geography, history, literature or art, the virtual tours are free and comfy (you are never tired when you visit from your chair!) and with many profitable learning experiences.

In order to foster engagement with digital tools and make them support sound teaching and learning, there are some steps that can be taken and considerations which teachers should be aware of:

- use digital technology to search and download materials for students;
- create home assignments that require digital channels;
- communicate with students by means of digital apps;
- post on the various platforms which allow the co-creation of content (e.g. a class blog);
- encourage students to design presentations;
- make extensive use of video sharing sites for entry points;
- never use apps just because, but rather for meaningful work;
- whatever works for you and your students is the best way to do things.

Although surrounded by digital technology, pupils are at the stage of naive experts (Ní Bhroin & Rehder, 2018:3) which need support from educators in order to acquire the concepts and the awareness needed to use it safely and effectively.

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3.2.4 Tools for school leaders

Digital technology comes with great promises, upon which it does not always deliver. Educators are becoming increasingly aware of the risks and limitations attached to it and need support in overcoming them. In the following paragraphs we highlight some of the tools at the disposal of school leaders, which can be used to support the building of an educational community in conjunction with the potential generated by new technologies.

Map of resources: Each type of resource needed to successfully integrate ICT in education, be they financial, technical or informational, comes with its own caveats. A general awareness of the ICT context needs to be developed at school-level and this can take the shape of a map of resources, which can be shared – either in part or as a whole – with school level stakeholders. Maps can be varied in their scope, theme (e.g. didactic resources, networks of experts, stakeholders, software) or information contained. They should be able to answer questions such as: what is the availability of a specific resource? what are the costs associated with accessing a specific resource? what is the relevance of the specific resources for the needs of the school? The complexity of resource maps can range from basic lists (e.g. names of community stakeholders), to multi-layered analysis of several factors.

Planning tools: In order for ICT to become an effective educational tool, there needs to be a shared vision regarding its role amongst school-level stakeholders. Making sure that everyone is on the same page when it comes to expectations, potential limits and benefits of the use of ICT is paramount to creating an educational community. Which findings should be formalized into a document agreed to by the whole community depends on their purpose, the requirements of the larger educational system in which the school functions and the school culture.

Training opportunities: Continuous professional development of the teaching staff is the key to having an updated set of skills and being able to deliver quality educational services. An exercise in mapping the local training offer and making it available to teaching staff is highly recommended. Depending on what training opportunities can be accessed and the available expertise among school staff, one can consider organizing in-house training.

Communities of practice: Sharing of experiences among teachers is a great way to promote peer learning, which is rich in high quality local information. School should foster communities of practices regarding the use of ICT for teaching and learning. Schools should create spaces for sharing practices in ICT use in the classroom, which would also allow results to be made visible and celebrate. Consider organising common learning events and making the results persistent, by either displaying them or by integrating them in the educational proces**s.**

Involving students in the design of learning: The fact that we consider digital natives as the reference group and non-natives as an ever-diminishing one, summarises the current view in the educational systems throughout the world. Crediting students, which are digital natives, with expertise is an effective mechanism of opening teaching practices to a wealth of insights and skills. Students are the best source of information on their own needs, which should be tapped into regularly. They are also competent users of ICT devices and are

able to support the teaching process with their skills and their feedback. The fact that students acquire ICT skills in non-formal and informal contexts means that they might not be supported by a critical apparatus and it will be the task of the teacher to create critical thinking skills.

Local partnerships: Schools are living organisms, within the community they serve. School management needs to put in practice the concept of an open school, as otherwise they risk alienating local stakeholders, with tangible negative consequences. Schools have to assume the role of connecting people and this is best done through local partnerships. Parents, the wider local community, companies and public services, all have an important role to play when it comes to shaping the use of digital technology in a meaningful way. Schools should aim to provide services for the community, outside their core mission of educating pupils. Empowering pupils to take the role of teachers for adults in the community, would be one way of providing such services. Digital technology is especially susceptible to be used in such educational settings.

Sharing with the global society: Digital technology has expanded the world beyond anything which was possible just two decades ago. Nowadays schools are connected to the world stage by simply tapping the screen of a smartphone. The challenge now is to think big and embrace the global society brought on by new technologies. Pupils can be in direct contact with their peers from different cultures and different continents, rather than just learning about them from a textbook. ICT has enabled every school to engagement in a meaningful way with global issues of any nature – the environment, migration, cultural identity and so on. The message that school leaders need to promote is that teaching should be rooted in issues that go beyond our immediate environment in order to be prepared for future challenges.

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4. Practices, training and skills needs of the digital teachers[67]

Stefania Capogna [1]

Maria Chiara De Angelis [2]

Flaminia Musella [3]

4.1 Key characteristics of the survey

The rapid evolution and digitalisation of society means that schools are having to adjust the ways in which they communicate with students. Teaching methods and practices are having to adapt to these changes and must take into account how important technology is for younger generations. These “digital natives” (Prensky 2001b; 2005b) require technology to be part of their learning process, and this means that there is an obvious need for teachers to increase their digital awareness. In the past, Information and Communication Technology (ICT) education and training facilities and teaching staff have typically had "technology" and "incorporating" approaches, with the result that teachers appreciate and use technology, but rarely bring it into class. In recent years, there has been a growth towards a more intrusive breakdown of traditional teaching schemes, in particular with small scale interventions. To this extent, it is important to review pedagogical-methodological approaches.

The comparative survey aimed to detect experiences, skills and training needs of teachers involved with the aim of detecting strengths, areas for improvement and development prospects, encouraged by the changes observed in the new educational paradigm, through a multi-dimensional and multi-perspective approach. The comparative survey aimed to reconstruct the digital innovation trend in educational agencies (intermediate level), supporting the accompanying demands of educational agencies.

Survey questions arised around four main issues:

- What is the daily practice of teaching in relation to the technological equipment provided by the school?
- How does the use of technologies and personal resources in daily professional practice and teaching work?
- What is the state of the experience and skills most widely used today among our teachers?
- What are the most relevant experiments carried out?

[67] The study is the result of a joint work, only for the award, it can be considered the following paragraph division: Capogna § 4.1, §4.4; Musella § 4.2; De Angelis § 4.3.

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For this purpose, a structured questionnaire was designed which represents a so-called standard detection technique among the most prevalent in social research. This involved a long procedure of processing the applications to guarantee simplicity, adequacy, clarity, uniqueness, etc..

The questionnaire is organized around five thematic macro-sections with questions aimed at taking a socio-demographic profile, practices, attitudes and beliefs of teachers involved (in the Appendix): a) school data; b) teachers profile; c) teachers practice in ICT with a specific focus on the use of digital tools and technologies in teaching and learning process; d) training needs of teachers, with a specific section dedicated to the self-assessment of the teacher's digital skills according to the DigCompEdu Framework; e) personal opinion of teacher in relation to the use of ICT in teaching and professional practices.

The sections "School data and teacher profile" focused on personal data and a series of information on the context in which each teacher performs their activities: distribution of respondents by school type, teacher age range, gender, teaching area covered over the last three years, type of contract in the school, teaching role covered over the last three years, role as digital coordinator in the school.

The “Teaching practice in ICT” section investigated the use of digital tools during the teaching-learning process. This section intended to help us to understand the frequency which digital technologies are used in the classroom.

The section “Training needs of teachers" investigated achieved training and perceived training needs and accompaniment of teachers in relation to the use of digital technologies in professional practice. Within this section, there is the sub area of investigation “Digital Competence of Educators (DigCompEdu)”. This section aimed to evaluate the digital skills level of teachers, through a self-assessment of the digital skills according to the DigCompEdu framework, issued by the EU in 2018 as explained in Chapter 1.

Finally, the section "Personal opinion" investigated the widespread opinions among teachers in relation to the use of ICT to recognise basic assumptions and values that guide their educational use of digital technologies.

4.1.1 The profile of the survey participants

The online survey involved a total of 2652 teachers from all levels and kinds of schools, so distributed: 366 FIN, 693 ES, 937 IT, 255 UK and 401 RO. Out of these numbers, the following completed the entire questionnaire:

1. Spain/Catalonia: 425
2. Italy: 776
3. Romania: 291
4. UK : 255

5. FI: 291[68]

The groups of teachers belong to four school types: Secondary school, VET, Primary and Early Years. The majority of teachers who participated in the survey belong to VET (61%) and Secondary (37%).

The characteristics of participants are as follows: female teachers are more represented, and have an age comprised between two ranges: 41-50 and 51-60; except for British respondents who are represented by a higher percentage of male teachers (59%). 58% aged between 31-40 years and 19% 41-15 years. The age of the participants confirms what emerged by Eurydice research on the statistical sample studied. The data is congruent with the profiles of teachers emerging from the results of TALIS research (2013): most of the teachers are women, and their age is included in the range observed by this survey for all the nationalities involved. The highest percentages of female respondents are Romanian teachers (female: 90.7%, male 9.3%).

The most represented teaching areas are Literacy, Numeracy and Science. The British teachers teach a wide variety of disciplines: 17% teach Literacy and 16% focus on Numeracy-related teaching. 12% of respondents facilitate PSHE delivery, 12% work in Special Education and a further 12% specialise in Learning Approaches. The Romanian teachers respondents are represented by the following disciplines: Science 35%, Social Science 21,3%, Numeracy 17,2% and Literacy with 16.2% The Catalan teachers who participated in the survey are represented by these disciplines: Literacy 34,4%, Science 33,4% and Numeracy 27,1%. Finnish teachers work in these disciplines: Arts 37,05%, Science 35,84%, Physical Education 34,04%. Italian teachers are represented by the following disciplines: Literacy 30,7%, Science 29,6%, Numeracy 29,1% and History 24,9%.

Employment contracts are mainly permanent (about 90%) except for Catalonian teachers who have a lower percentage (63.8%). The data confirms the findings in the previous research TALIS research for Italians (81,5%), Finnish (82%, TALIS 76.9%), British teachers (93%-93,6% TALIS) but not for Catalans (63,8% TALIS 81,7%) and Romanians (92.8% TALIS 69,5%).

In all surveys, the teacher's role is represented by high percentages around 95%, while Finnish respondents are represented by 75%. The role of the Digital Coordinator is generally poorly represented, especially for British respondents who are represented by 3%, while Italian teachers are represented by 29.8%, Romanian by 20.3%; Finnish by 13% and Catalan by 11.8%.

4.2 From the factors analysis to cluster. The methodology

A first comparative analysis of the collected data was followed by a second level analysis (ACP and Cluster Analysis), which allowed to define for each country synthetic profiles of the practices related to the use of digital technologies in teaching.

[68] Finland: It should be noted that for Finnish teachers respondents a total of 396 answers were received. Of these, have been eliminated 105 because they were incomplete. All interpretations made refer to the sample of 291 complete answers.

In this Section, we shortly describe the procedure we adopted to perform this second level analysis. The methodology, applied equally for each data matrix of every Country, is two-folds.

4.2.1 Information condensing

Analysing a data matrix means to catch the right information collected on several multivariate data, by ignoring redundant information. Statistically speaking, there are many interesting multivariate techniques to condense information. More of them are computationally efficient if applied on complete cases only. Therefore, for each country, we only worked on data matrix without missing values. The matrix complexity reduction can be gained by making an exploratory factor analysis. This statistical multivariate technique is useful for extracting the latent information laying among observed variables. In detail, the technique has been applied on questionnaire questions related to the frequency use of digital tools (q0009), the frequency of some specific digital activities (q0012) and the frequency use of digital tools in some scenarios (q0020). The reason why we selected these questions is related to the strategic meaning information belonging them, deeply connected with the main goal of research. More specifically, for each sample, we started by testing the factor analysis adequacy of every set of questions by using two different statistical tools: the Bartlett test and the KMO test both providing information about the adequacy of each variable to be treated with a factor analysis. For each country, tests significant allowed us to proceed in the analysis. Performing an explorative factor analysis requires to determine the proper number of factors able to reproduce the relevant information contained in the entire data matrix. In literature, the selection of the right factors number can be done by many alternatives and equivalent methods, some based on the total variance replicated by factors, some based on the eigenvalues. We chose factors number by comparing all methods, but mainly preferred the parallel analysis (the most spread recently). Once the choice was done, we proceeded with the factors' extraction. Performing the extraction can be done by approaching different methodologies. We adopted the principal analysis method; as common, varimax rotation of factors and Bartlett procedure for getting factor loadings have then been used. Moreover, in order to verify if the extraction was statistically meaningful, we checked some important indexes of goodness of fit. These indexes, helping in understanding if the factor analysis is satisfying i.e. if the statistical technique information reduction properly reproduce the observed data matrix. They are:

I. the root mean square of residuals (RMSR) whose good reference value is those much closer as possible to 0;

II. the Tucker Lewis Index (LTI) whose reference value is those much closer as possible to 0.9 or greater;

III. RMSEA index whose reference value is those less than or equal to 0.05.

Since statistics were satisfying, we proceeded with the factors' interpretation and extraction. Factors have been studied in terms of their composition by specifically observing the factor loadings, i.e. the contribution of each variable to the factor. This element is crucial to better interpreter the factor and named them. This step is strategic since factors are then usually more deeply analysed to carried out some conclusions about the samples. In order to facilitate the factors explanation, the composition of each factor has been pictorially represented by a path diagram, i.e. a graph where factors and relative observed variables connected to an

edge weighted by the factor loadings. Each factor has been named and it is interesting to observe that some factors composition, and thus meaning, is replicated in the different samples.

Once factors have been interpreted, the factor scores have been saved in the original matrix as new variables in order to be more deeply analysed.

4.2.2. Clusters' analysis

The exploratory factor analysis helps users in catching latent variables condensing in a smaller number of variables all the strategic information necessary to have at disposal information of the samples. Therefore, starting from extracted factors, it is common to perform a cluster analysis in order to verify how statistical units (teachers in our case) can be grouped into similar clusters. We performed, for each country, a cluster analysis on extracted factors by proceedings along two steps. First, exploratively, we decide the right number of clusters by a hierarchical cluster analysis accompanied by a dendrogram. This graph helps users in understanding the distance (mathematically computed on the base of computations among factors' scores) between groups of units. Statistical units (teachers) more distant to each other in terms of analysed information (factors in our case) probably belong to different clusters. The proper number of groups to extract is usually determine in base of the most gap between set of units. Once the proper number of groups have been chosen, a k-means cluster analysis is performed for estimating, for each statistical unit, the belonging cluster. There are many different algorithms and methods to perform the analysis; we chose the complete one. Results, consisting in a number representing the belonging group have been saved in the original matrix as well. This information has been interpreted by jointly analysing belonging groups and other observed variables with aim to carry out a profiling of each group of teachers. The interpretation has been led by considering the average distance of each factor to the cluster (this can help in understanding the contribution of each factor to the cluster) and it is described for each country in the following paragraph.

4.3 Practice digital technologies in teaching

4.3.1 Italy

The factorial analysis conducted according to the method of the main components allowed to extract six factors that summarize altogether about 70% of the total variance, thus offering a good approximation with respect to the information content of the original matrix.

The first extracted factor "*Online student engagement/activation and network document application use*" focuses on the enhancement of students' online learning activity and summarizes three variables that take on the same weight in defining the factor itself: regular contact with my students through online communication (email, forums, blogs etc.) to continue the learning process outside the classroom (0.7); ask students to document online what they have learnt (0.7); involve students in collaborative online work (0.7). This factor reproduces 7% of the variance of the original matrix and it summarizes the practices of engaging and activating students online and the documentation activities of the learning process in progress and online collaboration, a collaboration that seems aimed at maintaining contact, involving and soliciting.

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Collaboration means a prevailing situation of information exchange aimed at mutual aid in which students working together, sharing of tasks, with the explicit intention to "add value" - to create something new or different. A broad definition of collaborative learning could be the acquisition by individuals of knowledge, skills or attitudes that are the result of group interaction, or, more clearly stated, individual learning as a result of a group process (Kaye, 1994).

In cooperation, on the other hand, the architecture of interactions is more complex, and requires a process of continuous negotiation-choice for the achievement of a common goal-task (Calvani & Rotta, 2000). In cooperation, roles and functions between the actors that participate in the process come to assume a greater systematization (Johnson, Johnson & Holubec, 1996; Comoglio, 2000; Trentin 2010).

This component, therefore, expresses certain attention to the social and collaborative dimensions of learning that can be realized inside and outside digital environments. The component seems to collect the aspects connected to the pedagogical competence that is expressed through the attempt to integrate digital resources and assessment practices to facilitate student empowering paths (DigCompEdu). Compared to the taxonomy of Bloom, revised in a digital key, it characterizes a high level of competence in the upper part of the pyramid, in that sphere of competences that lies between “analyzing and evaluating/collaboration” (Churches, 2008).

The second extracted factor *“Use of advanced and collaborative digital technologies for educational purposes”* summarizes the use of advanced digital technologies for educational purposes and it is able to reproduce 35 % of the variance share.

There are six variables that contribute to the formation of the factor. Among these, three assume a slightly greater weight; the frequency of use of: 1) digital educational content and OER (Open Educational Resources), 2) resources for the creation of blogs, websites and hypertexts and 3) the practice of computational thinking (Coding). The factor is also defined by the frequency of use of multimedia programs relevant to the discipline, digital environments for learning, sharing, communication and collaboration, and resources for creating audio, video and graphic content.

The extracted factor refers to productive use of technologies aimed at creating digital content (software and audio-video-graphics), according to the constructivist approach that considers knowledge anchored to the concrete context and as a product of the active construction of the subject. It configures the habitus of a specialist technical teacher.

Still referring to the Bloom taxonomy, the factor seems to be oriented towards the top of the pyramid, the one that identifies the active approach of the teacher in creating new contents of creating knowledge (Churches, 2008), giving an account of the professional skills of the educator.

The third extracted factor *“Use of basic digital tools”* summarizes three variables: the use of Office and similar package, the use of research tools, and residual with respect to the first two, the frequency of use of software for downloading audio-video files.

The extracted factor refers to a use of basic technologies, of a transversal nature and not anchored to uses specifically linked to the enhancement of learning paths; on the contrary, their use in teaching practice refers

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to an approach of a markedly informative-transmissive character that captures only one of the two aspects highlighted by the definition of digital competences of the European Parliament (2006): the use of computers to find, evaluate, store, produce, present and exchange information. The factor does not have within it variables that refer to the second area of communication and participate in collaborative networks via the Internet. The factor, therefore, describes what today we could define the "minimum" digital baggage of the citizen that in the aforementioned taxonomy constitutes the basic toolbox used by the teacher to stimulate the students' memory and understanding (Churches, 2008).

This factor almost entirely corresponds to the United Kingdom's P4 and seems to configure a focus on tradition-continuity which expresses a certain difficulty in integrating digital technology in traditional teaching practices, leaving a glimpse of basic use of ICT, resistance to change, technical/methodological skills of basis. It configures the professional habit of a traditional teacher.

The fourth extracted factor "*Online participatory/creative activities"* focuses on the frequency of use of ICT for creative online activities aimed at student empowerment. There are three variables that contribute to the formation of the factor. Among these, one takes on greater weight: creative work through the use of online applications. This is followed by the use of the network to encourage interdisciplinary projects and, at a residual level, the assessment of the student, which represents a practice that is still not particularly frequent. This component summarizes 2% of the variance of the original matrix.

The factor focuses on the promotion of participatory and creative activities through the enhancement of digital resources; we can see the attempt to accompany digital technologies in new learning situations even for speculative purposes. The extracted factor refers to a metacognitive use of technologies aimed at conceptual/participatory work and the assessment that, according to Bloom's taxonomy, can recall the application work, aimed at using learning in new situations. The factor describes the attempt to use the new technologies for epistemic purposes, to accompany the student to build his own framework of knowledge also through the use of the network for learning purposes. Also, in this case, we place ourselves on the upper part of Bloom's learning pyramid with certain attention to increase students' digital skills. It configures the professional habit of an innovative teacher.

The fifth extracted factor "*Digital technologies for networking*" summarizes the practice of using digital technologies for networking. The factor summarizes two variables, which contribute to the same weight to the definition of the factor itself: the construction of professional networks and the construction of social networks. This component summarizes 5% of the variance with respect to the original matrix.

The factor describes a use of the network functional to the growth of the socio-professional capital of the teachers, who therefore seek to seize on the web and in the use of social networks opportunities for contact and development of professional practice communities and the opening up of job opportunities and/or professional training and updating (eg through the use of social networks like Facebook and LinkedIn). Referring to the theoretical framework explained in the introduction, this professional practice seems to recognize a certain value to the relational dimension and is attentive to the possibilities and contaminants that

can come from the Internet. The factor seems to represent a predominantly pragmatic use in the approach concerning opportunities and social networks that can be developed through the Internet.

The sixth extracted factor "*Digital technologies for self-empowerment and leisure"* summarizes the practice of using digital technologies for self-empowerment and loisir and represent the 3% variance with respect to the original matrix.

The factor summarizes two variables, which contribute approximately with the same weight to the definition of the factor itself: the use of ICT for personal and professional growth and for leisure time. It describes a use of digital technologies aimed at the self-empowerment of teachers, less projected towards the purely functional use of the network and more aimed at a self-oriented use, the deepening of their interests, the game, the free time, the curiosity. The dimension of personal pleasure is central and seems to express an approach detached from an exclusively pragmatic use and integrated with teaching practice.

Based on the factors we developed a factor analysis and we have obtained 3 clusters. From the analysis of the factors that emerged through the ACP statistical model, three profiles can be defined in the use of new digital technologies in teaching.

Table 4: Cluster trend with respect to the average of the factors (Italy)

Profile	Online student engagement/ activation and network document application use	Use of advanced and collaborative digital technologies for educational purposes	Use of basic digital tools	Online participatory/creative activities	Digital technologies for networking	Digital technologies for self-empowerment and leisure	N
1	-0.03	0.20	**-0.02**	-0,05	0,31	**-1,24**	295
2	-0,32	**-0.80**	**0,42**	**0,74**	0,18	**0,65**	277
3	0,35	**0,70**	-0,47	**-0.83**	**-0,62**	**0,80**	228

Profile 1 (cluster 1) brings together the majority group of 295 teachers. Teachers who, despite having sufficiently advanced digital skills, and making use of technologies for professional and personal use, fail to systematically transfer the use of ICT in teaching. For profile 1 the network is a medium useful tool for the construction of socio-professional networks (eg through the use of social networks like Facebook or LinkedIn), functional to the creation of opportunities for contact with those who share their professional profile or expansion of your social network (new FB contacts, Instagram, etc.).

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However, the enhancement of these tools to engage students and foster an active, documentary and collaborative use of technologies on their part, to support student-centred learning processes, appears very marginal (0.03). The dominant orientation with respect to the way in which the digital interface is approached seems to focus on interaction; while it seems to lack a specific use of digital environments as mediators of knowledge. The digital resource/artefact is not incorporated into teaching practices. The combined compound of these elements is poured into a mainly transmissive, re-elaborated and instrumental professional practice; a 'cold' practice that, presumably, does not respond to intrinsic motivation. The use of ICT appears peripheral, oriented to the object, motivated by duty, without attribution of meaning with respect to its specific function as a mediator of knowledge.

Profile 2 (cluster 2) brings together 277 teachers. This group concentrates those teachers who use the basic digital technologies for the realization of creative and participatory activities through the web, trying to activate interdisciplinary and metacognitive approaches, where even the online evaluation finds its space. The teachers of profile 2 also have a high level of confidence with the ICT used for self-empowerment and for leisure, expressing a proactive attitude in the use of ICT both on the professional and on the personal side (interests, hobbies, etc.). They are those teachers who seem to have fun or find advantage in using ICT in their personal lives and tend to integrate them into their professional and didactic practice.

Profile 2 collects those teachers who, while using basic, non-specialist/transversal digital technologies, are able to promote creative and participatory activities.

If we look at the way in which ICT is used as an interface that allows us to extend our capacity for action, interpretation and knowledge of the world, a guided orientation seems to emerge, in order, from the value attributed to interaction/relationship, also for the purposes of learning (0.74), from the reflective dimension, aimed at self-empowerment (0.65), and from access/construction of new knowledge (0.42).

Profile 2 groups of teachers who seem to favour predominantly collaborative and re-elaborative practices. In this sense, the attribution of meaning that seem to underlie the use of the digital interface seem to respond more to its epistemic function aimed at extending the capacity for subjective growth and knowledge of the subject acting on digital technology; focused on the dimension of discovery, on the comparison with the indeterminate, the growth of knowledge, rather than its pragmatic function of an application type aimed at achieving a clear and predetermined objective/ product.

Finally, profile 3 (cluster 3) identifies 228 teachers. This group includes teachers who frequently use advanced digital technologies, including the use of digital educational content and OER (Open Educational Resources), computational thinking and resources for creating blogs, websites and hypertexts. In this group, the separation between personal dimension and professional dimension seems to be reduced. These are teachers who integrate the use (even expert) of digital technologies in their professional and didactic practices. These are teachers who live the network mainly as a "place" for the development of the self and leisure, also for the purpose of self-training on ICT.

Teachers belonging to profile 3 do not seem interested in building social and professional networks, and also seem to have little interest in promoting collaborative online activities. Attention to the social/ relational dimension of learning does not seem to emerge.

The use of advanced digital technologies in this specific case assumes a productive-transmission orientation. They are teachers with a profile of high skills in the use of advanced digital assets, but they seem less likely application of innovative teaching methods in teaching practices. In using a digital artefact, it seems to prevail an orientation to self and object/production of knowledge, accompanied by a pragmatic and experimental attribution of meaning.

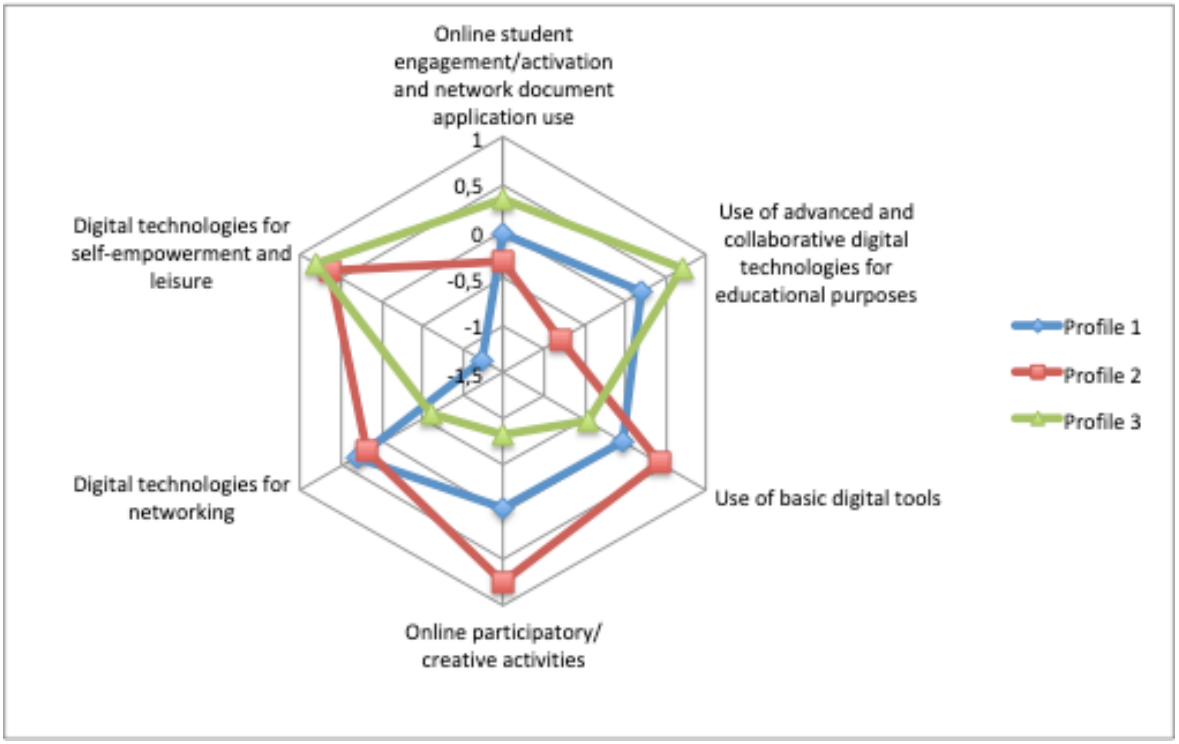

Figure 8:Clusters with respect to factors extracted (Italy)

4.3.2 Romania

The first extracted factor "*Engagement, collaborative and interdisciplinary use"* focuses on the enhancement of students' online activity which is expressed through the synthesis of four variables, of which the first, "I involve students in collaborative online work", assumes the highest weight (0.9). Follow the documentation and contact practices (0.7), those relating to the promotion of interdisciplinary projects through the network and creative work (0.6) and finally the online assessment of students (0.5) This factor reproduces 32% of the variance of the original matrix.The factor describes a wide and varied use of the resources offered by the network, aimed at creating a learning environment overall, through online communication with students and among students, feeds the involvement and participation in the social construction of knowledge.

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The practices summarized by the factor "*Engagement, collaborative and interdisciplinary use"* refer to different interpretative paradigms of the potential offered by digital technologies. We can identify at least three: the paradigm of sharing, that of epistemic awareness and finally the expressive paradigm (Calvani, 2004). In the paradigm of sharing, the focal point is language and the use of language to discover and structure knowledge; the computer is then used to support the social conversation between peers who have knowledge to be called into question in the interpersonal process of construction of new meanings. The power of the computer facilitates the exchange, allows the revision and the reorganization of knowledge (for example through "groupware" and "e-learning"). In the paradigm of epistemic awareness we encounter the concept of computer-cognitive tool that supports in structuring thought, in its organization and in problem solving. Finally, the paradigm of expression refers to the fact that new technologies can be used to increase creative and communicative abilities, to favor the overcoming of anxieties and inhibitions connected to communication. The factor then summarizes the paradigms described: technologies are used to support social conversation among peers, facilitating the exchange, revision and continuous reorganization of ideas for the construction of new meanings, creating opportunities for meta-reflection on one's learning path, amplifying creative and communicative capacities, offering spaces for intersection between different fields of knowledge.

The second extracted factor "*Advanced digital technologies for teaching and online communication*" focuses on the use of advanced digital technologies aimed at learning, communicating, collaborating and creating content for the Internet and summarizes four variables within it, the first of which, Digital educational content and OER, takes on the highest weight (0.7). Follow the multimedia programs relevant to the discipline (0.6), the digital environments for learning, sharing, communication and collaboration (0.5) and, finally, the resources for the creation of blogs, websites and hypertexts (0.4). This factor reproduces 2% of the variance of the original matrix. If the first factor focuses on the practices of use of technologies and on the pedagogical models that underlie these practices, the second factor summarizes the digital technologies, the tools used, and specifically includes those that we could briefly define: technologies for teaching and for web communication. These are resources that, unlike basic digital technologies, are characterized by a specific purpose of use. While Office or the Internet browser are transversal, minimum common denominator that characterizes any application field, the resources synthesized by the factor "*Advanced digital technologies for teaching and online communication*" are inserted in teaching practices, modifying relations, processes, products, meanings linked to the learning-teaching process.

The third extracted factor focuses on the "*use of basic digital tools and specialized technologies for creating audio video and graphic content*". This factor reproduces 7% of the variance of the original matrix. The factor summarizes four variables, the first three with the same weight in determining the factor: Software for downloading audio/video files (0.6), Office Package or similar (eg OpenOffice, etc.) (0.6) and Browser for web browsing (0.6). Slightly lower is the weight of the variable Resources for creating audio, video and graphic content (0.5).

The factor refers to the use of basic digital technologies and also integrates resources for the creation of audio-video and graphic content, a skill that over time has become established even in non-experts and which, from specialized expertise, is becoming a widespread portfolio of skills, also thanks to the use of tools with

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user friendly interfaces. The factor therefore refers to an orientation which in the tradition/innovation continuum is characterized by an openness to experimentation with diversified languages.

The fourth extracted factor "*Personal and professional use of digital technologies*" refers to the frequency of use of ICT for the construction of socio-professional networks, for leisure and self-empowerment. This factor summarizes 8% of the variance of the original matrix and is synthesized by four variables. Among these the greater weight assumes the variable *Construction of professional networks* (0.9), then follow *Construction of social networks* (0.7), *Personal and professional growth* (0.6) and *Leisure* (0.5).

The summarized factor is very similar to the Finnish and the UK case. Personal and professional growth are perceived as integrated realities and the use of the network expresses this reconciliation of life fields. But unlike Finland and the UK the weight of the variables in determining the factor is shifted more towards the construction of professional and social networks, where the former are predominant. The functional/instrumental value of the network is stronger than the potential expressed by the network itself with respect to the game/exploration activity that characterizes the personal dimension of self empowerment.

The fifth extracted factor refers to the frequency of *use of advanced programming technologies*. This factor synthesizes 4% of the variance of the original matrix and is synthesized by a single variable: *Coding-computational thinking*. The factor describes a use of specialized programming languages oriented to the problem and its resolution.

The technology in this specific case expresses its potential for use according to the paradigm of cognitive structuring that refers to the concept of *computer-cognitive tool*; we can think about the large set of flexible tools for taking notes, correcting, building annotation systems, dialog boxes, or filters, organizers (logical operators, outliner schemes, etc.), amplifiers (like microworlds, logic programming languages, etc.); in these cases it is as if the mind used a variety of "cognitive crutches", reducing redundancy (Calvani, 2011). In this factor, the technological artefact is characterized by a mediation that has a dual value: pragmatic and structural. The focus is on the subject activated on the epistemic side of the discovery/experimentation and the practical application of the digital artefact, through the coding that we can define computational thinking: a logical-creative process that allows to break down a complex problem in different parts, more manageable if faced one at a time, training thought in algorithmic logic and in multiple levels of abstraction.

From the analysis of the factors that emerged through the ACP statistical model, three profiles can be defined in the use of new digital technologies in teaching.

Table 5: Cluster trend with respect to the average of the factors (Romania)

Profile	Engagement, collaborative and interdisciplinary use	Advanced digital technologies for teaching and online communication	Use of basic digital tools and specialized technologies for creating audio video and graphic content	Personal and professional use of digital technologies	Use of advanced digital tools	N
1	-0.16	0.32	**-1,25**	-0,11	0,03	104
2	0,68	0,25	**0,45**	-0,14	**-1,56**	65
3	-0,20	-0,37	**0,77**	0,15	**0,74**	132

Profile 1 (cluster 1) includes a group of 104 teachers. Profile 1 is essentially characterized by a scarce use of basic digital technologies and a slightly more frequent use (0.32), of advanced digital technologies aimed at teaching and communication through the network. Profile 1 does not appear to be involved in online activities aimed at building personal and professional networks or at enhancing the online student. The dominant orientation with respect to the way in which the digital interface is approached seems to center on the object to which a pragmatic mediation function is attributed through the use of OER, digital resources for the discipline, digital environments for learning, sharing, communication and collaboration; these resources modify relationships, processes, products, meanings linked to the learning-teaching process.

Digital resources are presented as tools oriented to the elaboration and re-elaboration of contents for the Internet, tools of action, with a specific focus on experimentation and manipulation of contents. The orientation of the action is directed to the object of knowledge and not to the socio-relational growth of knowledge both of the teachers, in terms of creation of socio-professional networks, and of the students involved in the learning process. The approach teacher seems to be “self referential”.

Profile 2 (cluster 2) characterizes a minority group of 65 teachers. The group is characterized by a creative-collaborative orientation to the use of basic digital technologies and for the creation of audio-video-graphic contents. Profile 2, similar to profile 1, does not consider digital technologies for the construction of socio-professional networks and for self empowerment. The focus is on the communication-engagement of the student and on the creation of online learning environments that favor the exchange, sharing and social learning around specific contents and objectives, which can also be those of collaboratively creating audio, video and graphic content, as the contribution of the factor “*Use of basic digital technologies and specialized technologies for creating audio video and graphic content*” seems to affect. It emerges a vision digital artefact as an instrument of action, with a specific focus on experimentation and manipulation of content, according to a pragmatic view of mediation, but oriented to the involvement of the subject and the social and relational

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growth of knowledge through collaboration among peers. The use of digital technologies is functional to collaboration to achieve defined and collaborative goals.

Profile 3 (cluster 3) is characterized by the larger group made up of 134 teachers. The group is characterized by a high frequency of use of basic and specialized technologies for the creation of audio-video and graphic content and a high use of digital resources for programming. No meta-reflective practices emerge, attentive to the construction of collaborative learning environments, although among the three profiles there is one in which there is a higher frequency of use of the network for self-empowerment and the construction of socio-professional networks. The focus is on the discipline and the approach seems to be functional, that is aimed at favoring the knowledge and the possibilities of application of the digital artefact also in relation to behaviors, interactions, effects and relationships between the various objects of knowledge. The digital artefact appears to present itself as a medium of discovery, as an instrument of action (problem solving, computational thinking) according to a pragmatic vision of mediation, where the focus is on the object of knowledge. The subject is not involved, except to a limited extent, in the creation of networks through the use of digital resources.

In all three clusters, *a pragmatic use of technology dominates*, with little regard for speculation and meta-reflection, and an orientation mainly directed towards the object rather than either the subject or the interactions.

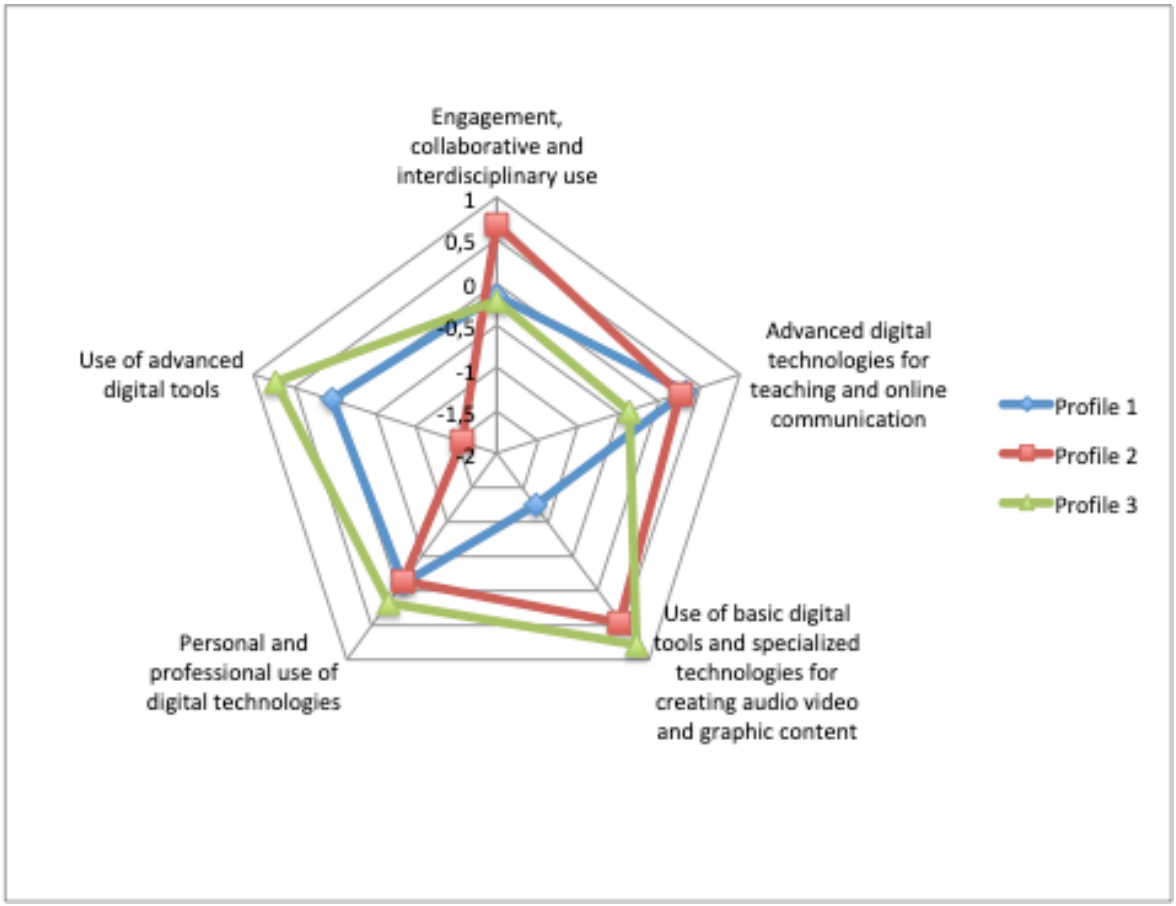

Figure 9: Clusters with respect to factors extracted (Romania)

4.3.3 United Kingdom

The first factor "*Personal and professional use of digital technologies*" describes the situations in which teachers use digital technologies.

This component summarizes 42% of the variance of the initial matrix through four variables, three of which contribute with the same weight to the definition of the factor itself (0.8): construction of professional networks, personal and professional growth and free time. Slightly less is the variable construction of social networks (0.7).

The first factor extracted through the ACP describes a use of ICT characterized by a functional approach to the growth of the socio-professional capital of teachers and to the dimension of play, of fun, of cultivation of personal interests.

In the UK, however, teachers generally use digital technologies more frequently for leisure and social networking. Teachers use digital technologies less for professional growth and networking as this is often done face-to-face at events rather than online. For example, teachers find out about promotions or new job opportunities by word-of-mouth. Teaching is unique in that, within the sector, professionals can be quite open about their desire to move on from a school/job. Consequently, teachers are less likely to solely search online for new job opportunities.

In this specific case, the integrated use of the network in professional and personal contexts seems to mean the widest experience of balancing the different areas of life and overcoming the dichotomy between professional space/time and private space/time attributed to digital artefact. It is a professional practice that seems to enhance social networking through engagement and participation in online activities, which does not necessarily translate into social learning.

The second factor extracted "*Frequency of use of digital technologies in teaching and tracking progressions*" describes the frequency that teachers use digital technologies with their students for learning and tracking progression.

The second extracted factor focuses on the enhancement of students' online activity, summarizing 3% of the variance of the initial matrix. This component summarizes four variables, two of which have a greater weight in determining the factor (both with 0.7): the practice of asking students to document online what they have learned and the involvement of students in collaborative online work. Then follow the online assessment of the students (0.5) and finally the use of resources for the creation of blogs, websites and hypertexts, which is the most marginal variable in the definition of the factor (0.4).

The majority of survey respondents reported that they sometimes, closely followed by often, ask their students to document online what they have learned. This is very similar to the frequency that they involve students in online collaborative work. Although the majority of survey respondents sometimes use online assessments, a higher number reported that they never use them, compared to how many answered that they never ask

students to document online what they have learned or involve students in collaborative online work. This could account for this question contributing less to the factor.

No teachers reported that they always use resources for creating blogs, websites etc. which could explain why this element contributes less to the factor. Over half of teachers (53%) in the survey did report that they sometimes use resources for creating blogs, websites etc. whilst 28% said they often do and 18% never do.

The factor "*Frequency of use of digital technologies in teaching and tracking progressions*" seems to bring out a careful practice to the documentation of the learning process and of the evaluation through the assessment of the students through the network.

The factor describes a collaborative use of the network, attentive to the social dimension of learning. Students can exchange information and share content, including self-produced content, while at the same time focusing on their own learning process, both in terms of vision (and revision) of their knowledge, and with respect to the ways in which the knowledge itself was acquired, processed and eventually managed.

Technology is experienced as a functional learning environment for sharing and connecting. The type of function attributed to the technological artefact seems to express a triple orientation, that aimed at the construction of knowledge, the one aimed at interaction with others and the one aimed at reflexivity; while the functions of use of the technological artefact seem to refer to the possibility of "acting on" knowledge (pragmatic mediation) through the use, re-use and/or revision of the contents by the subject.

The third extracted factor "Use of basic digital tools" describes how frequently teachers use basic digital tools in teaching and it summarize 4% of the variance referred to the initial matrix bringing to light a basic use of digital technologies for educational purposes. The variables that contribute to the formation of the factor are three, all with the same weight (0.7): the frequency of use of the Office Package or similar (eg OpenOffice, etc.); the use of web browsers; the use of software for downloading audio-video files.

The majority of teachers (63%) from the survey reported that they often use Office and similar text packages whilst only 18% report that they sometimes do and 13% always do. By comparison, more similar numbers of teachers often or sometimes use search tools (34% often and 41% sometimes) and software for downloading audio and video files (45% often and 39% sometimes).

Similar numbers of teachers always use Office and search tools (14%) whereas only 4% always use software for downloading audio and video files. Similar numbers also never use search tools and software for downloading audio video files (11%) while 0% never use Office as this is an integral part of education and the most basic technology used by teachers. The extracted factor refers to a use of basic technologies with a markedly informative-transmissive character that focuses only on one of the two aspects highlighted by the definition of digital competences of the European Parliament (EC, 2006): the use of computers to find, evaluate, preserve , produce, present and exchange information. The factor does not summarize variables that refer to the second area of communication and participation in collaborative online networks. The factor therefore describes what today we could define the "minimum" digital baggage of the citizen that in Bloom's

taxonomy constitutes the basic toolbox used by the teacher to stimulate the students memory and understanding (Churches, 2008).

The fourth extracted factor "*Use of advanced digital tools*" describes how frequently teachers use advanced digital tools in teaching that require more specific knowledge of complex procedures and digital skills. The factor summarizes the 11% of the variance referred to the original matrix. This component refers to the use of advanced digital technologies for educational purposes. The variables that contribute to the formation of the factor are three, two of which assume a greater weight in the definition of the factor itself: computational thinking-Coding (0.7) and use of multimedia programs relevant to the discipline (0.7). Less relevant in the definition of the factor is the use of Resources for the creation of audio, video and graphic content (0.4).

The factor concerns a minority of teachers reached by the survey. The majority of teachers in fact never use coding or educational multimedia programs for discipline - 79% and 53% respectively. By contrast, only 17% of respondents never use resources for creating/editing audio/video contents. This large difference may explain why this is a smaller contributor to the factor. Instead, 53% of teachers say that they sometimes use resources for creating/editing audio/video content. For all three measures, very few or no teachers reported that they always use them - 0.5% for educational multimedia programs for discipline and 0% for the other options.

The extracted factor refers to a specialized and professionalizing technical use of digital technologies, which presumably is linked to teaching disciplines in the technical-scientific and/or professional area. The type of function attributed to the technological artefact seems to express an orientation towards the object/contents of learning; and a mediation of knowledge based on the pragmatic dimension that is aimed at acting on the object/content of learning through an empirical, experimental perspective and/or the re-mixing of different works/contents with the aim of increasing the explanatory potential.

The fifth extracted factor "*Creative and interdisciplinary use of digital technologies*" describes how frequently teachers ask their students to use digital technologies in the classroom as part of the learning process.

The factor summarizes the 3% of the variance referred to the initial matrix by adding a use of digital technologies aimed at creative work and interdisciplinary design. The variables that contribute to the formation of the factor are two and take on the same weight: creative work through the use of online applications (0.6) and encourage interdisciplinary projects through the use of online technologies (0.6).

From the results of the Decode survey, UK teachers infrequently implement digital technologies in students' activities, as in total 76% sometimes or never encourage interdisciplinary projects through the use of online technologies (never being slightly higher than sometimes) and 75% sometimes or never encourage creative work using online applications (sometimes being higher than never). Similar numbers often carry out these activities (21%) while only 2% always do.

The extracted factor refers to a creative and interdisciplinary use of digital technologies. However, in the factor there is no reference to practices of sharing, collaboration and exchange between teacher and student and between peers, bringing out a vision of constructivist-individual learning. The factor describes a use of the network for essentially productive-transmissive practices, with a low level of collaboration between students.

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The sixth extracted factor "*Use of collaborative and communication tools in the learning process*" describes how often teachers use digital technologies for communication and collaborative learning in their teaching practice. This component summarizes the 5% of the variance of the original matrix. The variables that contribute to the formation of the factor are three, two of which assume a greater weight in the definition of the factor itself: Digital environments for learning, sharing, communication and collaboration (0.6) and Digital educational content and OER (Open Educational Resources) (0.6). Less important in defining the factor is the activity of regular contact with students through online communication (0.4).

Most teachers sometimes use digital environments for learning, sharing, communication and collaborating online (57%), and digital educational content and OER in their practice (64%). Whereas most teachers often keep regular contact with their students through online communication (66%) and only 17% sometimes - this difference in frequency of use may explain why this contributes less to the factor.

Table 6: Cluster trend with respect to the average of the factors (UK)

Profile	Personal and professional use of digital technologies	Frequency of use of digital technologies in teaching and tracking progression	Use of basic digital tools	Use of advanced digital tools	Implementation of digital technologies in student learning activities	Use of collaborative and communicative tools in the learning process	N
1	-0.38	-1,2	**-0.1**	-0,28	0,85	**0,81**	42
2	0,15	0,01	-0,31	0,43	**-0,80**	0,09	90
3	0,03	**0,79**	0,51	-0.44	**0,57**	**-0,67**	63

The factor refers to a collaborative re-elaborative use of the network, where the teacher takes on the role of guide and mediator for the students who are involved in a student-centered teaching, where interaction, information exchange and peer help are central. The use of digital and OER educational content is part of the construction of a complex learning environment, in which the set of information is not only transmitted but becomes the starting point that contributes to the definition of new content and new knowledge. From the analysis of the factors that emerged through the ACP statistical model, three profiles can be defined in the use of new digital technologies in teaching.

Profile 1 (Cluster 1) is characterized by the smaller group made up of 42 teachers. The cluster is characterised by teachers who frequently use digital technologies in learning activities and a series of collaborative and communication tools both inside and outside the classroom. These teachers ask students to use digital

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technologies for creative work, projects, collaborative work, learning, research and to keep in touch with the teacher online if they have any questions or queries.

However, these teachers have limited use of digital technologies as they infrequently ask students to document online what they have learned, use digital technologies for assessment, create online content (such as blogs and websites) or ask students to work collaboratively. These teachers have a slightly limited use of digital technologies in their personal life and for professional progression and advanced digital tools such as coding and editing content.

The profile suggests a use of the network in which emerge the distributed nature and situated knowledge, amplifying the reformulation of the educational relationship that transforms the teacher from the one who transmits knowledge to the student, to a facilitator of the learning process. In this case, the type of function attributed to the technological artefact seems to express a dual orientation: the one aimed at interaction and the one aimed at the collaborative construction of knowledge through comparison and cooperation. The type of mediation exercised to favor access to knowledge instead describes an active subject who uses the technological device to expand their new knowledge frameworks through social action. The focus is on the person/group/community according to the social constructivism approach.

Profile 2 (Cluster 2) brings together the majority group with 90 teachers. It is characterised by teachers who frequently use advanced digital technologies. These teachers use digital technologies for coding, editing and creating audiovisual content and multimedia programs. Although these teachers have advanced knowledge of digital technologies, and use them for both professional and personal progression and well as communicating with students, they do not implement digital technologies into student learning activities - such as creative learning and interdisciplinary projects.

Profile 2 collects those teachers who express a productive-self-referential transmissive approach characterized by a strong but self-referential technical competence. With respect to the use of ICT in their interface function that allows us to extend our capacity for action, interpretation and knowledge of the world, an orientation centered on the object/content of learning seems to emerge; and a type of mediation acts on the object/content of learning focused on the possibility of "acting" experimenting, experiencing, manipulating, letting emerge a constructionist/individualist perspective of learning, focused on the result.

Finally the profile 3 (cluster 3) includes 63 teachers. It is characterised by teachers who competently use digital technologies in a functional way as part of the learning process. They frequently use basic digital tools such as Office, search tools and can download content and create blogs and websites. They also implement digital technologies into teaching and learning activities and for tracking progression by asking students to complete online assessments, document what they have learned, work collaboratively and ask their students to use digital technologies for creative work and interdisciplinary projects. However, these teachers do not use digital technologies for communication and collaboration purposes. This shows that these teachers have incorporated digital technologies into their practice whilst keeping a more traditional style of learning where information is gained in the classroom alone and students work individually. The professional and didactic practice in this case is expressed through a collaborative-re-elaborative approach. In this sense, in the use of

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digital artefact, a focus on interaction, reflexivity and the object/content of learning seems to prevail. To this orientation is added the function attributed to the digital interface as an epistemic mediation tool that allows the subject to 'know' (think, understand, know, connect) the object/content of learning, bringing out a socio-constructor of learning focused on the dialogic, social and reflexive dimension and on the centrality of the person/group.

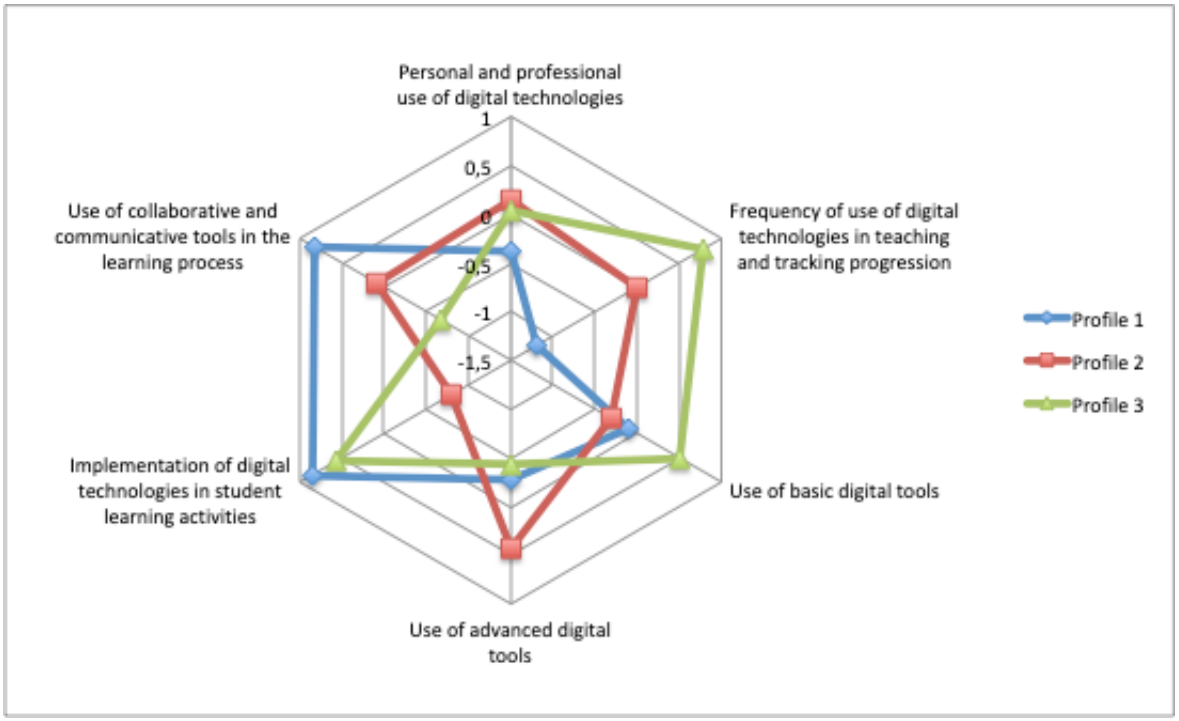

Figure 10:Clusters with respect to factors extracted (UK)

4.3.4 Finland

The analysis of the main components allowed to extract six factors that summarize altogether about 70% of the total variance with respect to the original matrix. However, the composition and distribution of factors appears slightly different than in Italy, offering a good approximation with respect to the information content.

The first extracted factor *"Personal and professional use of digital technologies"* refers to the frequency of use of ICT for the construction of socio-professional networks, for leisure and self-empowerment. This factor summarizes the 7 % of the variance of the original matrix four variables, three of which contribute with the same weight to the definition of the factor itself: construction of professional networks, construction of social networks and free time. Slightly less is the variable personal and professional growth.

The first extracted factor describes a use of ICT where the functional approach converts to the growth of the socio-professional capital of the teachers and the personal one of the game, the entertainment, the cultivation of personal interests. The issue of reconciling the areas of life and the integrated experience of ICT in everyday practices emerges in this specific factor. There is no dichotomy between professional space/time and private space/time. This is a professional practice that seems focused on the relational dimension that is

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experienced within digital environments. It considers the opportunities for growth and development that can derive from it. In this sense, a pragmatic approach seems to emerge in the use of digital artefact with regard to the possibility of personal and professional growth and to its socially integrated nature.

The second extracted factor *"Use of basic digital tools for documentary-collaborative use"*, summarizes the 4 % of the variance of the original matrix. There are four variables that contribute to the formation of the factor. Among these, two take on a slightly greater weight: the frequency of use of the Office Package or similar (eg OpenOffice) (0.8) and the use of online browsers (0.6). The last two variables that contribute to the definition of the factor, with a slightly lower weight than the first two (both 0.5), are the activities of asking the students to document online what they have learned and the frequency of use of digital Environments for learning, sharing, communication and collaboration. The factor therefore describes a use of digital technologies that integrates the collaborative dimension with the applicative dimension, enhancing the social dimension of knowledge construction. It is important to remember that more than 30% of the respondent teachers teach in the VET area, where portfolio documentary activity is central to accompanying adults in professional practice.

The third extracted factor summarizes a "Use of digital technologies for creative, collaborative and design activities". The third component collects 5% of the information variance present in the original matrix. There are four variables that contribute to the formation of the factor. Among these, three take on greater weight: creative work through the use of online applications (0.7); student involvement in online collaborative work (0.6) and encouragement for the implementation of interdisciplinary projects through the use of online technologies (0.6). Less weight is taken from the fourth variable: resources for creating blogs, websites and hypertext (0.4). The extracted factor refers to a creative use of technology, based on the exchange, collaboration, sharing, aimed at the creation and dissemination of content on the web. In this sense, the teacher promotes the use of collaborative-productive ICT also involving the processing of content and "containers" (websites, blogs, etc.). Also in this case a marked attention seems to emerge to the social dimension of learning and the construction of knowledge, accompanied by a certain familiarity with digital technologies for the creation of contents.

The fourth extracted factor *"Student engagement and online assessment"* summarizes a use of ICT aimed at engagement, communication with students outside the classroom and evaluation. The fourth component collects 37% of the information variance present in the original matrix. There are two variables that contribute to the formation of the factor. The weight assumed by the first variable in the definition of the factor is preponderant: *Regular contacts with my students* (0.8). The second variable *Online Student Assessment* is less incident instead (0.4). The digital technologies in this specific use are not used only in terms of tools but of learning environments, modifying the methods of teacher-student and student-students interactions, the processes of access to knowledge and the evaluation that becomes corrective training. In this case, the type of function attributed to the technological artefact seems to express an orientation towards the facilitation of interaction and a pragmatic epistemic mediation, mainly aimed at achieving an objective, namely the realization of a VET training model in able to respond to the needs of a differentiated and often adult audience.

The fifth extracted factor *"Technologies for teaching and computational thinking"* summarizes the use of advanced digital technologies for educational purposes and summarizes 2% of the variance with respect to the

original matrix. The variables that contribute to the formation of the factor are three and have the same weight in the definition of the factor itself (0.5): use of multimedia programs relevant to the discipline, use of digital educational content and OER (Open Educational Resources) and computational thinking (Coding). The extracted factor refers to a specialized technical use of ICT linked, presumably, to the discipline.

The sixth extracted factor *"Download/creation of audio, video and graphic content"* refers to the use of digital technologies for downloading and creating audio, video and graphic content, and summarizes 3% of the variance with respect to the original matrix.

There are two variables that contribute to the formation of the factor. The one that takes a slightly greater weight is the variable resources for the creation of audio-video content and graphics (0.7). Following the variable Software for downloading audio-video files (0.5).

The extracted factor refers to a technical, professionalizing practice that uses the digital artefact as a mediator that integrates several other educational mediators: symbolic, iconic and experiential (active/analogical).

From the analysis of the factors that emerged through the ACP statistical model, three profiles are outlined in the use of digital technologies. Although this is not a statistical-representative investigation, it allows us to explore the configuration of the dominant teaching and professional practices in Finland.

Table 7: Cluster trend with respect to the average of the factors (Finland)

Profile	Personal and professional use of digital technologies	Use of basic digital tools for documentary-collaborative use	Use of digital technologies for creative, collaborative and design activities	Student engagement and online assessment	Technologies for teaching and computational thinking	Download/creation of audio, video and graphic content	N
1	-0.36	0.07	**0.92**	-0.29	-0,16	**-0,80**	66
2	-0,11	-0.35	**-0.57**	**0,87**	**0,9**	0,03	63
3	0,52	0.28	-0,41	-0.58	**-0,84**	**0,84**	60

Profile 1 (cluster 1) identifies the majority group made up of teachers (66) who usually use ICT for the creation of creative works through the network, promoting interdisciplinary collaboration and planning among their students (0.92); and at the same time they are the ones that appear most distant from the use of ICT for downloading/creating audio, video and graphic content (-0.80).

The digital artefact has no particular importance in the cluster and the use of digital technologies seems oriented to a collaborative-productive practice, functional to the social construction of shared contents, objects

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and concepts. Teachers belonging to profile 1 does not seek, on the other hand, online contact opportunities for the development of professional or social networks, or networks for self-empowerment and leisure. The use of ICT seems to be directed exclusively towards teaching practice and has no purpose related to personal and professional growth. The dominant orientation with respect to the digital interface in its knowledge mediator, seems focused on the object and on the relations or cooperation that are established in the digital environment. This is accompanied by a pragmatic, practical use, aimed at fostering collaboration and active experimentation of the subject to achieve objectives, the resolution of defined problems, the knowledge of how it works, and how one moves/behaves, in the socio-technical space used.

Profile 2 (cluster 2) gathers those teachers (63) who mostly use advanced digital technologies linked to the discipline/disciplinary contents (multimedia programs, Open Educational Resources and computational thinking), using the network also to engage students, to communicate with them via email, forum, blogs and to structure online assessment paths. In this specific group the centrality of the multimedia tools, software and App emerges. The attention to the learning environment and the intent of the social construction of knowledge are not predominant in the teaching practice of these teachers. The orientation in the use of ICT is of a re-elaborative transmission type. Also in this specific cluster the teachers appear not interested in a relational use of ICT, aimed at the possible creation of socio-professional networks or at their own professional and pleasure growth. A profile very focused on the objective or product and less on the social dimension of learning is outlined.

Finally, profile 3 (cluster 3) groups together those teachers (60) who demonstrate a technical-professional use of ICT aimed at creating and downloading audio, video and graphic content. They are presumably VET teachers who teach disciplines such as graphics, web design or web content. Unlike the clusters described above, this is the only group that brings together professors interested in using the web for the creation of socio-professional networks and for leisure. This is an element that responds to the profiling described so far and that takes into account the exploratory dimension and the importance of the professional network for a constant updating of technical skills and competences. The teacher belonging to profile 3 has a dual orientation: they look at the digital artefact in their function of knowledge mediator able to integrate (and re-mediate) traditional educational mediators (Martini, 2007): symbolic, iconic, experiential; and at the same time presents a functional and instrumental pragmatic approach to the achievement of specific objectives. Although the use of digital technologies for documentary and collaborative use is not significant, this is the group that summarizes the greatest concentration on this factor (0.28).

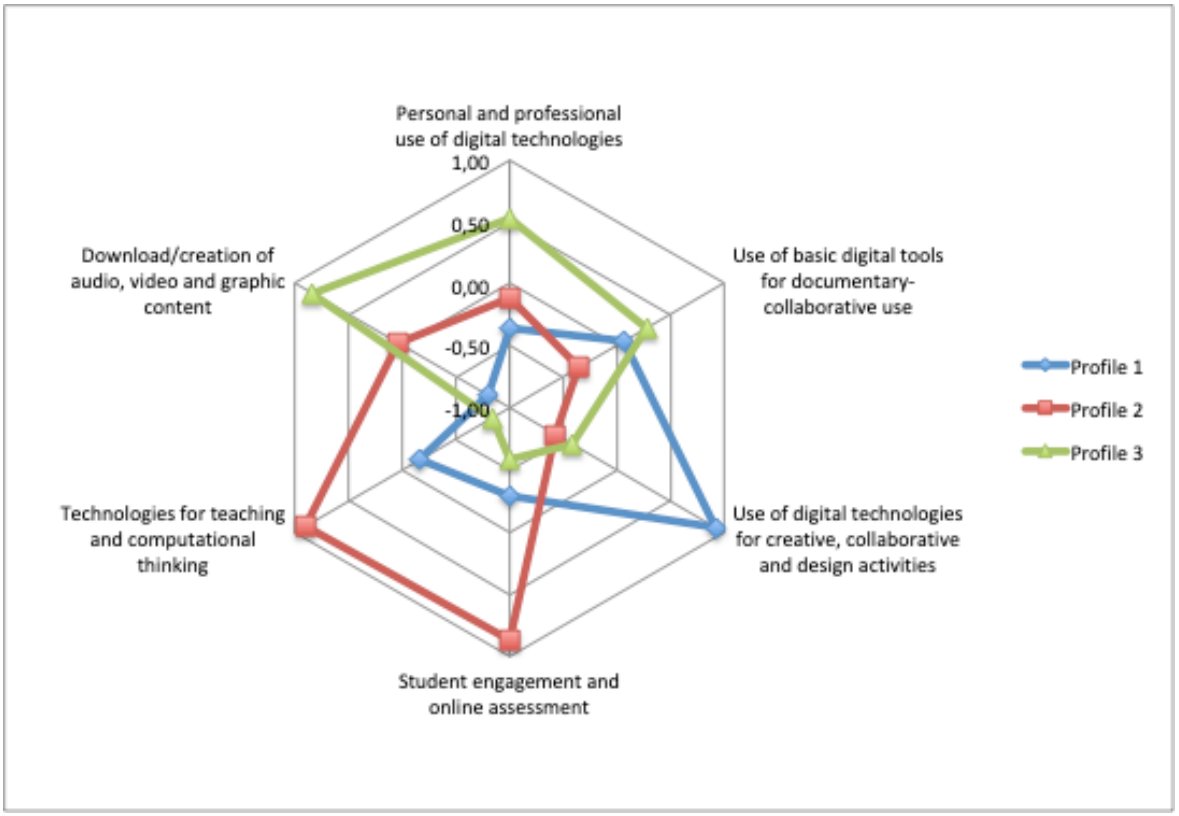

Figure 11: Clusters with respect to factors extracted (Finland)

4.3.5 Spain

The first extracted factor "*Digital technologies for teaching and students learning integrating online teamwork*" summarizes a use of ICT for collaborative and documentary work, online assessment through the structuring of digital environments for learning and sharing and engagement of students and it reproduces the 31% of the variance of the original matrix. There are seven variables that contribute to the formation of the factor. The weight assumed by the first and second variable in the definition of the factor is preponderant: involving students in collaborative online work (0.8) and asking students to document online what they have learned (0.8). Then follow the variables Online student assessment (0.7) and Regular contacts with students (0.7). Finally, they assume a slightly lower weight: Creative work through the use of online apps (0.6), Interdisciplinary projects through the use of online technologies (0.5), and Digital environments for learning, sharing, communication and collaboration (0.4). This factor describes how teachers use technology to foster communication and collaboration with students and among them in digital environments. The factor describes digital resources and practices of use that belong to the constructivist sociocultural paradigm where the role of the epistemic subject and the cognitive relationship with a learning community are central. The use of technological artefact is functional to the co-construction of knowledge and is acted with the intention of creating an environment that favors social interaction and community sharing of learning. The knowledge building process is situated and bottom up. The teacher has the function of a mentor, a guide for facilitating learning. The learning community becomes the meeting place, real and/or virtual, in which the exchange of personal knowledge, the new acquisitions to be learned and the cultural heritage of each member of the

community takes place. The subject is invested with a responsibility with respect to the process of constructing knowledge and this requires a constant personal re-elaboration of the information, necessary when the type of problem does not report an immediately obvious solution. The factor refers to a meta-reflexive approach to the construction of knowledge that involves the subject in the effort of understanding and critical reflection.

The second factor "*Personal and professional use of digital technologies*" describes teachers' use of technology in their professional and personal development. This factor summarizes the 8% of the variance of the original matrix. The factor synthesizes four variables, which have a slightly different weight in the definition of the factor itself. The variable that assumes greater weight is that relative to the construction of social networks (0.7), followed by the construction of professional networks (0.6) and personal and professional growth (0.6) and finally by leisure (0.5).

The factor describes an integrated use of ICT, where converge the approach related to the growth of social and professional capital of teachers, and the personal approach of the game, the fun, the cultivation of personal interests. Although the functional dimension in the use of the network has a slightly greater impact than the one aimed at self-empowerment, this specific factor seems to describe the reconciliation of life spheres and the integration of digital technologies in teachers' daily practices. There is no dichotomy between professional space/time and private space/time. Personal and professional growth are perceived as unique.

The third factor *"Digital Educational Content and OER for teaching"* describes a priority use of digital resources (specially Multimedia programs) for the teaching activities followed by computational thinking. There are three variables that contribute to the formation of the factor. Among these, two assume greater weight: the frequency of use of Digital Educational Content and OER (0.7) and Multimedia programs relevant to the discipline (0.6). Finally, the concurrence of the Coding variable (0.3) appears to be marginal in the definition of the factor. This factor summarizes the 5% of the variance of the original matrix.

The extracted factor refers to a productive use of technologies aimed at the fruition and the creation of multimedia digital content (software and audio-video-graphic). The use of the digital artefact are oriented to the subject in terms of content use (artefact as a medium of reproduction) and to the object, as a medium that activates the subject to act the instrument, to experiment for creating a product. Still referring to Bloom's taxonomy, the factor seems to move towards the top of the pyramid, the one that identifies the active approach of the teacher in "creating" new contents of knowledge (Churches, 2008), highlighting the value of the educator's professional skills. Configure the habitus of a teacher halfway between the speculative and technical specialist approach.

The fourth factor *"Use of basic digital tools"* describes the use of the most common tools for preparing teaching activities that are the search of the information that need to define their teaching practices and the tools to write, elaborate and present it. The extracted factor summarizes the 4% of the variation with respect to the original matrix. There are two variables that contribute to the formation of the factor: Search tools (0.7) and Office and similar packages (eg. OpenOffice, etc.) (0.6). The extracted factor refers to a use of basic technologies of a transversal nature and not linked to uses inherent specifically to the enhancement of learning

paths. They are the basic tools from which to start for any subsequent development of the digital skills of the citizen and in the specific case of the teacher engaged in the learning-teaching process.

The fifth and last factor *"Creation of digital resources"* points out the tools that teachers use to create digital resources in order to develop their teaching practices. The extracted factor summarizes the 3% of the variation with respect to the original matrix. Three variables contribute to the formation of the factor. Among these, two assume greater weight: the frequency of use of Resources for creating/editing audio/video content and graphics (0.6) and the use of Resources for creating blogs, websites etc. (0.5). The focus here is on the product and outcome resulting from the use of digital technologies. The factor configure a teacher profile that could be called "Producer" and which is characterized by high technical and specialized digital skills.

From the analysis of the factors that emerged through the ACP statistical model, three profiles are outlined in the use of digital technologies.

Table 8: Cluster trend with respect to the average of the factors (Spain)

Profile	Digital technologies for teaching and students learning integrating online teamwork	Personal and professional use of digital technologies	Digital Educational Content and OER for teaching	Use of basic digital tools	Creation of digital resources	N
1	-0.15	-0.04	-0.50	-0.24	**1.24**	170
2	0.20	-0.25	-0.19	**1.10**	**-0.92**	134
3	-0.005	0.33	**0.92**	**-0.87**	**-0.71**	121

Profile 1 (Cluster 1) brings together the largest number of teachers (170). The cluster is characterized by the main use of digital technologies for the production of online resources (1.24). Teachers usually use digital environments for creating/editing audio, video content and graphics and for creating blogs or websites. In this specific group the use of digital technologies is not aimed at the integrated use of the network for teaching and collaborative learning nor for personal and professional growth. Even the use of Digital Educational Content and OER for teaching and of the General search and office tools are not so frequent as to characterize the cluster. For this specific group of teachers, digital resources are tools mainly oriented to the creation and elaboration of content for the web, tools of action, with a specific focus on experimentation and manipulation. The action is oriented to the object of knowledge and not to the socio-relational growth of knowledge, both with respect to students involved in the learning process and to the self and professional empowerment of teachers.

Profile 2 (Cluster 2) brings together 134 teachers. The group is characterized by a marginal use of digital technologies in teaching practice and in the context of self-empowerment and professional growth. The main

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use of digital artefact is limited to the general web search and office tools (+1.10). The cluster is also characterized by a very low impact of the factor relating to creative use of digital technologies (-0.92).

The emerging profile outlines an "information-transmission" approach to the use of digital technologies. The teachers described seems to not be interested in experimenting and creating content, nor in promoting innovative ways of teaching and learning. The cluster described above is characterized by a basic use of ICT and by an evident difficulty in integrating the digital technology in teaching practices. The focus is on continuity with traditional didactics that denotes a resistance to innovation and the persistence in the teachers of basic technical and methodological skills. The professional habitus described by the cluster is, therefore, that of the traditional teacher, who expresses a positional leadership (linked to the role) more that a situational leadership (strongly anchored to the context-situation).

Profile 3 (Cluster 3) is composed of 121 teachers. The cluster brings together those teachers who are “consumer” of *Digital Educational Content and OER for teaching* (0.92) but only for transmission purpose. Infact, the use of ICT for the creation of online resources (websites, blogs, video, etc.) negatively affects the cluster (-0.71) and furthermore, also the weight of the factor *Digital technologies for teaching and students learning integrating online teamwork* is marginal in the cluster definition (-0.005). Digital technologies are experienced by teachers mainly as a repository of information and multimedia materials (videos, audio, etc.), to support students' learning. The focus in this third cluster is the content that teachers and students seem to passively consume. The digital artefact is a “medium of reproduction” that activates the subject to know but does not stimulate the creation of new knowledge or the attainment of definite and collaborative goals. Digital technology is experienced as an epistemic mediator of knowledge, but it is not experienced as an instrument of action that can impact on reality.

In general, in all three clusters there is a clear lack of practices aimed at involving students in collaborative work through the network and a scarce propensity on the part of teachers to use digital technologies for their own self-empowerment and for the creation of social and/or professional networks. The interaction dimension is hardly present, and is relegated mostly in the third cluster (0.33), almost absent or negative respectively in the first (-0.04) and in the second group (-0.25).

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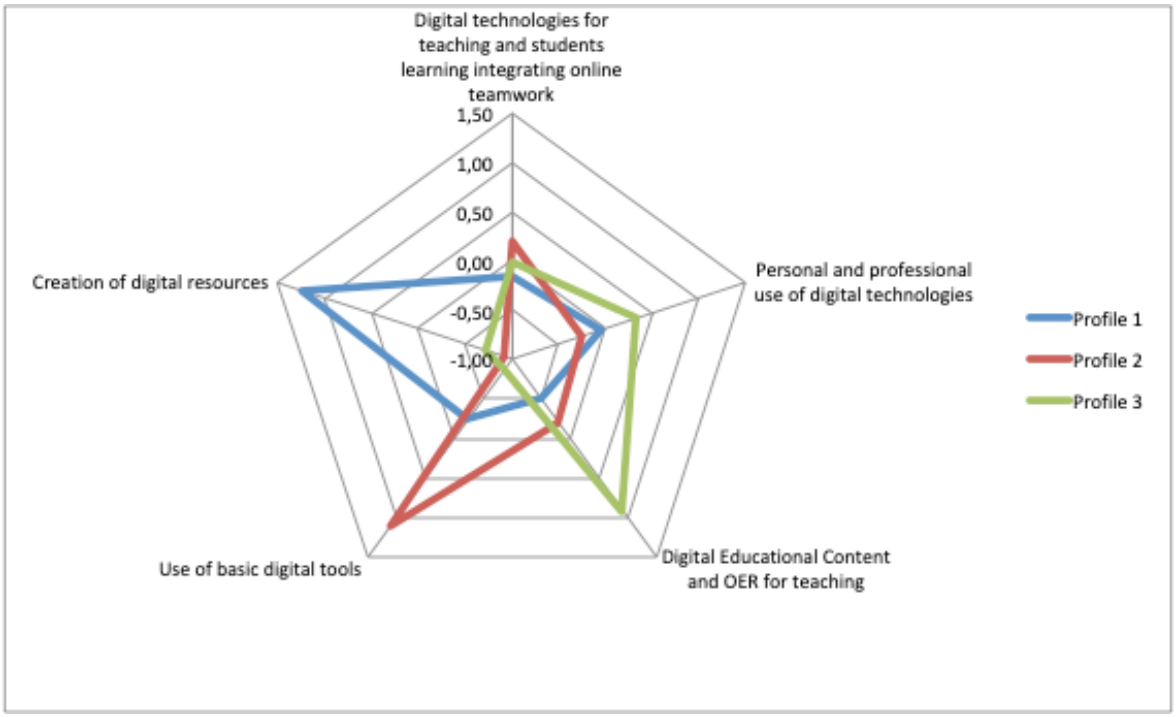

Figure 12: Clusters with respect to factors extracted (Spain)

4.4 Main trends regards the use of digital artifacts in teaching practices

To make conclusions of this work, it is most useful to relate the findings to the core questions that have directed the research project in an attempt to offer the reader a vision of more significant, emerging elements. In fact, although without any claim of representativeness and at risk of generalization, this project offers important and interesting ideas, also taking into account the initial bias due to the fact that the teachers participated freely in the online survey, introducing, presumably, an element of distortion that can be explained by a positive propensity to use digital tools in the educational field. The first thing to note is that, absolutely transverse to the different national contexts, despite cultural differences, regulations and the differences which distinguish the educational systems of the partner countries, are observed dynamics, trends and critically applicants, as already revealed in the phase of qualitative research. The quantitative survey of which it gives account in the present report confirms that experimentation and virtuous experiences and innovation are distributed to leopard spot in different territories, and collide, in general, with common problems and widespread issues that transcend national borders.

Specifically, we can observe, in the first place, the way in which the daily didactic practice relates to the technological equipment available in the school. In this regard, for each country and the related cross-examination of the evidence that has emerged, the difficulty for the teaching body to interpret and integrate the opportunities offered has been revealed.

With respect to the use of digital technologies in the educational context, we observe the permanence of a predominantly transmissive teaching orientation that direct/guide the use of digital technologies in an instrumental and practical way. In the United Kingdom and Finland, for example, an objective and product

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centered approach prevails, less focused on the socio-relational dimension of learning. The technical-professionalizing dimension is predominant (probably due to the wide participation of VET professors in the questionnaire). Also in the case of Romania, a pragmatic use of technology is predominant, centered on the object of knowledge, rather than on the subject and interactions. Knowledge speculation and meta-reflection don't seem to be at the centre of their attention.

Regarding the daily practice of teaching in relation to the technological equipment provided by the schools, the data showing a sort of polarization of the practices among those who, faced with a certain degree of awareness and competence, have been able to stimulate the creative work of students through online applications, and those who, showing lesser mastery of use, let an approach still emerge broadly transmissive; an approach in which digital tools tend to be used more to replicate a traditional teaching model than to promote student-centred learning logic. It should also be said that, in general, the participants in this survey show a largely positive view of the contribution that digital technologies can give to teaching in enhancing students' basic skills; in fostering in them the development of a responsible approach, but also in activating virtuous learning processes and self-evaluation processes. At the same time, however, in Italy at least in a group of teachers there is a greater attention to the methodological dimension. In fact, teachers of the second profile are used to structure learning environment as a holistic system that takes into account the interrelations between the teacher, students, learning spaces and digital resources (OECD, 2013, 22-23) and is built on innovative teaching principles and practices that focus on students with their active commitment, who promote well-organized cooperative learning, and leverage the ability of teachers to tune in to students' motivation, to understand individual differences, promoting horizontal interconnection between areas of knowledge and disciplines. The Catalan case, instead, is characterized by a propensity to use digital technologies to produce or consume digital resources. In both cases, however, the approach to technology is solitary, not mediated by a cognitive relationship with a learning community. In all countries there is a polarization with respect to the use of basic technologies and advanced teaching technologies.

With respect to the use of technologies and personal resources in daily professional practice and teaching work, aimed at investigating the way in which professional approach and daily teaching takes place, the personal approach to digital technologies, although there is a certain openness of mind, confirmed by a system of basic assumptions and an overall emotional sphere quite positive towards the usefulness of digital technologies in teaching, there is no automatic transfer of the practical knowledge acquired in the extracurricular experience. In the partner countries the integrated use of the network in professional and personal contexts seems to mean a wider experience of reconciling the different areas and overcoming the dichotomy between professional space/time and private space/time acted through digital artefact.

Also, in this case, the phenomenon appears to be distributed fairly evenly without letting any particular differences emerge between the partner countries. Only Italy, compared to partner countries, presents a dichotomous approach with respect to the use of the network: on the one hand aimed at networking and on the other for self-empowerment and loisir.

The prevalence of individual experience through which the professional practice is represented and the paths of development of digital competence show the strength and persistence of a social community based on the

analogue dimension where digital represents an alternative that, although valid under many aspects, exhausts to be incorporated into the relationship and construction processes of a renewed professionalism. In this path, absolutely non-linear, we perceive lost subjectivity when it seems to lack a professional community with which to share the weight of choices and strategies located in the context of belonging, as neither the disciplinary or departmental dimensions seem able to support the change in act.

In relation to the most widespread experiences and skills among teachers, the tension that exists between exploitation and exploration emerges (Holland 1975; Cyert and March, 1963; March 1991). On the one hand, there is a tendency to adapt the strategies and established practices (exploitation) on the part of the professional body, while on the other, there is an attempt to experiment with innovative solutions and develop new skills (exploration). These are two tensions that coexist, leaving pockets of more or less diffused resistance emerging that is based on a certain difficulty in interpreting and adapting the change that has taken place. Also, in this case, the absence of an accompanying system that is able to provide new explanatory keys to the teaching professionalism seems to emerge in a transversal manner.

With respect to teaching innovation spaces, it is confirmed that, while appreciating and using technology, many teachers are struggling to bring it into the classroom (OECD, 2013 / a: 2013 / b). This means that in spite of the easy access and use to various types of digital equipment, which are represented according to the category of the French sociologist Bourdieu the objectified capital available, these resources are not automatically translated into cultural capital for educational use, therefore incapable to bring real added value to educational practice. What emerges is the development of the professional practice is the result of complex and uncertain “translation” processes (Callon, 1984) that develop within the professional community, and through which technologies are appropriated, transforming the ordinary processes of work and relation. School organization *fields* appear fragmentated, a space where different kink of teacher profile and professionalism emerge entering into conflict with one another. It clearly emerges that there is a predominantly pragmatic use, expressed by those occupy organizational role.

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5. Testing training models for improve teachers' competence for digital era

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Introduction

As a result of the emergence of Information and Communication Technologies (ICT), that are understood as one of the more efficient key agents of social change (Domingo & Marquès, 2011), we are currently experiencing a period of major evolution. In this sense, citizens must be competent in their use in the different dimensions of their lives so, in consequence, education plays a key role in helping them to acquire the competences which enable them to be autonomous in both academic and professional environments, where ICT are considered crucial.

As Ilomäki, Kantosalo, and Lakkala (2010) stated in recent years, digital competence has become a key concept in the discussion of what kind of skills and understanding people should have in the knowledge society. In the same line, the Parliament and the European commission established 8 key competences for lifelong learning. Among them, they considered Digital Competence (DC from now on) as one of the most important ones. Authors such as Punie (2012) agree that DC is a transversal competence because it facilitates the acquisition of other key competences; this is one of the factors, in conjunction with the immersion of ICT in the society, that makes it a key competence in the educational system.

If the educational system is essential for the citizens' acquisition of DC, teachers are a key to achieve it since they are an active part of the educational process. This fact implies that they must take advantage and effectively integrate the potential of technologies in their training practice to facilitate students' acquisition of DC. In this sense, it is necessary that teachers value them as an essential element in the teaching-learning process, so it is not enough to just know or master them, but they must acquire "new professional skills that guarantee both knowing and how to know-how, know-how and know-how in and with ICT " (Falcó, 2017, p. 75); that is, they must acquire, in the same way as students, digital competence.

Being aware of the need of improving teachers' DC (TDC from now on) and considering their key role in education previously mentioned, DECODE project developed, as one of its IO, a training for in-service TDC. UOC, as leaders of this IO and based on their 20 years of experience in online training in DC, proposed an online training model which considered TDC beyond the instrumental use of ICT in the classroom as the

Catalan government (Generalitat de Catalunya, 2018) defined distinguishing it from the methodological TDC[69], in the same line as Calvani, Fini and Rainieri (2010) who states that, in this deeper sense, DC is more than a technical competence, becoming a more powerful and pedagogical tool.

In this sense, the proposed model was based on the definition of methodological TDC:

"Teachers' capacity to mobilise and transfer their knowledge, strategies, abilities and attitudes regarding ICT to real situations in their professional practice in order to: a) Facilitate students' learning and the acquisition of their digital competence. b) Carry out processes for improving and innovating teaching according to the needs of the digital era. c) Contribute to their professional development in accordance to the changes that take place in society and in schools." (Generalitat de Catalunya, 2018).

For the design of the model both Catalan and European (DigCompEdu) were considered by comparing them in order to determine coincidences that could be useful.

As will be explained in the subsequent sections of this chapter and from the methodological point of view, the proposed model, which was subsequently implemented in all partner countries, is based on an active and innovative approach (Challenge-based learning) in which participants had to solve three challenges that allowed them to integrate TDC in their teaching practices. In order to do so, they had to collaboratively perform a series of activities in a fully online environment.

In addition, in the following sections, a comparative analysis of the implementation of the model will be performed explaining all of the vectors of improvement detected that will be useful to apply the proposed model beyond the DECODE project. Finally, the impact of the training (inside and outside of the project) will be explained.

5.1 Online training model in Digital Competence for in-service teachers

In this section both the process of design of the model and the model itself will be explained.

During IO4, information about teachers' training needs was gathered. The questionnaire included a section about the TDC dimensions defined by the Generalitat of Catalonia, as well as the teachers' self-rated training need for each one as answered on a scale of 1 to 5. The TDC dimensions were prioritized for the design of training by means of analysing the frequency of the results. Subsequently, a comparative analysis was carried on the two reference frameworks of the TDC both in Catalonia and Europe to elaborate a proposal of dimensions and descriptors of the TDC that constituted the basis of the training. To validate this proposal and prioritize dimensions and descriptors, an online questionnaire was conducted with national and international experts in TDC.

[69] It is important to point out that UOC's DECODE partners actively participated in this definition of TDC as a part of a panel of experts in this field from all Catalan universities. This panel was formed in the framework of a project promoted by the Generalitat of Catalonia called "Interdepartmental Project of Teachers' Digital Competence" (PICDD in Catalan Acronym).

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Considering that the design of the training was elaborated by the Catalan partners, it was based on the results of the questionnaire distributed to Catalan teachers during IO4 with a total of 425 responses. Subsequently, the online questionnaire for the prioritization of the descriptors was distributed to a group of 34 experts in TDC, including national experts and members of the DECODE project and a discussion group was performed as well.

After the priorization of the dimensions of TDC, the training was designed for in-service teachers in Catalonia in an online seminar format. This design was validated by the same group of experts from the previous phase who took part in a discussion group. Finally, to validate the design of the training, a face-to-face discussion group was held with the 34 TDC experts involved in the previous phase.

Subsequently, the seminar was designed. It is based on collaboration among teachers since it is a fundamental element in their professional updating (Romeu, Guitert, & Sangrà, 2016).

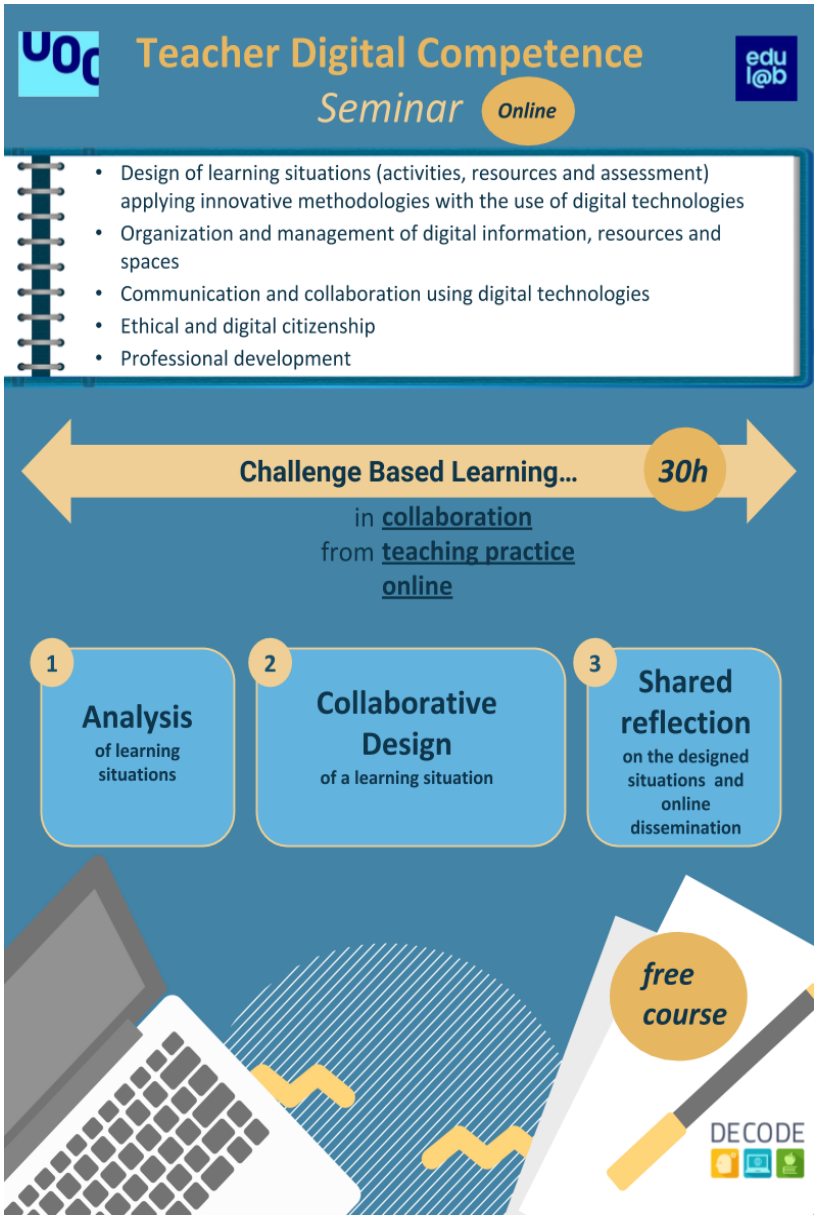

Figure 13: Teacher Digital Competence Seminar, 2019

The seminar focused on (a) the design of learning situations (activities, resources and assessment) applying innovative methodologies with the use of digital technologies, (b) the organization and management of digital information, resources and spaces, (c) the communication and collaboration using digital technologies, (d) ethical and digital citizenship and (e) professional development.

The objective of the seminar was to integrate and apply methodological TDC in their teaching practice by acquiring the TDC dimensions. The seminar lasted 30 hours and took place over the course of a month.

The **methodology** of the seminar was based on Challenge-Based Learning (CBL). CBL approaches learning from a problem/situation and poses a series of challenges that students must actively achieve. It is a methodology that involves the participants in the definition of a solution to a real and relevant situation linked

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to their environment, in this case it involves the design, in a collaborative way, of a learning situation[70] applicable to the teaching practice of the participants. A space for reflection and work based on the teaching practice was generated, allowing teachers to achieve digital competency.

The participants carried out collaborative work in small groups based on the achievement of three challenges:

- **Definition of the learning situation.** The learning situation is understood as the set of concrete situations used as a motivating challenge which can be resolved by the mobilization of knowledge and skills that allow it to successfully solve the task and develop the competences (Perrenoud, 2012).
- **Design of the learning situation carried out in a group.**
- **Assessment of the learning situation of another group and dissemination on the network of the learning situation.**

The seminar consisted of a set of **open educational resources** (OER) responding to the dimensions of the TDC. The methodology of the group work of the seminar as well as the diffusion in network of the designed activities, tried to promote sharing among equals.

The assessment model of the seminar was based on continuous assessment and took into account the agents involved in the learning process. The participants were an active part of the assessment process based on the performance of self-assessment and co-assessment activities during the training process.

This seminar was implemented in a **Moodle virtual environment** using the Google Apps that were the tools most used by participants in their teaching practice and, in turn, facilitated collaborative work online.

The **role of the teacher** in this seminar was proactive and they provided feedback to the participants to guide their training process.

5.2 Implementation, general results of the pilots and perspectives of improvement.

This section will consider the different pilot studies as outlined in the IO5 report. In doing so, the focus will be on the implementation, general results of the pilots and the suggested improvements which have been mentioned based on the results of each individual pilot. Specifically, we will focus on the evaluation of the pilots. Following this, we will address the suggested improvements as a means of improving the training model itself.

To evaluate the methodology of the training model, a continuous assessment approach was undertaken. Furthermore, this approach ensured that all learning processes were accounted for. As such, participants play an active role in the assessment process from the beginning of the activities through self and co-evaluation.

[70] Learning situation can be commonly named as “Good practice”.

Subsequently, the results of the pilots are presented from an analytical and comparative point of view, considering the most relevant issues that can be useful for the application of the training model beyond the DECODE project. In order to do so, the comparison has been divided in:

5.2.1 Participants' satisfaction with the course

Catalonia	Finland	Romania	Italy
Almost all participants (90%), who completed the course stated that it managed to stimulate their interest.	Data was not provided.	Almost all participants (86%), who completed the course stated it stimulated their interest.	25.6% of participants expressed that they found the course stimulating.

Table 9: Participant course satisfaction

As evident in Table 9 participants from both Catalonia and Romania were highly satisfied with the course. We posit that in the case of Catalonia the high satisfaction rate is related to the fact that the course itself was developed there. For this reason, its subsequent implementation was carried out as envisioned. Conversely, in Italy we see that participants did not feel stimulated by the course. Finally, Finland did not collect data regarding course satisfaction and as a result we did not gain insight into how the course was perceived.

5.2.2 Methodology

Catalonia	Finland	Romania	Italy
100% satisfied with Challenge-Based Approach. 89% rated the online collaborative learning positively.	Data not collected.	59% stated that the challenge-based approach helped to achieve the course objectives. 80% rated the online collaborative work as helpful.	34% stated that the challenge-based methodology helped teachers achieve the objectives of the seminar 26% stated they are slightly agree. 26% rated the online collaborative work as helpful. 42% slightly agree

Table 10: Course methodology satisfaction

In terms of satisfaction with the methodology of the course we see that Catalonia rated it highest in comparison to their counterparts with 100% satisfied with the methodology, and 89% rating the collaborative

learning experience positively. In contrast, the Romanian participants did not rate the methodology with the same level of satisfaction as only 59% of participants rated it useful in achieving course objectives. Nevertheless, 80% of the Romanian cohort did feel that the online collaborative work was useful. In Italy we saw less satisfaction with both the methodology, with only 34% stating that it helped to achieve the objectives of the seminar. In similar fashion, only 26% rated the online collaborative work as helpful. Finally, Finland did not collect data on the satisfaction with the methodology and thus no insight was gained.

5.2.3 Course description evaluation

Catalonia	Finland	Romania	Italy
95% stated the course objectives and evaluation criteria were clear from the start. 98% said the description of activities was easy to follow	Assessment criteria were clear for two of the respondents. All other respondents partly agreed or disagreed with the statement.	90% stated the course objectives and evaluation criteria were clear from the start. 94% said the description of activities was easy to follow	44% stated that the course objectives were clear from the start.

Table 11: Course description evaluation

The results from this table are based on the various elements of the seminar including (a) objectives, (b) evaluation criteria and (c) activities. In Catalonia 95% of respondents said that the course objectives and criteria were clear from the start, with 98% of them rating the description of activities as easy to follow. In Finland two participants felt that the assessment criteria were clear, however, the remaining participants were more divided either partly agreeing or disagreeing with the statement. In the Romanian cohort, 90% said that the course objectives and evaluation were clear from the beginning of the course and 94% describing the description of the activities as easy to follow. Finally, in Italy 44% of participants felt that the course objectives were clear from the start.

5.2.4 Course Resources Evaluation

Catalonia	Finland	Romania	Italy
31 people consulted the resources, with 96% of them rating them slightly, quite or very useful. The most consulted resource	Data not collected.	Roughly 80% of participants consulted the resources. Further results highlighted the most consulted resources as: *Digital Communication and Collaboration, ICT use in*	Between 65 – 80% of participants consulted the resources. The most consulted resources were: *guidelines on virtual*

at 91% was *How to design learning situations that promote the digital competency of students*		*education, and the Design of learning situations*	*debates, digital communication and collaboration and digital citizenship.*

Table 12: Course Resources Evaluation

The overall picture taken from the presented results is that the course resources were extremely well received across countries (with the exception of Finland who used different resources and as such did not collect data regarding this area). The main differences worth highlighting are those that reference the most consulted resources. For example, in Catalonia the most consulted resources was *"How to design learning situations that promote the digital competency of students".* This resources was central to the seminar in that it was based on the development of the challenge that the students have to solve. In Romania similar results were seen but in the resource for *"Digital Communication and Collaboration".* This could be due to the fact that they have less experience in the development of collaborative activities online. Furthermore, for the Italians, the difference was more pronounced, given that the highlighted resource was not actually the most consulted. We propose that this is due to the fact that this resource was not promoted as much as it was in both Catalonia and Romania. Presumably then, in the Italian seminar other resources were promoted more hence the difference in results.

5.2.5 Seminar duration evaluation

Catalonia	Finland	Romania	Italy
Participants stated that 2 and a half / 3 months as the ideal duration.	Respondents that 1 month to over 2 and a half months was the ideal duration.	Overall, the feedback suggested that 1 month was appropriate for a majority of the participants. However, ¼ of participants wanted at least 1 month/1 month and a half, two months or even longer than two and a half months as the ideal duration.	30,2% state the ideal duration for this seminar is from two months to two and a half; while 27,9% state the ideal duration is less: from one month and a half to two months.

Table 13: Seminar duration evaluation

As seen in Table 13, all countries shared that the initial preparation model based on 30 hours was not enough. The average time recommended by participants was 2 ½ months, which suggests the need to increase the time needed to carry out and complete the activities in more detail and quality.

5.2.6 Online teacher's evaluation

Catalonia	Finland	Romania	Italy
94% rated the teacher's role as very useful. 98% stated that the orientations were clear and communication was clear for completing the work.	Mixed results were provided. A majority of participants either partly agreed or disagree with the statement as well as with the statement considering the usefulness of the teachers' feedback.	60% of respondents believe that the role of tutors was a key element of the course. 90% rated the tutor feedback positively 99% rated the tutors' instructions clear.	The role of the teacher was a key element in the seminar for 34.9% of respondents. The teacher's orientations were clear for 41,9% of respondents.

Table 14: Online teacher's evaluation

In Catalonia, the tutor's role was most highly valued in the training, most likely due to the fact that the UOC has over 20 years of experience in these types of training and courses. Moreover, the design itself was based on the role of the teacher as a key element in its success for the students learning. In Romania, although the ratings were lower, the instructions of the teachers were highly rated. On the other side, and perhaps more extreme case we can dissect the results from both Finland and Italy. Firstly, in Finland the evaluation was not carried out by the teacher and was instead based on peer-assessment, resulting in the teachers' role being diminished. Similarly, in Italy the participants suggested the necessity of a teachers training in order to apply the model. In fact, both communication and evaluation guidelines were passed, but in consideration of the results, were not satisfactory.

5.2.7 Future perspective of training in TDC

Catalonia	Finland	Romania	Italy
84% intend to continue training in the field of digital competencies of teachers.	Data not collected.	77% intend to continue training in the field of digital competencies of teachers.	86.1% would like to continue developing these skills.

Table 15: Future perspective of training in TDC

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Evident from the results in Table 15, a large majority of participants expressed interest in continuing their training in TDC. In this sense, we consider the seminar itself as having a positive impact on their attitudes in this area given that it introduced the participants to the field and it allowed them to discover an area of professional development.

To finish this section, it is important to consider the suggested improvements as highlighted from each country. We have combined the feedback and will present it as an overall suggested improvements approach.

The following is a list of the suggestions for improvement:

- The main limitation of the training was the time limit offered to achieve the desired objectives. In particular, the time limit was restrictive in terms of optimal development of the proposed challenges and goals. Some participants echoed this sentiment stating that one month was not enough time to design learning situations to a satisfactory in-depth level. This subsequently had a negative impact on the opportunities to work collaboratively. For example, in **Italy**, 30.2% stated that the ideal duration for this seminar is from two to two and a half months with 27.9% suggesting from one and a half to two months. Moreover, some participants would have wanted a longer period and others a lesser course duration, suggesting that it take place during school holidays.

- Related to this is the fact that the training was delivered online. Participants commented that whilst they did enjoy this aspect of the training that it would be useful to have some form of post-training forum in which they could keep in contact and collaborate further when desired. This would allow participants not only to collaborate but continue sharing knowledge and relevant experiences with each other, suggesting that this type of research could have a long-lasting impact given the right circumstances and resources.

- Respondents gave feedback and suggestions in an open question in the final survey but also via e-mail straight to teachers. They suggested:

    - **Improving layout and a larger focus on group work as it was difficult to maintain interaction.** This was based on the feedback from countries such as Italy and the UK who experienced technical issues with Moodle. Some participants also had trouble with notifications and did not know when other members had posted in the forums. Consequently this has a negative impact on the collaborative work as participants struggled to keep in contact and follow different forms of feedback.

- The most challenging part of the course appeared to be online teamwork: between modules 3 and 4 it was difficult to maintain student's motivation, and many gave up with the course even though teachers tried to motivate them to continue via e-mails and by phone calls. In order to overcome this issue, we feel that one way to interpret this feedback is to encourage with emphasis the advantages of collaborative learning. In doing so we hope to highlight its importance to the participants and can also explicitly underline the importance of dedicating time to this style of learning.

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- Much of the criticism that arose was related to technical difficulties. For example, the design of the platform raised issues in allowing real-time communication with colleagues. Furthermore, some participants had difficulty accessing the website. A potential factor contributing to this is the fact that participants depend on the Link Campus University's Moodle which may be a disadvantage. Moreover, the messages that the participants received were in Italian, leading many to think the messages were spam. A prime example comes from the UK, a monolingual country which normally receives all mail in the English language. As such, messages in foreign languages are directly sent to their spam folders causing them not only to not understand the messages but also to miss them as they do not receive notifications for their spam folder.

- Although Moodle supports conversation forums, it is difficult to access and doesn't allow for collaboration on documents. This may have been a large obstacle to the group task as the objective was to develop a shared document about a new learning situation and the group was unaware of how to proceed with its creation.

- Other requests from participants involved translating of all the support resources into the specific language of the participating country. For example, as mentioned previously the UK participants received the messages in Italian and therefore did not understand them. The same can be said for Catalonia who would primarily need to receive the mails in one of the two official languages (Catalan and/or Spanish), Romania in the Romanian language and Finland in Finnish. Going forward this is an excellent point to have in mind for course improvement. It is also a very feasible adjustment to make.

- Respondents suggested that it would be useful to receive a score evaluation at the end of each activity. There are two reasons why this could be beneficial and should be considered for future reference. Firstly, given that as aforementioned, motivation was lacking for some participants, a grade may improve their motivation as it gives them a measurable goal to work towards. Secondly, grading each activity would allow each participant to identify their strengths and weaknesses in each one. As such, this could help participants know where and what to focus on for future training programs/workshops etc. On a side note, it would also allow us to identify areas in which those participating need further support and thus we could tailor the course based on the individual needs of each teacher.

- In particular, some teachers had difficulties in finding materials and understanding deliveries. The addition of a clear chrono-program at the beginning of the course and a check-list for each phase of the course are suggested by some to facilitate the work. Many suggested the need to reconsider the timeframe for deliveries given that the academic year is already so full with general school commitments.

- Participants positively rated the work of the tutors especially their continued communication through the reserved area and private messaging on the platform, as well as their help during the course itself. In this regard, the most frequent improvement suggestions concern the diversification of

communication methods, such as tutorials, webinars, interactive presentations, along with non-textual in-depth resources in order to make the work environment more effective.

- Some participants highlighted the need to improve the random composition of the groups. Longer and more relaxed times would have allowed a better engagement among the participants who could have been grouped based on affinity. In fact, in the Catalonian pilot, groups were formed considering their affinity, and this is one of the reasons why it worked better during this pilot.

- Throughout the training process, the main problem faced was that not enough people were enrolled on the course most notably in the UK. If larger numbers of teachers were enrolled, there would have been more interaction, encouraging others to participate in tasks. It is important therefore to consider how we may achieve this in future. Logically we must consider the suggestions and feedback for improvement of the course overall. Specifically, in relation to participant numbers, a potential way to gain more numbers would be to consult educational institutions and policy makers directly and discuss a way of introducing the course as an official training requirement in the future. A second way would be to improve the engagement of students through an adaptation of the training to their interests or to provide a more detailed monitoring and feedback to participants during the development of the seminar.

- The course was demanding in terms of time and prior knowledge needed. Many people presumed that the course would have been more basic and so dropped out as they didn't feel able to complete it.

5.2.8 Impact of the training

In order to analyze the impact of the training developed during the DECODE project, we consider the items of the pilot surveys referring to the transference of the training:

Catalonia	Finland	Romania	Italy
87% of participants stated that the resources were extremely transferrable to their teaching. 89% of participants stated that they will share what they learned with their fellow colleagues. 93% would recommend the seminar to a colleague.	Data not collected.	Nearly all participants would recommend it to colleagues. 50% would disseminate the experience of the course among colleagues in their school / institution.	60% of participants stated that the resources were very useful. 39% of participants will share what they learned with their fellow colleagues. 37% of respondents would recommend the seminar to a colleague.

Table 16:Training Impact

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Based on the prior table, it is evident that this course has made an impact on many of the participants in terms of transferability. Transferability, as suggested by the name, refers to the competences developed which participants feel they can make use of in their professional life. Firstly, it is clear that the resources used in the course were useful in terms of promoting transferability. We saw this in the responses from both Catalonia and Italy. Furthermore, a large majority of the participants from each country would recommend the course to their peers, suggesting that they valued the impact of the course and considered it useful for their and their colleagues' professional development in the field of Digital Competence. An added bonus for the creators of the course, and perhaps an unexpected surprise, is the fact that some respondents even suggested that they would like to continue and further their training in this area. As such, not only has the course provided its participants with transferable skills, but it has also encouraged their professional and personal development in the field beyond the level of the course.

To fully understand the true impact of this training course, it is important to highlight the number of people who were trained using it. This information is provided below, with the total number at the end.

- **Catalonia:** 97 participants enrolled in the seminar and 51 finished it (but 47 filled the final survey) and it lasted 5 weeks.
- **Finland:** Pilot finished with 50 students enrolled and 20 finishing the course. The seminar lasted 8 weeks.
- **Romania:** Pilot finished with 350 participants enrolled, out of which 200 accessed the platform at least once and 96 that finished the seminar. The seminar lasted 6 weeks.
- **Italy:** Pilot started with 250 participants enrolled in 5 classrooms composed by 50 people. 60 participants finished the seminar. The seminar lasted 15 weeks.
- **UK:** Due to problems with student's enrollment and completion of the seminar, they had 23 enrolled and 3 people engaged.
- **Total:** A total of 750 participants enrolled overall, with 230 (30.6%) finishing the course. This is the sum of participants from all 5 countries.

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6. A proposal of Guidelines for Educational Agencies

Licia Cianfriglia [1]

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The development of technologies has extended to infinity the places and times of education, involving the school and all the subjects that in various ways live it in a continuous and unstoppable process of transformation. If, on the one hand, an acceleration push towards change and innovation emerges, on the other hand, there are hesitations and fears that the school, and with it the teachers, may lose sight of the pedagogical sense that gives purpose to their educational function and training. It is essential for teachers, as citizens, and as educators, to possess digital skills, not only because they represent a model for their students, but also because they can be able to use technologies to facilitate learning effectively.

It is necessary to consider the transformations induced by the use of technologies at various levels - professional, organizational and educational - to adopt responsible and effective behaviors, capable of supporting and accompanying change, rethinking the various roles of the actors involved: managers, teachers, students, families, technicians. To integrate the use of technologies, making them truly effective, it is necessary to intervene on the entire organizational system, on processes and procedures, on communication and learning environments, also reversing the role of the student, who becomes the architect of his process of learning. For the design of learning environments for the skills of the 21st century, it is worth referring to some fundamental principles that emerged from the 2010 OECD research:

1. Focus on students, activate their involvement and make them aware of their activity as learners.
2. Based on the social nature of learning.
3. Have "professionals" who are experts in learning, who are in tune with the motivations of the students, aware of the role of their emotions for school success.
4. Be sensitive to individual differences, taking into account natural knowledge.
5. Building on challenging and challenging schedules for all.
6. Work on key expectations evaluated consistently; role has the training feedback for learning.
7. Foster horizontal integration with other areas of knowledge and subjects, with the community and the real world.

Another fundamental aspect concerns the concept of "learning environment", which with constructivist psychology has seen the transition from the paradigm of teaching to that of learning, centered therefore on the student, focusing on three aspects; objectives, roles (teacher and learner), relationships between learners.

According to some of the most accredited theories, the learning environment is:

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• a dynamic open system in which to live a real learning experience, rich in resources, in which the objectives are more the direction than the goal to be reached, in which the contents are not pre-packaged, but constitute a flexible resource from which to draw as needed (Marconato 2013);

• a physical or virtual place, a mental or cultural, organizational and emotional / emotional space (Loiero 2008);

• a place where knowledge is not transmitted but built through an activity anchored to a context that gives it meaning. The construction of meaning arises from a problem, a question, a disagreement, and is shared through conversation. Reality is seen from different perspectives (Jonassen 1999);

• a place composed of a subject that acts, uses tools, collects and interprets information, interacts with others, in which we help each other to pursue learning and problem solving objectives; learning is not direct but stimulated and supported (Wilson 1996);

• a place where students can determine their goals, choose activities, access information resources and tools, work with support and guidance. Learners choose different activities in which to engage, with different objectives; the teacher is the coach, the facilitator, uses peer tutoring (Perkins 1991);

• a background scenography (a setting), a learning ecosystem that includes the activity and the learning outcomes and recognizes the context (the students with their social profiles, experiences, knowledge, expectations and family values) as essential and integral to the protagonists and environment variable OECD

In the words of Ken Robinson, given the challenges we face today, education must not be reformed but transformed. The key is not standardization but personalization: building success by discovering the talent of each student, putting students in an environment where they want to learn and where they can discover their passions (Robinson 2009).

The fundamental elements and dynamics of learning environments, which constitute its "pedagogical heart", are represented by learners (who?), Educators (with whom?), Contents (what), resources (with what?). The organization of the four elements is realized:

- in the organization of the groups of learners, by size, age or different profiles;
- in the actions of teachers: group teaching, professional development deriving from group work, alternation between individual and group teaching;
- in time planning: flexibility and / or customization of the timetable;
- in the integration of non-formal learning;
- in educational innovation: inquiry based methods, authentic tasks, etc.

According to the OECD study (2010/2013), innovation moves from four elements:

1. new students: they can be added through the network in virtual classrooms;
2. peer teaching;
3. content innovation, knowledge, skills, values: it also includes the skills of the 21st century, such as social learning, creating connections between disciplines with interdisciplinary approaches, focusing on language and sustainability;

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4. resources: they can be buildings, infrastructures, but above all digital resources.

For the educator, the development of a digital competence goes beyond the merely technological dimension, translating itself into the knowledge and understanding of some digital features, considering the media language, the content, the productive and receptive dynamics. To these are added other dimensions ranging from analysis to application, from production / design to the evaluation of a process / product. In this perspective, a training course on digital education literacy is one of the main objectives:

- reduction of the communication gap between teachers and students;
- experimentation of new training strategies that envisage the use of digital languages to renew
- teaching and facilitate the learning process of students;
- promotion of transversal skills, such as the spirit of initiative, communication, collaboration and participation;
- strengthening the creative and innovative use of technologies in teaching;
- development of a training course functional to the development of digital skills in reading, writing, critical dimensions, analysis and production.

With the spread of communication and information technologies, the alphabet-based world of letters is turning into a world of digital objects that require new skills compared to writing (Midoro 2013). Digital Literate is the one who is able to work effectively in the knowledge society using the typical objects of this world and the related technologies. He can be an ICT literate, a literate media or an information literate, able to participate in social life as an active member of a society characterized by collective intelligence.

The responses to challenges from educational institutions will depend on how they will be able to interpret their autonomy, grow the professional community, communicate with the outside, personalize learning, moving towards a path of continuous growth and innovation. This will depend on several factors and can be achieved according to two opposing points of view, including those that can be integrated together: the topdown model, which draws the stimulus from educational policies that invest in promoting change with economic resources and specific programs, entrusting the implementation to the manager ; the bottom up model, starting from the inside of each school, thanks to the staff's organizational and educational innovation capacity. The leadership model appears fundamental in the drive towards continuous growth, as well as the strategic vision of the leader who will know:

• have the ability to identify and remove obstacles, starting from a careful survey of the instrumental and didactic resources, in order to promote strategies to overcome any difficulties;

• provide the functional tools to satisfy the concrete needs of teachers, students and staff, suitable for the various starting levels, flexible and flexible to facilitate relationships and learning, also through the creation of adequate spaces;

• provide support, promoting continuous professional development, openness to other communities and confrontation with the outside;

• enhance, capitalizing on progress and results p

• enhance, capitalizing on the progress and results produced to stimulate growth and improvement;

• take care, paying due attention to the various stakeholders' requests;

• creating a future, promoting individual autonomy, safety and responsibility in the use of technologies.

Each school must be a community that continues to learn, thanks also to the use of technologies, according to a model of social practice in which the subjects involved interact, with different roles and variable configurations, through daily practice, empirical observation and dialectical relationships.

The use of technologies, the production of data and artefacts also implies the need to redefine rules, symbols, strategic choices, establishing behaviors and new models of relationship and interaction. Furthermore,

the effective introduction of technologies in teaching cannot be separated from the emotional aspect, which must be considered in three aspects:

1. from a point of view of self-efficacy, as a device;
2. as objects of interactive mediation, which allow the opening to new relationships;
3. as objects of reflective mediation, which enter the process of constructing personal identity and overcoming frustrations in the event of errors.

The path towards expertise proceeds according to a learning process that goes from strangeness to planning capacity, creating the implicit curriculum that accompanies the educational action. The new techno-social space favors the coexistence of many learning environments, in which to move and learn.

European research, very vast and active, brings back the need to focus attention on technologies that are functional to the acquisition of more autonomy: decreasing routine, increasing information, communication, sharing and intellectual tasks. Over the years many researches have been carried out aimed at promoting a better use of technologies, rethinking the way of learning, providing digital skills to generate growth, work and inclusion. JRC Learning and skills Project represents an important point of reference for those working in educational contexts, as well as the Actions resulting from the commitment undertaken with Digital Education Action Plan (COM / 2018/022), addressed to primary and secondary school teachers, so synthesizable:

Action 1 - Connectivity in Schools

Action 2 - Self reflection tool and mentoring scheme for schools

Action 3 - Digitally - Signed qualifications

Action 4 - Higher Education Hub

Action 5 - Open Science Skills

Action 6 - EU Code Week in schools

Action 7 - Cybersecurity in Education

Action 8 - Training in digital and entrepreneurial skills for girls

Action 9 - Studies on ICT in education

Action 10 - Artificial Intelligence and analytics

Action 11- Strategic foresigh

The role of technologies in learning is fundamental above all to promote social inclusion and equal opportunities, but the effectiveness depends not only on the use of ICT, but rather on the reorganization of the learning situation and the ability of teachers to use the ICT. The acquisition of new skills can be related to two aspects: the acquisition of skills related to the use of technologies for themselves and the acquisition of skills related to the use of technologies to create educational environments for students.

The declination of digital competences, functional to define its development models and standards, after years of studies and research flows into the DigCompEdu framework, structured in five dimensions:

1. competence areas identified to be part of digital competence
2. competence descriptors and titles that are pertinent to each area
3. proficiency levels for each competence
4. knowledge, skills and attitudes applicable to each competence
5. examples of use, on the application of the competence to different purposes

In each area there are different skills, divided into four levels: foundation- intermediate- advanced - highly-specialized

The levels of progression are further elaborated across levels.

The use of Digicomp and Digicomp Edu in the school context allows educators to know which digital pedagogical skills are considered fundamental, at what levels they have actually been reached (on a scale ranging from A1 to C2), in order to be aware of which these are the deficiencies to be filled to move from Newcomer (A1) and Explorer (A2), to Integrator (B1), to Expert (B2) up to Leader (C1) and Pioneer (C2).

The ductility of technologies, their very rapid evolution, the ubiquity that distinguishes them and the continuous support to be provided to students, implies the possession of a solid set of digital pedagogy skills on the part of teachers, which must be able to analyze and identify the needs, to create engaging and stimulating environments that translate into a learning community in which interests and goals are shared, according to a completely revised model compared to the traditionally transmissive one.

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The institutions involved in the growth process, in order to facilitate the use of technologies in teaching / learning practices, may follow different paths, taking into account some priority objectives such as:

- promote digital culture among all members of the professional community;
- make resources and tools available;
- plan training actions;create networks between different institutions (schools, universities, research centers, etc.);
- offer a replicable model of action research in the field of ICT in education.

Innovation takes on meaning and value when learning opportunities are amplified, promoting the digital citizenship of pupils, increasing strategic skills such as: critical thinking, problem solving, effective communication, creativity, making decisions. The use of technologies implies a change of perspective in the didactic planning, in the classroom setting, in the role played by the student and in the different approach to the disciplines. It is becoming increasingly necessary to overcome the limits of traditional curricula, such as the fragmentation of disciplines, their extraneousness with respect to new social needs and the real problems of life, the poor consideration of the new skills required by the digital society (creativity, problem solving, capacity to learn independently). The possibility of learning in environments where physicality and virtuality come together in a social, informative and educational continuum requires an extension of the competences compared to those required by traditional educational processes (Midoro 2013). They could be divided into three blocks:

1. skills and competences with which the individual faces the phases of a process: exploration and problem setting, problem solving, and communication, autonomy;
2. relational skills;
3. organizational skills of a process.

rom the analysis of the experiences compared, it emerges that to proceed in innovation, among the objectives that the school aims to make students reach are priorities:

- learn how to select digital tools according to the tasks to be carried out
- know the use of different software and applications, configure, process and manage documents;
- learn how and what to look for, select sources, have a critical view, organize
- learn to participate in virtual spaces, use digital resources with an ethical sense and responsibility;
- learn to recognize and prevent risks.

Training and professional development should therefore be aimed at building a full and conscious digital citizenship for each student. It is precisely the latter that represents a fundamental dimension that guides teaching by directing students to live, work and share digital environments in a positive and constructive way, promoting communication skills, creativity and participation, respectful of everyone's rights. Students are guided to the acquisition of a fruitful awareness, which refers to the ability to contextualize digital skills, the ability to face and solve concrete problems within specific operational contexts, on the basis of rules, principles

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and methods already acquired at the previous levels and in different situations, through the application of learned knowledge. In summary, such a path provides for teachers to be able to recognize the fruition strategy and also those that the different communication tools implement, to capture the attention and stimulate the cognitive processes of the learners in a creative and rational way.

While it is true that teachers have the task of promoting innovation, integrating digital technologies and skills, it is equally true that functional pedagogical skills are needed to develop new teaching methods that can make learning meaningful. The focus is on the ways and tools with which knowledge is created, communicated, shared and negotiated. Issues such as digital literacy, innovation in education and training systems, the new ethics required by technologies in educational processes and in society, the impact of social media on relationships and the development of new knowledge and learning are the framework to design training courses within the new curricula, taking into account a different conception of the nature of knowledge and how it is produced.

A project proposal for the creation of a meaningful, active, social and motivating learning environment can include five elements:

1. the document research phase, which helps students to research and select;
2. interaction between students that promotes social skills;
3. the digital presentation that empowers and stimulates the ability to organize ideas;
4. the use of a database;
5. the virtual tour that gives students the opportunity to move anywhere.

Teachers' commitment to transform teaching with digital integration must be supported by managers. Institute leaders are required to guide staff towards a new school model, drawing new horizons of meaning and a new organization of processes. The school becomes the privileged field for learning and using new technologies, in which the collaborative climate and the tension towards the new are essential conditions for success.

In order to build an educating community ready to develop a technological pedagogy, school heads will have to implement a plan that includes some basic steps:

- resource mapping: teaching material, experts, software, etc .;
- shared planning between the various subjects (teachers, students, families);
- the choice of appropriate training activities for continuous professional development;
- sharing of good practices within the professional community;
- the involvement of students in educational planning;
- the alliance with other institutions pertaining to the vast sphere of school governance;
- sharing with the global society.

The school organization is, according to many studies, the key to change. It is central in linking the fundamental elements of the learning / teaching process, learners, teachers, contexts, contents and resources. The search for simple answers is not adequate for the school, but the school context characterized by variety, variability, indeterminacy, also represents the environment in which the professional community can generate innovation, according to a bottom-up process, which it allows teachers to face complex challenges, putting together their collective intelligence (Bain 2007). To the push towards the change generated from the bottom as a requirement of the school community to evolve and learn, however, a strong impulse coordinated from above, through the implementation of innovative policies must be added, which can find an effective boost from the comparison of available good practices in the international scenario. Such an opportunity is also offered by the DECODE project, which has allowed us to highlight evidence, strengths and weaknesses in the educational systems of partner countries, with respect to the use of technologies in teaching, social and organizational practices that affect the school system.

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Conclusions

Stefania Capogna [1]

We know, one of the most critical issues affecting the development of the old and new media in education is the lack of a systemic vision and the lack of precise empirical data about transformation introduced by the digital revolution in school, under the pressure of European policies.

The results offered by this comparative research is only a first contribution to support policies for lifelong learning that take into account the digital transformation of society as a whole. Fundamental processes for the future of the entire education system - such as automation, digitization, dematerialization, virtualization, cloud and mobile computing, big data and so on - impose an explicit knowledge of the state of the art to inform and guide the policies of the future and the “translation processes in practice” at the level of national states.

The primary objective of the project was to enter the 'black box' of teaching practice to reconstruct the process by which European guidelines and recommendations translated into national educational policies. To this end, the first step of the research path has led us to reconstruct European policies on education and digital challenges to acquire the common theoretical framework, necessary to guide all subsequent phases of the research in a transnational perspective. This research confirmed that digital competences widely promoted by central authorities as a tool for teaching and learning, but there are still considerable disparities regarding their implementation.

On the basis of this common interpretative framework, the second action envisaged the realization of a comparative analysis aimed at understanding how national policies decline European indications on the in digital education policy, a path from macro to micro that slowly, but progressively, it allowed us to investigate the didactic and professional practices in their comparison with digital. This work has allowed us to bring to light elements of similarity and differences, perspectives and criticalities, offered by digital for educational use, starting from those who make and live the school every day. The results of these preliminary researches highlighted some transversal limits and requirements in the implementation efforts in the different national policies. The recurrent problems, regardless of the local, cultural, organizational and system differences are to be seen in general:

- lack of a vision and a unified national framework concerning school policies and how they accompany the digital revolution within educational processes;

- lack of a firm commitment to transform technology into a new educational model, which gives rise to the absence of national coordination on digital innovation at school;

- absence of a system and process vision of "school as complex organization" and consequent difficulty in enhancing virtuous experiences, spread like a leopard in different national contexts;

- endemic lack of investments and quality training for School Managers and teachers about how digital can transform the school organization and the educational pact between school-student-family-educating community.

Faced with these problems found across all five of the national contexts involved the need to:

- build networks and "create a system", involving the various institutions that, at different levels, contribute to guaranteeing digital innovation processes in individual countries, promoting integrated and participatory policies;

- know how to intercept the information and skills capital that students already have at the entrance and that needs to be addressed, restructured and systematized for transforming into learning, knowledge and understanding processes;

- improve the accessibility and reliability of the tools and equipment used by schools that often prove to be an impediment.

The effort to increasingly understand the organizational reality of the school in the digital challenge led to the realization of an even more profound qualitative analysis, through interviews with privileged witnesses (institutional actors, policies and decision-makers). These interviews made it possible to identify the strategic factors that must be observed to favor the integration of ICT in the teaching-learning process, and to outline, in this way, in a transnational key, the strategic dimensions of attention that can accompany a digital enhancement process in teaching and professional practices.

Following the logic of the action-research, to accompanying the construction of quality processes, chapter three identified monitoring criteria and indicators to provide support tools useful for the design and evaluation of digital for educational use (Practical Guide for Schools - «Framework of quality for the integration of Digital Skills in the teaching-learning process). This analysis focuses on the need for organizational planning aimed at identifying the areas in which ICT can be useful for improving the teacher's professionalism. Not all devices and software have the same educational potential, so schools must adopt a critical and design approach. The quality of teaching and learning is not improved simply by improving the technical resolution of digital technologies. The mediating role of the teacher continues, indeed it becomes even more relevant. The first step in every attempt at digital innovation in educational processes is thus to develop a clear vision with respect to the ways in which new technologies can be integrated into the organizational and didactic space, defining a shared educational policy and a short, medium and long project functional period to support both organizational and process change within the school community, as well as the involvement and training of all its components.

An on-line questionnaire for school teachers of all levels reconstructed the processes of "incorporation" of digital technologies into teaching and professional practices; identify teachers' experiences, skills and training needs in order to understand strengths, areas for improvement and development prospects. By the online

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survey, we have tried to move from the policies plan to the "translation into practice" of ideas. The questionnaire explored four main areas: the daily practice of teaching concerning the technical equipment provided by the school; the concrete use of technologies and personal resources in professional practice and daily teaching; the heritage of experience and skills of teachers; the most relevant experiences. An essential point of reference was the Digital Competence Framework for Educators (DigCompEdu), through which the teachers involved were able to self-assess their digital skills. As far as the way in which the daily didactic practice enters into relation with the technological equipment available to the school, the reading for each country and the relative cross-sectional analysis show the difficulty of teachears (independently of the contexts territorial and cultural) in interpreting and integrate the opportunities offered by digital technologies in the educational context. Overall, the results of this research are in continuity with the survey carried out by the Italian team in 2016 (Capogna et. al). What emerge by the transversal analysis of national contexts is the absence of an accompaniment system able to provide new explanatory keys to teach in the XXI century and the need to structur an effective and quality lifelong learning system to promote the development of educational skills throughout the whole teaching career.

Learning paths analysis about training in the use of digital technology in teaching shows in all countries teacher are alone and formed in paths of self-socialization played mostly for out of contexts and formalized paths. Research results show the difficulty in intercepting and enhancing innovative teachers capable of doing research and experimentation, critically and reflexively, questioning the uses of technologies for educational purposes, bringing out at the same time: a) the difficulty in intercepting the body teacher less inclined to attend social-networking spaces/communities; b) the need to rethink and recompose paths of tertiary socialization essential in the formation of the professional habitus and ethos that should distinguish the teacher in the third millennium. The teacher who confronted with the potential offered by the Internet is increasingly required to abandon the traditional habit to acquire new professional tasks characterized by more complex competences of design, management, evaluation, communication, relational and empathic nature, even before digital and methodological. The teacher's professionalism does not end with the merely disciplinary knowledge and skills, nor within the class boundary.

We, therefore, observe the need to promote a renewed 'network' culture able to create in the territories - and not only - stable mixed networks (school-university-civil society-local and national institutions) for supporting the educational project towards the changes imposed by the digital revolution. Only in a network logic (educating community) we can hope in overcoming episodic and localized approaches which follow 'stop and go' logic in according to temporary financing possibilities that struggle to be valued within a system perspective.

Addressing the issue of introduction digital in teaching and professional practice, free from the simplistic explanation connected to the resistance and personal digital gap of teachers, obliges us to look at the problem in terms of "school as complex organization", addressing the problem in planning, organizational and process terms, and seriously facing the question of e-leadership, not only at school level but considering first of all the weight and the strategic role of direction and valorization that resides at local and central level. No digital policy for education can ignore the need in confronting the original mission of 'doing school' which brings to mind the essential function of 'ex-ducere' (the Latin root of education) which means to pull out, to

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bring forth to the light. In the digital society children arrive at school with " heads full" of images, words, communication and consumption models that have nothing to do with education, since television, network and radio unequivocally calibrated to pedagogical and communicative models non-educative (by virtue of the style according to the fact that one who screams loudest wins, without paying any attention to authentic listening, recognition and respect for otherness). In such a context, the role of the school should go far beyond the simplistic "in-struere" (Latin root of instructing) which means bringing in, inserting, transferring, transmitting, to support, on the contrary, processes of deconstruction of reality, internal and external, to favor the formation of culture and social competences increasingly recognized as an ineliminable prerequisite of the digital society.

Digital revolution transform our ecological environment in an “infosphere” (Floridi, 2017) where there is no longer a distinction between being connected and being disconnected. An environment characterized by advanced (third-order) technologies that dialogue each other, defining our margins of action and possibility that we are aware of them. An increasingly massive and invisible presence that educational systems can no longer ignore. The understandig of the real practices and the sharing of knowledge and virtuouse experience is the only strategy to support the education system to adapt its mission to the new challenges that already inhabit our present.

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ANNEX 1: Best Practices

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Title of the learning situation	A Debate on Emotions	
Application context	Stage / education level	Secondary schools – first to third year
	Curricular areas involved	Italian, Art, Science and Music
Description of the learning situation	Skills	**Communication** Use vocabulary and functions of the Italian language appropriate to the communication context: social, cultural, scientific, economic, technological. **Digital competence** Use and produce visual and multimedia communication tools, according to expressive strategies and technical tools of online communication. **Learning to learn** ● Participate in activities ● Find, organize and use information from different sources to perform certain tasks

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		• Organize one's own learning • Acquire study skills **Social and civic competences** • Acting autonomously and responsibly – have knowledge of and observe rules • Collaborate and participate in discussion and activities while understanding different points of view **Sense of initiative and entrepreneurship** • Solving problems by proposing solutions • Assessing risks and opportunities • Making decisions • Working flexibility • Cultural awareness • Recognize the value and potential of artistic and environmental features, for their proper use and enhancement • Establish links between national and international cultural traditions • Recognize the geographical, ecological and natural features and their connections with demographic, economic, social and cultural structures and the transformations that occurred over time • Understand the communicative, cultural and relational features of physical expression

	Methodology	Discussion: Group work (simulating, in small groups, a debate around a problem): ● some students will present an argument ● some students will present a counter-argument ● some will judge the validity of the argument and counter argument ● a moderator ● a verbalizer ● a presenter will deliver the multimedia presentation In groups, students will find documents and conduct online research
	Activities	**What you are asked to do**: Students will carry out a debate between classes on a problem **How**: Students will write an argument / counter-argument, use the debate methodology and work collaboratively **Which products**: Students will create a multimedia presentation in support of the argument and counter argument **Objectives**: Students will understand how to evaluate and express new and personal opinions and how to work in a group. They will also understand the importance of writing to create debate by presenting information in a balanced and informed way **Time:** 10 hours of lessons

	Learning resources and digital technologies	-Computer Lab and WLAN/Wi-Fi connection -PCs -Laptops -Interactive White Boards/Monitors -School Library In addition to computers and personal devices, students will conduct online research for content, images and online apps to create multimedia presentations (e.g. prezi.com, genial.ly.com, adobespark.com, padlet.com)
	Monitoring and evaluation	**Assessment criteria**: Multiple aspects will be assessed: ● what the students have learned to do ● the skills learned through group work and how effectively students have worked collaboratively ● responsibility and punctuality of work ● the required skills for using digital tools and apps **Assessment Rubric** **Advanced level**: the student produces correct, well-supported and balanced debate texts, with rich and appropriate vocabulary, works in groups with responsibility and respect, and uses digital tools and online apps with autonomy. **Intermediate level**: the student produces mostly correct and balanced debate texts with appropriate vocabulary and works well in a group but not always with responsibility and respect, and sometimes requires assistance/guidance when accessing digital tools and online apps. **Basic level**: the student produces moderately correct debate texts with a fairly appropriate vocabulary, has some difficulties interacting in a group setting and is starting to use digital tools and online apps for the first time.

	Teacher role	Moderator/Coach
	Workload	**6 hours** to illustrate the methodology **4 hours** debate of opinions among classes
Learning outcomes	Various aspects will be verified: - what the students have learned to do - competence in working in groups, responsibility, punctuality in delivery - competence in producing multimedia texts that meet the seven requirements of textuality: cohesion, coherence, intentionality, acceptability, information, situationality and intertextuality	

Authors

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Title of the learning situation	Digital Skills Europe	
Application context	Stage / education level	Secondary school - first and second year
	Curricular areas involved	History, Technology, Geography, Italian
Description of the learning situation	Skills	- Communication in native language - Digital skills - Learning to learn / being autonomous

		- Enterprising skills
	Methodology	- Flipped Classroom - Peer Education - Cooperative Learning - EAS - Taught lesson
	Activities	1-Preparatory phase (EAS) 2-Research and share (Flipped) 3-Build the route (cooperative) 4-Preparation for the presentation of the route 5-Presents the Path (EAS) 6-Debriefing
	Learning resources	Textbook Maps and topographical maps Advertising materials (flyers, travel catalogues..) Postcards Photos
	Digital technology	Hardware: Computer or tablet with connection, LIM or video projector, cameras/smartphones Software-App: Presentation tools, Google Maps, Google Earth, Tour Builder, Crowdmap, StoryMap, Fieldpapers, Thetruesize, Geacron, Pow Toon. For the teacher: zunal, Rubistar, WeSchool, Curriculum Mapping

	Monitoring and evaluation	Evaluation Section Check list remark Test
	Teacher role	Designer, (planning and preparation). Tutor Director and facilitator (towards pupils)
	Workload	20 hours for the students 18 hours for the teacher
	Learning outcomes	**Italian**: Students will develop: ● Listening skills – listening to information the teacher and other classmates provide about their research ● Analytical skills – reading diagrams and maps etc. ● Vocabulary skills - through understanding the appropriate use of basic vocabulary, recognising where specialist vocabulary should be used and understanding which situations formal and informal language should be used **History** Students will know: ● The fundamental aspects of world history, from the Neolithic civilization to the Industrial Revolution, to globalization ● The essential aspects and processes of the history of the country under consideration ● Aspects of cultural heritage and how to relate them to the historical situations studied

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Geography

Students will be able to:

- Use geographic maps, contemporary and historic photographs, images from remote sensing, digital elaborations, graphs, statistical data, and geographic and digital information systems to effectively communicate spatial intelligence
- Observe, read and analyse different territories territorial systems at different locations and times to different geographic scale.
- Recognize European landscapes and compare them to Italian landscapes, identify the significant physical elements and the historical events that took place there
- Recognise artistic and architectural structures as cultural heritage to be protected and valued

Technology

Students are able to:

- Hypothesize the possible consequences of a decision or a technological choice and recognize opportunities and risks in every innovation
- Use adequate material (including digital materials), informative and organizational resources for the design of simple products
- Read and analyse texts or tables of market information in order to express evaluations using different types of criteria.
- Demonstrate the properties and characteristics of different types of communication, and are able to effectively use them in learning activities
- Follow technical instructions to complete complex operational tasks in a methodical and rational way, as well as collaborate and cooperate with partners

Design graphs and tables / infographic content using elements of

		technical drawing or other multimedia and programming languages.

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Title of the learning situation	Little Geographers – learning through lights and shapes	
Application context	Stage / education level	Primary school
	Curricular areas involved	· Geography · Geometry/Maths · Art · Physical education · Democratic citizenship · Language skills · ICT

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Description of the learning situation	Skills	**Disciplinary skills** Students will: • Obtain geographic information through observation and graphs of the chosen area • Recognize different spaces with specific characteristics and functions and how they link to one another • Be able to orient themselves in the surrounding space using mental maps and topological indicators • Use geographic terms and diagrams to describe spaces, plan routes and create simple maps and / or three-dimensional projects • Recognize geographical and physical features and be able to compare them • Observe, explore, describe and decode different types of images • Recognize and identify the main features of arts and crafts and understand how they are made • Develop and experiment with different types of images using multiple techniques, materials and tools **Key competences for lifelong learning:** • Functional alphabetical competence • Competence in maths, science, technology and engineering • Competence in the field of awareness and cultural expression • Personal and social competence and the ability to learn and be autonomous in their education • Digital competence **Digital skills:** • Knowing how to identify, recover and organize information

		and judge their importance ● Identify needs and decide on the appropriate digital instrument/tool ● Communicate within digital environments, share resources and collaborate by interacting and participating in virtual communities.
	Methodology	Teaching methods are active, collaborative and aimed at developing skills: · Learning by doing · Tutoring / peer education · Cooperative learning · Gamification In particular, through cooperative work the students will learn new ways of observing the space that surrounds them, capturing details that will lead them to discover the artistic side of space. Within working groups, the students will adopt roles that will allow them to acquire organizational and relational skills.

	Activities	• Discover the world of a geographer and what geographical studies entail • Move in the known space • Lateralization games • Observe different landscapes across changing seasons • Identify the 4 cardinal points • Discover notable photographers • Create shapes and identify the various features related to them • Use applications related to design and graphics and the production of simple documents
	Learning resources	Tablet camera PC LIM User-friendly material Online resources
	Digital technology	Digital technologies are used as a tool to integrate pupils' ideas, enriching their thoughts, language and ways of communicating and creating. Applications / software for: · image capture · research / collection of materials · repository and virtual collaboration · drawing and graphics (also 3D) · compass

	Monitoring and evaluation	Sub-articulated process observation grid in: - problem-solving skills - communication and collaboration skills - creation of digital content - information processing and management
	Teacher role	The teacher will guide the students, particularly in the problem solving situations, and act as director of the learning situation
	Workload	65 hours. This will include a weekly meeting with the psycho-pedagogical team to link the activities together.
Learning outcomes	Students will be able to: • Analyze, compare and evaluate data, information and content within structured digital environments • Create and develop contents in different formats to express themselves through digital tools • Use digital tools and technologies to collaborate with others • Use digital tools and technologies to identify suitable solutions to improve learning • Apply good behavioral rules in digital communication • Understand how to protect themselves and others from possible dangers in digital environments and when needed, asks for help from an adult.	

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Title of the learning situation	Learning Fractions with Scratch 3.0	
Application context	Stage / education level	Secondary school – first and second year
	Curricular areas involved	Mathematics, Information Technology
Description of the learning situation	Skills	• Working with numbers for calculus and measurements • Programming digital environments • Using resources for planning and developing simple digital products
	Methodology	- Traditional lesson - Flipped classroom - Brainstorming - Learning by doing - Peer tutoring - Gamification
	Activities	**Analysis:** Knowledge of fractions and their calculation rules (traditional lessons, flipped classroom) **Ideation**: choice of the type of product (brainstorming) **Planning and development:** definition of the Algorithm and production of the "game" with Scratch (learning by doing, peer tutoring) **Sharing and validation:** publication of the activity on the school website and collection of feedback by online form

	Learning resources	• Video lessons prepared by teachers on fraction theory and algorithms • Paper notes for students who don't have digital devices at home to watch video lessons prepared by the teacher
	Digital technology	Hardware: computer science lab with Internet connection, Lim, Software: Scratch 3.0 and website
	Monitoring and evaluation	• Test on fractions knowledge (by online test prepared with Google-form) • Monitoring of the planned activities by means of a checklist • Evaluation of the effectiveness of the defined algorithm • Evaluation of the produced game • Evaluation of students' work by means of observation sheets
	Teacher role	Maths teacher: project coordination, preparation of the video-lessons, tutor in brainstorming phases, supervisor in cooperative learning phases Technology teacher: help in ideation, planning, development and sharing phases
	Workload	Working hours in class: Maths 11 hours and Technology 9 hours

Learning outcomes	Students working on this project: ● Will understand fractions and their uses, as well as operations with fractions ● Will learn to: ○ Produce an algorithm ○ Implement this algorithm by using Scratch visual programming ○ Verify its correct functioning ○ Perform a logical-creative process that can divide a complex problem into simpler parts and solve different problems by using specific instruments (computational thinking development and problem-solving) ○ Identify mistakes and eventually correct them ○ Cooperate with classmates, know their own role and how to interact to find a common solution

Authors

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Title of the learning situation	Love: Common thread between “old” and “new”	
Application context	Stage/ education level	High school – third year
	Curricular areas involved	English, Italian, ICT

Description of the learning situation	Skills	**Digital Skills:** Be able to responsibly use ICT to search for, produce and process data and information. Be able to interact with other people to support creativity and problem solving techniques. **Learning to learn:** Be able to have a balanced asset of knowledge and basic skills. Be able to search for and organize new information. Make the learning process autonomous. **Communication in foreign languages** Be able to speak English at an intermediate level (B2 of the Common European Framework of Reference for Language) and apply it to everyday situations and with ICT. **Attitudes** Be able to take initiative to develop ideas and produce creative plans. Be able to take on responsibilities, ask for help when in need and to know how to help someone else asking for help. Be able to self-analyze and to challenge new situations and unexpected/unforeseen events. **Communication** Be able to have good language skills for: understanding and writing texts, expressing ideas and using the appropriate tone and style **Social and civic skills** Be able to take care of themselves and others, be aware of other people's needs whilst respecting the time they have available to complete tasks and being able to work independently or in a group. **Self-awareness and cultural expression** Be able to express their talents in a personal way: physical, artistic

		and musical
	Methodology	• Lesson using slides and mind maps on the IT platform Edmodo / using an interactive whiteboard • Cooperative Learning • Peer to peer • Use of BYOD (bring your own device) techniques • Video (Interactive Whiteboard) • Dramatization

	Activities	• Interactive lesson about W. Shakespeare (life, literary works, language, world vision, historical period) and presentation of "Romeo and Juliet" • Storytelling in the classroom about "Romeo and Juliet" (roles and theatre parts) - this activity will be carried out during the working period. • Watch the film "*Shakespeare in Love*", directed by John Madden, 1998 • Modern-day (Re)Writing of the five acts of the play "Romeo and Juliet", by using the IT platform Edmodo • Script writing of "Romeo and Juliet" in a modern-day version both in Italian and in English • Staging of the theatre drama both in Italian and in English
	Learning resources	Textbooks PowerPoint Slides Internet (online digital materials offered by the teacher) Film
	Digital technologies	Use of didactical IT platforms and personal devices
	Monitoring and evaluation	Monitoring: • Entry test about the level of knowledge concerning some computer programs (e.g. Work, PowerPoint and the Edmodo IT platform) • On-going monitoring test: online questionnaire through Kahoot • Final Test: "What have I understood about W. Shakespeare as a dramatic author, director, actor and writer?" Assessment using an evaluation grid created by the Italian and

		Foreign Languages Departments.
	Teacher role	Tutor – Guide – Learning Facilitator – Digital Animator
	Workload	Class (Re)writing and script writing of the drama "Romeo and Juliet" - 24 hours in total (divided into 12x2 hour lessons) Staging of the theatre drama both in Italian and in English Afternoon staging of "Romeo and Juliet" - 20 hours in total divided into 10x2 hour lessons
Learning outcomes	Students will be able to: - obtain and demonstrate digital skills - analyze and rework texts - acquire specific knowledge about the topic of the project In terms of citizenship skills, students will: ● be able to work in a team - negotiate and make decisions while respecting others ● be mindful of those with disabilities and learning difficulties when developing the workload and dividing activities so that everyone can be included equally ● improve their English skills	

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Authors:

Castilla, Begue, Lorenzo & Gomez

Title of the learning situation	Step by Step to China	
Application context	Stage / education level	1st – 3rd year of secondary school (12-14 years)
	Curricular areas involved	• Physical education • Natural Sciences • Social Sciences • Maths • Technology • Religion • IT • English
Description of the learning situation	Skills	Digital skills 1. Select, configure and program digital devices according to the tasks to perform. Install and configure the different applications used on mobile devices, tablets and computers. 2. Use text editing applications, multimedia presentations and numerical data processing for the production of documents. Use text processors, spreadsheets and presentations (Google Drive Apps) collaboratively to complete the tasks.

		3. Use basic applications for fixed image, sound and video editing. 4. Search, contrast and select digital information suitable for the activities, considering various sources and digital media. 5. Increase personal knowledge through information processing strategies with the support of digital applications. 6. Organise and use a personal (online) environment of work and learning with digital tools. 7. Participate in interpersonal communication environments and virtual publications to share information. 8. Complete group activities using virtual collaborative tools and environments (Google Drive Apps). 9. Carry out citizenship and personal development actions, using digital resources. 10. Promote habits of healthy use of ICT linked to ergonomics. 11. Act responsibly with the use of ICT, considering ethical, legal, security, sustainability and digital identity issues Personal and social skills 1. Personal awareness and being aware of the process of personal growth. 2. Understand and put in practice strategies and habits that intervene in one's own learning. 3. Develop abilities and attitudes that confront the challenges of lifelong learning - the daily improvement, overcoming hardship, motivation and the desire to achieve a common goal. 4. Participate in the classroom in a reflective and responsible manner. Practical skills: 1. Apply a work plan to improve or maintain health in relation to the daily practice of physical activity. 2. Evaluate the effects of an active lifestyle based on the integration of healthy habits in the practice of physical activity with the use of the O10K

		App. ● This app recommends the daily target of 10,000 steps, the study of the different pathologies of various countries, their diet and associated behaviours that are contrary to a healthy lifestyle (sedentary lifestyle, alcohol, drugs, tobacco ...) 3. Apply techniques and tactics of different sports. 4. Put in practice the values of sport in a competitive situation through respect for peers, the collaboration of the whole group, taking into account individual differences. 5. Enjoy the practice of recreational physical activities, paying close attention to those carried out in the natural environment. 6. Plan and organise group activities for leisure purposes. 7. Use physicality and body language to communicate with others. 8. Use activities with musical support, as a means of social relationship and community integration
	Methodology	A methodology based on gamification, and learning based on challenges, will be used. For each 1000km route, the students will find a checkpoint where they will be able to locate badges that will give them additional points. Through this challenge, students will discover and learn about the different countries they visit. Digital competence is particularly important given that various IT resources will be used to reach Hong Kong.
	Activities	● Analysis and reflection ● Case studies ● Information research ● Collaboration ● Problem resolution ● Reading or watching videos

	Learning resources	Wi-Fi connection and a computer and tablet per group
	Digital technologoes	Computers or tablets will be used to create documents, and mobiles will be used to track the daily steps of each student. The applications that will be used are: ● O10K - to track the steps taken. ● Google Forms - where the students will add their daily steps to the global calculation. ● Google documents – for collaboration. ● Google spreadsheets - to compare the differences between countries. ● Google presentations – to present the findings at the end of the project. ● Kahoot (for groups) for extra points according to the result of the competition. ● Edpuzzle - students will have to watch a video and answer questions related to the challenge. ● Screen-o-matic or Lenso-Create - to make tutorial videos responding to questions and challenges posed in the control points of the journey. ● Green Screen – enabling a group picture of students to be taken and photoshopped into the destination that the simulation has reached.

	Monitoring and evaluation	Recommended by the Department of Education for ESO levels: the Assessment for Learning (AxA) aims to teach teachers and students, share the learning objectives and the assessment criteria. Monitoring of the project is based on feedback with assessed activities that encourage feedback between teachers and students. This will enhance the self-evaluation of each group and the co-assessment of the other groups. The teacher will provide headings for each activity. These headings will be given to each group in order to carry out the self-evaluation of the activity and the co-assessment of the activities of the other groups participating in the project. In the description of control activities to evaluate, examples of self-evaluation and co-assessment sections are shown.
	Teacher role	In the project, self-improvement and co-development will be enhanced, so the role of the teacher will be to prepare class activities and observe/oversee each group.
	Workload	12 hours teaching with 8-13 hours homework so 20-25 hours in total. As it is an interdiscplinary project, the teaching load should be shared out between the involved subjects.
Learning outcomes	This project puts students in the face of a great challenge that they have to overcome in groups to reach Hong Kong. This forces them to measure, face challenges, organise themselves and respect one another. They will encounter unexpected obstacles and find new and diverse solutions. As a result, students will increase their cultural knowledge and discover new information in a more motivating way. Students will also learn that there are times when certain problems cannot be solved without acquiring new knowledge, so they must accept failure as a normal experience in life and one which you can grow from. They will learn to self-evaluate by discovering loopholes that will help them detect their strengths and weaknesses, what they have learned and what they still need to learn.	

	Students will develop cooperative and collective intelligence, since this project relies on cooperation. Finally, students will learn values and put them in practice: understanding, respect, friendship, altruism etc.

Authors:

Davida, Gudel, Olm & Sellares

Title of the learning situation	Roman Europe	
Application context	Stage / education level	Final 2 years of secondary school (16-18 years old)
	Curricular areas involved	Languages, Social Media
Description of the learning situation	Skills	**Environment knowledge:** ● To interpret the present by analysing changes and continuities over time. ● Interpret the environment from the geographical elements of the territory and use this knowledge to follow a route and move around. **Learning to learn:** ● Organise the learning process and apply appropriate techniques. ● Use communication and group learning techniques.

		Digital scope: ● Use basic text editing applications, numerical data processing and multimedia presentations. ● Use programs and applications to create drawings and edit still images, sounds and videos. ● Learn new knowledge through information processing strategies with the support of digital applications. ● Organise and use personal digital work and learning environments. ● Develop healthy habits when using digital technologies. **Linguistic scope:** ● Write informative texts and present them to the group – adapting communication styles when needed. ● Use search strategies and information management to acquire knowledge. ● Write texts using a vocabulary and structure that are appropriate to the type of text, how it will be used and the intended reader/audience. ● Use multilingual strategies for communication.
	Methodology	Resolution of students' challenges from group work. Following instructions from Google Classroom.
	Activities	Individual work Group work Collaboration Presentation

	Learning resources	Videos Written material Search engines
	Digital technologoes	Devices: Chromebooks Tools: ● Image editing / drawing software ● Sketch UP ● Canva / Piktochar(described in the activities) ● Translation tools Platform: GSuite, Google Classroom
	Monitoring and evaluation	Evaluation of the process and the outcome of each challenge Self-assessment and co-assessment tools.
	Teacher role	Guide in the learning process
	Workload	The teacher will prepare the Google Classroom environment, and then monitor the students as they independently complete the tasks. 15 hours in total
Learning outcomes	As a result of the series of challenges, students will be skilled in a series of applications, know aspects of Roman life through "living" as a Roman, understand the historical expansion of the Roman Empire throughout the Mediterranean and be able to effectively communicate everything they have learned to their class.	

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Authors: Bayot, Brodard, Torras & Vallori

Title of the learning situation	Activity 2.1. Prehistory. Reflecting upon the past with technology	
Application context	Stage / education level	Primary school students (up to age 11)
	Curricular areas involved	• Catalan • Social Sciences • Maths • Natural Sciences • (incorporate student subject interests)
Description of the learning situation	Skills	• Problem solving • Research • Collaborative working • Analysis • Presentation • Selection of appropriate resources • IT • Critical thinking through evaluation
	Methodology	Problem-based learning: The teacher will introduce the topic of prehistoric civilizations and explain that the first civilizations focused heavily on family and society and that we can learn from how humans lived then. Students will receive a letter from the directors of an interactive history museum due to open in two weeks asking for help as they have lost all the information and material they had in their prehistoric hall. The students have the task of developing a

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project where they can solve the problem of the missing material/exhibits by providing resources (using the following questions as a guide at all times for development of the final product:)

- What do we want to talk about?
- Who will make up my group and why?
- When we will carry out the project?
- How will each group contribute?
- What tools will be used?

Cooperative Learning.

Groups will have 4-5 students each Students will work from the documents provided in Google Drive, organised in the following way:

- Research
  - Documentation
  - Multimedia
- Agreements and discussion
- Preliminary draft
- Final project

Gamification and interactive roleplaying.

Elements and components of the game itself will be used within a situation of learning to achieve the objectives. Older students or those with expereince of computer programming will lead on developing a story through Scratch covering the below topics:

- When did it happen?
- What were the people like who lived there?
- Where did they live?

		• What were their habits? • What did their diet consist of? • Were they organised into different classes depending on their social conditions? • What was the role of men? • What was the role of women? • Discoveries • Interesting facts
	Activities	Activity typology: • Research activities - individually or in small groups, students will collect a handful of written and multimedia resources for the presentation to be shared with class members (in?) Debate activities • Tasks assignment activities - Each student will be assigned a role and will establish a handful of conditions and rules for the aspect of the project they are leading on. • Construction activities - Through Scratch, the students will collaboratively develop resources for the project. • Synthesis activities - Each group, through a multimedia creation tool (Glogster or canva, for example), will compile the most important information they have found and share it with the rest of the groups. • Self-evaluation/co-assessment activities - Students will complete analysis and evaluation forms throughout the entire activity. As well as completing co-evalutation forms, each student will provide a self-evaluated grade – based on specific provided criteria.

	Digital technologoes	• Classroom computer • Projector • Chromecast playback device • Chromebook laptops with Internet access • Scratch • Multimedia tools – Gloster or canva • G-suite
	Monitoring and evaluation	Follow-Up: The teacher will follow the progress of each group. They will encourage those who have difficulties in keeping up with peers by offering them support. They will also establish additional communication channels such as email, Hangouts or Meet to resolve doubts or conflicts that may arise. Evaluation: Student evaluation will be based on: • 50% average score provided by the involve teaching staff • 35% co-evaluation • 15% self-evaluation G-Suite surveys will be used to carry out the co-evaluations and self-assessments of the groups, taking into account the following: • Adaptation of the established guidelines • Spelling and grammar • Aesthetics • Impact • Oral Presentation • Involvement in the exhibition

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		• ICT Skills
	Teacher role	Subject teacher - motivator, instigator, guide, facilitator ICT coordinator – solve technical problems and manage software Support teacher - support those with additional needs
Learning outcomes	Students will have: • Learned about the main features and stages of the Prehistoric age. • Correctly synthesised the information they have researched and appropriately present it to the group. • Participated responsibly and equally in cooperative work proposals. The works will be presented with an interactive poster in a large group to be analyzed and evaluated.	

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ANNEX 2: Decode Survey

SECTION 1

1. SCHOOL DATA

Please tick the following boxes which apply to your school:

q0001 School Type:

□ Early Years (3-5 years)

□ Primary School (6-10 years)

□ Secondary School (11-16/11-18 years)

□ VET (Vocational Education and Training) (14-18 years)

q0002 Region (closed answer)

□ England

□ Wales

□ Scotland

□ Northern Ireland

SECTION 2

2. TEACHER PROFILE

Please tick the following boxes which apply to you: ***(Your answers will remain confidential.)***

q0003 Age range

□ Up to 25

□ 25 - 30

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□ 31 - 40

□ 41 - 50

□ 51 - 60

□ 60+

q0004 Gender

□ Male

□ Female

□ I prefer not to identify

q0005 Which subject area have you taught over the past three years?:

q0005_0001 Literacy (Refers to all subjects related to reading and writing, including language learning and development, and word recognition).	□
q0005_0002 Numeracy	□
q0005_0003 Science (Refers to all scientific subjects, including geography and natural science)	□
q0005_0004 History	□
q0005_0005 Arts (Refers to all subjects related to some form of art, including sculpturing, painting and drama)	□
q0005_0006 Music	□

q0005_0007 Physical Education (Refers to all sport subjects, including dance)	☐
q0005_0008 Personal Social and Health Education	☐
q0005_0009 Religious Education	☐
q0005_0010 Ethics and Democratic Citizenship	☐
q0005_0011 Social Sciences (Refers to subjects such as Psychology, Sociology, Human Geography etc.)	☐
q0005_0012 ICT	☐
q0005_0013 Modern Foreign Languages	☐
q0005_0014 Learning Approaches (Refers to subjects around study and research skills)	☐
q0005_0015 Special Educational Needs	☐
q0005_0016 Other (please specify)	☐

q0006 What is your current employment status at the school?

Permanent contract ☐

Temporary contract ☐

q0007 Describe the roles which you have undertaken within the school over the past three years: *(please tick all which apply)*

q0007_0001 Leadership role ☐

q0007_0002 Management role ☐

q0007_0003 Teaching role ☐

q0008 Are you currently a designated ICT/Digital Coordinator at your school?:

YES ☐ NO ☐

SECTION 3

3. TEACHING PRACTICE IN ICT

This section is intended to help us to understand the frequency which digital technologies are used in the classroom. Please tick the box which is most relevant *(your answers will remain confidential).*

q0009 How often do you use the following digital tools and technologies in your teaching activities? *(one answer per row)*

	Always	**Often**	**Sometimes**	**Never**
q0009_0001 Office and similar packages	☐	☐	☐	☐
q0009_0002 Software for downloading audio/video files	☐	☐	☐	☐
q0009_0003 Search tools	☐	☐	☐	☐
q0009_0004 Resources for creating/editing audio/video content and graphics	☐	☐	☐	☐

q0009_0005 Resources for creating blogs, websites etc.	☐	☐	☐	☐
q0009_0006 Digital environments for learning, sharing, communication and collaborating *(online platforms, websites, blogs, social and educational social networks, gamification, edutainment etc.)*	☐	☐	☐	☐
q0009_0007 Digital Educational Content and OER (Open Educational Resources)	☐	☐	☐	☐
q0009_0008 Multimedia programs relevant for your discipline	☐	☐	☐	☐
q0009_0009 Coding - Computational thinking	☐	☐	☐	☐
q0009_Other (Please specify) ……..				

q0010 Please indicate which of the following digital teaching methods you use / are aware of: *(one answer per row)*

	NOT AWARE OF	**AWARE OF**	**USE**
_0001 Active methodologies (such as Flipped Classroom)	☐	☐	☐
_0002 Collaborative learning	☐	☐	☐
_0003 Project-based learning	☐	☐	☐

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_0004 Problem-based learning	☐	☐	☐
_0005 Case-based learning	☐	☐	☐
Other (Please specify) ……			

q0011 Please indicate which assessment methods you use digital technologies for:

Portfolios ☐

Rubrics ☐

Conceptual maps ☐

Self- and peer assessment ☐

Nothing ☐

Other (Please specify) ……

q0012 Please indicate how often you have carried out the following activities as part of your teaching in the past two years *(one answer per row)*

	Always	**Often**	**Sometimes**	**Never**
q0012_0001 Regular contact with my students through online communication (email, forums, blogs etc.) to continue the learning process outside the classroom	☐	☐	☐	☐
q0012_0002 Ask students to document online what they have learnt	☐	☐	☐	☐
q0012_0003 Involve students in collaborative online work	☐	☐	☐	☐

q0012_0004 Online student assessment	☐	☐	☐	☐
q0012_0005 Creative work using online applications	☐	☐	☐	☐
q0012_0006 Encourage interdisciplinary projects through the use of online technologies	☐	☐	☐	☐
q0012_Other (Please specify) ……..				

q0013 To what extent do digital tools and technologies support the following: *(one answer per row)*

	Very Useful	**Useful**	**Average**	**Partially**	**Not at all**
q0013_0001 Make students more autonomous	☐	☐	☐	☐	☐
q0013_0002 Empower students in their own education	☐	☐	☐	☐	☐
q0013_0003 Make the learning process more meaningful for the student	☐	☐	☐	☐	☐
q0013_0004 Make the learning process more effective (students achieving higher results than expected)	☐	☐	☐	☐	☐
q0013_0005 Make the learning process more efficient (achievements with less effort and/or lower costs)	☐	☐	☐	☐	☐

q0013_0006 Integrate formal, non-formal and informal learning	☐	☐	☐	☐	☐
q0013_0007 Involve other actors in the learning process	☐	☐	☐	☐	☐
q0013_0008 Improve communication, collaboration and coordination between colleagues, students and institutions	☐	☐	☐	☐	☐
q0013_0009 Improve teacher CDP	☐	☐	☐	☐	☐
q0013_0010 Link school activities with work experience placements	☐	☐	☐	☐	☐

SECTION 4

4. TRAINING NEEDS OF TEACHERS

This section investigates the ICT development and training needed for teachers, including how this could benefit them in their daily teaching practices.

4.1 Training and updating

q0014 Please indicate the types of training you have attended around using digital technologies in education: *(more options are possible*)

q0014_0001 Formal learning (*Organised, guided by a formal curriculum, leads to a formally recognized credential such as a diploma or a degree, and is often guided and recognised by the government*).	☐
q0014_0002 Non formal learning *(Organised , may or may not be guided by a formal curriculum. This type of education may be led by a qualified teacher or by a leader with more experience)*	☐

q0014_0003 Informal learning (*No formal curriculum and no credits earned. The teacher is simply someone with more experience such as a parent, grandparent or a friend*)	☐
q0014_0004 Face to face	☐
q0014_0005 Blended *(A mix of face-to-face and online training)*	☐
q0014_0006 Fully Online	☐

4.2 Digital Competence of Educators (DigCompEdu)

This section aims to evaluate the digital competency level of teachers. How would you rate your knowledge of digital technology for the following scenarios? Please tick the relevant box:

q0015 1. Professional Engagement *(one answer per row)*

A1 = Making little use. Being Unsure

(*Very limited knowledge; little usage)*

A2 = Being aware. Basic tools use

(*Limited knowledge; basic usage)*

B1 = Effective use; responsible use, experimentation

(Functional knowledge; effective usage)

B2 = Structured, Creative, Responsive, Transparent, Reflective practice

(*Good knowledge; creative usage)*

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C1 = Critically, Strategically, Evaluating, Discussing, Reflecting

(*Excellent knowledge; strategic usage)*

C2 = Re designing, Innovating

(*Expert knowledge; innovative usage)*

1.1 Data management (q0015_0001)

To use digital tools to effectively and safely store, retrieve, analyse and share administrative and student-related data. To contribute to discussing and critically reflecting on data management strategies and policies at the organisational level.

A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

1.2 Organisational communication (q0015_0002)

To use digital technologies to enhance communication with learners, parents and third parties. To contribute to collaboratively developing and improving organisational communication strategies.

A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

1.3 Professional collaboration (q0015_0003)

To use digital technologies to engage in collaboration with other educators, sharing and exchanging knowledge and experience and collaboratively innovating pedagogic practices.

A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

1.4 Reflective practice (q0015_0004) To individually reflect on, critically assess and actively develop one's digital pedagogical practice.					
A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐
1.5 Digital Continuous Professional Development (CPD) (q0015_0005) To use digital resources for Continuous Professional Development.					
A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

q0016 2. Digital Resources *(one answer per row)*

A1 = Making little use. Being Unsure
(*Very limited knowledge; little usage and unsure on functionality)*

A2 = Being aware. Basic tools use
(*Limited knowledge; basic usage)*

B1 = Basic criteria, basic strategies, some advanced features
(Functional knowledge)

B2 = Advanced strategies, complex criteria, creating resources
(Good knowledge)

C1 = Comprehensively using advanced tools, publishing resources
(Excellent knowledge)

C2 = Professionally creating and publishing
(Expert knowledge)

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2.1 Selecting digital resources (q0016_0001)ù

To identify, assess, and select digital resources for teaching and learning, understanding applicable copyright and accessibility requirements.

A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

2.2 Organising, sharing and publishing digital resources (q0016_0002)

To organise digital resources for one's own current and future use and re-use, as well as for sharing them with others. To digitally publish learning resources and share them with learners, parents and other educators, respecting the rules of copyright. To understand the use and creation of open licences and open educational resources, including their proper attribution.

A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

2.3 Creating and modify digital resources (q0016_0003)

To modify and build on existing openly licensed resources and other resources where this is permitted. To create or co-create new digital educational resources. To consider the specific learning objective, context, pedagogical approach, and learner group, when designing digital resources and planning their use.

A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

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q0017 3. Digital Pedagogy *(one answer per row)*

A1 = Making little use. Being Unsure
(Very limited knowledge)

A2 = Being aware. Basic tools use
(*Limited knowledge)*

B1 = Integrating and implementing meaningfully
(Functional knowledge)

B2 = Enhancing, Scaffolding
(*Good knowledge)*

C1 = Orchestrating, flexible adapting, strategically purposefully
(*Excellent knowledge)*

C2 = Innovating teaching
(*Expert knowledge)*

3.1 Instruction (q0017_0001)

To implement digital devices and resources into the teaching process, so as to enhance the effectiveness of instructional practices. To appropriately scaffold, manage and orchestrate digital teaching interventions. To experiment with and develop new formats and pedagogical methods for instruction.

A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

3.2 Teacher-learner interaction (q0017_0002)

To use digital tools and services to enhance the interaction with learners, individually and collectively, within and outside the learning session. To use digital technologies to offer timely and targeted guidance and assistance. To experiment with and develop new forms and formats for offering guidance and support.

A1	A2	B1	B2	C1	C2
☐	☐	☐	☐	☐	☐

3.3 Learner collaboration (q0017_0003)

To use digital technologies to foster and enhance collaborative learning strategies, e.g. as a basis for the collaborative exchange in the group, as a tool for conducting a collaborative assignment, or as a means of presenting results.

A1	A2	B1	B2	C1	C2
☐	☐	☐	☐	☐	☐

3.4 Self-directed learner (q0017_0004)

To use digital technologies to support self-directed learning processes, i.e. to enable learners to plan, monitor and reflect on their own learning, evidence progress, share insights and come up with creative solutions.

A1	A2	B1	B2	C1	C2
☐	☐	☐	☐	☐	☐

q0018 4. Digital Assessment *(one answer per row)*

A1 = Making little use. Being Unsure
(Very limited knowledge)

A2 = Basic tools use within traditional approaches
(*Limited knowledge)*

B1 = Employing digital tools to enhance traditional approaches
(Functional knowledge)

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B2 = Strategic, effective use
(Good knowledge)

C1 = Comprehensive, Critical, Reflective practice
(Excellent knowledge)

C2 = Innovating Assessment
(Expert knowledge)

4.1 Assessment formats (q0018_0001)

To use digital tools for formative and combined assessment. To enhance the diversity and suitability of assessment formats and approaches.

A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

4.2 Analysing evidence (q0018_0002)

To generate, select, critically analyse and interpret digital evidence on learner activity, performance and progress.

A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

4.3 Feedback and Planning (q0018_0003)

To use digital tools to provide targeted and timely feedback to learners. To adapt teaching strategies accordingly and to provide targeted support based on the evidence generated by the digital tools used. To enable learners and parents to understand the evidence provided by digital tools and use it for decision making.

A1	***A2***	***B1***	***B2***	***C1***	***C2***

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☐	☐	☐	☐	☐	☐

q0019 5. Empowering Learners *(one answer per row)*

A1 = Making little use. Being Unsure
(*Very limited knowledge)*

A2 = Being aware, Basic tools use
(*Limited knowledge)*

B1 = Addressing learners engagement
(Functional knowledge)

B2 = Strategically using a range of tools to empower
(*Good knowledge)*

C1 = Comprehensively, Critically enhancing
(*Excellent knowledge)*

C2 = Innovating Strategies
(*Expert knowledge)*

5.1 Accessibility and inclusion (q0019_0001)

To ensure accessibility to learning resources and activities, for all learners, including those with special needs. To consider and respond to learners' (digital) expectations, abilities, uses and misconceptions, as well as contextual, physical or cognitive constraints to their use of digital tools.

A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

5.2 Differentiation and personalisation (q0019_0002)

To use digital tools to address learners diverse learning needs, e.g. by allowing them to follow different learning pathways and goals, by offering alternative approaches and tools, and allowing learners to proceed at different speeds towards individual learning goals.

A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

5.3 Actively engaging learners (q0019_0003)

To use digital tools to foster learners' active and creative engagement with a subject matter.

A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

q0020 6. Facilitating Learners Digital Competence *(one answer per row)*

A1 = Making little use of strategies for learners' DC
(*Very limited knowledge)*

A2 = Encouraging learners to use digital tools
(*Limited knowledge)*

B1 = Implementing activities fostering learners' DC
(*Functional knowledge)*

B2 = Strategically using a range of strategies
(*Good knowledge)*

C1 = Comprehensively and Critically fostering learners' DC
(*Excellent knowledge)*

C2 = Using innovative formats for fostering learners' DC

(*Expert knowledge)*

6.1 Information and media literacy (q0020_0001)

To incorporate learning activities, assignments and assessments which require learners to articulate information needs; to find information and resources in digital environments; to organise, process, analyse and interpret information; and to compare and critically evaluate the credibility and reliability of information and their sources.

A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

6.2 Digital communication & collaboration (q0020_0002)

To incorporate learning activities, assignments and assessments which require learners to effectively and responsibly use digital tools for communication, collaboration and civic participation.

A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

6.3 Digital content creation (q0020_0003)

To incorporate assignments and learning activities which require learners to express themselves through digital means, and to modify and create digital content in different formats. To teach learners how copyright and licences apply to digital content, how to reference sources and attribute licenses.

A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

6.4 Wellbeing (q0020_0004)

To take measures to ensure learners' physical, psychological and social well-being while using digital technologies. To empower learners to manage risks and make use of digital technologies to support their own social, psychological and physical wellbeing.

A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

6.5 Digital problem solving (q0020_0005)

To incorporate learning and assessment activities which require learners to identify and solve technical problems or to transfer technological knowledge creatively to new situations.

A1	***A2***	***B1***	***B2***	***C1***	***C2***
☐	☐	☐	☐	☐	☐

4.3 ICT Training Needs

q0021 Where do you feel that you need further training to be able to use digital technologies effectively in the classroom? *(max 3 options)*:

q0021_0001 Basic uses of ICT *((Training in how to use ICT and digital technologies from a novice level)*	☐
q0021_0002 Design, planning and classroom delivery*(Training in how to use ICT and digital technologies to aid with lesson planning and preparation)*	☐

q0021_0003 Organisation and management of educational spaces and resources. *(Training in how to use ICT and digital technologies to facilitate and improve working environments)*	☐
q0021_0004 Communication and collaboration *(Training in how to use ICT and digital technologies to communicate, collaborate, create, share content and build knowledge in the classroom)*	☐
q0021_0005 Digital ethics *(Training in how to use ICT and digital technologies for issues relating to legality, security and digital identity)*	☐
q0021_0006 Professional development *(Training in how to use ICT and digital technologies to for your own teaching development)*	☐
q0021__ Other (Please specify)……	

q0022 Please indicate if you have any digital skills qualifications:

ECDL ☐

EIPASS ☐

MICROSOFT MOUS (Microsoft Office User Specialist) ☐

IC3 Global standard ☐

CISCO ☐

PEKIT (Permanent Education and Knowledge on Information Technology) ☐

I have no official certifications ☐

Other (Please specify) …… ☐

SECTION 5

5. PERSONAL OPINION

This section examines teachers' personal views regarding using ICT and digital technologies in the classroom.

q0023 Please indicate how strongly you agree or disagree with the following list of statements: *(one answer per row)*

	Strongly disagree	**Disagree**	**Agree**	**Strongly agree**
q0023_0001 The use of digital technologies helps when designing and organising educational materials	☐	☐	☐	☐
q0023_0002 The use of digital technologies promotes the development of basic skills (reading, writing, comprehension)	☐	☐	☐	☐
q0023_0003 The use of digital technologies promotes the development of responsible media and digital skills	☐	☐	☐	☐
q0023_0004 The use of digital technologies creates positive learning outcomes by influencing how learners behave	☐	☐	☐	☐
q0023_0005 The use of digital technologies should not replace traditional teaching methods	☐	☐	☐	☐

q0023_0006 The use of digital technologies encourages self-assessment among students	☐	☐	☐	☐
q0023_0007 The use of digital technologies increases the level of cyberbullying	☐	☐	☐	☐
q0023_0008 The use of digital technologies is a distraction for students	☐	☐	☐	☐
q0023_0009 Digital technologies do not improve education processes, learning, etc.	☐	☐	☐	☐
q0023_0010 It is necessary to integrate e-learning into teaching activities, alongside traditional classroom-based teaching methods	☐	☐	☐	☐
q0023_0011 Daily use of technology in the classroom is not enough, students need to learn how to use books	☐	☐	☐	☐

q0024 How often do you use digital technologies for the following scenarios: *(one answer per row)*

	Always	**Often**	**Sometimes**	**Never**
q0024_0001 Social networking	☐	☐	☐	☐
q0024_0002 Professional networking	☐	☐	☐	☐

q0024_0003 Personal and professional growth	☐	☐	☐	☐
q0024_0004 Leisure *(culture, hobbies, entertainment, travel, etc.)*	☐	☐	☐	☐
q0024_ Other (Please specify) ……..				

NOTES

Thank you for completing this questionnaire – if you have any further comments, please use the box below: