A comparative analysis of international frameworks for Teachers' Digital Competences

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ABSTRACT

With the ubiquity of digital technology in K-12 education, digital competency frameworks for teachers have been published over the past several years that range from local initiatives to international standards. This study aims to understand how teachers' digital competence is envisioned and implemented in an ecosystem of existing frameworks, drawn from the initiatives of governments and organizations. A comprehensive search for information about teacher's digital competence frameworks was conducted, resulting in 20 documents that were analyzed in detail. The frameworks were compared on their (1) underlying rationales, (2) goals and (3) definition of digital competence for educators. The analysis started with the European Framework for the Digital Competence of Educators (DigCompEdu) as a focal point of the analysis and went in search of these frameworks to make a comparison. The findings indicate a large degree of alignment among the frameworks. The study shows that even if the competence areas differ in some way, the standards in the frameworks are closely related. This article aims to make a theoretical contribution to the categorization of teachers' digital competency.

Keywords*: Digital competence; Framework; Teachers; Education; DigCompEdu.*

INTRODUCTION

The 2030 Agenda for Sustainable Development recognizes that the widespread use of Information and Communication Technologies (ICTs) has the potential to accelerate the progress of the digital culture and the development of inclusive Knowledge Societies. Moreover, all predictions indicate that most jobs in the future will require digital abilities (Olivares, Angulo, Prieto, & Torres, 2018).

Living in an ever-evolving state of technological innovation, demands ongoing review of Educators' Digital Competence to be current and maintain relevancy with the incorporation of digital technologies within the educational environment, whether related to performing daily tasks such as scheduling, professional teacher activities, or student learning. Indeed, with the COVID-19 pandemic, educators had to shift suddenly to fully online teaching and learning with many of them lacking adequate preparation and resources and skills in digital pedagogy to make this shift successfully.

The OECD publication on the opportunities created by the digital transformation and the risks it poses for people's well-being points out that the use of digital resources by teachers lacking the appropriate digital skills may, in fact, distract pupils and teachers thereby resulting in a negative impact on learning outcomes (OECD, 2019). Again, teachers are recognized as having a key role in ensuring the appropriate employment of digital technologies. According to the 2nd Survey of Schools (European Commission, 2018), teachers see the lack of appropriate skills and pedagogical models for using ICT in the learning process as important obstacles to implementing digital

technology in their classrooms.

Ally (2019) revealed a variety of elements that are shaping the future of different education systems. These forces place a sense of urgency on education systems by impacting the skills that are required by future teachers to be equipped to provide quality education while also supporting learners and teachers (Figure 1).
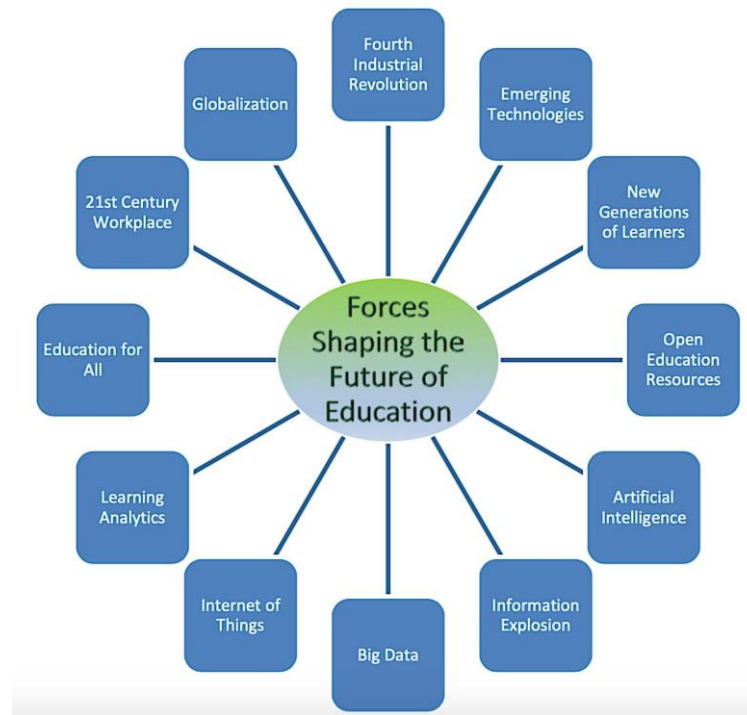

Figure 1: Forces shaping the future of education (Ally, 2019)

One of the most pressing needs, therefore, is to pay particular attention to the professional development of teachers and equip them to efficiently integrate ICTs into their work. To implement meaningful, effective and intentional teacher training, there is the need to define what digital competence is for teachers. The importance of measuring educators' digital competences has gained importance in the last few years in the field of education research (Rodríguez-García et al. 2019). In recent years, several international, European and national frameworks describing the digital competence of teachers have emerged. Various organizations and institutions have also identified different indicators or standards that describe teachers' digital competence (Muñoz-Repiso, Martín, & Gómez-Pablos, 2020).

The current context has given rise to an important number of critical questions regarding the classification of the competencies that teachers must develop across different areas and descriptors: What constitutes an educator who has attained digital competency? How is digital competence for educators defined across different frameworks? To what extent are there similarities and differences across frameworks that purportedly have the same goal? This study aims to address these questions by examining different frameworks that all focus on teachers' digital competence.

TERMINOLOGIES OF TEACHERS' DIGITAL COMPETENCE

Digital literacy or digital competence?

Digital competence and digital literacy are concepts that are increasingly used in public discourse. Buckingham (2015) argued that the term literacy is frequently used in conjunction with lower-status terms to elevate its importance. Hence it could be argued that the term 'computer literacy' elevates 'computer skills' from a vocationally-based understanding to a more universal ability needed by all, reflecting a pursuit for social acceptance of the skill as much as a change in focus.

The European Commission has argued that digital literacy is needed to achieve digital competence suggesting that digital competence encompasses digital literacy (European Parliament and the Council, 2006). Along a similar line, Pettersson (2018) stated that digital competence often refers to the skills and literacies needed for the average citizen to be able to learn in and navigate a digitalized knowledge society.

Spante et al., (2018) highlighted that 'digital competence' is the preferred term in continental Europe and Scandinavia whereas in other global regions, including North America, Australia, UK and Asia, the term "digital literacy" is more widely used. When reviewing the use of "digital literacy" and "digital competence" in higher education research literature, Spante et al., also found that while both terms are used, the term competence has grown since 2010 but that of literacy is still dominant. Therefore, for the purposes of this study, the term "digital competence" will be used throughout.

Understanding Teachers' Digital Competence

Concerned about the gap in digital skills of their children and youth, some countries have come to realize that the development of digital competence during important school-age years is necessary. To fill this gap, there is a need for teachers to be prepared and equipped with a set of specific competencies to realize the potential of digital technologies to transform their teaching and learning (Redecker, 2017). Indeed, teacher digital competence is an inseparable part of the teachers' professional practice. Digital competence is fully integrated into the pedagogical and administrative work of teaching. For example, it is an essential component of planning and carrying out teaching in a digital environment, assessing pupils with the aid of digital tools, communicating and building partnerships with parents and colleagues online (Kelentrić, Helland & Arstorp, 2017).

Teachers' digital competence is widely regarded as a complex competence, composed of a set of abilities, capacities and attitudes that teachers must develop if they are to incorporate digital technologies into their professional practice and development (Lázaro et al., 2019). Along a similar line, researchers (Bourgeois, Birch, & Davydovskaia, 2019) have explained that Teacher Digital Competence extends into all areas of a teacher's work, including teaching and learning, assessment, communicating and collaborating with colleagues and parents, and creating and sharing content and resources.

Likewise, the Department of Education of the Generalitat of Catalonia (2018) defines Teachers' Digital Competence, as a capacity to mobilise and transfer their knowledge, strategies, abilities and attitudes regarding ICT to real situations in their professional practice to:

    a) Facilitate students' learning and the acquisition of their digital competence.
    b) Carry out processes for improving and innovating teaching according to the needs of the digital era.
    c) Contribute to their professional development in accordance to the changes that take place in society and in schools

In this study, "Digital Competences of Teachers" refers to a set of ICT knowledge, abilities and/or skills applied to the teaching profession, that can help teachers to resolve professional and/or pedagogical challenges (Cabero-Almenara & Palacios-Rodríguez, 2020; European Commission, 2018; Ghomi & Redecker 2019).

RESEARCH METHODOLOGY

The need for a systematic response to defining digital competence for teachers has resulted in national frameworks which can be linked to broader professional standards for teachers. We interpret "Teacher Digital Competence framework" as a tool for the development or assessment of digital competence according to a list of criteria. These criteria then establish descriptors of intertwined competencies.

The frameworks that are selected and presented in this paper aim to provide a broad scope of what is currently available regarding how Teacher Digital Competences are interpreted and conceptualized. The case studies presented here have been identified and collected via Google searches for the expressions "Teacher Digital Competence framework" and "Educator Digital Competence framework". The selection criteria were frameworks: 1) created with teachers or educators as their target audience; 2) developed within the last five years; 3) developed by national authorities and governments or international organizations such as UNESCO, EU or the Erasmus program. Academic papers have been excluded. This search concluded a dataset that included over 18 frameworks. From these 18 results. 12 recent frameworks were selected. The remaining models were excluded as they lacked sufficient detail to proceed with analysis.

Our analysis is based on a benchmark of the selected digital competence frameworks. We compared the selected frameworks with The European Framework for the Digital Competence of Educators (DigCompEdu). We selected DigCompEdu based on its methodological approach grounded in two major stages: The in-depth analysis, clustering and mapping of existing frameworks, self-assessment tools, guidelines, conceptual models and instruments used for the development of educators' digital competence; and a series of expert and stakeholder consultations to refine, re-arrange, correct and validate the conceptual model developed in the previous stage (Caena et Redecker, 2019).

DigCompEdu is organized around six main areas that focus on different areas of educators' professional activities (Redecker, 2017) as follows:

- Area 1: Professional Engagement: Using digital technologies for communication, collaboration and professional development.
- Area 2: Digital Resources: Sourcing, creating and sharing digital resources.
- Area 3: Teaching and Learning: Managing and orchestrating the use of digital technologies in teaching and learning.
- Area 4: Assessment: Using digital technologies and strategies to enhance assessment.
- Area 5: Empowering Learners: Using digital technologies to enhance inclusion, personalization and learners' active engagement.
- Area 6: Facilitating Learners' Digital Competence: Enabling learners to use digital technologies creatively and responsibly for information, communication, content creation, wellbeing and problem-solving.
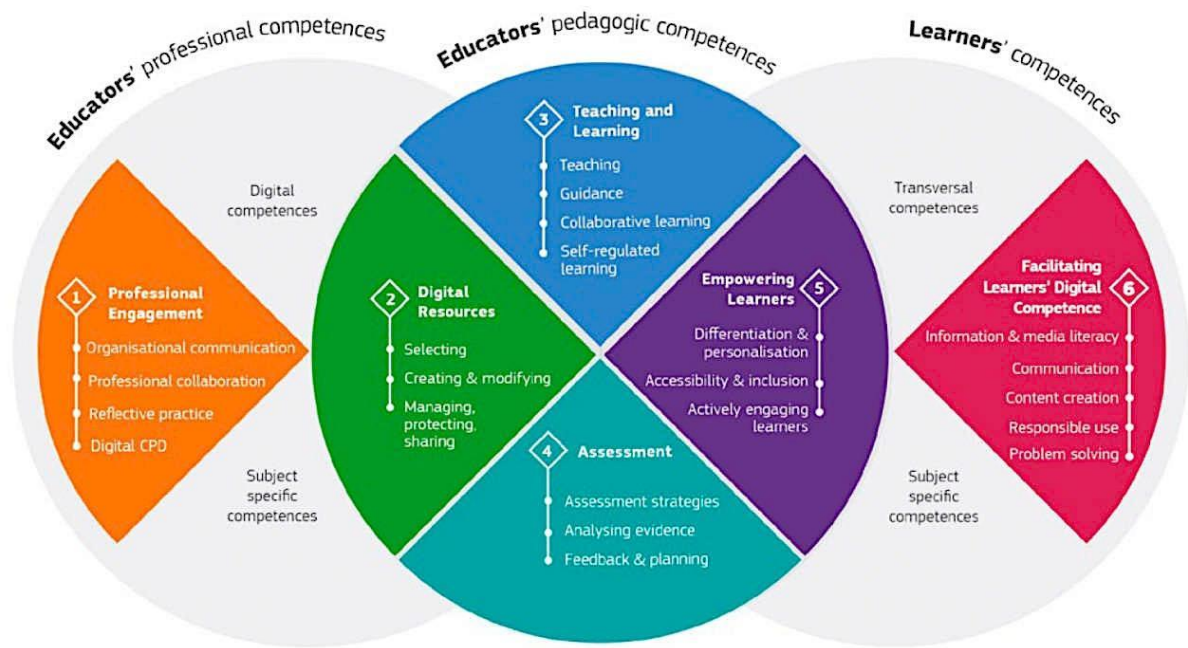
Figure 2: The DigCompEdu framework (Redecker et al., 2017)

DigCompEdu's six main areas cover twenty-two competencies. The DigCompEdu framework foundation is represented by areas 2 to 5, where technologies are integrated into teaching with pedagogical content knowledge.
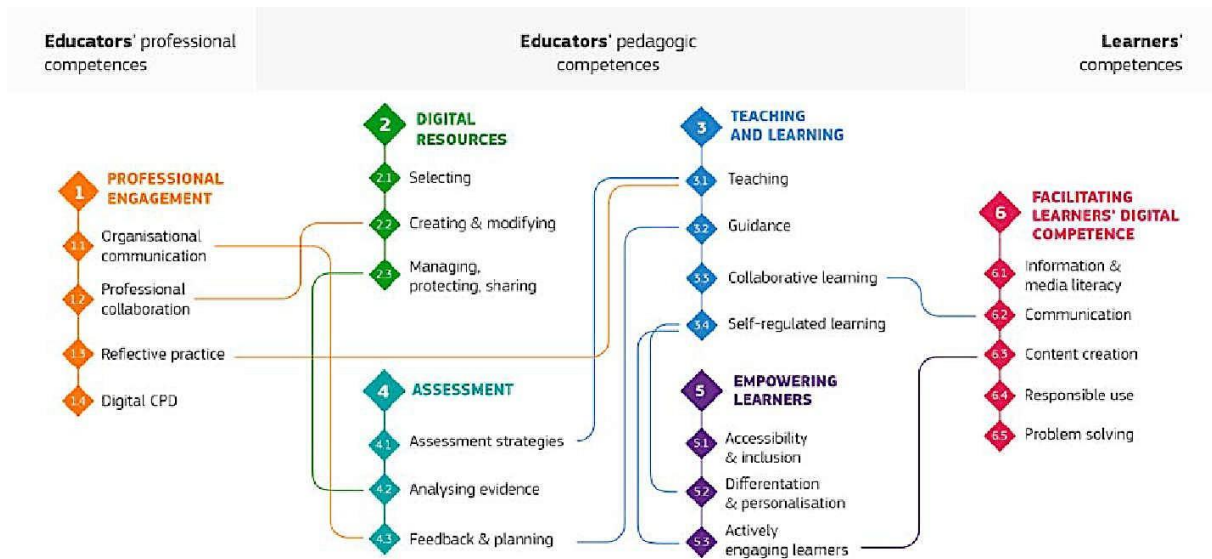

Figure 3: DigCompEdu areas and sub-areas (Redecker et al., 2017)

RESULTS AND DISCUSSION

In this section, we present the selected frameworks, identify similarities, and share additional competencies within the frameworks.

Selected frameworks

The selected frameworks were reported upon by compiling a fact sheet. Analyzing each framework using a table enabled us to provide comprehensive information on several dimensions. A short description of the frameworks is presented in the following table.

Table 1: *Overview of the selected frameworks*

Model Framework	Institution	Areas or dimensions of teachers' digital competence
The Learning Maturity Model for Digital Education Competence EdDico (2021)	The EdDico Consortium – Erasmus+ programme of the European Union	▪ Professional engagement, digital resource ▪ Teaching and learning. ▪ Assessment. ▪ Empowering learners. ▪ Facilitating learners' digital competence ▪ Health.
	https://eddico.eu/wp-content/uploads/sites/24/2021/07/EdDiCo_Output_2_Report_Learning_Maturity_-Model_-Rev2_July2021.pdf	
The Digital Competency Framework (2019)	Digital Action Plan for Education and Higher Education - Québec's Ministry of education and higher education, Quebec	▪ Exercising ethical citizenship in the digital age, developing and mobilizing technological skills. ▪ Harnessing the potential of digital resources for learning, developing and mobilizing information literacy. ▪ Collaborating, communicating, producing, using digital tools to foster inclusion and address diverse needs. ▪ Personal and professional empowerment. ▪ Solving diverse problems. ▪ Developing critical thinking. ▪ Adopting an innovative and creative approach to the use of digital technology.
	http://www.education.gouv.qc.ca/fileadmin/site_web/documents/ministere/Cadre-reference-competence-num-AN.pdf	
Digital competence framework for Ukrainian educators, DigComEduUA (2019)	Kharkiv National University of Radio Electronics and Information Technologies Institute, Ukraine	▪ Digital resources. ▪ Professional development and collaboration. ▪ Educational activities and facilitating learner's digital competence.
	http://fit.univ.kiev.ua/wp-content/uploads/2020/07/DC-profiles-for-teachers-other-citizens-and-social-inclusion-profile.pdf	

Digital Teaching Professional Framework (2018)	Education and Training Foundation (ETF) in collaboration with Joint Information Systems Committee (JISC), United Kingdom	▪ Planning your teaching. ▪ Approaches to teaching. ▪ Supporting learners to develop employability skills. ▪ Subject-specific and industry-specific teaching. ▪ Assessment, accessibility and inclusion, self-development.
	https://www.et-foundation.co.uk/wp-content/uploads/2018/11/181101-RGB-Spreads-ETF-Digital-Teaching-Professional-Framework-Full-v2.pdf	
ICT Competency Framework for Teachers (Third version, 2018)	United Nations Educational, Scientific and Cultural Organization (UNESCO)	▪ Understanding ICT in educational policies. ▪ Curriculum and evaluation. ▪ Pedagogy. ▪ Organization and administration. ▪ Professional development.
	https://unesdoc.unesco.org/ark:/48223/pf0000265721	
Professional Development Framework for Digital Learning (2018)	Department of Basic Education's (DBE) , ministry of education, South Africa	▪ Professional Growth and Knowledge. ▪ Curriculum Focus. ▪ Leadership.
	https://www.education.gov.za/Portals/0/Documents/Publications/Digital%20Learning%20Framework.pdf?ver=2018-07-09-101748-95	
Teachers' digital competence in Catalonia (2018)	Department of Education of the Generalitat of Catalonia	▪ Design, planning and didactic implementation. ▪ Organization and management of school environment and digital resources. ▪ Communication and collaboration. ▪ Digital ethics and citizenship. ▪ Professional development.
	https://repositori.educacio.gencat.cat/bitstream/handle/20.500.12694/229/teachers_digital_competence_in_catalonia_2018.pdf?sequence=2&isAllowed=y	
Common Digital Competence Framework for Teachers (2017)	Institute of National Educational Technologies and Teacher Training (INTEF), Spain	▪ Information and data literacy. ▪ Communication and Collaboration. ▪ Digital content creation. ▪ Safety. ▪ Problem Solving.
	https://aprende.intef.es/sites/default/files/2018-05/2017_1024-Common-Digital-Competence-Framework-For-Teachers.pdf	
Professional Digital Competence Framework for Teachers (2017)	Centre for ICT in Education, Ministry of Education and Research, Norway	▪ Subjects and basic skills. ▪ School in society. ▪ Ethics. ▪ Pedagogy and subject didactics. ▪ Leadership of learning processes. ▪ Interaction and communication. ▪ Change and development.
	https://www.udir.no/contentassets/081d3aef2e4747b096387aba163691e4/pfdk-framework.pdf	

European Framework for the Digital Competence of Educators - DigCompEdu (2017)	European Commission, Joint research center	▪ Professional Engagement. ▪ Digital resources. ▪ Teaching and learning. ▪ Assessment. ▪ Empowering Learners. ▪ Facilitating learners' digital competence.
	https://ec.europa.eu/jrc/en/digcompedu	
The Mentoring Technology Enhanced Pedagogy-MENTEP (2016)	European Computer Driving Licence Foundation	▪ Digital Pedagogy. ▪ Digital Content Use and Production. ▪ Digital Communication and Collaboration. ▪ Digital Citizenship.
	http://mentep.eun.org/tet-sat;jsessionid=D6428526AD6DDD5279B240885FF2BD18	
Digital competence model digi.kompP (2016)	University College of Virtual Teacher Education, Federal Ministry of Education and Women's Affairs, Austria	▪ Digital literacy and education. ▪ Digital living, developing digital materials. ▪ Teaching and learning digitally. ▪ Digitally teaching in the subject. ▪ Digitally managing. ▪ Digital school community. ▪ Digital professional development.
	https://digikomp.at/?id=592	

Similarities and additional competences within the selected frameworks

The following table displays the similarities among areas of competences in the selected frameworks as compared with DigCompEdu.

Table 2: Competences similarities in the selected frameworks

DigCompEdu areas and sub-areas	Similarities in the selected frameworks to DigCompEdu			
Area 1: Professional engagement **1.1 Organisational communication**	The Digital Competency Framework - Quebec **1.1 1.2 1.3 1.4**	Professional Development Framework for Digital Learning - South Africa **1.1 1.2 1.3 1.4**	Digital competence framework for Ukrainian educators - Ukraine **1.1 1.2 1.3 1.4**	Teachers' digital competence in Catalonia **1.2 1.3 1.4**
1.2 Professional collaboration **1.3 Reflective practice** **1.4 Digital continuous**	Common Digital Competence Framework for Teachers - Spain	ICT Competency Framework for Teachers – UNESCO **1.1 1.2 1.4**	Professional Digital Competence Framework for Teachers – Norway **1.2 1.3 1.4**	The Learning Maturity Model for Digital Education Competence **1.1 1.2 1.3 1.4**

professional development	Digital Teaching Professional Framework - UK 1.2 1.3 1.4	The Mentoring Technology Enhanced Pedagogy - EU 1.1 1.2 1.4	The Digital capabilities: the six elements – UK 1.1 1.2 1.3 1.4	Digital competence model - Austria 1.1 1.3 1.4
Area 2: Digital resources **2.1 Sharing and selecting** **2.2 Creating** **2.3 Managing, protecting, sharing**	The Digital Competency Framework - Quebec 2.1 2.2	Professional Development Framework for Digital Learning - South Africa 2.1 2.2 2.3	Digital competence framework for Ukrainian educators - Ukraine 2.1 2.2 2.3	Teachers' digital competence in Catalonia 2.1
	Common Digital Competence Framework for Teachers - Spain 2.2 2.3	ICT Competency Framework for Teachers– UNESCO 2.1 2.2 2.3	Professional Digital Competence Framework for Teachers – Norway 2.1 2.2	The Learning Maturity Model for Digital Education Competence 2.1 2.2 2.3
	Digital Teaching Professional Framework - UK 2.1 2.2 2.3	The Mentoring Technology Enhanced Pedagogy - EU 2.1 2.2 2.3	The Digital capabilities: the six elements – UK 2.1 2.2 2.3	Digital competence model - Austria 2.1 2.2
Area 3: Teaching and learning **3.1 Teaching** **3.2 Guidance** **3.3 Collaborative learning** **3.4 Self-regulated learning**	The Digital Competency Framework - Quebec 3.4	Professional Development Framework for Digital Learning - South Africa 3.1 3.2 3.3	Digital competence framework for Ukrainian educators - Ukraine 3.1 3.2 3.3 3.4	Teachers' digital competence in Catalonia 3.1
	Common Digital Competence Framework for Teachers - Spain 3.1 3.2 3.3 3.4	ICT Competency Framework for Teachers – UNESCO 3.1 3.2 3.3 3.4	Professional Digital Competence Framework for Teachers – Norway 3.1 3.3	The Learning Maturity Model for Digital Education Competence 3.1 3.2 3.3 3.4
	Digital Teaching Professional Framework - UK 3.1	The Mentoring Technology Enhanced Pedagogy - EU	The Digital capabilities: the six elements - UK 3.1	Digital competence model - Austria

	3.2 3.3 3.4	3.1 3.2 3.3 3.4	3.2 3.3 3.4	3.1 3.2
Area 4: **Assessment** **4.1 Assessment strategies** **4.2 Analysing evidence** **4.3 Feedback & planning**	The Digital Competency Framework - Quebec	Professional Development Framework for Digital Learning - South Africa **4.1 4.2**	Digital competence framework for Ukrainian educators - Ukraine **4.1 4.2 4.3**	Teachers' digital competence in Catalonia **4.1 4.2**
	Common Digital Competence Framework for Teachers -Spain **4.1**	ICT Competency Framework for Teachers - UNESCO **4.1 4.2 4.3**	Professional Digital Competence Framework for Teachers – Norway **4.1**	The Learning Maturity Model for Digital Education Competence **4.1 4.2 4.3**
	Digital Teaching Professional Framework – UK **4.1 4.2 4.3**	The Mentoring Technology Enhanced Pedagogy – EU **4.1**	The Digital capabilities: the six elements - UK **4.1 4.2 4.3**	Digital competence model - Austria **4.1 4.2**
Area 5: **Empowering learners** **5.1 Accessibility and inclusion** **5.2 Differentiation and personalisation** **5.3 Actively engaging learners**	The Digital Competency Framework - Quebec **5.1**	Professional Development Framework for Digital Learning - South Africa **5.1 5.2 5.3**	Digital competence framework for Ukrainian educators - Ukraine **5.1 5.2 5.3**	Teachers' digital competence in Catalonia **5.1**
	Common Digital Competence Framework for Teachers - Spain **5.1**	ICT Competency Framework for Teachers – UNESCO **5.1 5.3**	Professional Digital Competence Framework for Teachers – Norway **5.2 5.3**	The Learning Maturity Model for Digital Education Competence **5.1 5.2 5.3**
	Digital Teaching Professional Framework - UK **5.1 5.3**	The Mentoring Technology Enhanced Pedagogy - EU **5.2 5.3**	The Digital capabilities: the six elements - UK	Digital competence model - Austria
Area 6: **Facilitating learners digital competence**	The Digital Competency Framework - Quebec **6.1 6.2 6.3** **6.4 6.5**	Professional Development Framework for Digital Learning - South Africa **6.1 6.2 6.3**	Digital competence framework for Ukrainian educators - Ukraine **6.1 6.2**	Teachers' digital competence in Catalonia **6.1 6.2** **6.3**

6.1 Information and media literacy			6.3 6.4 6.5	
6.2 communication **6.3 Content creation** **6.4 Responsible use** **6.5 Problem solving**	Common Digital Competence Framework for Teachers -Spain 6.1 6.2 6.3 6.4 6.5	ICT Competency Framework for Teachers – UNESCO 6.2 6.5	Professional Digital Competence Framework for Teachers – Norway 6.1 6.2 6.3 6.4 6.5	The Learning Maturity Model for Digital Education Competence 6.1 6.2 6.3 6.4 6.5
	Digital Teaching Professional Framework – UK 6.1 6.2 6.3 6.4 6.5	The Mentoring Technology Enhanced Pedagogy - EU 6.2 6.4	The Digital capabilities: the six elements - UK	Digital competence model - Austria

The analysis reveals that the selected frameworks identify the importance of digital creation, communication, collaboration, engagement and digital identity as important elements for teachers' digital skills development. Most of the sections in the selected frameworks originate from the DigCompEdu (Figure 4).
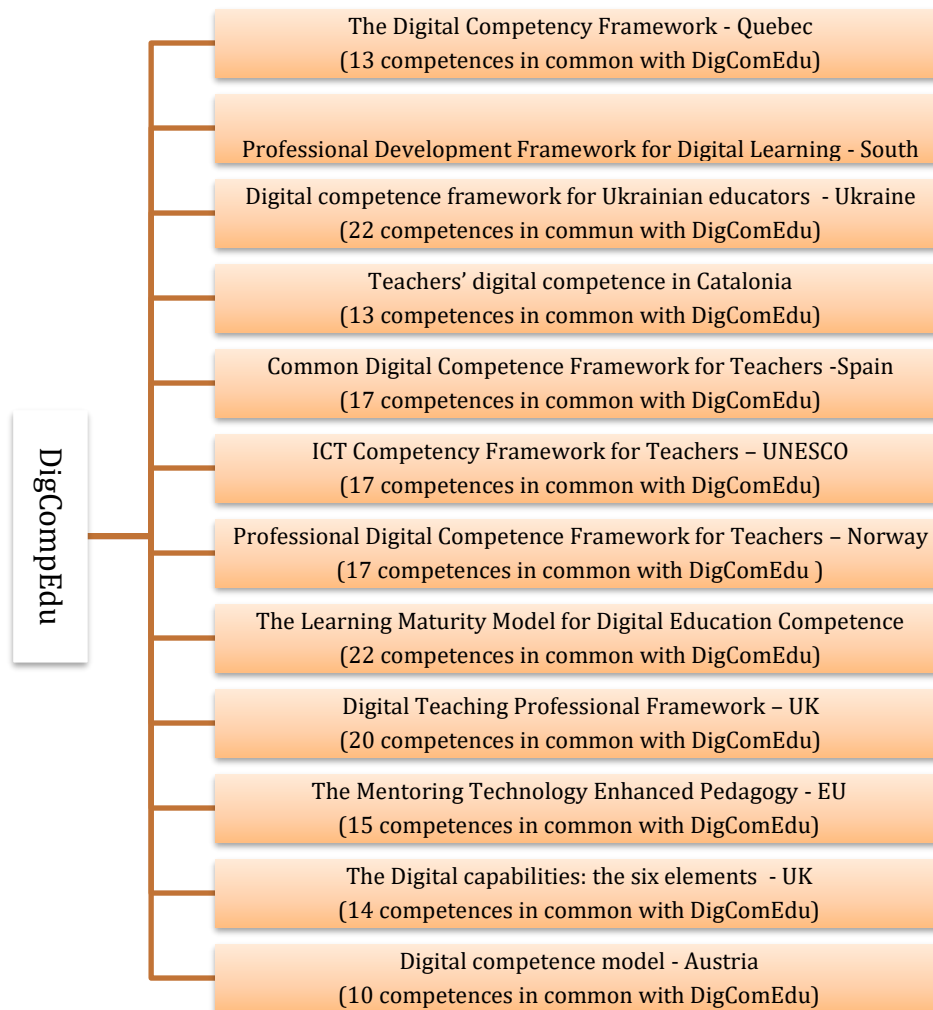
The Digital Competency Framework - Quebec
(13 competences in common with DigComEdu)

Professional Development Framework for Digital Learning - South

Digital competence framework for Ukrainian educators - Ukraine
(22 competences in commun with DigComEdu)

Teachers' digital competence in Catalonia
(13 competences in common with DigComEdu)

Common Digital Competence Framework for Teachers -Spain
(17 competences in common with DigComEdu)

ICT Competency Framework for Teachers – UNESCO
(17 competences in common with DigComEdu)

Professional Digital Competence Framework for Teachers – Norway
(17 competences in common with DigComEdu)

The Learning Maturity Model for Digital Education Competence
(22 competences in common with DigComEdu)

Digital Teaching Professional Framework – UK
(20 competences in common with DigComEdu)

The Mentoring Technology Enhanced Pedagogy - EU
(15 competences in common with DigComEdu)

The Digital capabilities: the six elements - UK
(14 competences in common with DigComEdu)

Digital competence model - Austria
(10 competences in common with DigComEdu)

DigCompEdu

Figure 4: Competences in common with DigCompEdu

For example, the Common Digital Competence Framework for Teachers draws from DigCompEdu framework in its 5 main competencies. Although the general structure is very similar in these two frameworks, DigCompEdu establishes additional variables focused on the digital competence of students' educational organizations.

The Digital Teaching Professional Framework and The Digital capabilities (the six elements) from the United Kingdom, the Digital Competence Framework for Educators of Ukraine (DigCompEduUA), the Professional Development Framework for Digital Learning and the Learning Maturity Model all operationalize DigCompEdu dimensions by decomposing them into its constituent elements.

An analysis of the content of DigCompEdu and Teacher digital competence in Catalonia reveals a clear, sometimes even direct correspondence between the dimensions (called "areas" in the case of DigCompEdu) of each of these frameworks. An analysis of the Digital Competence Framework in Quebec reveals a similar correspondence. This model breaks down digital competence into 12 dimensions, each comprising several elements, most of which are similar to the ones included in DigCompEdu.

In summary, using a well-designed framework such as DigCompEdu as the benchmark clearly demonstrates that it is possible to reconcile stakeholders' diverse purposes while also presenting a vision and pathway toward innovation in 21st-century pedagogies.

Additional competences within the selected frameworks

When comparing the areas and sub-areas of the frameworks to DigCompEdu our analysis reveals additional competencies found in some of the selected frameworks. These additional competences and the corresponding sub-areas from DigCompEdu are outlined in Table 3 below.

Table 3: Additional competences

Additional competencies	
The Learning Maturity Model for Digital Education Competence – EdDico, 2021	
Micro-Credentialisation: To design badges/credentials that contain all the available information to facilitate recognition (of intermediate achievements).	To be added to « **Assessment** » sub-area
Gamification: To use gamification elements such as challenges, competitions, points, badges, and leaderboards to make the learning experience more enjoyable and the learning outcomes more sustainable.	To be added to « **Teaching and learning** » sub-area
Agile Working: To empower learners in an interdisciplinary team to collaboratively develop a rapid prototype that creates value for the user using agile and iterative methods.	To be added to «**Empowering learners** » sub-area
Digital Teaching Professional Framework (2018)	
Managing online learning environments: Managing online learning environments informed by ethical considerations and data management strategy.	To be added to «**Professional engagement**» sub-area
Distance and blended learning: Using digital resources and tools, online learning environments and platforms to ensure students' learning within and beyond the classroom.	To be added to «**Empowering learners** » sub-area
ICT Competency Framework for Teachers, Third version, 2018 - UNESCO	
Understanding ICTs in the educational policies: - To articulate how the classroom practices correspond to and support institutional and/or national policy. - To design, modify and implement classroom practices that support institutional and/or national policies, international commitments and social priorities. - To critique institutional and national education policies alike, suggest revisions, design improvements and speculate on the impact of these changes.	To be added to «**Professional engagement**» sub-area

Teachers' digital competence in Catalonia, 2018	
Organization and management of school environment and digital resources: - To employ digital technologies (devices, applications) and infrastructure available in the school to enhance education. - Organization of the digital technologies taking into account the different learning spaces. - Involvement in school projects related to digital technologies.	To be added to « **Professional engagement**» sub-area
Professional Digital Competence Framework for Teachers, 2017 - Norway	
Algorithmic and computational thinking: - To understand the basic principles of algorithmic thinking, and its relevance to digital technology and digitalization in society. - To engage with computational thinking concepts and processes as part of teachers' digital competence.	To be added to « **Professional engagement**» sub -area
Digital competence model digi.kompP, 2016- Austria	
Digital life: - To describe the interactions between technology and society there by identifying opportunities for sustainable education. - To contribute positively and ethically in the digital world, considering safe and responsible digital practices.	To be added to « **Professional engagement** » sub-area

This finding confirms the robustness of DigCompEdu framework and its strong transnationality. Most of the additional competences we have identified in the selected frameworks are classified under the DigCompEdu sub-areas.

CONCLUSION

In the coming years, advances in digital technologies will continue to influence and transform the processes of teaching and learning. When teachers are equipped with digital competences, their teaching and personal professional learning are enriched.

The selected frameworks in this study are important milestones for understanding and identifying areas of focus for developing teachers' digital competences. We identify a set of competences evident in the selected frameworks when benchmarked to DigCompEdu (indicated by black color font in the table).The additional competences found are represented in the following table in red colored font. These competences are part of what teachers need to develop to improve their teaching practice and for their continuous professional development.

Table 4: *Areas and sub-areas of Teachers' Digital Competences*

Area 1: Educators professional competences	
1. Professional Engagement	▪ Understanding ICTs in the educational policies ▪ Organizational communication ▪ Professional collaboration ▪ Managing online learning environments ▪ Digital technologies and school level infrastructure ▪ Reflective practice ▪ Digital life ▪ Continuous Professional Development ▪ Computational thinking

Area 2: Educators pedagogical competences	
2. Digital resources	▪ Searching and selecting ▪ Creating and modifying ▪ Managing, protecting and sharing
3. Teaching and learning	▪ Guidance Teaching ▪ Collaborative learning ▪ Self-regulated learning ▪ Gamification
4. Assessment	▪ Assessment strategies ▪ Analysing evidence ▪ Feedback and planning ▪ Micro-Credentialisation
5. Empowering Learners	▪ Accessibility and inclusion ▪ Differentiation and personalisation ▪ Actively engaging learners ▪ Agile working ▪ Distance and blended learning
Area 3: Learners' competences	
6. Facilitating learners' digital competence	▪ Information and data literacy ▪ Communication and collaboration ▪ Content creation ▪ Responsible use ▪ Problem solving

Self-reflection tools should accompany digital competency frameworks for teachers to enhance their impact and effectiveness. At this point, the content of the frameworks needs to be translated into indicators that can be used by teachers as part of a set of tools for self-reflection. Teachers' digital skills would also be enhanced by including clear feedback on possible professional development activities.

The limitations of this research are the selection and use of a limited set of frameworks. The literature investigated previously developed frameworks from governments, international organizations and programs and excluded academic research related to this subject. Considering the growing trend of this subject, an appropriate next step would be to explore the possibility of conducting a meta-analysis that would enrich and provide statistical validity to the results.

Finally, it should be noted that competences are evolving from general digital competences to subject-specific and role-specific (for example, competences for school administrators, instructional coaches) which are crucial in supporting the varied roles within the current educational landscape.

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