DoCENT – Digital Creativity ENhanced in Teacher Education

FRAMEWORK OF DIGITAL CREATIVE TEACHING COMPETENCES

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Introduction

Context

Both creativity and digital technologies are considered central for success and development in today’s society. Creative skills are considered essential to face the social and economic changes which characterize the XXI Century (Craft, 2013; Beghetto, 2010). Also, the labour market depends more and more on employees’ inventiveness, as well as their digital skills. Indeed, an innovative workforce requires working with technologies, as well as the ability to adapt and to generate new ideas, products and practices (Sefton-Green & Brown, 2014). As a result, digital and creative competences have gained the attention of European policies and have become crucial educational objectives (Ferrari, Cachia & Punie, 2009a).

Nevertheless, a gap remains between policies and practices. EU education fails to keep pace with the creative and digital economies (Sefton-Green & Brown, 2014). This is mainly because teachers are not prepared for fully exploiting the potential of digital technologies, and to adopt pedagogical strategies that foster creativity. Although these are current topics in Initial Teacher Education (ITE) policy recommendations, curricula usually do not address them appropriately.

Teacher educators are key players for ensuring the quality of teaching professions and the support of educational innovation (European Commission, 2013b). Yet, they are often neglected by policies and are given little opportunities and resources in terms of professional development. As a result, some EU educational systems do not fully benefit from the knowledge and experience of this profession. Therefore, opportunities for professional development appear as an essential need to allow teacher educators to become aware of the latest challenges in society and education, so future teachers can learn how to respond to these challenges.

The DoCENT project

DoCENT is a timely response to the aforementioned needs. The overall goal of the project is to enhance digital creativity in ITE contexts. We will develop, implement, validate and disseminate an innovative model to guide teacher educators in applying digital creative teaching practices. In this context, the DoCENT seeks to provide new models for promoting teachers’ and learners’ creativity. The project objectives are defined as follows:

- To provide a pragmatic insight regarding the integration of digital creativity in EU ITE contexts, by designing a framework of digital creative teaching competences (Output 1), as well as producing guidelines and policy recommendations for enhancing digital creativity in teacher education (Output 4);
- To design, implement and validate a training model for enhancing digital creativity in EU ITE, including a curriculum, a MOOC and a series of Open Educational Resources (OERs) (Output 2);
- To integrate pedagogical scenarios related to digital creativity in an innovative training tool based on a serious game and gamification elements (Output 3);
- To intertwine ITE providers and EdTech research centres and companies in a community of practice (CoP);
- To disseminate and exploit the outputs at institutional, national and EU levels by making them freely and easily available to policy makers, practitioners, researchers and educational stakeholders.

The project is applied by seven partners in four EU countries, i.e., Italy (University of Naples Federico II – UNINA; SMARTED), Spain (University of Barcelona - UB; CreaTIC Nens - CREATIC), Greece (University of Athens - NKUA; FORTH), and Luxembourg (European University Fondation - EUF).

About this document

The first output of the project (O1 - Framework of digital creative teaching competences) aims to define the key-components of competences needed by teacher educators for effectively integrating digital creativity in teaching contexts, as well as to provide and validate a EU reference framework for developing and evaluating digital creative teaching competences. The framework of competences targets teacher educators, educational policy makers, as well as EdTech research centres and companies, and indirectly pre-service / in-service teachers. O1 provides a foundation to develop the DoCENT MOOC (O2) and Serious Game (O3).
The first section presents the main concepts around digital creativity as applied to education. Section 2 reviews European policies in relation to the integration of digital technologies and creativity in ITE systems. The third section draws up DoCENT pedagogical framework, i.e. it defines the project training approach, and the conceptual dimensions addressed. Section 4 defines the methodology employed to design the DoCENT competence framework. Section 5 reports a desktop study on ITE systems in Greece, Italy and Spain. Finally, Section 6 presents the prototype model of the competence framework.
1. Main concepts around digital creativity as applied to education

Creativity is considered to be critical for facing the social and economic changes of today’s society (Craft, 2013; Beghetto, 2010), as well as for attaining personal development, social inclusion, active citizenship and employment (European Commission, 2008). In addition, the labour market depends more and more on employees’ abilities to work with technologies, as well as to generate new ideas, products and practices (Sefton-Green & Brown, 2014). In this context, digital and creative skills have gained the attention of worldwide policies, and have become important educational objectives (Ferrari, Cachia & Punie, 2009a).

The present section attempts to review and resume the conceptions of digital creativity as applied to education. We first attempt to conceptualize educational creativity, i.e., we present the seminal theories and definitions of creativity, the main characteristics of creative education, as well as a series of creative pedagogies. Afterwards, we focus on digital creativity in education, including a definition, a series of pedagogical theories and digital tools which are particularly suitable to the emergence of creativity.

1.1. Creativity in education

1.1.1. Different approaches to the study of creativity

Creativity constitutes a complex and elusive concept which remains difficult to explore. It has been studied through the lens of different paradigms, e.g. pragmatic, psychodynamic, psychometric, cognitive, and evolutionary approaches (European Commission, 2014). Some of those have brought valuable contributions to the understanding of creativity; nevertheless, they do not allow for a holistic approach of the phenomenon. Hence, several theories attempted to explore its different dimensions in a comprehensive manner.

For instance, Csikszentmihalyi (1996) described creativity as the result of a system composed of three distinct elements: (a) the domain, which contains a specific set of rules and practices; (b) the individual, who produces a novel variation in the content of the domain through cognitive processes, personality traits, and motivation; this variation is evaluated by (c) the field for its inclusion in the domain.

Furthermore, Rhodes (1961) developed the four P’s model, which places creativity at the interplay of four distinct strands, i.e., process (the different stages of a creative activity), person (the characteristics of individuals), press (the qualities of the environment where creativity happens), and product (the tangible or intangible outcomes of the creative process). Rhodes’ classification has become a major framework for the holistic exploration of creativity. The next subsections examine the four components in the light of influential theories of creativity.

Process-oriented approaches

Those theories mostly explore and describe the creative process through an iterative sequence of stages (Howard, Culley & Dekoninck, 2008) which commonly consist of the identification of the task, a phase of preparation, and an evaluation of the obtained outcome. Nevertheless, process models present some discrepancies: some researchers view the emergence of ideas as a sudden and intuitive process characterized by an illumination or insight (e.g. Csikszentmihalyi, 1996); on the contrary, other theories describe a mindful process of idea generation (Howard, Culley & Dekoninck, 2008). For instance, the well-known componential model of Amabile (1983) proposes a system of five phases: a) Problem or task identification (conscious recognition of the task or problem); b) Preparation (building or reactivation of the information which is useful to the completion of the task); c) Response generation (creation of possible solutions or responses); d) Response validation (evaluation of the possible responses or solutions); and e) Outcome (evaluation and diffusion of the outcome).

Person-oriented approaches

Here researchers use biographical and historiometric methodologies to explore the individual characteristics and personality traits of creative persons. Such theories result in a series of creative individual components which include thinking styles, personality attributes (e.g., a positive disposition towards overcoming obstacles, taking risks and tolerating ambiguity) and intellectual abilities (Sternberg & Lubart, 1999), as well as concentration, playfulness, discipline, passion and objectivity (Csikszentmihalyi, 1996). Amabile (1983) brings a classification which differentiates domain-relevant skills (knowledge and skills in the domain), task motivation (extrinsic and/or intrinsic), and creativity-relevant skills (personality characteristics, like flexibility and a persistent work style).
Press-oriented approaches

This strand concentrates on the characteristics of the environment which may nurture or hinder creativity. First, social, cultural, and political factors may influence on creativity (Simmonton, 1999, as cited in Amabile, 2012), like family upbringing, cultural traditions, and the historical milieu (Runco & Pagnani, 2011). In addition, Csikszentmihalyi (1996) highlighted some environmental features which may foster creativity, including training, expectations, resources, recognition, and reward. Similarly, Amabile and Gryskiewicz (1989) identified a series of elements of the workplace environment which may foster creativity, such as freedom, challenge and leaders’ recognition. At the contrary, some factors proved to hinder creativity, like time pressure, evaluation (Amabile & Gryskiewicz, 1989), lack of respect and competition (Runco, 2004).

Product-oriented approaches

The last dimension focuses on the tangible or intangible outcomes of the creative process. Researchers commonly define two characteristics of creative products, namely usefulness and novelty (Howard, Culley & Dekoninck, 2008; Amabile, 1983). Usefulness refers to the adequacy of the outcome to its context of use. As for novelty, literature distinguishes between Big-C (consensual) and little-c (personal) creativity (Craft, 2001). Kaufman & Beghetto (2009) proposed a Four C Model which differentiates mini-c (interpretive creativity), little-c (everyday creativity), Pro-C (expert creativity) and Big-C (“legendary” creativity).

1.1.2. Towards a definition

Defining creativity results to be a complex task (Sawyer, 2011). The word has been applied to a variety of fields, settings and theories (NACCCE, 1999); hence, scientific literature lacks a sound definition. Nevertheless, there appears to be consensus on the main features of creativity (Villalba, 2008): it refers to the ability to create something novel and appropriate (Amabile & Pillemer, 2012). The term “novel” describes an original solution, while the term “appropriate” refers to the usefulness of the product as applied to a specific need (Sternberg & Lubart, 1999).

As applied to the field of education, NACCCE (1999) provided a comprehensive definition, which does not limit to the product dimension, describing creativity as an “imaginative activity fashioned so as to produce outcomes that are both original and of value” (p. 30). Cremin, Clack and Craft (2012) added some components to this definition, so that it matches a personal view of creativity (little-c): “purposive imaginative activity generating outcomes that are original and valuable in relation to the learner”. In this view, creativity processes involve four characteristics: (a) they consist of thinking imaginatively; (b) they are purposeful (i.e. directed towards a specific goal); (c) they result in an original and valuable outcome; and (d) the learner constitutes the reference point.

1.1.3. Characteristics of creative education

Educational research and policies acknowledge the need of enhancing students’ creativity. Indeed, it is important that all citizens develop creative skills which would allow them for facing the complexity of the modern society (Beghetto, 2010). Nevertheless, a gap remains between policies and practices, as education often fails to keep pace with creative and digital economies (Sefton-Green & Brown, 2014; Beghetto & Kaufman, 2014). This is mainly because teachers are not prepared for adopting pedagogical strategies that foster creativity.

As mentioned by Beghetto (2010), teachers play a key-role for integrating creativity in the curriculum. Nevertheless, the author identified a series of obstacles to the implementation of creative practices in the classroom, including convergent teaching practices and teachers’ negative beliefs towards creativity. Furthermore, educators are not prepared to apply creative teaching strategies which match their institutional and curricular requirements (Lin, 2011).

Creativity can be taught

The research community views creativity as a developmental quality which is amenable to teaching (Lin, 2011). A review of literature in creative education allows for identifying three clear characteristics of creative education:

- A democratic approach: traditionally, creativity is seen as a quality reserved for exceptionally talented individuals (NACCCE, 1999). This exclusive perspective recently changed towards an inclusive one, to which all people from all ages can be creative (Runco & Pagnani, 2011; Cremin, Clack & Craft, 2012). This new angle
is widely adopted in the field of education, considering that all students have a creative potential which can be fostered or hindered depending on the teaching strategies used [26].

- **A focus on little-c creativity**: small levels of creativity give importance to personal processes beyond outstanding accomplishments. As applied to education, this perspective encourages students to develop new and personally meaningful insights and discoveries, as well as to attain their full potential in their everyday domains (Ferrari, Cachi & Punie, 2009a).

- **A domain-wide approach**: creativity is often associated to the domain of arts (NACCCE, 1999). Recently, this scope has been widened to other areas of everyday life (Ferrari, Cachi & Punie, 2009a). Hence, in the field of education, creativity can be developed in all curricular subjects, such as languages and science (Craft, Cremin, Hay, & Clack, 2014).

**Creative pedagogies**

Creativity and education literature highlights a series of creative pedagogies, i.e. teaching practices which contribute to the development of students’ creativity. In a review of 210 pieces of educational research, Davies et al. (2013) mentioned the flexible use of space and time, the study outside the classroom, collaborative and game-based learning approaches, as well as respectful relationships, non-prescriptive planning, and the participation of educators as learners in the classroom activities.

Cremin and Barnes (2014) outlined similar characteristics, i.e., an agency oriented ethos, multimodal methodologies, exploration and discovery, risk taking, tolerance of ambiguity and uncertainty, safe and non-judgmental environments. In this line, Sawyer (2011) considers the possibility to try before getting it right, and the use of failure as a positive learning factor. The author also considers collaborative and improvisational practices which allow students for externalizing their understandings and reflecting on their learning processes.

Barajas and Frossard (2018) proposed a set of four main creative pedagogies, each one characterised by different components: (a) learner-centred approaches (matching curricular objectives with students’ interests, making learning relevant and engaging, encouraging students’ ownership and problem solving, value learning processes above outcomes so to promote students’ reflection on their learning trajectory); (b) open-ended ethos (providing space for uncertainty, exploration, and spontaneity in a safe classroom environment); (c) synergistic collaboration (rich collaborative practices based on joint problem solving and collective decision making), and; (d) knowledge connection (linking content to real life situations, bridging different domains and disciplines, and placing knowledge in a wider context).

**1.2. Digital creativity in education**

Technological devices have entered all aspects of our everyday life [32]. In this digital society, the concept of creativity is being rethought. Indeed, the affordances of technologies may have a strong influence on creative processes and achievements. As mentioned by Loveless (2002), “digital technologies can be tools which afford learners the potential to extend or enhance their abilities, allow users to create novel ways of dealing with tasks which might then change the nature of the activity itself, or provide limitations and structure which influence the nature and boundaries of the activity” (p. 64). Nevertheless, understanding the interplay between digital and creative yet appears as a challenge, and the two are often studied as separate domains (Sefton-Green & Brown, 2014).

As a first step to bridge this gap, we propose the following definition of digital creativity, as applied to education (based on NACCCE, 1999; Cremin, Clack & Craft, 2012): “purposive imaginative activity, mediated by digital technologies, generating outcomes that are original and valuable in relation to the learner”. As applied to education, digital creative teaching would consist of applying digital technologies with the aim to support creative pedagogies, i.e. learner-centered approaches, open-ended ethos, synergistic collaboration and knowledge connection.

The following sections propose pedagogical theories and digital tools which may support the development of digital creativity in the classroom.

**1.2.1. Pedagogical underpinnings**

To our view, four pedagogical theories are particularly suitable to the application of digital creative teaching practices, namely experiential education, critical pedagogy, constructivism and constructionism.
Experiential education

This movement questioned the pedagogical assumptions of its time, to which education relates to an accumulation of knowledge, in favour of active student-centred methodologies based on learning-by-doing and problem-based learning. To this view, learners build knowledge on the basis of the present experience and the active interaction with their environment (Dewey, 1938; Kolb, 1984).

Critical pedagogy

This philosophy and social movement denounces the “banking concept of education” which consists of simply depositing knowledge in a de-contextualized manner (Freire, 1974). At the contrary, Freire promoted the importance of developing learners’ critical awareness towards the society and viewed education as a path to empowerment and emancipation. In this line, education should directly connect to meaningful problem solving (Blikstein, 2013).

Constructivism

This influential paradigm considers knowledge as an experience that is developed by interacting with the world on the basis of prior knowledge. Hence, students are not passive recipients of knowledge. Rather, they make sense of the world by actively building and transforming meaning (Jordan, Carlile & Stack, 2008); teachers become facilitators who guide students towards processing information through active exploration. From this perspective, every learning process is creative, as learners create their own meaning as they attempt to understand the world. As stated by Craft (2005), “in a constructivist frame, learning and creativity are close, if not identical” (p. 61).

Constructionism

Influenced by Freire and Piaget, Papert elaborated the theory of constructionism. He shares Freire’s endeavour to free the latent potential of students, by creating learning environments which connect to their passions (Blikstein, 2013). Building on constructivism, constructionism argues that learning better occurs when students make and share tangible artefacts (Ackermann, Gauntlett, Wolbers & Weckstrom, 2009). Hence, this theory is directly related to the maker and digital making movements.

Papert pioneered the educational use of digital technologies. More than information and communication devices, he considers technologies as powerful educational tools which allow students for concretizing and expressing their ideas by designing, building and engineering. Constructionist learning environments are usually not based on a fixed curriculum. Rather, students use technology to build their own projects, while teachers act as facilitators of the process (Blikstein, 2013). Hence, learners become designers. The constructionist view highlights the importance of social participation in the knowledge construction process, and considers making as an inherently social activity, through which learners design artefacts that are of relevance to a larger community (Kafai & Burke, 2016).

1.2.2. Digital tools for creativity

We suggest the following tools and educational strategies which may support digital creative teaching activities.

Manipulative technologies

Manipulatives, in the context of education, are physical tools that engage students in hands-on learning. Based on the constructivist theories, the manipulation (i.e. organisation, combination, comparison, etc.) of objects, such as blocks, figures and puzzles, is central to the learning process, as it stimulates multi-sensory experience. Commonly, manipulatives are used to teach STEAM to young students and to bring fun to the learning process (Moyer, 2001). Recent studies show a high level of acceptance of digital manipulatives by teachers and students, as well as a positive impact on learning (e.g., Miglino et al. 2013).

For example, Magic Blocks (Di Ferdinando, Di Fuccio, Ponticorvo & Miglino, 2015) are RFID tagged logical blocks which children can manipulate in order to perform educational tasks set by a real or a virtual teacher, to stimulate learning of mathematical and logics concepts. LittleBits\footnote{https://www.littlebits.com/} are small electronics objects, each one with a distinct function (motion, light, sound, sensor, etc.), that easily fit to each other through magnets, used to create electronic circuits. They stimulate the inventive nature of children to create numberless projects, while they learn logic, maths, electronics, but also product design, prototyping and entrepreneurship. Furthermore, digital manipulatives stimulate a Makers attitude, turning students into active creators. Learning in a Makers environment provide opportunities for...
disrupting students’ conventional practices of invention, exploring through play, failure, risk-taking, and refiguring creation as remix and craft (Faris et al., 2018).

Virtual manipulatives, such as WOLFRAM Demonstrations Project², Shodor Interactive Activities³ and Geogebra⁴, completely substitute the physical elements. Empirical studies show that virtual manipulatives encourage creativity and increase the variety of solutions that students encounter (Moyer-Packenham & Westenskow, 2013), which is in line with the constructivist theory.

Cubelets⁵ and RoboWunderkind⁶ enable young children to design and construct robots through manipulatives – mountable blocks that contain the functions of a robot (a switch, a motor, a sensor, etc.). These tools demonstrated to positively change students’ attitude towards STEM and computer science (Correll, Wailes, & Slaby, 2014), as well as to foster critical thinking skills (Gross & Veitch, 2013).

Educational robotics

Educational robotics uses tangible materials to teach a variety of topics, including STEM, literacy, social studies, dance, music and art (Eguchi, 2014). Such teaching strategy enhances students’ learning experience through hands-on / mind-on activities integrated with technology. Nowadays, a large number of educational robotics tools are available on the market, including LEGO WeDo⁷ and LEGO Mindstorms⁸, mBot⁹, BeeBot¹⁰, Ozobot¹¹, Dash and Dot¹². For the younger learners (age below six years) educational robotics often focuses on learning the basic programming principles, simple logics and mathematics concepts. Commonly, the creation of both hardware and software parts of a robot encourages children to think imaginatively, stimulates them to analyse situations and apply critical thinking in solving real-world problems.

In addition, robots can be involved in teaching and learning social skills (Ray & Faure, 2018). Indeed, robotics activities are usually organised in a collaborative manner, with small number of students working together to achieve the proposed objectives (Denis & Hubert, 2001). Hence, teamwork and cooperation are an integral part of any robotics project: students learn to express their ideas and listen to those of their peers; all can offer arguments and reach conclusions jointly. Students focus on resolving problems for achieving the goals of their projects, and learn from their errors on the way.

Game design and coding

Since Papert first introduced the Logo Programming language and the “Logo turtle”, coding and developing computational thinking skills has become more and more important in today’s world, and particularly in education (Bers, 2017). Mass acceptance is enabled by the availability of programming tools which are appropriate for younger learners. Indeed, several visual programming languages using puzzle-like blocks appeared in recent years, such as Scratch¹³, Kodu¹⁴ and Alice¹⁵. Students focus on learning programming concepts and practice a variety of skills (Lye & Koh, 2014), instead of solving syntax problems. Those programming environments, when appropriately integrated in teaching practices, promote exploration, risk-taking and autonomous learning, as well as increase students’ motivation (Fowler & Cusack, 2011) and spark students’ imagination (Tsur & Rusk, 2018).

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² http://demonstrations.wolfram.com/
³ http://www.shodor.org/interactivate/activities/
⁴ https://www.geogebra.org/
⁵ https://www.modrobotics.com/
⁷ https://education.lego.com/en-us/support/wedo
⁹ http://www.makeblock.com/mbot
¹⁰ https://www.bee-bot.us/bee-bot.html
¹¹ http://ozobot.com/
¹² https://www.makewonder.com/dash
¹³ https://scratch.mit.edu/
¹⁴ https://www.kodugamelab.com/
¹⁵ https://www.alice.org/
2. Digital creativity in ITE contexts: an overview of EU policies

This section aims to settle the context background of the DoCENT project, i.e. on the light of European policies, it outlines the main trends and challenges faced by ITE systems, as well as describes the profile of teacher educators. Furthermore, it reviews the current situation regarding the integration of digital technologies and creativity in European educational contexts.

2.1. European ITE systems: main trends and challenges

Recent reports from the Programme for International Student Assessment (PISA) highlight the essential role of teachers for students’ achievement (OECD, 2013). It is therefore critical to raise teacher quality, so to ensure the potential of schools for improving academic results. As highlighted in the EC guide on policies to improve ITE (European Commission, 2015), education systems have to continuously adapt to the evolving characteristics of our society, and are, consequently, becoming more and more complex. In this context, the expectation towards teachers is increasing, and it has become essential to develop their capacity to adapt to changing educational contexts and students’ needs.

ITE constitutes a key factor for designing the future of education, enhancing teacher quality and developing their flexibility (European Commission, 2015). Indeed, it constitutes a critical stage in teachers’ careers: it sets the foundations of their professional mindset, and provides them with the basic tools to create meaningful learning opportunities (European Commission, 2014).

Hence, fostering the quality of ITE has become a priority objective for European policies. For example, the Strategic Framework ET2020 (European Commission, 2009) suggests focusing on the quality of teachers’ initial education. Similarly, the Council Conclusions on effective teacher education highlight the importance for ITE to “provide prospective teachers with the core competences required to deliver high quality teaching, as well as stimulate the motivation to acquire and update competences throughout their careers” (Council of the European Union, 2014, p. 3).

Nevertheless, the European ITE system faces a series of challenges. First, most member states ensure the provision of ITE through higher education institutions, with their own government regulation and supervision (European Commission, 2015); this leads to a diversity of regulations, priorities and programmes within and between countries, which can hamper professional quality and mobility (European Commission, 2014), as well as the creation of a comprehensive approach to teacher development (European Commission, 2015). In addition, there is a challenge for integrating subject knowledge, teaching practice and interdisciplinary aspects in ITE curricula (European Commission, 2014).

To face those challenges, targeted actions are needed so to strengthen the role of ITE in the fast-changing society. One strategy consists of focusing on the key-actors of ITE, those who educate teachers, i.e., teacher educators.

2.2. The profile of teacher educators

The term teacher educator refers to “all those who actively facilitate the (formal) learning of student teachers and teachers” (European Commission, 2013d), whether at the level of initial teacher education or continuing professional development (Council of the European Union, 2014). The profession of teacher educator usually encompasses a range of backgrounds, qualifications and work contexts. For example, the European Trade Union Committee for Education (ETUCE, 2008) highlights various profiles of teacher educators, including higher education academic staff who teach education, didactics or specific school subjects, and education researchers.

Teacher educators play an essential role for ensuring the quality of the teaching workforce, supporting teachers in raising student attainment, and integrating innovation into schools (European Commission, 2013d). As highlighted in the accompanying Staff Working Document, “the selection and professional development of those who educate teachers is a prerequisite for raising the quality of teaching and improving learning outcomes” (European Commission, 2012a).

Nevertheless, the profession appears to be generally neglected in policy-making in most EU member states. Most European countries lack a clear conceptualization and legislation of the profession of teacher educators, as well as a formal recognition and common quality requirements for their selection (European Commission, 2013d). In addition,
there is little policy regarding the formal education and professional development of teacher educators, and most member states do not provide them with any initial education (European Commission, 2013d).

Against this background, the provision of lifelong learning opportunities (through initial education, induction into the profession and continuous professional development) appears as an essential need to allow teacher educators for becoming aware of the latest trends in society and schools, as well as developing teachers’ competences (European Commission, 2012b, 2017b). Furthermore, the Council of the European Union (2014) suggests establishing professional competence frameworks and defining clear qualification requirements.

2.3. Integration of digital technologies

The ubiquity of digital technologies shapes the ways we think, communicate, work and organise our lives (European Commission, 2017a). Therefore, EU policies highlight the need to equip citizens with the competences required to use digital technologies critically and creatively. Furthermore, most European Member States have developed curricula to prepare the young generation to take part in the digital (European Commission, 2017a).

Digital technologies also affect the way we learn and impact on educational systems (Kikis, Scheuermann & Villalba, 2009). Hence, it is critical to help teachers to develop the necessary competences to exploit the educational potential of digital technologies and to adequately prepare their students for life and work in a digital society (United Nations, 2018). Many European Member States have made efforts for ensuring teachers’ continuous professional development in relation to digital technologies (European Commission, 2017a). To enhance these efforts, the report provided a framework for the development of educators’ digital competence in Europe.

As stated in the EU conclusions on effective teacher education (Council of the European Union, 2014), ITE systems should ensure teacher training opportunities in relation to innovative modes of teaching based on digital technologies. Indeed, teacher professional development appears to be the most important condition to ensure the effective use of technologies in education (European Commission, 2013a). In this line, the ET2020 working group argues that ITE plays a key role “to provide teachers with knowledge of innovative approaches to ICT, encourage them to experiment with digital technologies and reflect on their impact in teaching specific subjects” (European Commission, 2014). Furthermore, the JRC policy brief on ICT for Learning, Creativity and Innovation stresses the importance of teacher training initiatives which encourage teachers to experiment with digital and media technologies (Ala-Mutka, Punie & Redecker, 2008).

Nevertheless, the European Commission (2013a) reports that 58% of teachers have not received any training on how to use digital technologies in the classroom. Also, only half of the member states integrate digital technologies in their ITE systems (European Commission, 2014). Furthermore, teachers lack competences for digital pedagogy, and pedagogical approaches for using digital technologies are not sufficiently available to teachers, particularly during ITE. In fact, only 20 to 25% of students are taught by digital confident and supportive teachers (European Commission, 2013a). Therefore, there is an urgent need for ITE to address the development of digital pedagogical competences.

2.4. Creativity integration in European ITE contexts

EU policies consider creativity as a key educational objective (Wyse & Ferrari, 2015). For example, the strategic framework for European cooperation in education and training (European Council, 2009) sets “enhancing creativity and innovation at all levels of education and training” as a strategic objective. Furthermore, policy documents outline recommendations to promote “creative ways of teaching and learning” (European Commission, 2012c). According to a recent research (Wyse & Ferrari, 2015), creativity is explicitly referred in all national curricula of the EU27, meaning that policy makers and curriculum developers acknowledge its relevance for education. Nevertheless, the research found that its predominant location is situated in the arts subjects; this contrasts with the view of the creativity research field, to which creativity constitutes a cross-curricular topic.

Teachers are seen as key-players for bringing creative practices into the mainstream curriculum. Indeed, “no matter how good policies are, they rely on teachers to implement them in classrooms” (Ferrari et al., 2009a, p. 360). As outlined in a recent study (Cachia, Ferrari, Ala-Mutka, & Punie, 2010), teachers consider creativity as a relevant cross-curricular competence; nevertheless, they find it challenging to apply practices, assessments, and technologies to support its development. Indeed, teacher education programs do not seem to provide a sufficient basis for promoting creative teaching practices. Hence, there is a clear need for integrating creativity in the EU teaching
profession and for supporting future teachers’ creative competences. As stated by the European Commission (2014), it is crucial to include innovation and creativity in teaching and learning, through consistent approaches along the teacher education continuum.
3. Desktop study: digital creativity in European ITE contexts

This section outlines the current situation on the integration of digital creativity in ITE in the DoCENT project countries, i.e. Greece, Italy and Spain. For each country, we describe the status of ITE and proceed to a SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) for the integration of digital creativity in ITE contexts.

3.1. Greece

3.1.1. The status of ITE

The type of teacher education in Greece varies depending on the phase of a teachers’ career, on his/her role as a student or pre-service teacher, as a public or private school teacher, as private tutor etc. This diversity is relevant to the teachers’ educators’ profiles that conduct all these kinds of educational programs.

The basic teacher education (undergraduate studies) takes place in the Universities’ Schools of Pedagogy for Primary Education, where student-teachers become qualified to teach all subject, after a four-year study. Teachers of Secondary School (Junior-High School and High School) are specialized to teach a certain subject attending a four-year study at the related University Departments, i.e. a Mathematics teacher studies at the Mathematics Department of the University of Athens. Teachers’ educators in this phase are mostly Academics, or affiliates with doctoral studies and with expertise in Education, or in certain learning subjects (i.e. Mathematics). The crucial characteristic of their role is their duty and authority to assess the student-teachers.

Initial secondary teacher training is also provided by ASPETE (School of Pedagogical and Technological education), a teacher training institution, which is a self-administered public entity. ASPETE offers programmes of pedagogical training and further training or specialization for upper education degree holders (both pre-service and in-service). For prospective secondary teachers, the degree issued by the Departments of ASPETE is a “Certificate of Pedagogical and Teaching competence”, which qualifies its holders to teach in the discipline of their specialization in secondary education. For in-service secondary teachers ASPETE offers further pedagogical training and specialization courses, awarding a “Certificate for further training” or “Specialization Training”. Teachers’ educators are Academics or affiliates with doctoral studies in Education. ASPETE also offers four years studies that lead to a higher education undergraduate degree, where students are trained to be teachers of technological subjects, mostly in secondary vocational education.

Each year since 2014, the University of Athens offers a two-semester training programme for university degree holders, that leads to a “Certificate of Pedagogical and Teaching competence”, too.

After graduating, teachers can attend Master’s and doctoral programs in Education (postgraduate studies), offered by the Universities’ Education Departments. Teacher’s educators in this phase are mostly the same as in their undergraduate studies. However, their role is more consulting, despite the fact that they still assess the students.

When the state is in need of teaching personnel a small number of teachers are hired to work as teachers in public schools. Before their first year as teachers they are obligated to attend an initial training course of about 60 hours, where teacher educators are Academics, experienced teachers of primary and secondary education, school consultants and school principals. Although this process has a mandatory nature, the teachers are not assessed by the educators. Their successful attendance of the process is certified just by their presence. This practice leaves its mark to the role of educators; they mostly inform teachers about the certain framework of education in Greece, they talk about educational aspects of the curriculum, and answer to their questions, without asking them to make an assignment etc.

These continuous professional development (CPD) activities and training programmes for in-service teachers are also carried out by the 16 Regional Training Centers of Greece (PEK) that operate under the auspices of the Ministry of Education. Similar types of training are conducted for public and private school teachers, when a new kind of educational tool is introduced by the state (i.e. creative projects in High School, ICT in education etc.)

18 Experiences in-service teachers with master or doctoral degrees, which are authorized by the Ministry of Education to support teachers in their work.
A procedure of CPD for in-service teachers’ education “in the use of ICT in teaching” and learning is held in Greece since 2007, in large scale. This action which is called “Introductory and continuous training for exploitation of ICT in didactic practice”\(^{19}\) is carried out by Computer Technology Institute and Press (CTI) Diophantus under the supervision, support and the guidelines of the Greek Ministry of Education. It includes 78 hours courses in classes of 15, 18 hours of advisory meetings with the educators and 6 hours of implementation, for each trainee to create-design and make his/her own teaching interventions with the use of ICT in his/her classroom. The objectives of this training are trainees:

- to know the characteristics, function and ways of use of interactive teaching systems in the educational process,
- to be able to use the possibilities offered by the educational platforms and digital collection and distribution repositories hardware,
- to obtain supervision of modern general purpose tools, the Internet and its new dimensions, and to become aware of issues that are safe its use,
- to understand the prerequisites and the possibilities of using the digital technologies in the school, to upgrade the educational process.

At the end of the training period, the teachers sit for their certification exams that lead to a “Certification in the use of ICT in teaching”, which is also known as “Certification of B level on ICT” in the school teachers’ community. A large number of teachers have attended this professional development procedure and have been certified (around 35% of school teachers), although the education procedure is neither mandatory, nor easy to attend.

Until 2016 the Certification of B level on ICT was held only for primary school teachers and secondary school teachers of Linguistics, Mathematics, Science and Informatics. Since 2017 the training and certification model has been modified in order to be available for teachers of all the subjects in secondary school; the training period has been split in two phases:

- The introductory training in the use of ICT in teaching (B1 level on ICT), where teachers of all subjects are trained, separated in four clusters:

<table>
<thead>
<tr>
<th>Clusters of B1</th>
<th>Level Name of the cluster / expertise of the trainees Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster B1.1</td>
<td>Humanistic and Arts (for secondary school teachers of Greeks Language, Religion, Foreign Languages, Music and Arts)</td>
</tr>
<tr>
<td>Cluster B1.2</td>
<td>Science, Technology, Behavior, Health (for teachers of Science, Technology, Agricultural studies, physical education, Health and Medical subjects, etc.)</td>
</tr>
<tr>
<td>Cluster B1.3</td>
<td>Mathematics, Informatics, Economics, Management (for secondary school teachers of these subjects)</td>
</tr>
<tr>
<td>Cluster B1.4</td>
<td>Primary Education (for kindergarten and primary school teachers)</td>
</tr>
</tbody>
</table>

*Table 1: Clusters B1 specificities*

- The advanced training in the use of ICT in teaching (B2 level on ICT), where teachers’ that have been certified on B1 level, will continue their training.

The duration of B1 level training is around 12 weeks, 3 hours of in person courses, as well as one asynchronous assignment for each trainee, per week. For the asynchronous teaching and communication a Moodle Learning Management System is used\(^{20}\).

B2 level training has not started yet. However, the purpose of B2 is for the trainees to complete their education, and gain competences that correspond to ones of the former B level training.

Since 2017 the target of 30.000 more teachers for introductory training (B1 level on ICT), 5.000 teachers for continuous training (B2 level on ICT).

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\(^{19}\) [http://e-pimorfosi.cti.gr](http://e-pimorfosi.cti.gr)

The courses of B1 (and B2) training are carried out in schools, or other units of the educational system in Greece, like PEKs (i.e. PEK of Heraklion), which are called KSE. In these courses, the educators are in-service teachers that have already been authorized by the state as teacher educators in the use of ICT for teaching. Their role is to support trainees during the training period. After that they adopt the role of assessor, as they assess the trainees teaching interventions with ICT, before the final exam.

An in-service teacher has to attend an extensive training course under the University’s supervision to be certified as a teacher educator. In this course the role of educators is held by Academics with expertise in using ICT for teaching, and their affiliates with the same expertise. The planning for the next couple of years includes training for 300 newly recruited teacher educators.

To sum up, the education in the use of ICT for teaching is a large scale procedure of professional development, which is finally linked to the higher education institutions (Greek Universities). Moreover, in 2011-2012 PEK training activities targeted in-service teachers at the induction phase; among training thematic area was “the use of ICT in teaching”.

Other actions of teachers’ CPD are carried out by school consultants; however, the frequency and the duration of these educational procedures depend on the consultants’ availability.

3.1.2. SWOT analysis

Strengths

Creativity appears to be high-valued in one of the most cited educational policy texts issued by Greek state, since the middle 80’s. It is specially referred to as of the overall aim of primary and secondary education: “to promote overall harmonious and balanced development of students’ mental and psychosomatic potential, so that they become complete personalities and live creatively” (Sarakinioti & Tsatsaroni, 2015). In 2016, the emphasis on creativity was clearly stated in another official text through which the Greek Ministry of Education institutionalizes the use of the so-called “creative projects” as one of the required assignments for a high-school graduation.

As for digital technologies, a large numbers of teachers have been trained to use them in teaching. The institutionalized portals of the Greek Ministry of education contain over thousands of original artefacts called 'micro-experiments' with which students can experiment and dynamically manipulate some simulation or problem embedding mathematical and other concepts. Most of these artefacts are embedded in the e-book version of student’s books from grade 3 to 11. The latest version of mathematics curriculum (2016) teachers’ guide contains some of them as examples of classroom activities and as a basis for teachers to use them and to design their teaching plans and actions. Thus, these artefacts can be used as resources for teachers, to be creative, designing their own educational material (Kynigos, 2017). Research have shown cases of original school practices where the use of these resources might underpin creative design for teaching and have fostered students, through creative activity to make new meaning around mathematical concepts (Papadopoulos, et al., 2016; Diamantidis et al, 2015).

Higher education institutions that conduct programs of PD have the authority to provide affirmations that one has attended these programs. These affirmations gain currency and prestige among the teachers’ community which can take effect as a motive for teachers to attend these programs.

Since the students in postgraduate teacher education programs are of a lower number comparing to undergraduate studies, their participation in short PD courses or seminars that occasionally may be carried out, is dense. They are willing in attending these courses, compared to in-service school teachers.

In relation to recent educational policy initiatives for ITE and CPD: as of school year 2010-2011, Law 3848/2010 came into force establishing the acquisition of a pedagogical training certificate for secondary teachers. The most recent policy document concerned with the establishment of the certificate was released on May 2016 by the Educational Committee of the Greek Parliament (White paper, 2016). The document emphasizes among others the need to educate prospective and in-service teachers for effective use of new technologies in teaching and learning practice and provide recommendations to ITE and CPD providers on how to achieve this goal.

21 Law. 1566/1985, article 1
22 Presidential Decree 46/2016, article 8
Weaknesses

There are some drawbacks regarding the implementation of ICT’s use in classroom that leave their mark in teacher education: There is lack of devices in schools. The pc-lab in schools is not available very often, because of the complexity of the school program. There is also a prohibition for teachers and students to use mobile devices with them in school. All these obstacles create a framework where many teachers speak of the use of ICT in classroom, as a context that cannot be easily implemented.

Many PD programs are based on the voluntary involvement of teachers. Thus, it is sometimes hard for teacher educators to ensure the participation of a large number of trainees. This barrier is even more apparent in the cases of in-service teachers, where the institution conducting the PD program is not systemically linked to a School or a structure of primary or secondary education.

From the perspective of how policy mediators (teacher training institutions and providers) implement educational policy reforms towards enhancing teachers digital competences and digital creativity: the regulatory framework for secondary teachers’ training programmers has been very recently established and at the moment there is uncertainty on how the different universities and other institutions have started to and will respond to the new law on teachers’ professional development and initial teacher training.

Opportunities

According to EC/EACEA/Eurydice (2015) report incentives and supporting measures to encourage teachers of general lower secondary education to take part in CPD according to central regulations include: free courses offered; one-off financial allowances paid to teachers; travel expenses covered teachers get paid study leave.

The last two years, the State seems to give a boost to the PD programs on teachers’ education in the use of ICT in teaching.

Universities have adopted a crucial role in this procedure. Also regional educational structures like schools and PEKs are currently implementing training activities under the supervision of the Greek Ministry of Education and the support of CTI Diophantus on the area “Introductory and continuous training for exploitation of ICT in didactic practice”24.

The next two year it seems that “creativity” will be a main theme of discussion, reflection and a framework of action in Greek High Schools, taking in consideration that the assessment of students will be documented by students “creative projects”. Teachers in Greece are in quest of ways to identify creativity on students work, and how to support them in making creative projects.

During the school year 2016-17 the “creative projects” were widely implemented in High-School for the first time. In 2017, the Greek Institute of Educational Policy evaluated this implementation, highlighting their positive effect in school communities, while pointing out the importance of ICT in the actualization of the pedagogical aims of these projects. In the same time, the Institute of Educational Policy stressed the need for teacher’s education on how to carry out these projects in the classroom.

Threats

There is low budget invested for conducting in-service training for teachers. However, this drawback may be balanced by the need of training (that has been documented above).

There has been no recruitment of teachers in Greece since 2009 (except a small number of secondary school teachers, recently). Thus, the introductory training of teachers has stopped being held. A large number of deputy teachers are hired each year. However, their instable working status makes it difficult for them to attend a long term CPD course, since they are not working every year in the same school, not even in the same region of Greece.

According to the EU/OECD (2010) report based on TALIS 2008 survey, main barriers for teachers’ participation in CPD are: Lack of time to attend (57%), insufficient information (39%), and the limited number of teachers accepted (36%), and the costs of training (36%) were the most often reported barriers for undertaking (more) professional development. Other reported reasons were difficulties with school/service (11%) and other reasons (3%); 21% of the teachers in the sample mentioned that they did not face any barriers.

24 http://e-pimorfosi.cti.gr
3.2. Italy

3.2.1. The status of ITE

The profile of teacher educators

Teacher educators in Italy are professionals of both public and private sectors. In the latter case, the Italian distribution of the teacher educators is not clear, in reasons of two elements: (a) if we consider as teacher a professional who works in school sector, the Italian Ministry of Education poses structured and public formation course (see 1b); (b) if we consider as teacher a professional who does not work in school sector, but in all sectors where a teaching/learning relationship is present, we have to include also private realities where the teacher educators’ recruitment is not regulated by Ministry rules, but by private criteria. Thus, in this latter case is not possible to define a clear picture of the profile of teacher educators, that conversely is strictly linked to specificity of private course. However, in Italy almost all the training courses refer to the educational system (in every order and degree).

The School system

The school system is currently organized as follow: kindergarten for children aged 3 to 6; first cycle of education, with a total duration of 8 years, divided into primary school (5 years duration) for children aged 6 to 11; first level of secondary school (3 years duration) for pupils aged 11 to 14; second cycle of education consisting of two types of courses: second level secondary school of state competence, lasting 5 years, addressed to pupils aged 14 to 19. High schools, technical institutes and professional institutes belong to this path; three-year and four-year vocational education and training (VET) courses of regional competence, aimed at young people who have completed the first cycle of education. The compulsory education lasts 10 years, from 6 to 16 years of age, and includes the eight years of the first cycle of education and the first two years of the second cycle (Ministerial Decree 139/2007). After completing the first cycle of education, the last two years of obligation (from 14 to 16 years of age), can be completed in secondary school (high schools, technical institutes and professional institutes) or in vocational education and training pathways of regional competence (law 133/2008).

The recruitment of the teaching staff takes place through three rankings:

- Rankings of merit of competitions for qualifications and exams (for permanent recruitment);
- List (graduatorie) until exhaustion (for not-permanent recruitment and for temporary work and until the end of the didactic activities);
- School rankings (for short periods of works).

In all cases, to have access to the graduatorie, an aspiring teacher has to obtain the Abilitazione all’ Insegnamento (teaching qualification). This latter consists of formal test that can be sustained after specific training courses (see paragraph 1b).

Summarizing, a candidate teacher to actually become such has to follow three steps:

- follow a formal training course;
- obtain teaching qualification;
- be included in the national school’s rankings (graduatorie).

The figure of teacher educator can be found in the first step of this path (see 1b).25

The formal training course for candidate teachers

In Italy, as teacher educator (TE) we could identify those teachers that educate candidate school teacher at formal level (specific university courses) in the first step of their route. In all cases, TE is a university professor or a PhD or a person with higher education and qualification. TEs gain access to their role through competitions issued by the official training providers. These latter are Italian Universities proposing formal training courses, as instituted by Italian Ministry of Education.

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For instance, status, roles, competences, qualification requirements for teacher educators of FIT courses are the following: a) 1st and 2nd level professors, tenured researchers, fixed - term researchers (holders of contracts stipulated pursuant to article 24 of 30/12/2010 n.240) and ordinary assistants of the role to exhaustion, belonging to the scientific-disciplinary sector of reference of teaching or a similar field, in service at the Italian Universities; b) subjects who hold a position similar to the one indicated above at foreign universities or international. The formal training courses are of two typologies:

- TFA (Tirocinio Attivo Formativo; English translation: Active Educational Training);
- FIT (Formazione Iniziale e Tirocinio; English translation: Starting Education and Active Training) – for secondary school’s candidate teachers.

The TFA was defined by the Ministerial Decree n. 249 of 10 September 2010 as a path for the initial training of teaching staff. To obtain teaching qualification, the decree provides for the activation at the Academic Institution of a specific university course the TFA - Active Training Internship (1500 hours, 60 CFU). At the end of the course the teaching qualification exam is held. The TFA courses are limited (with access tests) and the places available for each competition class are established at regional level each year. They expect to pass three tests: preliminary test prepared at national level (DM No. 312/2014 and DM n.487 / 2014); written test and oral test by the Academic Institutions (DM No. 312/2014).

The FIT is of recent institution and it consists of a new version of TFA, peculiar for aspiring teachers of secondary schools. On 31 May 2017, a new law (d. l. 13 April 2017, n. 59 and D.M. 616/2017), came into force regulating the access and the path to become teacher. To introduce these changes, the Legislative Decree 59/17 is dedicated to initial training and to recruitment of teachers valid for both first and second level of secondary school. According to L.D., all those who intend to become teachers must first participate in public competition for qualifications; then, all those who pass the competition will be admitted to a three-year course of initial training, apprenticeship and inclusion in the teaching function (the FIT path), that is preparatory for permanent recruitment.

School teacher’s initial and continuous professional development

With the Ministerial Decree 797 of 19 October 2016, the National Training Plan for teaching staff was adopted for the 2016-2019 three-year period. The document represents an institutional framework of in-service training; it defines priorities and financial resources, and a coherent system of interventions for training and professional development. The NTP aims to promote connections between national priorities, schools’ training projects and teachers’ professional needs. It includes:

- Professional curriculum;
- Individual Educational story;
- Planning, documentation and reflexivity on didactic activities;
- Individual project and individual development.

Teachers Educator’s continuous professional development

As seen early, the teacher educators are mostly from university world. Alongside the high qualification of them, a continuous process of education is a crucial point to assure high quality standard of education system. This principle was achieved in the document known as the Bologna Process (1999), which indicates as a first point among the objectives to be achieved the need to improve the quality of educational and training path of universities, through efficiency and “effectiveness of education and training systems”. Basically, according to the Magna Charta of the Universities (1988), the Lisbon Convention (1997) and the Sorbonne Declaration (1998), the Bologna Process defined - as the starting point of a functional strategy for construction of future of European Higher Education - the need to modernize education systems and increase their quality and effectiveness. However, in Italy recent studies on the subject clearly shows the lack of a strategic plan for the training of professors of Italian universities, capable of

26 Source: http://www.istruzione.it/urp/abilitazione.shtml
27 Source: http://www.istruzione.it/allegati/2017/La_Buona_Scuola_Approfondimenti.pdf
guiding and innovating the educational/training practice and technological innovation of the universities themselves (Epasto, 2015, 53).

**Digital technologies in the teacher education programs in Italy**

The data from the OECD TALIS 2013 survey see Italy in first place for training needs ICT of their teachers: at least 36% have in fact declared not to be sufficiently prepared for digital teaching, compared with an average of 17%. Italy is also the first OECD country, with distance from others, per percentage of teachers over 50 years – the 62%, compared to an OECD average of 35% in secondary school (Source: OECD Education, 2014).

Thus, the integration of ICT in Italian teacher education programs is a key-point for the Italian Ministry of Education for long time. Programs to address the need of ICT integration have had a not-structured diffusion until recent times, basically following the impulse of local, national and European projects.

At national level, a number of actions were undertaken by Italian Ministry of Education from 2008 to 2014 (Table 2).

<table>
<thead>
<tr>
<th>Actions</th>
<th>Since</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azione LIM</td>
<td>2008</td>
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</tr>
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<td>2009</td>
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</tr>
<tr>
<td>Azione Scuol@ 2.0</td>
<td>2011</td>
<td><a href="http://hubmiur.pubblica.istruzione.it/web/istruzione/prot2221_11">http://hubmiur.pubblica.istruzione.it/web/istruzione/prot2221_11</a></td>
</tr>
<tr>
<td>Azione editoria digitale scolastica</td>
<td>2010</td>
<td><a href="http://hubmiur.pubblica.istruzione.it/web/istruzione/piano_scuola_digitale/editoria_digitale_scolastica">http://hubmiur.pubblica.istruzione.it/web/istruzione/piano_scuola_digitale/editoria_digitale_scolastica</a></td>
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</tbody>
</table>

**Table 2. National Actions for ICT integration in school.**

Under this framework a wide number of local project and schools was involved for instance for improvement of digital environments on school of all grades. That, with a number of investments for teacher training (especially primary and secondary school) to the use of new technologies.

For instance, UNINA was involved in a PON Project on ICT in primary-school: Inf@nzia Digitales 3.6 (2014-2016), focused on devising, designing and implementation of innovative teaching / learning methodologies and technologies -ESTeL (Environments for Smart Teaching and Learning).

**INDIRE Avanguardie Educative Project**

A specific remark at national level is to the INDIRE (the national institution of documentation, innovation and educational research) actions. INDIRE has allowed the birth of the Italian avant-garde educational network (Avanguardie Educative), which aims to codify and systematize the heritage of educational innovation and methodological experiment in schools. The online training environment for teachers in the year of training is designed and implemented in collaboration with the General Directorate for Scholastic Staff of the Ministry of Education. The digital platform will accompany in the 2016/17 the entry in the role of about 25 thousand teachers distributed in the various regions. At the teachers’ disposal, also online discussion forums for the exchange of

30 Source: http://schoolkit.istruzione.it/pnsd/2-1-la-storia-del-pnsd-e-dei-suoi-investimenti/
31 Source: http://schoolkit.istruzione.it/pnsd/2-1-la-storia-del-pnsd-e-dei-suoi-investimenti/
32 Source: http://infanziadigitales.altervista.org
materials and experiences. The online environment also allows guided access to a variety of educational materials that any teacher can immediately use. And again, text guides to all the activities of the online environment, guidelines and models derived from regional, national and international experiences.

The course is divided into 4 different phases:

- Preparatory meetings
- Training workshops
- Peer observation moments in class
- Online training

The 107/2015 Law has also identified the INDIRE Institute as a referent (in collaboration with MIUR) to carry out an annual monitoring of the paths and activities for improvement of the educational proposal of adult education projects.

**Piano Nazionale Scuola Digitale (National Plan for Digital School)**

Since 2015, according to the law 107/2015 of Italian Ministry of Education (known as La Buona Scuola), it was defined an overall structured plan to improve the ICT integration defined as Piano Nazionale Scuola Digitale (National Digital School Plan - PNSD; 2015). PNSD is a project of the Ministry of Education, University and Research for the launch of an overall strategy of innovation of the Italian school and for a new positioning of its educational system in the digital era. The PNSD is composed by four basic steps:

- tools
- skills, contents
- training
- accompaniment.

The training step (iii) is of major relevance for our analysis because it is aimed at all teachers of every order, degree and discipline. Namely, the PNSD (iii) provides:

- Action 15 - Scenari innovativi per lo sviluppo di competenze digitali applicate
- Action 18 - Aggiornare il curriculo di “Tecnologia” alla scuola secondaria di primo grado
- Action 21 - Piano carriere digitali
- Azione 23 - Promozione delle Risorse Educative Aperte (OER) e linee guida su autoproduzione dei contenuti didattici
- Azione 25 - Formazione in servizio per l’innovazione didattica e organizzativa
- Azione 26 - Rafforzare la formazione iniziale sull’innovazione didattica

**Focusing on higher Education**

As described in 1d paragraph, ICT integration in higher education has a less structured plan. Specifically, ITE takes place in the context of the Tirocinio Attivo Formativo (TFA - English translation: Active Educational Training), educational academic programs organized by Italian universities (see 1b). The courses of TFA integrate digital pedagogies for the following aims:

- Delivery of learning contents through digital tools, e.g. MOOC and other e-learning platforms;
- Pedagogical use of digital technologies that are present in the Italian schools, e.g. interactive whiteboards;
- Communication and exchange of learning resources, through platforms and social networks that allow for sharing information, practices, learning materials, e.g. Facebook, Twitter, Dropbox.

Beyond these standard practices, some local ITE programs integrate innovative ICT applications which foster many characteristics from creative pedagogies. For example, in the TFA program at University of Naples, in the context of the T3 - Teaching To Teach with Technology EU project (505169-LLP-1-2009-1-IT-KA3-KA3MP; LLP, 2010-11), introduce university teaching staff to the use of innovative technologies (e.g. serious games, simulations, commercial

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33 Sources: http://avanguardieduducative.indire.it; http://www.indire.it/progetto/didattiche-disciplinari-ict/  
34 Sources: https://labuonascuola.gov.it; http://www.istruzione.it/scuola_digitale/index.shtml  
35 www.t3.unina.it
video games, virtual environments and web 2.0 technologies) for teaching aims. The project was considered a best practice in ICT for Learning by the European Commission and included in the volume “Erasmus+: Building on Experience, Best Practices in ICT for Learning”36.

In addition, the TFA program at University of Naples proposes educational methodologies based on the creation of audio-visual tools, the use of hyper-textual tools as way to blend formal, non-formal and informal elements into formative processes, as well as educational robotics to support the adoption of soft skills (e.g. problem solving and collaboration).

Creativity in the teacher education programs in Italy

Although the creativity support was defined as one of the Ministry of Education aims in the curricula for school, it is difficult to identify plans/project structured in this direction. The PNSD gives attention to creativity, through the institution of Creative Atelier (FabLab- Action 7). For the first time in Italy, places dedicated to innovation and creativity are planned in schools, spaces where experiencing digital craftsmanship, serious games, and so on. The Creative Ateliers are innovative spaces in primary schools, where children ”develop the meeting point between craftsmanship, creativity and technology”, as stated in the Plan.

In 2014, INDIRE launched the Maker@Scuola Project. It monitors the actions that try to bring the movement maker into schools, and analyses the specificities of learning models proposed by the ”Movement Maker ”applied to laboratory teaching in the school. The Project aims to investigate the interactions between the work methods of the ”2.0 artisans” and the current learning schemes of the students37.

Furthermore, actions implemented not in connection with Creative Atelier can be found.

An exemple of project at local level implemented to foster creativity at school is BYOC: Bring Your Own Creativity38.

Good exemple of integration of digital technologies and creativity in teacher education at European level (with Italian direct involvement) could be identified:

- The Creative Thinking in Literacy & Language Skills Project (2014-1-UK01-KA204-000081), that brings together formal theories and principles of creative thinking, informal learning and ICT resources, within a range of accessible and applicable contexts that support teaching and learning within the areas of literacy and foreign language education39;
- The ProActive (505469-LLP-1-2009-1-ES-KA3-KA3MP) - Project that aimed to foster creative teaching by designing and using educational games in different training contexts40.

A specific context of integration of creativity support and ICT use is offered by Italians Digital Museums. A number of museums offers didactics for primary school and children based on the use of new technologies. On the contrary, they do not offer projects or activities for teacher educators, but only for a direct target, such as school children.

3.2.2. SWOT analysis

In summary, the analysis of Italian picture about teacher educators and both ICT and Creativity Integration in school/education curriculum highlighted strengths and weakness (see Figure 1). In our opinion, both (strengths and weakness) could be useful starting point for DoCENT Project. Indeed, the Italian Plans for Teacher Education demonstrated the focus on the teachers’ training, at national policies level. Likewise, the digital school plan can be seen as an anchor for policies to train teacher on new technologies. On the other hand, however, an unstructured focus on creativity constitutes a field in which DoCENT can provide a concrete contribution.

Finally, examples of creativity and digital competences integration in educational school practices and/or in teacher training are quite scarce. This evidence actually constitutes, in the Italian context, an “open field” for the activities of DoCENT.

36 http://bookshop.europa.eu/en/erasmus--pbEC0414358/?CatalogCategoryID=ljAKABstfuooAAAeJQZEY4e5L
37 Source: http://www.indire.it/progetto/maker-a-scuola
38 http://www.gjc.it/it/progetti/bryoc-bring-your-own-creativity
39 http://www.creativethinkingproject.eu
40 http://www.ub.edu/euelearning/proactive
3.3. Spain

3.3.1. The status of ITE

In order to describe the status of teacher educators in Spain, it is useful to describe first the status of ITE. According to National level legislation, those wishing to work in non-compulsory or compulsory formal education in Spain require a higher education degree. For working with students from 0 to 6 years of age, a Preschool teaching degree is needed. This is the case for Primary school teaching too, dealing with students from 6 to 12 years old (Gobierno de España, 2006). In order to teach at secondary school, which students from 12 to 18 years old attend, an undergraduate degree in any discipline and a master’s degree in secondary school teaching is needed (Gobierno de España, 2006). This means that in front of the law, ITEs in Spain have the status of “university teaching and research staff” (Gobierno de España, 2001).

However, within this category, like any other university lecturers, ITEs have substantially different conditions and responsibilities depending on the level of the hierarchy in which they are. According to National level legislation, there are mainly two types of university teaching and research staff. “Hired teaching and research staff” have a temporary contract and lower conditions in terms of pay, number of hours etc. than “teaching body lecturers”, who are full-time permanent lecturers with the status of civil servants.

Regarding the content, ITEs teach the curriculums of the aforementioned degrees. Those degrees include different profiles. For preschool and primary school teaching: Didactics of: corporal expression, musical expression, plastic expression, language and literature, mathematics, experimental sciences, social sciences; Didactics and school organisation; Physical and Sports Education; Research and Diagnose Methods in Education; Theory and History of Education (Gobierno de España, 2015). For secondary school teaching, the profiles are: Business, German, Biology and geology, Drawing, Economics, Physical Education, Philosophy, Physics and Chemistry, French, Geography and History, Greek, Computer Science, English, Italian, Latin, Spanish language and literature, Mathematics, Music, Portuguese and Technology (Real Decreto 1834/2008, de 8 de noviembre). This means that ITEs initial training in Spain would be heavily influenced by learning to teach for one or more of these profiles.

On the basis of previous work, Mas Torelló (2011) states that ITEs have mainly three tasks: teaching, research, and management. The author proposes the following competences for each task. Regarding teaching: 1) Design the teaching guide according to the needs, context and students’ professional profile in collaboration with others; 2) Carry out the teaching-learning process providing both individual and group learning opportunities; 3) Tutoring the learning process promoting autonomy; 4) Assessment; 5) Contribute to improving teaching; 6) Participate in the academic dynamic of the institution. Regarding research, the competences are: 1) Design, develop and/or assess research and innovation projects for teaching, for the institution or for creating knowledge of their knowledge area; 2) Organise and manage scientific meetings; 3) Elaborate scientific material; 4) Communicate knowledge.

In Spain, Universities hiring ITEs set the qualification requirements and selection criteria for ITEs. However, the positions must meet the regulations established at a National and, if applicable, at a Regional level. Regulations establish different qualification requirements for “hired academic staff” versus “teaching body lecturers”. For the lowest categories in the “hired academic staff” group such as “teqcher sssitnt”, at the University of Barcelona
(Faculty of Education), the following criteria apply: 1) Not be inhabilited for public positions; 3) Not be legally incapable; 4) Not have any illness incompatible with teaching duties; 5) Catalan/Spanish language knowledge; 6) Undergraduate degree; and 7) Another job outside university. Among the selection criteria, candidates are evaluated on their teaching and research skills (http://www.ub.edu/comint/pdi/concursos/20170609/bases.pdf).

In any case, in order to apply to any position other than “associate lecturer”, ITE candidates must first follow a process of accreditation by an independent agency. This agency will certify that the candidate is qualified to develop the tasks needed for a particular position in the hierarchy. The National level agency is called ANECA (http://www.aneca.es/) but some universities will also ask for the certification by a regional agency, for example AQU in Catalonia (http://www.aqu.cat/). The profiles in that region are Lector, Agregat, and Catedràtic (AQU, 2014).

Like the qualification requirements, Universities establish their selection process for ITEs. At Universitat de Barcelona, a dedicated commission evaluates the applications. CPD is not compulsory for ITEs (Reverter-Masià & Fidel Molina, 2016). Probably for this reason, the National Plan for teacher professional development is only addressed to teacher under university level, therefore there is a gap in National level opportunities for ITEs. This is also true a regional level. In the region of Catalonia, university teacher professional development is offered by Institutes of Education, which belong to Universities.

This means that CPD for ITEs takes place within the University where they work. As an example, the Institute of Professional Development at Universitat de Barcelona offers every year continuing professional development courses for academic staff. They are organised in three areas, namely 1) teaching; 2) research; 3) General. The Institute also runs the “Plan for language learning for internationalisation of teaching” with Rosetta Stone software. Similar programmes from other universities would be the Plan for training to foster teacher leadership at University of Valencia (López Martín & Freixas Soto, 2016) and the Strategic plan for teacher training at the Institute for Training and Educational Innovation at University of Burgos (Delgado, Casado & Lezcano, 2016).

In parallel, a number of organisations such as associations and foundations take the initiative in organizing professional development activities for higher education staff (See heading “Existence of helpful actors”)

3.3.2. SWOT analysis

**Strengths**

University lecturers such as ITEs are not subject to any requirement regarding their ICT competence by law (Carrera Farrán & Coiduras Rodríguez, 2011). Moreover, no explicit reference to creativity can be found in National level curriculum of the degrees in which ITEs teach. We can find, though, learning outcomes about ICT. One of the 12 objectives of the curriculum for the degree in preschool teaching is “Understand the educational implications of ICT and of television in particular in early infant years” (Gobierno de España, 2007). For primary school teachers, we can find the goal to “Understand and apply ICT in the classroom. Select audiovisual information which contributes to learning, civic education and cultural richness” among the 12 learning objectives of the whole degree (Gobierno de España, 2007). The master’s degree to become a secondary school teacher includes as a learning goal to “Search, obtain, process, and communicate information (aural, printed, audiovisual, digital or multimedia), transform it into knowledge and apply it in teaching-learning processes” (ORDEN ECI/3858/2007, de 27 de diciembre).

Since the National level legislation does not elaborate on those learning goals, the curricula of each university should be examined in order to find out about the particular use of ICT to support creative processes. Studies covering the whole country are not found. The most comprehensive data available refers to Catalonia. This is the third most populated autonomous region of Spain with 7.5 million citizens. An analysis of the curricula of nine Catalan universities reveals that the most used descriptor within digital competence for teaching in the curriculums of ITE programmes for preschool and primary education is “Using ICT as resources and teaching strategies in teaching and learning processes” (Sánchez, Alonso, Camacho & Estebanell, 2017). Considering the definition of digital creativity given in DoCENT, there is room for teaching how to use ICT for fostering creativity as it could fit in this descriptor.

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41 http://www.ub.edu/comint/pdi/concursos/temporal.htm
42 http://www.ub.edu/ice/cursos/ub/fp2018
43 http://www.ub.edu/ice/curso/ub/rosetta2017
Weaknesses

The definition and contents of what is known as digital competence for teaching are different across ITE programs from Spanish universities (Sánchez, Alonso, Camacho & Estebanell, 2017). The reason for this is the change from a college degree to a full university degree in the early 2000s. In the old model, national level legislation requested each ITE programme to teach a compulsory course called "New technologies applied to education". After ITE became a full university degree, decisions about how to teach digital competence for teaching are made at a university level.

This non regulatory approach has degraded the training that preservice teachers receive in ICT (Sancho, Bosco, Alonso & Sánchez, 2015; Gutiérrez Martín, Palacios Picos & Torredo Ejido, 2010). Other authors have found an obstacle to the integration of ICT in ITE in the very fact that in Spain, ITE is taught at the university, which is an educational institution traditionally resistant to change (Gutiérrez Martín, Palacios Picos, Torredo Ejido, 2010).

Opportunities: external factors which may favor the integration of ICT and creativity

Although Spanish legislation does not define the digital competence of ITEs, this topic seems to be of high interest among educational researchers. ICT is considered a basic competence in Spanish programmes for teaching quality assessment (Sancho, Bosco, Alonso & Sánchez, 2015). Durán Cuartero, Gutiérrez Porlán & Prendes Espinosa (2016) review competence models focusing on the ICT skills of university lecturers. They find two types of competences, namely general for the citizen of the 21st century and specific, i.e. relating to the teaching profession. Among the second ones, technical and communicational uses of ICT are predominant.

Carrera Farrán & Coiduras Rodríguez (2011) make a detailed proposal for university lecturers’ digital competence. Cejas-León, Navío Gámez & Barroso Osuna (2016) propose an adaptation of the Technological, Pedagogical and Content Knowledge (TPACK) framework for university lecturers. In this framework, TPCK and TPACK dimensions can be useful for ITEs to support their students’ creative processes.

The National Institute for Technologies and Teacher Training (INTEF in Spanish) – EducaLAB is the main National level training institution for in-service teachers. Although they don’t focus on the particular topic of creativity and ICT for ITEs, the Institute can be seen as an infrastructure that could support online training about this matter. Some successful courses in the past include a Massive Open Online Course about Personal Learning Environments for educators.

However, the activities from Fundación Telefónica (Telefónica foundation) might even be more well-known among teachers. It aims to promote a digital and cooperative society by increasing the opportunities of development for citizens. One of its four strategies is Education, and more specifically to find, experiment, understand and disseminate new educational trends.44

SM foundation, which belongs to a publishing house company, includes as one of its four strategies the one in "Education, technology and learning". It supports the Institute for Technology, Education and Learning (INTEA in Spanish).45

Espiral - educación y tecnología is an association with 25 years of experience in promoting and applying ICT in education. It organises at least 4 events per year and it is composed by both academics and practitioners.

Within academia, the Red Universitaria de Tecnología Educativa (RUTE) is a Network of research groups from Spanish speaking universities who investigate ICT in education. For 25 years now, this network has organised the symposia of ICT in Education. The association Asociación para el desarrollo de la Tecnología Educativa y las Nuevas Tecnologías aplicadas a la Educación (EDUTEC) carries out a similar task.

The most specific national level statement about teachers’ ICT competence is the “Common framework for teachers’ digital competence” (INTEF, 2017). These competences are organised in five areas: 1) Information and informational literacy; 2) Communication and collaboration; 3) Digital content creation; 4) Safety; 5) Problem solving.

Similarly, the regional government of Catalonia has recently published a law stating the digital competences that all non-university teachers must have (Departament d’Ensenyament, 2016). They are organised in five dimensions.

44 https://www.fundaciontelefonica.com/conocenos/la-mision/
45 http://www.fundacion-sm.org
namely 1) Pedagogical design, planning and implementation; 2) Organisation and management of educational resources and environments; 3) Communication and collaboration; 4) Digital ethics; 5) Professional development.

Even if they don’t mention creativity explicitly, some competences in the aforementioned frameworks cover the use of ICT to support creative processes. In the Spanish framework, within area 5) Problem solving, we can find competence 5.3 Innovation and creative use of digital technology. The competence includes knowledge, skills and attitudes including problem solving, exploration, use of diversity of formats and critical attitude.

Although these competences are for non-university teachers, both these documents constitute opportunities for embedding ICT in teacher education programmes for several reasons. First, they are published by government bodies responsible for writing and assessment of the education system. Second, they provide a systematic framework with quantifiable achievement criteria, which can easily become learning outcomes in ITE programmes.

**Threats**

Researchers have noted that Spanish legislation on ICT competence for educators has been abandoned or not given the attention it deserves. One reason for that is assuming that students of ITE already have knowledge about ICT (Sancho et al., 2015). This has created a gap between the reality of higher education institutions and the expert recommendations and education legislation (Gutiérrez Martín, Palacios Picos & Torredo Ejido, 2010).

**Conclusions**

Even if ICT is taught at education programmes where ITEs teach, Spanish legislation does not request ITEs to have ICT competence. This means that it is left to Universities / Education faculties to determine whether their teaching staff must 1) have initial training on ICT and / or 2) follow CPD on this matter. Analysis of a specific university call for positions reveals that ITEs are not required to have any ICT competence to be hired. Analysis of the internal CPD plans shows a lack of priority in this aspect.

However, in Spain there is both knowledge (i.e. competence models proposed by academics) as well as activities taking place in an informal setting (i.e. associations, foundations...) and an interest from the EU (see DigiCompEdu framework). This could support the adoption of a competence framework for creativity for ITEs.
4. DoCENT pedagogical framework

This section aims to define the pedagogical framework of the project. It first presents the DoCENT training approach (i.e., objectives, implementation model and target group) and key dimensions (namely creativity, digital technologies and pedagogy). Finally, it described the conceptual framework through which we will approach and explore creativity in the design, by teacher educators, of creative teaching scenarios.

4.1. Training approach

Objective

The overall objective of DoCENT is to enhance digital creativity in ITE contexts. To do so, we will develop, implement, validate and disseminate an innovative model to guide teacher educators in applying digital creative teaching practices. Within DoCENT training, participants will create and apply learning scenarios, based on digital technologies, aiming to enhance students’ creativity.

Target group

The DoCENT project aims to train teacher educators, i.e., “all those who actively facilitate the (formal) learning of student teachers and teachers” (European Commission, 2013). We will focus on those teacher educators for pre and in service teachers, who are connected to higher education institutions, i.e. higher education academic staff who teach education, didactics or specific school subjects, as well as education researchers.

We will approach teacher educators from different countries (Greece, Italy and Spain) and disciplines. Indeed, we adopt a cross-curricular approach, to which digital creativity can be applied to any subject, i.e. STEM (science, technology, engineering and mathematics), social studies (e.g. history, geography, languages) and creative expression (e.g. music, graphic arts).

Topics

The DoCENT training will approach the following topics:

- Main concepts and pedagogical approaches around digital creativity;
- Introduction to the model of digital creative teaching competences for ITE;
- Pedagogical approaches and associated technologies to foster digital creativity, i.e. digital manipulatives, educational robotics, game design and coding;
- Design and application of digital creative learning scenarios, based on teachers’ interests and areas of expertise.

Modalities

The DoCENT training will follow a blended learning approach, i.e. it will include face-to-face (f2f) and online learning modules (through a MOOC). The f2f modules will focus on acquainting participants with the main concepts around digital creativity and the competence model. Furthermore, they will include hands on activities in which participants will try out different types of technologies and analyze their educational affordances. Finally, they will include brainstorming activities in which they will reflect on the way to apply digital creativity to their teaching contexts, according to their teaching objectives.

Complementarily, online modules will focus on how to use the technologies suggested by the project and how to apply them in educational contexts. Following a sandbox approach, teacher educators will be able to choose among the available modules, according to their teaching interests, objectives and contexts. Nevertheless, the full collection of online modules will make a complete course. Each module will include evaluation activities.

Tools and resources

The DoCENT training will be supported by different online tools, as described below.

A MOOC platform

Available in all partners’ languages, the DoCENT MOOC will consist of a learning space which will host learning activities, a serious game and a series of OERs (as described below). Furthermore, it will include a collaboration space offering social networking tools to facilitate communication (either synchronous or asynchronous) and collaboration,
e.g. forum, wiki, blog, chat, online videoconferencing. These functionalities will facilitate the development of partnerships among teacher educators and EdTech stakeholders, as well as the creation of a sustainable CoP. Furthermore, users will be able to upload their own resources (user generated content).

**A set of Open Educational Resources (OERs)**

We will carefully and coherently organize a set of OERs:

- Lessons related to the main pedagogical concepts around digital creativity and the model of competences (slides, filmed lectures, articles of interest);
- Tutorials for learning how to use the digital technologies (videos and manuals);
- Good practices (articles, videos of interviews with EdTech companies and research stakeholders and classroom videos);
- Lessons / “how-to” related to the design and application of learning scenarios based on digital creativity (slides, filmed lectures, learning scenario templates);
- A set of selected learning scenarios: at the end of the implementation phase, the learning scenarios designed and applied by teacher educators will be evaluated. The ones that are validated will be made available as OERs;
- Evaluation materials allowing for assessing participants’ knowledge and competences.

This learning kit will be composed of some already existing OERs, and some other specifically created by the project team.

**A serious game**

DoCENT will be a game platform which allows for developing skills through a role-play simulation using autonomous agents as virtual interlocutors (3D bots). The game will be organized into different scenarios, each one independent from the others, in which users will play a teacher interacting with various students (virtual agents). The interaction aims to provide a realistic experience of the organization and management of a real classroom related to digital creative competences. Teacher educators will learn how to manage classroom and interact with students following creative pedagogies.

**4.2. Key dimensions of the DoCENT approach**

To reach the project objectives, we address three different dimensions, namely creativity, digital technologies and pedagogy. This three-fold structure has already been used in the TPACK model (Koehler & Mishra, 2009). It allows for addressing the interconnection between the three core constructs of DoCENT, as illustrated in Figure 3.
The following paragraphs describe the DoCENT approach to the different conceptual dimensions.

Creativity
As for the application of creativity in education, we focus on three clear directions: (a) an inclusive perspective according to which all individuals can be creative; (b) a focus on everyday creativity, also known as little-c and mini-c creativity, which gives importance to students’ personal processes beyond outstanding accomplishments (Big-c); and (c) a domain-wide approach to which creativity can be developed in all subjects.

Pedagogy
The DoCENT approach to digital creative teaching relies on the pillars of four pedagogical approaches: (a) experiential education, which focuses on active methodologies where students develop knowledge on the basis of the present experience and by interacting with their environment; (b) critical pedagogy, which aims to empower students and enhance their critical awareness through meaningful problem solving; (c) constructivism, which promotes active exploration processes where students build their own meaning as they make sense of the world; and (d) constructionism, to which learning happens when learners create and share tangible artefacts, particularly through digital technologies.

Digital technologies
We have selected a series of digital technologies to be included in the DoCENT training model. They can be divided in different categories: (a) manipulative technologies, i.e., physical tools, like blocks and puzzles, which engage students in hands-on learning processes and multi-sensory experiences; (b) educational robotics, i.e., the creation and programation of robots which stimulates students to analyse and solve real-world problems; and (c) game design and coding; i.e., the use of programming tools which engages students in creating and sharing their own games to develop computational thinking skills. The criteria for selection of those tools and educational strategies consisted in their potential for fostering creative pedagogies.

Creative pedagogies
DoCENT defines creative pedagogies as teaching practices which foster students’ creativity, i.e. (a) learner-centred approaches aiming to make learning engaging, promote students’ ownership and value learning processes; (b) open-ended ethos which make space for exploration and uncertainty; (c) synergistic collaboration based on joint problem solving and collective decision making, and; (d) knowledge connections which bridge the school to students’ real life and place knowledge in a wider context.

Digital education
Digital technologies shape the ways we think, communicate, work and learn. In the digital society, it has become crucial to prepare teachers to build the competences to exploit the educational potential of digital technologies. DoCENT aims to support teacher educators and strengthen their capacity to meaningfully integrate digital technologies into education.

Digital creativity
The operational definition of digital creativity is a core component of the DoCENT project. Indeed, it will inform the development and the evaluation of digital creative teaching competences. On the basis of of existing conceptualizations, the following operational definition was articulated: “purposive imaginative activity, mediated by digital technologies, generating outcomes that are original and valuable in relation to the learner”.

Digital creative pedagogies
DoCENT is at the core of the aforementioned dimensions. It aims to characterize, develop and evaluate teachers’ digital creative teaching competences.

4.3. Conceptual framework
To explore creativity, DoCENT adopts a multidimensional approach (Amabile, 1983, 1996; Csikszentmihalyi, 1988, 1996; Sternberg & Lubart, 1991, 1995) which examines the phenomenon as a system, in a holistic manner, and to take into account the various dimensions of its implication on educational settings, i.e. the individual, the process, the product and the environment.
Process dimension

The process refers to the different stages through which teacher educators design and apply creative teaching scenarios. DoCENT implementation model has been designed on the basis of one of the most acknowledged models of the creative process (Amabile, 1983, 1996). It consists of a five-stage circular model (see Figure 1) which will engage teacher educators with digital creative teaching practices:

- **Stage 1 - Task identification:** during face-to-face workshops, teacher educators will be introduced to the concept of digital creativity and to the framework of competences (O1). They will have the chance to meet stakeholders from EdTech research centres and companies. Through hands on sessions, they will have the opportunity to try out different applications (e.g. digital games, robotics, manipulative technologies) and to analyze their educational affordances. Furthermore, we will provide them with the necessary information to understand the nature of their future task, i.e. to design and apply learning scenarios to enhance digital creativity in their educational contexts.

- **Stage 2 - Preparation:** in the context of online modules, teacher educators will learn how to use and apply different digital creative pedagogical approaches and related digital applications.

- **Stage 3 - Response generation:** during co-design workshops, teacher educators will conceptualize and plan their own learning scenarios based on digital creative teaching approaches and applications. To do so, they will be guided by partners and EdTech stakeholders.

- **Stage 4 - Outcome:** under the guidance of partners and EdTech stakeholders, teachers will put their scenarios into practice with their students, i.e. pre-service teachers.

- **Stage 5 - Response validation:** with the guidance of partners and EdTech stakeholders, teacher educators will assess Stage 4, as well as validate their learning scenarios.

*Figure 2 - DoCENT circular model*
At all stages, we will ensure a close collaboration (both face-to-face and online) among teachers and EdTech stakeholders in the context of a CoP, i.e. a group of people interacting regularly and sharing practices. The DoCENT implementation model will empower teacher educators to become “digital creative teaching ambassadors”, i.e. change agents who develop strong links between ITE and EdTech, create and share OERs related to digital creativity education, as well as engage and mentor other teacher educators, to help them become experts in turn, in a self-sustainable circular process.

**Product dimension**

In the context of DoCENT, the product refers to the learning scenarios designed by the training participants. We will explore them in terms of (a) usefulness, i.e. adaptation to the planned pedagogical objectives and contexts; and (b) novelty, i.e., level of innovation in relation to little-c (the teachers themselves) and middle-c creativity (teachers’ educational communities, including their students and educational centre). To do so, we may call for the view of experts in the field (Csikszentmihalyi, 1996).

**Press dimension**

Hereby we refer to the elements of the environment which may influence the process through which training participants design apply learning scenarios, including: (a) the resources available to teachers, i.e., time, material resources; (b) digital environment, i.e., pedagogical affordances and usability aspects; and (c) social environment, i.e., the different actors which compose teachers’ social environment, like colleagues, students and educational centre.

**Person dimension**

In the context of DoCENT, personal aspects refer to teacher educators’ individual characteristics, and more specifically their digital creative teaching competences, i.e., required competences to create and apply a creative teaching scenario mediated by digital technologies.

Figure 2 illustrates the different conceptual dimensions of DoCENT.

![Figure 3 – DoCENT conceptual framework](image-url)
5. Design of the DoCENT competence framework

This section identifies a framework of competences for digital creative teaching, which will be developed through the DoCENT training. The framework is primarily devoted to teacher educators, and can also be used by teachers. It first defines the concept of competence, and then describes the methodology used to design the framework. Afterwards describing the different phases of the design process, we present the competence framework areas and items.

5.1. The concept of competence

Competence can be defined as “the proven ability to use knowledge, skills and personal, social and/or methodological abilities (attitudes), in work or study situations and in professional and personal development” (European Communities, 2008, p. 11), or as “a complex combination of knowledge, skills, understanding, values, attitudes and desire which lead to effective, embodied human action in the world, in a particular domain” (Deakin Crick, 2008). Competence is therefore distinguished from skill, which is defined as the ability to perform complex acts with ease, precision and adaptability.

In its guide for supporting teacher competence development (European Commission, 2013), the European Commission highlights several characteristics of the concept of competence as applied to education:

- it involves tacit and explicit knowledge, cognitive and practical skills, as well as dispositions (motivation, beliefs, value orientations and emotions);
- it enables teachers to meet complex demands, by mobilizing resources in context and deploying them in a coherent way;
- it empowers teachers to act professionally and appropriately in a situation;
- it allows teachers for undertaking tasks effectively (achieving the desired outcome) and efficiently (optimizing resources and efforts);
- it can be demonstrated to a certain level of achievement along a continuum.

The guide distinguishes between teaching competences and teacher competences (OECD, 2009): the former focus on the role of the teacher in the classroom, where professional knowledge and skills are mobilized for teaching in action, while the latter refer to a wider view of the teacher profession, in relation to different levels, i.e., the individual, the school, the local community, and professional networks. DoCENT aims to focus on both views.

5.2. Methodology

This section defines the methodological steps which were followed to design the framework of digital creative teaching competences.

Phase 1. Design of the prototype framework (lead by UB, participation of UNINA and UoA)

We developed a first proposal for the framework of digital creative teaching competences for teacher education. We identified the current status of digital creativity in EU teacher education contexts. We merged, structured and elaborated those results into a conceptual mapping. Furthermore, we analyzed and compared the most relevant competence frameworks currently available (e.g. the European framework of key competences and the ICT Competency Framework for Teachers of Unesco).

As a result, we defined a set of competence-areas, composed by a number of competences—each of them associated to different descriptors. Following an iterative process, the model was analysed and refined by the members of the consortium.

Phase 2. Consultation (lead by UB, participation of UB, UNINA and UoA)

We reviewed, refined and validated the prototype framework through a consultation process, i.e. we presented the competence framework to a panel of experts and practitioners (key-stakeholders from the educational sector including innovation teachers, managers of educational institutions, and educational decision makers). We collected their feedback in order to refine and validate results in terms of key competences for digital creative teaching. The consultation process was conducted in each participating country through face-to-face focus groups.

This second version serves as a basis for developing the DoCENT MOOC (O2) and the Serious Game (O3).
Phase 3. Definition of an International Professional Certification Programme (lead by EUF, participation of UB, UNINA and UoA)

EUF will concretise the criteria and procedures to evaluate the acquisition of the competences by teachers and educational managers, in compliance with the norms of CPD programs and certification systems at stake in each country.

Phase 4. Validation of the framework (lead by FORTH, participation of UB, UNINA and UoA)

During the pilot implementation (A3), partners will use the evaluation tools and strategies (defined in A4) to test the prototype with teacher educators. On this basis, EUF will refine descriptors and will elaborate on a subsequent final proposal of the model.

The validated framework will be documented in a professionally designed handbook available in four languages, i.e., English, Greek, Italian and Spanish. Furthermore, we will present the model in a scientific publication.

Figure 3 resumes the different phases of the competence framework design process.

![Diagram](image)

**Figure 4 - Competence framework design process**
5.3. Phase 1: design of the prototype framework

In order to design the DoCENT competence framework, we followed different steps, as described below.

Audit of existing competence frameworks

First of all, we identified and analysed a set of existing competence frameworks related to the different dimensions of DoCENT, i.e. creativity, digital technologies and teacher education. We also analysed frameworks related to 21st Century skills and lifelong learning. In total, we considered 26 frameworks.

General competence frameworks


Teacher competence frameworks

- European Commission (2013c), Supporting teacher competence development for better learning outcomes. European-Education and Training

Teacher educator frameworks

- Association of Teacher Educators (2015). Standards for teacher educators

Digital competences


Creative teaching competences

Other publications


Extraction of competences

Afterwards, the frameworks were deconstructed so to extract all the competences which they contained (See Annex 1). This process resulted to the identification of 305 possible competences.

Identification of competences for inclusion in the model

In order to include the most relevant competences, we applied a number of principled criteria: (a) corresponding to the three dimensions of dOCENT (Digital technologies, creativity and pedagogy); (b) conceptually clear; (c) formulated at a general rather than at a specific level, so to allow users for adapting the general to their specific contexts; and (d) conceptually distinct from other competences (Council of Europe, 2016).

Synthesis and adaptation

Afterwards, we organized the set of competences obtained into a number of descriptors structured in knowledge, skills and dispositions. To do so, we adopted a number of pragmatic considerations proposed by the guide for supporting teacher competence development (European Commission, 2013). The considerations were that the framework should:

- reflect the culture and context of use;
- be expressed in a way that promotes teacher agency;
- be based on a culture of trust;
- motivate teachers to grow as professionals;
- be of sufficient detail for the intended purpose;
- be dynamic, rather than too fixed, so to ensure further development in line with changing circumstances;
- use language in which teachers can recognise themselves and their school reality, i.e., as concrete as possible, unambiguous, clear, simple, understandable by all users, consistent, empowering, affirming and positive, action-oriented (e.g. can-do statements with examples of concrete applications to teachers’ daily work).

Finally, we made sure that all competences included in the model were teachable, learnable and assessable (either through self-assessment or assessment by others).
5.4. Phase 2: consultation

National expert workshops

The focus group workshops were organized in Greece, Italy and Spain. The aim was to gather educational experts’ and practitioners’ perspectives on the different clusters and components of the competence framework.

NKUA (Greece), UNINA (Italy) and UB (Spain) were responsible for organizing and hosting their workshop, presenting the addressed topics, facilitating activities and discussions, as well as collecting and reporting results. FORTH provided a guidelines document for guiding partners in planning their workshops, following a homogenous basis.

Participants

The events included educational experts from the academic/educational research sector, policy makers and innovative teachers with a high level of experience in digital education. Participants were carefully recruited, so to gather a heterogeneous group of teachers from different levels and disciplines. As the focus groups aimed to stimulate active discussion among participants and collect in-depth information about their perspectives, they gathered a small number of people (7 to 9). Workshops were widely diffused by each partner in order to reach the targeted number of participants. In total, 24 participants were gathered (9 in Greece, 8 in Italy and 7 in Spain).

Participants’ registration process

Interested participants were requested to fill in an online registration form, using Google Form or another similar tool. Selected participants were notified by e-mail and received an agenda of the event, as well as an introductory document (including the project outline and the first version of the competence framework).

Structure

In all countries and partner institutions, the focus groups were organized according to the following structure:

The workshop was organized according to the following structure:

- Brief presentation of the participants;
- Presentation of the DoCENT project: context, objectives, consortium, methodologies and digital tools;
- Presentation of the competence framework areas and descriptors;
- Focus group discussions:
  - Topic A - validation of the framework: discussion on the criteria for developing the framework.
    - Question A1: How appropriate do you find the selected criteria for developing a framework of digital creative teaching competence?
    - Question A2: How well do you think that the proposed framework addresses the criteria under which it has been developed? In what respects it might need improvement?
  - Topic B - refinement of the framework: discussion on the competence areas and descriptors.
    - Question B1: Are the competence(s) included the most important one(s) per area? Which other competence(s) might be also included?
    - Question B2: How appropriate are they for allowing assessment of the teacher educators’ competences (as can-do-statements). In what respects they can be improved?
- Afterwards, each group presented the outcomes of their discussions in a plenary discussion.
- To close the event, we informed participants of the follow-up activities of the project, and of how their feedback will be taken into consideration.

Reporting and data analysis

Partners reported their focus group events and results following a template provided by FORTH. A systematic analysis was performed around the following themes:

- Validation of the framework;
- Refinement of the framework (positive aspects and recommendations for improvement).

Main results

The workshop’s participants positively valued the different elements of the competence framework, and shared the criteria used by the DoCENT team to include the most relevant competences. To them, it reflects important aspects
of creative teaching practices (e.g., the teacher’s role of mediator, reflexive teaching practices, the promotion of students’ intrinsic motivation, metacognition, self-learning and risk taking behaviours). They particularly liked that it relates to the different steps pedagogical design, application and evaluation, instead of focusing only on the teaching activities at stake in the classroom. They also liked that it actively involves students in the learning activities, including knowledge construction and evaluation. It considers the different actors of the educational community, as well as promote their participation in learning communities.

In addition, participants provided some recommendations for improving the framework. Some participants suggested putting a stronger emphasis on inclusive education (i.e., ensuring learning for all students, without regard to gender, physical, intellectual, social, emotional, linguistic, cultural, religious, or other characteristics) (Spain) and on the promotion of the maker culture (i.e., considering the learner as a creator and the classroom as a space for invention) (Spain and Italy).

In addition, participants suggested including some elements to the framework, such as the use of social media (Italy), skills specific to creative processes (e.g., design thinking, storytelling, problem solving and divergent thinking), the ability to critically evaluate and select the creative technologies according to teachers’ contexts, and the collaboration teachers-teachers, students-teachers and students-students (Italy). Participants also suggested adding the promotion of students’ digital citizenship (i.e., encouraging students to participate safely, effectively, critically and responsibly in the digital world), methodologies for keeping record of the classroom activities (e.g. taking pictures, keeping a personal diary, creating a digital portfolio with students), and the transformation of explicit knowledge into tacit knowledge, (i.e., helping students to internalize new mental models and mindsets through meaningful, active learning experiences) (Spain).

In other cases, participants suggested merging some descriptors (Greece and Italy), as well as clarifying and adapting sentences (e.g., “investigation of theoretical and practical approaches” and “bridging of knowledge areas”) (Greece).

Finally, some participants suggested restructuring the framework, i.e., organizing the competences according to teaching activities, instead phases of scenario design.

**Expert validation**

In order to evaluate the framework from an academic perspective, we performed an expert validation with a creativity researcher, Dr. Simone Ritter, Assistant Professor at the Department of Behaviour Change and Well-Being at Radboud University Nijmegen (Netherlands). She performs behavioral, virtual reality, and neuroscientific research to broaden our understanding of the creative process and to enhance creative thinking. Her research on creativity has led to high impact scientific publications, and has been discussed in international newspapers, radio-programs and magazines. In 2014, Simone was awarded a NWO Veni grant with her project titled ‘What a Great Idea! Understanding and Improving the Selection of Creative Ideas’.

The expert carefully read the competence framework. Afterwards, UB conducted a face-to-face interview, during which the expert gave her view on the framework structure and contents (areas and elements). She both provided positive comments and suggestions for improvement.

Her main suggestions referred to the structure of the framework: as Italian participants, she argued that the competences should not be organized according to the different phases of the creative process. Rather, they should focus on different aspects of educators’ professional activities. Furthermore, the expert suggested mentioning the different aspects of students’ digital creative competences, i.e., divergent and convergent thinking, digital creation, information and media literacy, creative dispositions and attitudes, computational thinking and design thinking.

**Refinement of the framework**

We included the suggestions emerged in the consultation workshops and the expert validation, i.e., we adapted the existing descriptors and added new ones. In addition, we reorganized the competences following the structure of the DigiCompEdu framework (European Framework for the Digital Competence of Educators). This framework is organized in such a way that it addresses the different aspects of educators’ professional activities. It is directed towards educators at all levels of education. Furthermore, it provides a scientifically sound background and a reference point for Member States and developers of competence models; indeed, it has been designed to be directly adapted to other contexts and training programmes.
5.5. Presentation of the DoCENT competence framework

Based on the structure of the DigCompEdu framework, the new version of the DoCENT model considers the professional and pedagogical competences of educators, as well as the development of students' competences. As shown in Figure 5, it is divided into six areas and includes a total of 19 competences:

- Area A refers to teachers’ professional environment, i.e. their use of technologies to collaborate with the different members of the educational community, as well as for their professional development;
- Area B focuses on the competences required to identify, select, create and share digital creative resources;
- Area C addresses digital creative pedagogies, i.e., the use of digital technologies in teaching and learning;
- Area D relates to the use of digital strategies to assess and foster students’ creativity;
- Area E refers to the potential of digital technologies for promoting learner-centred strategies;
- Area F focuses on the competences required to enhance students’ digital creative competences.

Areas 2 to 5 constitute the pedagogical core of the model: they describe the competences required to promote creative, innovative, effective and inclusive learning strategies using digital tools.

The different areas of competence and their respective components are described below.

Figure 5 – DoCENT competence framework
Area A: Professional engagement

Use digital technologies for collaboration and professional development.

A1. Community building
Use digital technologies (e.g., social networks and media) to collaborate with different members of the educational community (other teachers / trainers, educational stakeholders, NGOs, innovation centres, parents and third parties), to exchange knowledge and experience and methodologies, as well as to initiate or participate in collaborative projects, communities, and outreach programs which contribute to educational change and improved teacher education.

A2. Reflective teaching practice and digital Continuous Professional Development (CPD)
Continuously reflect on and critically assess one’s own digital creative pedagogical practice; identify professional development opportunities and participate in training activities in the field of creative and digital education; investigate about current research, innovations and best practices in the field of creative teaching & learning mediated by digital technologies; inform teacher education programs with best practices; participate in the design of new instruments, materials and resources to improve professional competences and CPD programs.

Area B: Digital creative resources

Source, create and share digital creative tools and resources.

B1. Identify and select digital resources to generate creative pedagogical ideas
Create awareness on digital technologies with a creative educational potential (e.g. manipulative technologies, educational robotics, game design and coding tools); critically evaluate and select digital creative resources for teaching & learning, considering one’s specific curricular objectives and contents, resources (infrastructure, potential technological equipment, digital applications and other materials), learner group (profile, specificities such as diversity issues, personal interests) and pedagogical approaches; generate and select original ideas for using digital resources for one’s own teaching objectives, through divergent and convergent thinking.

B2. Create, modify and share digital resources
Create, co-create, build on, modify and share digital educational resources by participating in related online communities; correctly apply privacy issues and copyright rules when modifying and sharing digital resources.
# Area C: Digital creative pedagogies

*Use digital technologies to support creative teaching & learning*

<table>
<thead>
<tr>
<th>C1. Build a creative learning environment supported by digital technologies</th>
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<tbody>
<tr>
<td>• Create of a positive climate: establish a non-judgmental and ethical social climate, in which all students are supported and accepted; encourage open communication and trusting relationships; accept new ideas.</td>
</tr>
<tr>
<td>• Promote exploration and invention: make a flexible use of space and time; make time and space for exploration processes where students freely interact, investigate, create, look for and try out solutions; use the classroom as a lab; promote risk-taking opportunities where students try before getting it right; use failure as a positive learning factor; accept ambiguity and uncertainty.</td>
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<tr>
<th>C2. Apply creative teaching strategies mediated by digital technologies</th>
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<tr>
<td>Plan, implement and experiment with digital teaching strategies which may enhance students’ creativity (e.g. inquiry-based learning, project-based learning, design-based learning, game-based learning, modelling-based learning); use multimodal approaches, including physical, digital and hybrid environments; keep record of the classroom activities (e.g. taking pictures, keeping a diary, creating a digital portfolio with students).</td>
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<tr>
<th>C3. Facilitate classroom interactions that foster students’ creativity</th>
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<tr>
<td>• Foster synergistic collaboration: encourage students to define, distribute and complete tasks towards a common objective; allow them for evaluating and negotiating each other’s contributions and solutions through collective decision making; promote students-students, students-teacher and teacher-teacher collaboration.</td>
</tr>
<tr>
<td>• Stimulate expression and dialogue: settle and manage digital teaching &amp; learning environments (e.g., using social media) where all students can freely express their opinions, share their perspectives and exchange resources; manage group processes and effectively communicate to promote and mediate debates.</td>
</tr>
<tr>
<td>• Encourage democratic practices in digital teaching &amp; learning environments: promote students’ fair-minded and equal participation, sense of group responsibility, respect for others and for other perspectives.</td>
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<tr>
<th>C4. Facilitate synergies</th>
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<tr>
<td>• Create authentic learning opportunities by linking curricular concepts to real life situations: connect new knowledge to existing contexts and perspectives.</td>
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<tr>
<td>• Bridge between certain subjects, themes and concepts: create cross-curricular learning opportunities where students can bridge different disciplines and see the relationships between them.</td>
</tr>
<tr>
<td>• Relate different sources of information, media &amp; tools: encourage students to build knowledge based on different perspectives; link and form associations between different sources of digital information.</td>
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# Area D: Creative assessment

*Use digital technologies and strategies to assess and foster students’ creativity*

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<tr>
<th>D1. Actively engage trainees in assessment processes which foster metacognition and critical thinking</th>
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<tr>
<td>Involve students in self-evaluation and peer-evaluation; focus on both the learning process and the outcome, so to encourage students to critically reflect on their learning path, competences, mistakes and progress; use a variety of assessment formats and approaches; use digital technologies to carry out formative and summative assessment (e.g., learning analytics).</td>
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<tr>
<th>D2. Use technologies to evaluate trainees’ creativity</th>
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<tbody>
<tr>
<td>Apply criteria (e.g., fluency, flexibility, originality, elaboration) and tools (e.g., digital rubrics) for evaluating trainees’ little-c (personal) creativity.</td>
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</table>
### Area E: Empowering Learners

*Use digital technologies to enhance inclusion, personalisation and learners’ active engagement.*

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<th>E1. Call for students’ engagement</th>
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<tr>
<td>Select and use digital tools and strategies which call for learners’ interest and motivation, as well as create an inspiring and stimulating learning environment; work from students’ experiences.</td>
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<th>E2. Encourage self-learning</th>
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<tr>
<td>Encourage learners to take an active role in learning, work on their own learning needs, organize tasks, self-regulate and solve problems autonomously through digital and physical fabrication; view them as creators, inventors and tinkerers; promote their sense of initiative and decision making; support them to become active, responsible members of the digital society.</td>
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<th>E3. Personalize the learning process</th>
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<tr>
<td>Use digital technologies and strategies which address students’ specific needs, as well as enable them to learn according to their own level, rhythm, pathway and objectives; transform explicit knowledge into tacit knowledge (i.e., help students to internalize new mindsets through meaningful, active learning experiences).</td>
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<tr>
<th>E4. Promote creativity for all learners</th>
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<tbody>
<tr>
<td>Ensure accessibility to learning resources and activities, for all learners, without regard to gender, physical, intellectual, social, emotional, linguistic, cultural, religious, or other characteristics; consider and respond to learners’ expectations, abilities, physical or cognitive constraints to their use of digital technologies.</td>
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### Area F: Learners’ digital creativity

*Foster students’ digital creative competences*

<table>
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<th>F1. Divergent &amp; convergent thinking</th>
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<tr>
<td>Encourage students to identify and solve real-world problems using creative thinking skills, i.e., generate and apply original ideas and solutions by forming remote associations, conceptual combinations, and approaching problems from different angles; evaluate and select ideas using decision-making strategies, so to produce the best possible answers.</td>
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<tr>
<th>F2. Digital creation &amp; expression</th>
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<tr>
<td>Adopt a “maker culture” which fosters students’ creative expression of ideas, experiences and emotions in a range of media, through the creation of digital or tangible objects; allow for knowledge construction processes and expression based on students building, making, storytelling, prototyping, engineering and sharing objects that are relevant to a larger community.</td>
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<tr>
<th>F3. Information literacy &amp; digital citizenship</th>
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<tr>
<td>Encourage students to articulate information needs, find information and resources in digital environments; organise, process, analyse and interpret information; compare and critically evaluate the credibility and reliability of information and its sources; participate safely, effectively, critically and responsibly in the digital world.</td>
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<th>F4. Creative dispositions</th>
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<tr>
<td>Use digital technologies to promote students’ openness to experience, responsible risk taking, tolerance of ambiguity, learning from failure, and viewing challenges as possibilities for learning.</td>
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<tr>
<th>F5. Computational thinking and design thinking</th>
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<tr>
<td>Stimulate students to solve problems and model systems, as well as understand mindsets and behaviors, by drawing on the concepts fundamental to computer science and design thinking.</td>
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</tbody>
</table>
References


European Commission (2012c) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Rethinking

- European Commission (2013b). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Opening up Education: Innovative teaching and learning for all through new Technologies and Open Educational Resources.
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• Gobierno de España (2008). Real Decreto 1834/2008, de 8 de noviembre, por el que se definen las condiciones de formación para el ejercicio de la docencia en la educación secundaria obligatoria, el bachillerato, la formación profesional y las enseñanzas de régimen especial y se establecen las especialidades de los cuerpos docentes de enseñanza secundaria.

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• United Nations (2018). Building digital competencies to benefit from existing and emerging technologies, with a special focus on gender and youth dimensions.


ANNEX 1 – EXTRACTION OF COMPETENCES FROM THE FRAMEWORKS


1. KC1: Communication in the mother tongue: ability to express and interpret concepts, thoughts, feelings, facts and opinions in both oral and written form and to interact linguistically in an appropriate and creative way;

2. KC2: Communication in foreign languages: involving mediation and intercultural understanding;

3. KC3: Mathematical competence and basic competences in science and technology: ability to develop and apply mathematical thinking in order to solve a range of problems in everyday situations, with the emphasis being placed on process, activity and knowledge;

4. KC4: Digital competence: involves the confident and critical use of information society technology (IST) and thus basic skills in information and communication technology (ICT);

5. KC5: Learning to learn: ability to pursue and organise one's own learning, either individually or in groups, in accordance with one's own needs, and awareness of methods and opportunities;

6. KC6: Social and civic competences: personal, interpersonal and intercultural competence and all forms of behaviour that equip individuals to participate in an effective and constructive way in social and working life (understanding of codes of conduct and customs, civic competence, knowledge of social and political concepts and structures);

7. KC7: Sense of initiative and entrepreneurship: ability to turn ideas into action, involving creativity, innovation and risk-taking, as well as the ability to plan and manage projects in order to achieve objectives;

8. KC8: Cultural awareness and expression: appreciation of the importance of the creative expression of ideas, experiences and emotions in a range of media.


9. Global Awareness;

10. Financial, Economic, Business and Entrepreneurial Literacy;

11. Civic Literacy;

12. Health Literacy;


14. Creativity and Innovation;

15. Critical Thinking and Problem Solving;


17. Information Literacy;

18. Media Literacy;

19. ICT (Information, Communications and Technology) Literacy.

20. Flexibility and Adaptability;

21. Initiative and Self-Direction;

22. Social and Cross-Cultural Skills;

23. Productivity and Accountability;


25. creativity and innovation;
26. critical thinking,
27. problem solving,
28. decision making;
29. learning to learn and metacognition;
30. communication
31. collaboration and teamwork
32. (information literacy
33. information technology
34. communication literacy);
35. life and career
36. personal and social responsibility

D. *International Society for Technology in Education (ISTE, 2007)*
37. Creativity and Innovation;
38. Communication and Collaboration;
39. Research and Information Fluency;
40. Critical Thinking, Problem Solving, and Decision Making;
41. Digital Citizenship;
42. Technology Operations and Concepts

E. *Common European Principles for Teacher Competences and Qualifications, 2010*
43. social inclusion,
44. nurturing the potential of every learner,
45. knowledge of human growth and development,
46. self-confidence when engaging with others,
47. work with learners as individuals,
48. support them to develop into fully participating and active members of society
49. increase the collective intelligence of learners
50. co-operate and collaborate with colleagues to enhance their own learning and teaching.
51. work with a variety of types of knowledge: access, analyse, validate, reflect on and transmit knowledge
52. make effective use of technology where this is appropriate, integrate it effectively into learning and teaching
53. build and manage learning environments
54. make choices over the delivery of education.
55. guide and support learners in the networks in which information can be found and built
56. good understanding of subject knowledge
57. view learning as a lifelong journey
58. match a wide range of teaching and learning strategies to the needs of learners.
59. preparing learners to be globally responsible in their role as EU citizens
60. promote mobility and co-operation in Europe
61. encourage intercultural respect and understanding
62. respecting and being aware of the diversity of learners’ cultures and identifying common values
63. understand the factors that create social cohesion and exclusion in society
64. be aware of the ethical dimensions of the knowledge society
65. work effectively with the local community, and with partners and stakeholders in education – parents, teacher education institutions, and representative groups.
66. contribute to systems of quality assurance.

F. PLA (2010)
67. first order teacher competences (competence in teaching learners)
68. second order teacher competences (competence in teaching about teaching) Knowledge development, research and critical thinking competences;
69. System competences (i.e. managing the complexity of teacher education activities, roles and relationships);
70. Transversal competences (for instance, decision making, initiative taking, entrepreneurship, team work);
71. Leadership competences (inspiring teachers and colleagues; coping with ambiguity and uncertainty);
72. Competences in collaborating, communicating and making connections with other areas

G. Association of Teacher Educators (ATE) 2009
73. Model effective instruction to meet the needs of diverse learners
74. Demonstrate and promote critical thinking and problem solving
75. Revise courses to incorporate current research and/or best practices
76. Model reflective practice to foster student reflection
77. Demonstrate appropriate subject matter content
78. Demonstrate appropriate and accurate professional content in the teaching field
79. Demonstrate a variety of instructional and assessment methods including use of technology
80. Mentor novice teachers and/or teacher educators
81. Facilitate professional development experiences related to effective teaching practices
82. Ground practice in current policy and research related to education and teacher education
83. Exhibit practices that enhance both an understanding of diversity and instruction that meets the needs of society
84. Engage in culturally responsive pedagogy
85. Professionally participate in diverse communities
86. Model ways to reduce prejudice for pre-service and in-service teachers and/or other educational professionals
87. Engage in activities that promote social justice
88. Demonstrate connecting instruction to students’ families, cultures, and communities
89. Model how to identify and design instruction appropriate to students’ stages of development, learning styles, linguistic skills, strengths and needs
90. Foster a positive regard for individual students and their families regardless of differences such as culture, religion, gender, native language, sexual orientation, and varying abilities
91. Demonstrate knowledge of their own culture and aspects common to all cultures and foster such knowledge in others
92. Promote inquiry into cultures and differences
93. Teach a variety of assessment tools that meet the needs of diverse learners
94. Recruit diverse teachers and teacher educators
95. Investigate theoretical and practical problems in teaching, learning, and/or teacher education
96. Pursue new knowledge in relation to teaching, learning, and/or teacher education
97. Connect new knowledge to existing contexts and perspectives
98. Engage in research and development projects
99. Apply research to teaching practice and/or program or curriculum development
100. Conduct program evaluation
101. Acquire research-based and service-based grants
102. Disseminate research findings to the broader teacher education community
103. Engage in action research
104. Systematically assess learning goals and outcomes
105. Systematically reflect on own practice and learning
106. Engage in purposeful professional development focused on professional learning goals
107. Develop and maintain a philosophy of teaching and learning that is continuously reviewed based on a deepening understanding of research and practice
108. Participate in and reflect on learning activities in professional associations and learned societies
109. Apply life experiences to teaching and learning
110. Design, develop, or modify teacher education programs based on theory, research, and best practice
111. Provide leadership in obtaining approval or accreditation for new or modified teacher education programs
112. Lead or actively contribute to the ongoing assessment of teacher education courses or programs
113. Provide leadership that focuses on establishing standards for teacher education programs or on developing, approving, and accrediting teacher education programs at the local, state, national, or international level
114. Contribute to research that focuses on effective teacher education programs
115. Engage in cross-institutional and cross-college partnerships
116. Support teacher education in the P-12 school environment
117. Participate in joint decision making about teacher education
118. Foster cross-disciplinary endeavors
119. Engage in reciprocal relationships in teacher education
120. Initiate collaborative projects that contribute to improved teacher education
121. Acquire financial support for teacher education innovation to support collaboration
122. Promote quality education for all learners through community forums, activities with other professionals, and work with local policy makers
123. Inform and educate those involved in making governmental policies and regulations at local, state, and/or national levels to support and improve teaching and learning
124. Actively address policy issues which affect the education profession
125. Actively participate in professional organizations at the local, state, national, or international level
126. Edit/review manuscripts for publication or presentation for teacher education organizations
127. Review resources designed to advance the profession
128. Develop textbook or multimedia resource for use in teacher education
129. Recruit promising pre-service teachers
130. Recruit future teacher educators
131. Mentor colleagues toward professional excellence
132. Design and/or implement pre-service and induction programs for teachers
133. Support student organizations to advance teacher education
134. Advocate for high quality teacher education standards
135. Actively participate in learning communities that focus on educational change
136. Demonstrate innovation in the field of teacher education
137. Demonstrate qualities of an early adopter of technology and new configurations of learning
138. Actively pursue new knowledge of global issues
139. Support innovation adoption with research
140. Relate new knowledge about global issues to own practice and K-12 classroom teaching

H. Quality requirements for teacher educators Bob Koster, Mieke Brekelmans, Fred Korthagen, Theo Wubbels

141. Being able to discuss one’s professional field with others
142. Being perfectly at home with the content of one’s field
143. Having a vision with regard to the pedagogical side of one’s field
144. Being knowledgeable about the current situation in the field of education
145. Being able to anticipate new developments
146. Being able to evaluate one’s own teaching and make changes accordingly
147. Being able to reflect on the ways one operates and to develop alternatives
148. Being able to communicate with students from different backgrounds
149. Being able to give a good example in one’s interaction with students
150. Having excellent communication skills
151. Being able to manage group processes
152. Being able to clearly articulate one’s own opinion
153. Having an inquiry-oriented attitude Competence areas considered to be necessary
154. Being able to work in a team
155. Being able to interact with school supervisors
156. Being able to strike a balance between work and leisure
157. Being able to further develop a joint vision and implementing it
158. Being able to establish contacts outside the institute
159. Being able to deal efficiently with administration and record-keeping
160. Being able to plan and organize one’s own teaching activities starting from the existing competencies students possess and working towards competencies students should possess in the future
161. Being able to help students in working on their own learning needs
162. Being able to make one’s own pedagogical approach accessible to student teachers
163. Being able to adjust course components to the rest of the curriculum
164. Being able to work from the students’ experiences
165. Being able to give students concrete pointers for their teaching practice
166. Being able to be a model with regard to pedagogical and communicative competencies
167. Being able to develop and use evaluation and (self) evaluation systems for professional competencies
168. Being able to use ICT in one’s own teaching
169. Being able to stimulate learning among teachers in the field

I. *El profesor universitario: sus competencias y formación (más, 2011)*

170. Caracterizar el grupo de aprendizaje
171. Diagnosticar las necesidades
172. Formular los objetivos de acuerdo a las competencias del perfil profesional
173. Seleccionar y secuenciar contenidos disciplinares.
174. Diseñar estrategias metodológicas atendiendo a la diversidad de los alumnos y la especificidad del contexto
175. Seleccionar y diseñar medios y recursos didácticos de acuerdo a la estrategia
176. Elaborar unidades didácticas de contenido
177. Diseñar el plan de evaluación del aprendizaje y los instrumentos necesarios
178. Aplicar estrategias metodológicas multivariadas acorde con los objetivos
179. Utilizar diferentes metodologías en el proceso de enseñanza-aprendizaje
180. Gestionar la interacción didáctica y las relaciones con los alumnos.
181. Establecer las condiciones óptimas y un clima social positivo para el proceso de enseñanza-aprendizaje y la comunicación
182. Utilizar las TIC para la combinación del trabajo presencial y no presencial del alumno
183. Gestionar los recursos e infraestructura aportados por la institución
184. Gestionar entornos virtuales de aprendizaje
185. Planificar acciones de tutorización, considerando los objetivos de la materia y las características de los alumnos, para optimizar el proceso de aprendizaje
186. Crear un clima favorable para mantener una comunicación e interacción positiva con los alumnos
187. Orientar, de forma individual y/o grupal, el proceso de construcción del conocimiento de los estudiantes proveyéndoles de pautas, información, recursos... para favorecer la adquisición de las competencias profesionales
188. Utilizar técnicas de tutorización virtual
189. Aplicar el dispositivo de evaluación de acuerdo al plan evaluativo establecido
190. Verificar el logro de aprendizajes de los alumnos
191. Evaluar los componentes del proceso de enseñanza-aprendizaje
192. Promover y utilizar técnicas e instrumentos de autoevaluación docente
193. Tomar decisiones basándose en la información obtenida
194. Implicarse en los procesos de coevaluación
195. Afrontar los deberes y dilemas éticos de la evaluación
196. Participar con otros profesionales en la concepción y elaboración de nuevos instrumentos, materiales y recursos didácticos para ampliar y/o mejorar las competencias profesionales
197. Mantener relaciones con el entorno socioprofesional de forma sistemática y periódica para su actualización y perfeccionamiento docente.
198. Participar activamente en acciones de innovación orientadas a la optimización del proceso de aprendizaje
199. Aplicar técnicas e instrumentos de autoevaluación docente
200. Autodiagnosticar necesidades de formación para la mejora de la docencia
201. Participar en grupos de trabajo
202. Participar en las comisiones multidisciplinares de docencia
203. Promover y participar en grupos de trabajo respecto a las programaciones de asignaturas pertenecientes al área de conocimiento
204. Participar en la programación de acciones, módulos... formativos
205. Promover la organización y participar desarrollo de jornadas académicas, debates, mesas redondas...
206. Participar en el diseño y desarrollo de los nuevos planes de estudio a partir de las indicaciones, descriptores... aportados por los organismos competentes

J. Dutch standard
207. interpersonal: creates a safe (working) atmosphere;
208. pedagogical: creates for student teachers an inspiring and stimulating learning environment
209. organisational: improvises if necessary;
210. working with colleagues in the organisation: actively contributes towards the development and implementation of the organisation’s outlook and policy;
211. working in a wider context: has a relevant network and keeps it up-to-date;
212. working on your own development: reflects systematically on their own pedagogical approach and (teaching) behaviour towards students, colleagues and others.

213. Data management
214. Organisational communication
215. Professional collaboration
216. Reflective practice
217. Digital Continuous Professional Development (CPD)
218. Selecting digital resources
219. Organising, sharing and publishing digital resources
220. Creating and modifying digital resources
221. Instruction
222. Teacher-learner interaction
223. Learner collaboration
224. Self-directed learning
225. Assessment formats
226. Analysing evidence
227. Feedback and Planning
228. Accessibility and inclusion
229. Differentiation and personalisation
230. Actively engaging learners
231. Information and media literacy
232. Digital communication & collaboration
233. Digital content creation
234. Wellbeing

L. Digital problem solving The ICT Competency Framework for Teachers, Unesco, 2011

235. Understanding ICT in education
236. Curriculum and assessment
237. Pedagogy
238. ICT
239. Organisation and administration
240. Teacher professional learning


241. Navegación, búsqueda y filtrado de información, datos y contenidos digitales
242. Evaluación de información, datos y contenidos digitales
243. Almacenamiento y recuperación de información, datos y contenidos digitales
244. Interacción mediante las tecnologías digitales
245. Compartir información y contenidos digitales
246. Participación ciudadana en línea
247. Colaboración mediante canales digitales
248. Netiqueta
249. Gestión de la identidad digital
250. Desarrollo de contenidos digitales
251. Integración y reelaboración de contenidos digitales
252. Derechos de autor y licencias
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253. Programación
254. Protección de dispositivos
255. Protección de datos personales e identidad digital
256. Protección de la salud
257. Protección del entorno
258. Resolución de problemas técnicos
259. Identificación de necesidades y respuestas tecnológicas
260. Innovación y uso de la tecnología digital de forma creativa
261. Identificación de lagunas en la competencia digital

N. Catalan digital teaching competence framework

262. Ús de les tecnologies digitals com a recursos i estratègies en procesos d'ensenyament i aprenentatge
263. Selecció de recursos digitals per al disseny d'activitats i la planificació didàctica
264. Incorporació de tecnologies digitals en coherència amb el projecte educatiu i les infrastructures del centre
265. Incorporació de la competència digital dels alumnes a les programacions didàctiques
266. Ús de les tecnologies digitals per atendre la diversitat dels alumnes
267. Ús de les tecnologies digitals en el seguiment i l'avaluació dels alumnes
268. Aplicació de metodologies innovadores amb l'ús de tecnologies digitals
269. Coneixement i aplicació de les normes d’ús dels recursos, infrastructures i espais digitals
270. Coneixement i ús del programari d’aplicació general del centre
271. Organització de les tecnologies digitals tenint en compte els diferents ambient s d’aprenentatge
272. Implicació en projectes de centre relacionats amb les tecnologies digitals
273. Comunicació utilitzant tecnologies digitals
274. Participació activa en xarxes educatives en entorns digitals
275. Foment de la construcció col·laborativa de coneixement amb recursos digitals
276. Protecció dels drets fonamentals a la intimitat personal i a la pròpia imatge en l’ús de les tecnologies digitals
277. Ús responsable, segur i saludable de les tecnologies digitals
278. Promoció de l’accés als recursos respectant la propietat intel·lectual
279. Foment de la inclusió digital
280. Foment de la construcció d’una adequada identitat digital
281. Configuració de la pròpia identitat digital professional
282. Pràctica reflexiva sobre l’activitat professional relacionada amb les tecnologies digitals
283. Incorporació d’innovacions docents basades en les tecnologies digitals
284. Participació en recerques educatives relacionades amb les tecnologies digitals
285. Creació i divulgació de continguts i recursos educatius en format digital
286. Participació en comunitats virtuals d’aprenentatge per a l’actualització docent
287. Participació en activitats de formació permanent en l’àmbit de la competencia digital
O. Frossard, Barajas and Trifonova (2017)

288. Provide a safe environment which support risk taking
289. Make time and space for exploration
290. Accept uncertainty
291. Encourage critical reflection on learning processes
292. Call for engagement
293. Develop collaborative ownership
294. Match curricular objectives with student’ specific profiles
295. Promote joint problem solving
296. Ensure democratic participation
297. Promote respect for others and for different perspectives
298. Develop group responsibility
299. Stimulate expression, dialogue and information sharing
300. Facilitate cooperation
301. Support collaborative writing
302. Link curricular concepts to real life situations
303. Bridge knowledge areas
304. Relate different sources of informations, media and tools
305. Develop information literacy