Enhancing Digital Competence for Educational Engagement: Frameworks, Matrices, and Assessment Tools in Video Conferencing-Mediated Teaching

Soheil H.M.Salha, Maria Antonietta A Impedovo, Md Saifuddin Khalid

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1.0 Introduction

Digital competence is recognized as critical to human intelligence (OECD, 2019) and it has emerged as a crucial concept in discussions due to the digital skills and comprehension essential for persons in the digital era (Van Laar et al., 2017).

This scoping literature review summarises the existing digital competence matrix for teachers, students, and citizens focusing on higher educational contexts and the effective, efficient, and satisfactory use of video conferencing systems for educational activities and practices. Existing literature reviews are on digital literacy and competence matrix for citizens or non-higher education level. The contexts and purposes of digital competence requirements for teachers and students, particularly in higher education, are different from the digital literacy dimensions of citizens, despite some overlaps. For developing training and workshops for higher education teachers and students, defining the learning outcomes should build on a competence matrix for the quality use of video conferencing systems. So, as part of the Erasmus+ KA2 project "Portable Video Conferencing Toolkits and Online Applications for Engaging Learning Experience Design in Higher Education Classroom (EdViCon)", this paper synthesises the digital competence frameworks in the recent peer-reviewed articles and other documents.

1.1 Definition of Digital Competence

There are numerous definitions of digital competence and perceived differently according to professions and roles. The term competence shares the thematic concept with other terms, which are, for example, knowledge, skills, attitudes, aptitude, and capability.

> The set of knowledge, skills and attitudes (abilities, strategies, values) are required when using ICT and digital media to perform tasks, solve problems, communicate, manage information, collaborate, create and share content and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically and reflectively for work, leisure, participation, learning, socialising, consuming and empowerment (Ferrari, 2012, p.30)

> Digital competency involves more than knowing how to use devices and applications, which is intricately connected with skills to communicate with ICT, as well as information skills. Sensible and healthy use of ICT requires particular knowledge and attitudes regarding legal and ethical aspects, privacy and security, as well as understanding the role of ICT in society and a balanced attitude towards technology (Janssen et al. 2013, p. 480).

> Digital literacy is the set of knowledge, skills, attitudes, and values that enable children to confidently and autonomously play, learn, socialise, prepare for work and participate in civic action in digital environments. Children should be able to use and understand technology, search for and manage information, communicate, collaborate, create and share content, build knowledge and solve problems safely, critically and ethically, in a way that is appropriate for their age, local language and local culture (Nascimbeni, & Vosloo, 2019).

It is worth noting that digital competence is related to all these types of literacy, often used as a synonym for digital literacy (Mattar et al., 2022)

The authors believe that due to different contexts, participants, and learning environments, digital competence in VC integration may consider competence, skill and literacy, online and hybrid and teachers and students, as main components.

The creation of a digital competence matrix will be based on a limited systematic review of related work and to contextualise and localise the targeted competence matrix to meet the VC needs of each partner.

2.0 Related Empirical Work on Competence Assessment

Yelubay et al. (2020) indicated that digital competence (DC) is one of the European Union's eight key competences for lifelong learning. Tretinjak and Anđelić (2016) concluded that there are five digital competence areas, including information, communication, security, problem solving, and content creation. All teachers should become familiar with them in order to make learning and teaching effective based on 6 areas of Digital Competence of Educators (DigCompEdu Framework) (Redecker and Punie, 2017)

Muammar et al. (2023) adopted the DigCompEdu Framework to investigate the level of digital competences of educators in universities in UAE. In their findings, the majority of faculties are digitally competent in all the 6 areas pertaining to professional engagement, digital resources, teaching and learning, assessment, learner empowerment, and learner facilitation which help to reflect the extent to which they interact with and use technology in different perspectives of teaching.

Pedaste et al. (2023) developed an instrument for assessing Digital Competence for Learning (DCL) and psychometrically validating a DCL assessment test in primary and lower secondary schools contributing to ongoing discussions about the dimensionality of digital competence (DC) and introducing ideas about reframing the dimensions of DC. They stated that DC is needed for carrying out effective learning (meaning: DCL) and noted DCL as a specialised competence has not been widely studied and therefore rely on DC in the development of the concept and assessment instrument for DCL.

There are 3 challenges that are highlighted in literature:

1. Self-assessment based on Likert- type Scales
   - students' self-reported levels of competence were not in line with their actual performance (Siddique et al. 2016).
   - educational context, confidence in one's digital abilities is only partially associated with students' actual performance of digital tasks (Porat et al., 2018)
   - trustworthiness of self-reports in information and communication technology (ICT) skills measurement that people with higher ICT skills are more likely to overreport having these skills but decreasing in age (Palczy´ nska & Rynko, 2021)

Jin et al. (2020) suggested that performance-based digital skills assessment would more likely provide accurate data since competences develop mostly through real-life experiences,
Siddiq et al. (2016) and Reichert et al. (2020) concluded that the best way for assessing them could be with the help of assignments drawn from real-life situations

2. Assessment of DC or DC on group of people older than 16 students leaving out primary and lower secondary school students
3. Focus on the assessment of only skills or abilities; whether the concept of DC or DCL is unidimensional or comprising several dimensions; very specific context.

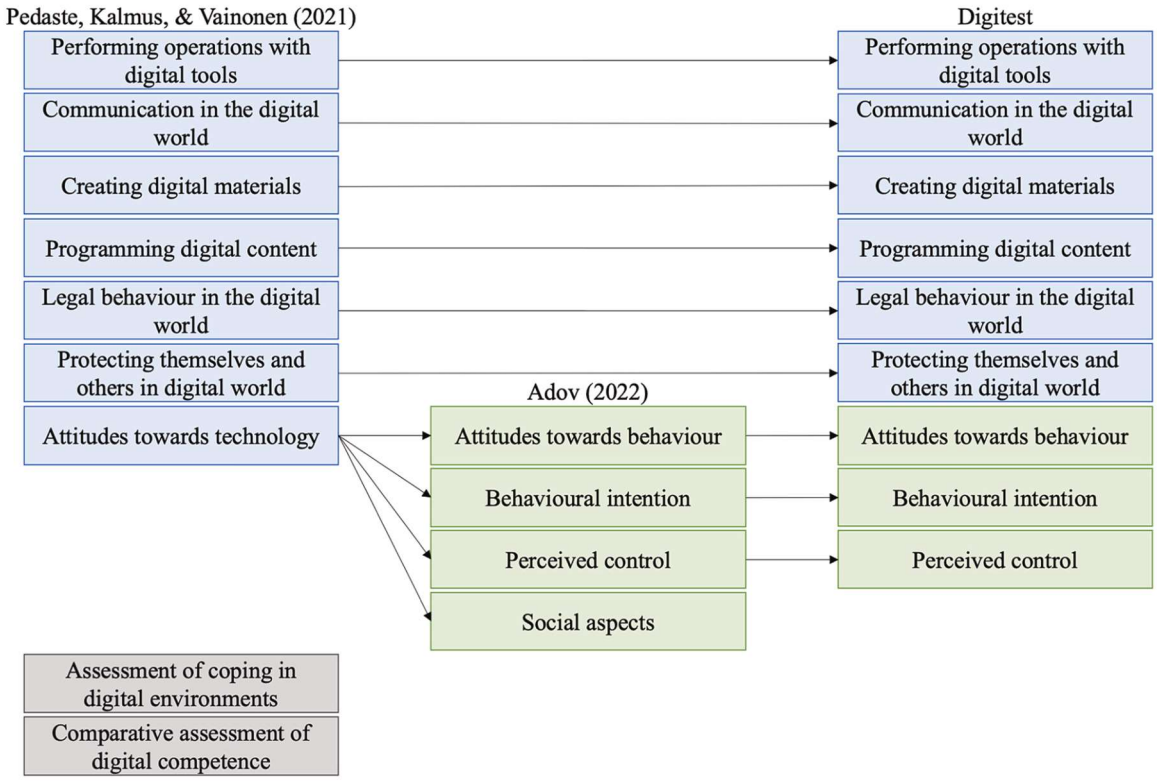

Figure 1: The Pedaste, Kalmus and Vainonen

Compilation of the dimensions of the Digitest (blue boxes indicate the Digitest dimensions originating from the study by Pedaste et al. (2021); green boxes refer to those originating from Adov (2022); and grey ones refer to dimensions that were not included in the current study).

Findings: This digital competence for learning assessment test (Digitest) was carried out with 836 third to ninth grade students from Estonian schools. IRT analysis and confirmatory factor analysis were conducted to establish the potential of the test to measure digital competence for learning and discover which latent variables can be differentiated with it. The results showed that nine dimensions describing attitudes, skills and behaviours can be distinguished with the Digitest and that the test items have good fit to assess digital competence for learning. However, the study also revealed that two higher-order dimensions of digital competence for learning could be identified: motivational and cognitive-behavioural. Thus, empirical data collected with the Digitest is initiating discussions for assessing students' digital competence in a holistic way but also more general discussions on the concept of competence. This can help educators put greater emphasis on areas where students need further improvement.

Li (2016) classified digital competence into four levels: beginner, intermediate, higher, and advanced, and specifies the ability level of each level in detail. Among them, learners at a higher ability stage can re-screen and integrate the fragmented information presented by various media to form new content, and comprehensively use multiple digital tools to carry out research-based learning and form conclusions. Learners in the advanced ability stage can develop digital tools to improve learning and research efficiency and apply critical thinking to identify problems in cognitive, communication, collaborative learning, research, and other learning activities.

To summarise…

The majority of frameworks focus on skill development and the proficiency in using specific tools or applications. However, as highlighted in the above definition, skills constitute just one aspect of Digital Competence. There are various learning domains encompassed within Digital Competence, and proficiency in utilizing tools or applications is merely one facet among several that users must cultivate to effectively navigate a digital environment (Ferrari, 2012).

Newman (2008) also suggests viewing digital literacy through the lens of critical thinking skills within the context of technology usage. Under this perspective, digital literacy entails both technical proficiency and critical thinking abilities. In the diagram provided by Newman (2008) (see Fig. XXX), critical thinking skills are depicted as an integral component of information literacy. Newman emphasises that the emphasis lies more on critical thinking rather than solely on technical proficiency, and indeed, in some instances, "information literacy" is used interchangeably with "digital literacy" within the context of an information literacy review.

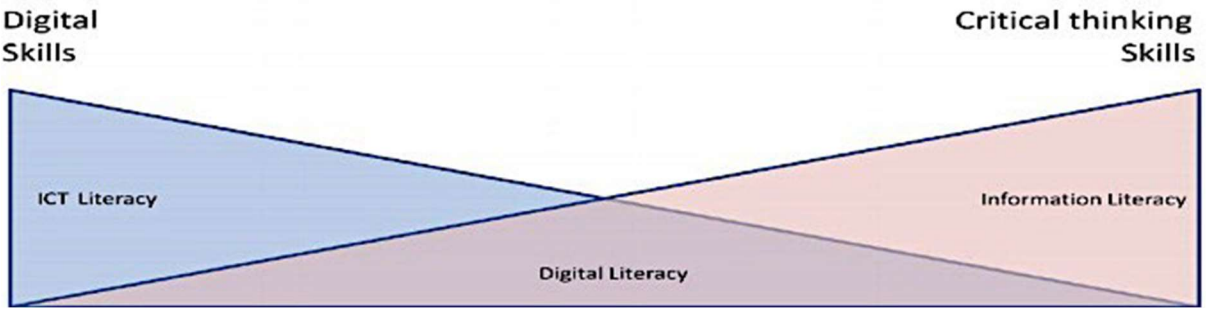

Figure 2. A review of digital literacy in 0 – 16 year olds: evidence, developmental models, and recommendations. Newman T. (2008).

3.0 Methods

The search conducted during week two of January 2024, the keyword "digital competence framework", for peer-reviewed papers, websites and book chapters published during 2018-2023 returned 14 items from IEEE Explore.

1. UNESCO ICT in Education Curriculum for Schools and Programme of Teacher Development
2. The digital competence framework for primary and secondary schools in Europe.
3. Quebec Digital Competency Framework.
4. French framework of digital competences
5. European Framework for Digitally-Competent Educational Organizations
6. The Digital Competence Framework.
7. Competency Framework for the University Bachelor of Technology.
8. The teacher digital competency (TDC) framework
9. The HeDiCom framework: Higher Education teachers' digital competencies for the future
10. Indonesian National Digital Literacy Framework
11. Self-reflection tool Higher Education SELFIE for TEACHERS
12. European Framework for the Digital Competence of Educators
13. The DC4LT Assessment Framework (Perifanou, 2022)

The approach of this report (research) is based on literature review. In our work, we follow the methodologies adopted by Perifanou (2021) for the development of the “Digital Competence Assessment Framework and Tool for Language Teachers” inside the project: Digital Competences for Language Teachers (DC4LT https://www.dc4lt.eu/).

The steps followed are:

- the results of the literature review with the aim to explore and identify assessment frameworks and tools available to assess teachers and students’ digital competence with emphasis on videoconferences systems.
- The literature review is connected to the other phases of the general research that we have run in the context of the EDVICON project, which envisages creating a theoretical framework and useful tools that are needed in order to support teachers and students

The main aims of the analysis of the Framework will be first to identify the key digital skills needed to be acquired by teachers and students in situation of videoconference.

4.0 Analysis and Synthesis of Existing Competence Matrix for Educational Contexts

The various digital competence frameworks for the teachers, students, and other educational roles and contexts are identified and reviewed in this section. At the end of the section, selecting various elements and concepts from the reviewed frameworks, for the context and efficient and effective use of video-conferencing systems during live online and hybrid teaching scenarios, a framework is proposed.

4.1 UNESCO ICT in Education Curriculum for Schools and Programme of Teacher Development: Nine ICT Literacy Units

The UNESCO publication titled "Information and Communication Technology in Education: A Curriculum for Schools and Programme of Teacher Development" (2002) is part of a series of related publications released in 2002 by the Division of Higher Education. This publication represents UNESCO's effort to support Member States in effectively incorporating new technologies, such as multimedia, e-learning, and distance education delivery, into their educational systems. The primary objectives of the book are twofold. Firstly, it aims to outline an ICT curriculum for secondary schools that aligns with current international trends. Secondly, it seeks to propose a teacher professional development program essential for the successful implementation of the specified ICT curriculum. The document includes a description and rationale for nine ICT Literacy units in a programme of teacher professional development (p. 46)

Unit	Description
A1 Basic Concepts of ICT	• to identify and understand the functions of the main components and of various peripherals of a typical information and/or communication system. • to understand the main functions of the systems software environment in relation to the main generic applications software.
A2 Using the Computer and Managing Files	• to use the main functions of the systems software environment and to utilize its features in relation to the main applications software being used.
A3 Word Processing	• to use a word processor skilfully and intelligently to produce various readable and structured documents.
A4 Working with a Spreadsheet	• to understand and make use of a prepared spreadsheet.
A5 Working with a Database	• to understand and make use of a prepared database.
A6 Composing Documents and Presentations	• to make and use graphical (re)presentations.
A7 Information and Communication	• to understand and be able to communicate with computers online, with sources of information, as well as with other people.
A8 Social and Ethical Issues	• to understand the social, economic and ethical issues associated with the use of ICT. to explain the current situation and trends in computing against the background of past developments.
A9 Jobs and/with ICT	• to be aware of the nature of change of jobs in one's own discipline and in the teacher profession itself, to be aware of the way ICT plays a role in these different jobs.

Figure 3: UNESCO Literacy Units

4.2 The digital competence framework for primary and secondary schools in Europe

The digital competence framework for primary and secondary schools in Europe (Guitert et al., 2020) includes five competence categories.

Competence 1: Digital citizenship

SC 1.1 Managing digital identity, health and well-being

SC 1.2 Protecting data and digital systems and becoming digitally ethical

SC 1.3 Engaging in citizenship using digital technologies
Competence 2.Communication and Collaboration
SC 2.1 Interacting and sharing through digital technologies
SC 2.2 Collaborating through digital technologies
Competence 3. Information seeking and management
SC 3.1 Planning, searching and selecting data, information and digital content
SC 3.2 Managing data, information and digital content
Competence 4.Digital content creation
SC 4.1 Developing digital content
SC 4.2 Developing creativity using digital technologies
Competence 5.Digital technology
SC 5.1 Applying digital solutions to identified needs
SC 5.2 Solving technical problems
SC 5.3 Configuring and programming

4.3 Quebec Digital Competency Framework

Quebec Digital Competency Framework (Quebec Ministry of Education and Higher Education, 2019) aims to foster the development of digital competency throughout the educational community so that Quebecers may be autonomous and exercise critical judgement in their use of digital technologies. The framework sets out the key dimensions of learning and personal development for learners as well as teachers and non-teaching professionals. The framework is constructed around 12 dimensions listed below:

1. exercising ethical citizenship in the digital age;
2. developing ethical citizenship in the digital age;
3. developing and mobilizing technological skills;
4. harnessing the potential of digital resources for learning;
5. developing and mobilizing information literacy;
6. collaborating via digital technology;
7. communicating via digital technology;
8. producing content via digital technology;
9. using digital tools to foster inclusion and address diverse needs;
10. mobilizing digital technology for personal and professional empowerment;
11. solving diverse problems via digital technology; developing critical thinking with regard to the use of digital technology;
12. adopting an innovative and creative approach to the use of digital technology.

4.4 French framework of digital competences

The progressive model organised in several factors are taken into account simultaneously:
the student's degree of familiarization with the proposed situation (simple, common, new)
the complexity of practices with digital tools (elementary, complex)
the degree of autonomy (with help, alone, shared with others)
the complexity of the procedures (application, development) and the goals to be achieved

the knowledge necessary for their implementation
https://eduscol.education.fr/document/20398/download

4.5 European Framework for Digitally-Competent Educational Organizations

The European Framework for Digitally-Competent Educational Organisations (DigCompOrg) is developed to facilitate transparency and comparability between related initiatives throughout Europe and play a role in addressing fragmentation and uneven development across the Member States (Kampylis, Punie, & Devine, 2015). The primary purposes of DigCompOrg framework are (i) to encourage self-reflection and self-assessment within educational organisations as they progressively deepen their engagement with digital learning and pedagogies (ii) to enable policymakers to design, implement and evaluate policy interventions for the integration and effective use of digital learning technologies.

The DigCompOrg framework consists of seven main elements and 15 sub-elements that apply universally across various education sectors. Additionally, there is flexibility to incorporate elements and sub-elements specific to particular sectors. Each element and sub-element in DigCompOrg is accompanied by a set of descriptors, totaling 74. Visually, the framework represents these elements, sub-elements, and descriptors as segments of a circle, highlighting their interconnected and interdependent nature.

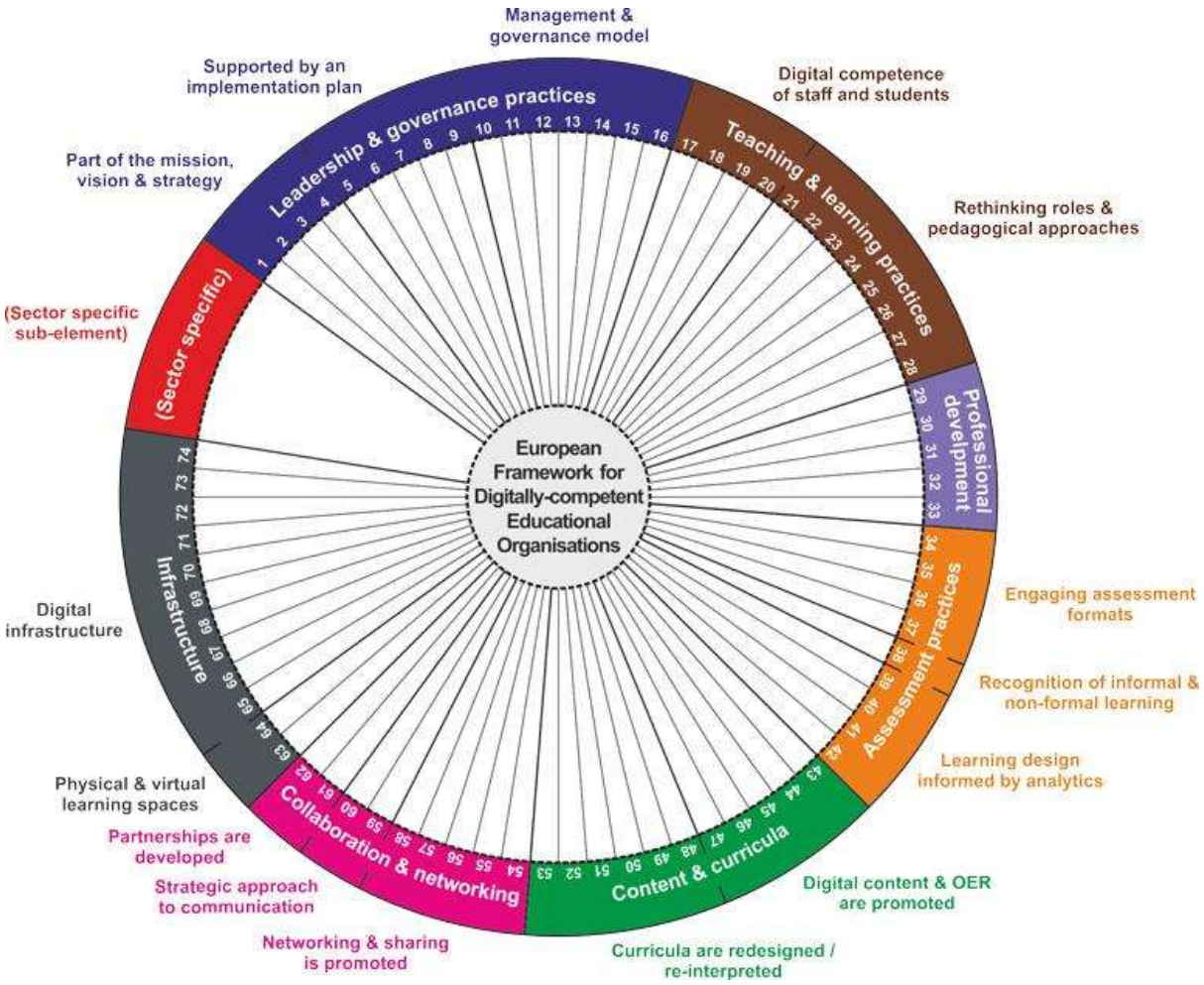

Figure 4: DigCompOrg Framework[1]

4.6 The Digital Competence Framework

Janssen et al.'s (2013) Delphi study provides insights into the digital competence framework. Their survey of 95 experts including representatives from academic, education and training, government and policy and IT business sectors, revealed twelve elements considered essential to broadly-based digital competence. An explanation of Janssen et al.'s (2013) areas of digital competence is shown in the Table below (Falloon, 2020).

[1] DigCompOrg Framework, https://joint-research-centre.ec.europa.eu/european-framework-digitally-competent-educational-organisations-digcomporg/digcomporg-framework_en

Competency	Knowledge and understanding of
Functional	terminology, use of digital technologies for basic purposes
Integrative	effective integration of digital technologies into everyday life
Specialised	optimising digital technology use for work and creative purposes
Communication and collaboration	digitally-supported networking for collaborative knowledge development
Information management	using digital technologies to access, organise, analyse and judge the relevance and accuracy of digital informatio
Privacy and security	measures to protect one's personal identity, data, and security
Legal and ethical	socially appropriate behaviours in digital environments, including legal and ethical factors associated with the use of digital technologies and content
Technology and society	the context and use of digital technologies, and the impacts of these on people and society
Learning with and about technology	emerging digital technologies, and how they can be used to support learning across the lifespan
Informed decision making	critical selection of digital technologies suited to needs and purpose
Coherence/self-efficacy	using digital technologies to improve personal and professional performance
Dispositional	the importance of maintaining an objective and balanced perspective on digital innovations, and being confident to explore and exploit their potential as opportunities arise

Table 1: An explanation of Jansses et al.'s' (2013) areas of digital competence

4.7 Competency Framework for the University Bachelor of Technology

Georges and Poumay (2020) drafting the competency framework for the University Bachelor of Technology in French and Belgium. To develop a competency framework that guides the training program and directs its implementation, it is necessary to specify five elements for each competency. Here are the five steps for drafting the framework:

1. Define the competencies, the know-how to be developed by students throughout the program.
2. Define the essential components of action that reflect the complexity of the competency, provide information about its quality, and facilitate its evaluation.
3. Define the families of situations (often types of professional contexts) that illustrate the scope of the competency.
4. Define the levels of competency development targeted at the end of specific learning periods (maximum three levels for a University Bachelor of Technology).
5. Define the critical learnings to master in order to achieve a specific level of competency development.

Two additional elements will be present in the program, even if they are not part of the competency framework itself. They aid in drafting the framework and are generally addressed during its construction:

6. Define the Learning and Assessment Situations (LAS) in which students will immerse themselves to develop and assess the targeted competencies.

7. Define some of the resources (knowledge, skills, professional attitudes) that will be useful for the development of the competency.

4.8 The teacher digital competency (TDC) framework

In Falloon's (2020) article, a conceptual framework is introduced that redefines teacher digital competence (TDC), advocating for a comprehensive understanding beyond technical and literacies perspectives. The article explores the interdisciplinary nature of the framework and emphasizes the imperative for faculty engagement to effectively address the evolving knowledge and skills essential for young individuals to navigate diverse digital environments ethically and productively.

Falloon (2020) argued regarding the application of the framework, that, to ideally foster digital competence in teacher education programs, all faculty members need to be actively involved, adopting an interdisciplinary approach rather than relying on the expertise of just a few educators. The successful implementation of this approach necessitates the collective participation of all teaching faculty, ensuring a consistent understanding of the competencies across disciplines. A unified, coordinated foundation for delivering the framework's goals can be achieved through a shift from the prevalent discipline-based models to a more collaborative and interdisciplinary approach, as advocated by Habowski and Mouza (2014).

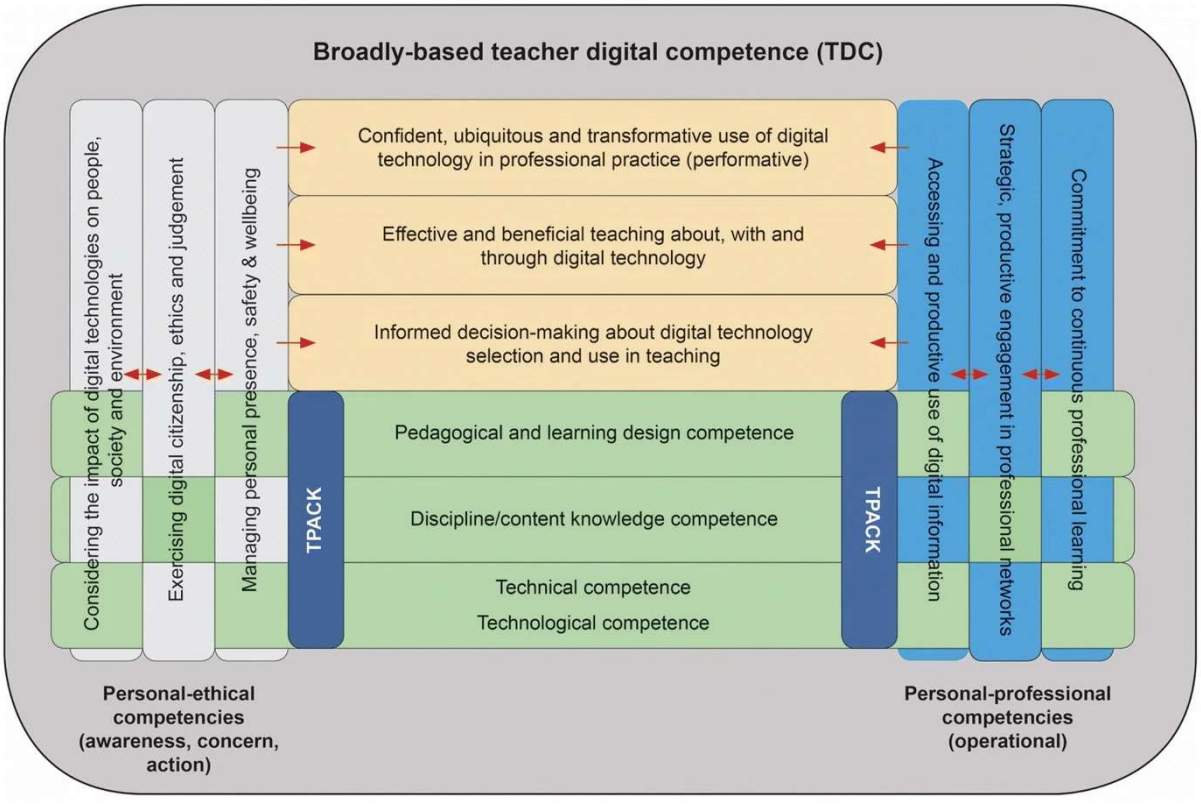

Figure 5. The teacher digital competence (TDC) framework (Falloon, 2020)

4.9. The HeDiCom framework: Higher Education teachers' digital competencies for the future

Tondeur et al. (2023) developed the HeDiCom framework. There is little consensus about the nature of teachers' digital competencies in higher education. Moreover, existing digital competence frameworks have largely been developed for teachers in secondary education. In response to this, the current study focuses on developing and validating a framework of digital competencies for teachers in higher education.

First, a review was conducted to determine the state of digital competence research regarding dimensions and the definition of digital competence. In the next step, similarities and differences between existing digital competence frameworks were identified. Based on the outcomes of the review and the framework comparison, a framework was developed in an iterative process through expert meetings with policymakers, experts in the field of educational technology, and validated with practitioners.

The new framework includes four dimensions of teachers' digital competencies: (1) Teaching practice, (2) Empowering students for a digital society, (3) Teachers' digital literacy, and (4) Teachers' professional development. The resulting Higher Education Digital Competence (HeDiCom) framework will provide guidance and clearer expectations for teachers' digital competency. Ultimately, improving teachers' digital competencies will contribute to enhancing the quality of students' digital competencies.

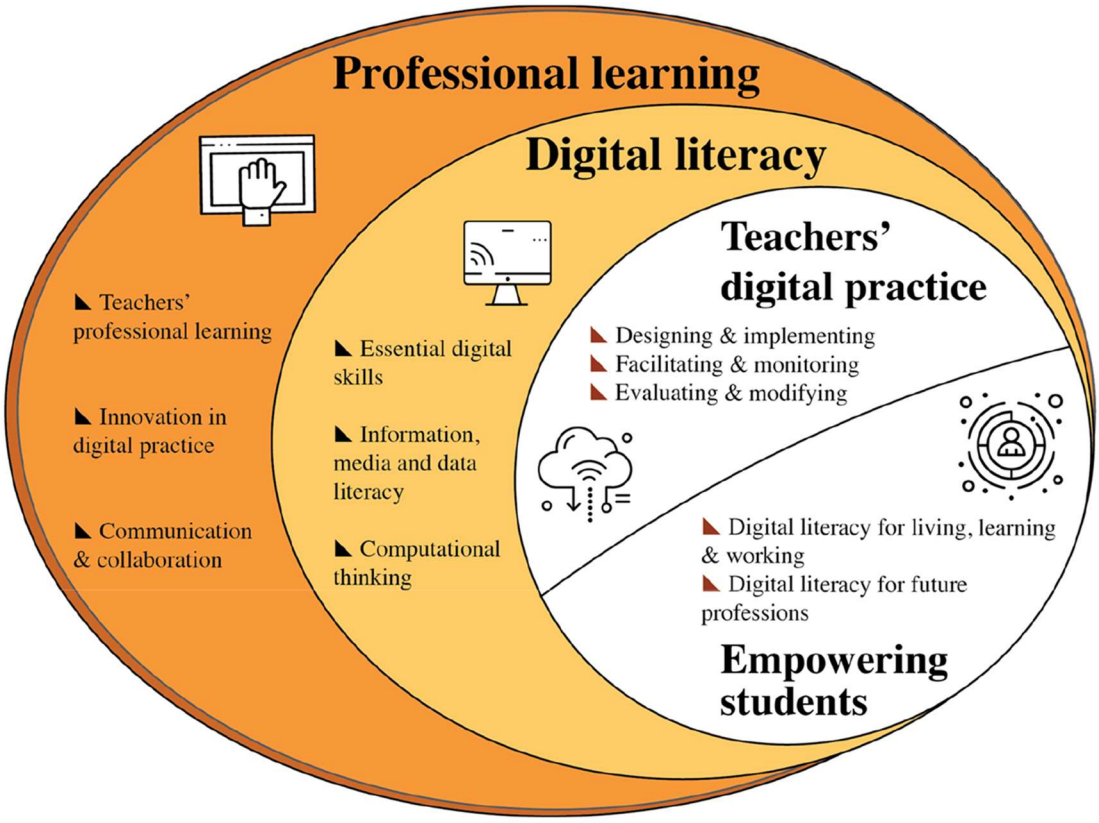

Fig. 6 The HeDiCom framework (Tondeur et al., 2023)

Competencies for the dimension of teachers' digital practice

Designing and implementing: The teacher is able to...
Design digital learning that is consistent with conceptions of teaching, the discipline, and the institutional vision of education.
Design digital learning that responds to students' individual needs and supports student ownership.
Support, combine, and coordinate the learning process in a variety of contexts (e.g., face-to-face, online, and in the workplace).
Take the well-being of students and inclusion into account in digital learning design.
Select, modify, organize, and create digital resources and learning materials.

Facilitating and monitoring: The teacher is able to...
Use ICT to monitor and support students' learning processes using formative and summative assessment.
Use ICT to collect, analyze, and report on student data to understand and improve their learning processes.
Use ICT to provide timely and personalized supervision and support.

Evaluating and modifying: The teacher is able to...
Evaluate and optimize digital learning designs.
Reflect on the benefits of implementing digital learning and redesign accordingly.
Reflect on their digital teaching practice and adapt it to individual, institutional, and societal needs.

4.10 Indonesian National Digital Literacy Framework

The framework is part of a national movement 'SiBerkreasi'[2](Bahasa, 2021) to overcome the threat of the biggest potential dangers faced by Indonesia, namely the spread of negative content through the internet such as hoaxes, cyberbullying and online radicalism. In raising awareness in the Indonesian community of the need for digital skills, the resource presents the national digital education program and curriculum.

The framework is presented in Bahasa Indonesia and English. It encompasses the Indonesian Ministry of Communication and Informatics' launch of the National Digital Literacy Program, including curriculum and education. The site raises awareness of the essential nature of digital skills for the community and for education.

Through tools such as videos and podcasts, the site presents the Indonesian government's national digital education programme and curriculum. In raising awareness of the need for digital skills, through tools such as videos and podcasts, the site presents the national digital education programme and curriculum. For example, the videos explain what

[2] https://www.siberkreasi.id/

digital literacy is, why it is important and outline curricula and education for digital literacy as they relate across society. 'Indonesia is Getting More Digitally Capable- Launching a National Digital Literacy Programme' is the Ministry of Communications and Informatics' Roadmap for digital literacy 2021-24 which comprises four frameworks for: Digital Skills; Digital Safety; Digital Ethics and Digital Culture. These comprise new modules and curricula.

4.11 Self-reflection tool Higher Education SELFIEforTEACHERS

This self-reflection tool is based on the European Framework for the Digital Competence of Educators (DigCompEdu, JRC 2017). This model comprises 22 competences organised in six areas. The competences are described in 6 different levels of skills: A1, A2, B1, B2, C1, C2. In addition, it has included a seventh area - Open Education. It is based on the OpenEdu Framework (JRC 2016, 2019), of which 3 dimensions have been addressed: Open Educational Resources (OER), Open Educational Practices (OEP) and Open Science. These frameworks support and motivate lecturers and researchers to use digital tools in order to improve their teaching and foster innovation in education. In total there are 25 self-reflection statements. The complexity in the answer options has been defined through: (1) The application of an adaptation of the Bloom's Digital taxonomy and (2) The application of progression levels based on the complexity of the proposed activities. [11]

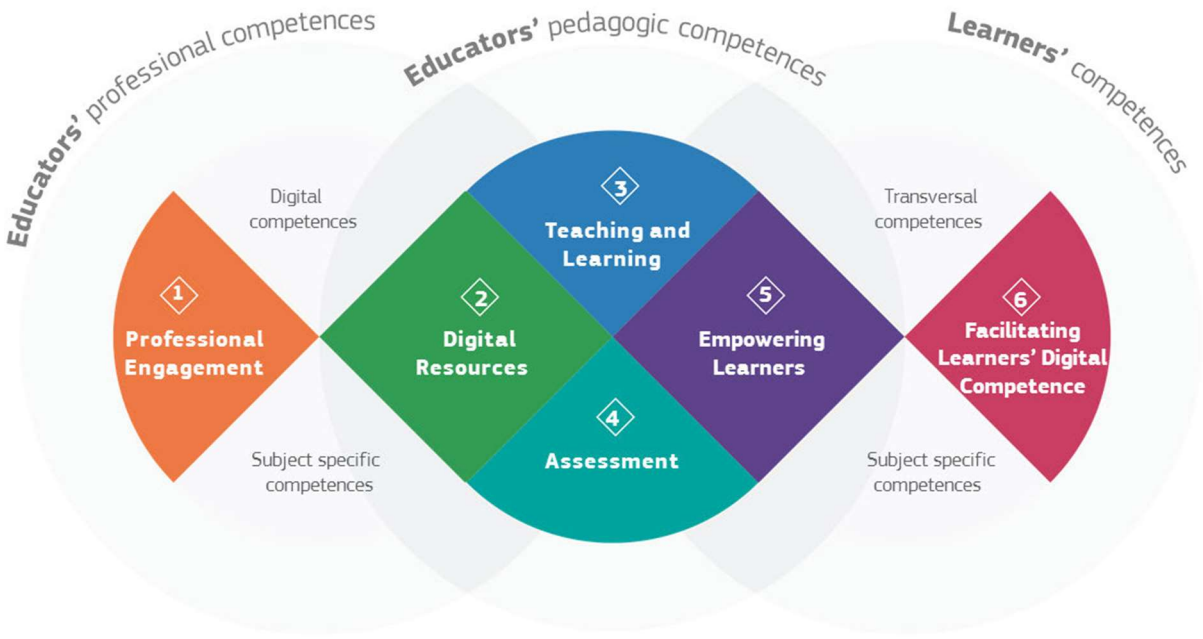

Figure 7. Self-reflection tool Higher Education SELFIEforTEACHERS.

Personal ethical competencies (awareness, concern, action) and personal professional competencies (operational) (Falloon, 2020)

4.12 European Framework for the Digital Competence of Educators

European Framework for the Digital Competence of Educators DigCompEdu Christine Redecker (Author) Yves Punie (Editor)
https://core.ac.uk/download/pdf/132627227.pdf

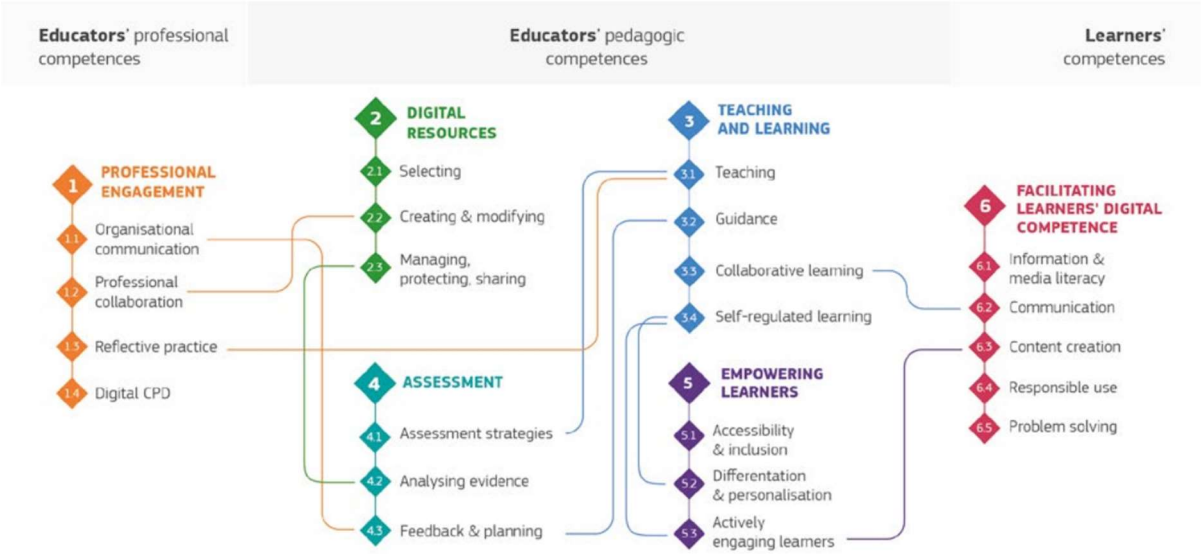

Figure 8. European Framework for the Digital Competence of Educators (Redecker & Punie, 2017)

4.13 The DC4LT Assessment Framework (Perifanou, 2022)

The main components of the DC4LT Assessment Framework include six main categories and their subcategories (thematic areas). The six (6) main categories are the following: 1) Technology, 2) Pedagogy, 3) Assessment, 4) Content, 6) Professional development, and 7) Learners' support. Each category includes a set of five (5) concrete subcategories (Table 4). The first category is entitled "Technology" and includes the description of three levels of proficiency related to the efficient use of technology in the context of language education. Each level comprises a different level of knowledge and skills that a language teacher should have on specific topics such as: 1) digital tools and devices; 2) tools for language education; 3) social media and collaboration platforms; 4) netiquette and 5) security issues.
The thematic topics treated in each of the six (6) DC4LT assessment framework's components are various and are presented all together in the following table.

5. A Proposed Digital Competence Framework for Video-Conference Mediated Teaching

In this section, for the educators and students in higher educational contexts using video-conferencing systems, a framework is proposed by selecting relevant concepts and elements from frameworks presented above.

Competency	Sub comptences	Description	The framework
Technical skills	Platform Navigation	Proficiency in navigating video conferencing platforms.	A1-A9 UNESCO ICT Literacy Units; Indonesian National Digital Literacy Framework Bahasa, (2021)
	Technical Setup	Setting up necessary technical components for video conferencing.	
	Distraction Management	Managing and eliminating distractions during video conferences.	
	Background Management	Managing virtual backgrounds.	
	Breakout Room Management	Creating and managing breakout rooms.	
harnessing the potential of digital resources for learning	Essential Hardware	Regular use and maintenance of necessary hardware.	Quebec Digital Competency Framework
	Supporting Software	Proficiency in using supporting software for presentations and document sharing.	
	Additional Tools	Use of additional tools to enhance video conferencing.	
Manage the complexity of practices with digital tools	Computer/Smart Devices	Varying levels of proficiency in using computers and smart devices.	French framework of digital competences
	Video Camera & Microphone	Proficiency in using video cameras and microphones.	
	Specialized Equipment	Use of specialized equipment like auto-zoom cameras.	
	Software Platforms	Proficiency in using various software platforms	

Communication and Collaboration	Constructivist Approach	Encouraging interactive and engaging activities for students to construct their own understanding.	The digital competence framework for primary and secondary schools in Europe (Guitert et al., 2020); European Framework for the Digital Competence of Educators (Redecker and Punie, 2017)
	Collaborative Approach	Facilitating teamwork and collaborative projects.	
Empowering students	Integrative Approach	Integrating multimedia resources and tools for comprehensive learning.	Tondeur et al. (2023) developed the HeDiCom framework; DigCompEdu, JRC (2017).
	Inquiry-Based Approach	Encouraging questions and research for deeper understanding.	
	Reflective Approach	Providing opportunities for reflection on learning experiences and outcomes.	
Privacy and security issues		Mesures to protect one's personal identity, data and security	DigCompOrg Framework; The DC4LT Assessment Framework (Perifanou, 2022)
Learning and Assessment Situations (LAS)	To perform and act the targeted competencies	Virtual classroom simulations Online collaborative projects Digital teaching portfolios	Competency Framework for the University Bachelor of Technology Georges and Poumay (2020)
Ressources awarness, concern, actions	to navigate diverse environments productively	Considering impact on personal and collective wellbeing and environment	The teacher digital competence (TDC) framework Falloon (2020)

Table 2: A Proposed Digital Competence Framework

Creating digital competence frameworks depends on several considerations, one of these considerations being the learning environment (in person, blended or online). It's worth noting that many related frameworks were designed in the time of face to face learning. Another consideration is time management which now is digital time management where people meet each other in different, convergent or divergent time zones. The competency or the skill of time management is vital in digital and online learning. Another consideration could point to digital health practices. Usually people have a type of life when they move from home to other places

like work or schools. This type of life is accompanied by “face to face” health practices. Any framework of digital competency may include a digital competency to educate people how to care about their health in online meetings.

Guitert et al., 2020	Quebec Digital Competency Framework	Jansses et al.’s’ (2013)
Digital citizenship	Exercising ethical citizenship in the digital age;	Functional, Integrative, Specialised
Communication and Collaboration	developing ethical citizenship in the digital age;	Communication and Collaboration
Information seeking and management	developing and mobilizing technological skills;	Information management
Digital content creation	harnessing the potential of digital resources for learning;	Learning with and about technology
Digital technology	developing and mobilizing information literacy;	Informed decision making. Coherence/self efficacy
	collaborating via digital technology;	Dispositional
	communicating via digital technology;	Privacy and security
	producing content via digital technology;	Legal and ethical
	using digital tools to foster inclusion and address diverse needs;	
	mobilizing digital technology for personal and professional empowerment	
	solving diverse problems via digital technology; developing critical thinking with regard to the use of digital technology;	
	adopting an innovative and creative approach to the use of digital technology.	

Table 3: Comparations

Based on the existing frameworks provided, here's a draft for a new competency framework for Higher Education Digital Competence:

Higher Education Digital Competence (HEDC) Framework

1. Competencies:

- Technical Skills
- Harnessing the potential of digital resources for learning
- Readiness in manage the complexity of practices with digital tools
- Pedagogical Practices (Communication and Collaboration/Empowering students)
- Privacy and security

2. Essential Components of Action:

Digital Teaching Practice:

- Designing and Implementing
- Facilitating and Monitoring
- Evaluating and Modifying

3. Families of Situations:

- Classroom Teaching (face-to-face)
- Online Teaching
- Blended Learning Environments

4. Levels of Competency Development:

- Foundational Level
- Intermediate Level
- Advanced Level

5. Critical Learnings:

Digital Teaching Practice:

- Designing digital learning materials
- Facilitating interactive online sessions
- Evaluating effectiveness of digital teaching methods

6. Learning and Assessment Situations (LAS):

- Virtual classroom simulations
- Online collaborative projects

- Digital teaching portfolios

7. Resources:

- Online teaching guides and tutorials
- Educational technology tools
- Professional development workshops
- Personal-athical awarness, concern, actions

This framework integrates aspects from various existing frameworks, emphasizing the importance of digital competence for educators in higher education. It provides a structured approach to developing and assessing digital teaching skills, ensuring educators are equipped to effectively navigate digital environments and enhance student learning experiences.

In summary

The in-depth analysis of our study framework has shed light on the need of a matrix of competence for the adoption of video conferencing tools, posing a major challenge for teachers in mastering the associated skills. Current practices rely on the presumption of a certain level of digital literacy among the teaching staff, but the proliferation of competency frameworks in this field suggests a need for training, particularly for optimal use of video conferencing in distance and hybrid learning. Indeed, self-taught use of a tool does not guarantee mastery of the skills necessary for its optimal use, unlike structured training. However, to trigger a need for training, it is essential for teachers to be able to assess their practices by comparing them against the expectations of the framework.

More, the literature review conducted has shown us the theoretical aspect of the current institutional framework and its lack of concrete applications for educational staff. Following this observation, means must be considered to operationalize these generalist frameworks for trainers. Developing a competency matrix specific to video conferencing seems relevant to enable a better understanding of the expected skill levels.

5. A proposed matrix for video conferencing-mediated teaching

In order to complete the process of a proposed digital competencies framework, its assessment may be integrated within the framework design. Guitert et al., (2020) mentioned three components of the assessment. The first one is the targeted competencies, the second component is the sub-competencies of the main competencies, while the third and the significant component is the performance criteria for each sub-competence. For the purpose of the EdViCon project, a fourth component is included which is presented by the video conferencing tool. The idea of adding a VC tool is to adopt the assessment of digital competencies with the specific context of each partner institution and to be coherent with R3. Table 1 presents the assessment approach.

Competence	Sub-Competence	VC Tool(s)	Assessment (Performance Criteria)
Technical Skills	Platform Navigation	Zoom, Teams	Proficient use of menu, chat, screen sharing, settings
	Technical Setup	Various VC tools	Correct configuration of audio, video, and connection
	Distraction Management	Various VC tools	Control of background noise, participant muting, alerts
	Background Management	Virtual Background	Selecting/uploading backgrounds, visibility adjustments
	Breakout Room Management	Zoom, Teams	Effective room setup and monitoring
Usage of Equipment/Applications	Essential Hardware	Computer, webcam	Regular use, maintenance, quality audio/video
	Supporting Software	PPT, Word, etc.	Document presentation skills
	Additional Tools	Auto-Zoom Cameras	Proficiency in advanced tools for enhanced interaction
Competency Levels in Equipment Usage	Proficiency Assessment	All tools	Identify training needs per skill level
Pedagogical Practices	Constructivist Approach	Various VC tools	Promoting interactive learning

	Collaborative Approach	Breakout Rooms	Effective teamwork and project facilitation
	Integrative Approach	Multimedia Tools	Use of diverse resources
	Inquiry-Based Approach	Chat, Q&A Features	Fostering curiosity and research
	Reflective Approach	Various VC tools	Opportunities for self-assessment and feedback

Table 4: Competences and sub competences

A matrix regarding video conferencing skills for teachers

Based on the document, which highlights the challenges and needs regarding video conferencing skills for teachers, we can propose a matrix of competence tailored specifically for video conferencing. Here's a draft of such a matrix:

Competence Area	Sub-Competenc	Description	Performance Criteria (Assessment)
Technical Skills	Platform Navigation	Ability to navigate VC platforms (e.g., Zoom, Teams)	- Proficient in locating and using basic functior chat, screen sharing, settings
	Technical Setup	Setting up audio, video, and connection	- Proper configuration o microphone, camera, an internet connection

	Distraction Management	Managing background noise and participant control	- Controls background noise, mutes participant when necessary, manag notifications
	Background Management	Adjusting and managin virtual backgrounds	- Uploads, selects, and adjusts virtual backgrounds for clarity and professionalism
	Breakout Room Management	Setting up and monitoring breakout rooms	- Efficiently creates rooms, monitors activities, and moves between rooms
Usage of Equipment/Applications	Essential Hardware	Proficiency with basic VC equipment	- Uses and maintains computer, webcam, microphone, and speake effectively
	Supporting Software	Using presentation and document-sharing software	- Uses Microsoft PowerPoint, Word, etc., during VC for content sharing
	Additional Tool	Using advanced tools fo interaction	- Utilizes tools like Aut Zoom cameras, extende screens, and stylus pens for better engagement
Competency Levels in Equipment Usage	Skill Evaluation	Recognizes skill gaps in equipment/software use	- Self-assesses and identifies specific traini needs based on proficiency level

Pedagogical Practices	Constructivist Approach	Engaging students in knowledge constructior	- Designs activities fostering interactive and student-centered learnin
	Collaborative Approach	Facilitating teamwork v breakout rooms	- Uses breakout rooms f group work, manages group dynamics
	Integrative Approach	Incorporating multimed for diverse learning	- Integrates videos, graphics, and other med for a richer experience
	Inquiry-Based Approach	Encouraging questions and exploration	- Uses chat/Q&A featur for prompting student inquiry and critical thinking
	Reflective Approach	Enabling self-reflection on learning outcomes	- Provides time and tool for students to reflect or their learning progress

Table 5. Video Conferencing Competence Matrix for Teachers

Competence Area	Sub-Competence	Description	Performance Criteria (Assessment)
Technical Skills	Platform Navigation	Ability to navigate and use various video conferencing platforms effectively.	Efficient use of basic functions: chat, screen sharing, settings

	Technical Setup	Setting up necessary technical components for a successful video conference.	Correctly connects and configures microphone, camera, and internet connection
	Distraction Management	Minimizing and managing potential distractions during online classes.	Controls background, mutes/unmutes as needed, manages notifications effectively
	Background Management	Using and managing virtual backgrounds appropriately.	Selects and adjusts virtual backgrounds for clear and professional appearance
	Breakout Room Management	Participating in and effectively using breakout rooms for group activities.	Joins breakout rooms promptly, navigates between rooms, collaborates with peers
Equipment Usage	Essential Hardware	Regular use and understanding of necessary hardware for video conferencing.	Operates computer, microphone, webcam, and speakers with ease and quality
	Supporting Software	Using software tools to enhance learning and presentations.	Effectively uses PowerPoint, Word, and platform tools to share and present content
	Additional Tools	Utilizing additional tools to improve video conferencing experiences.	Uses extended screens, stylus pen, and pen tablet to interact and present seamlessly
Competency Levels	Computer/Smart Devices	Proficiency in using computers and smart devices for online learning.	Demonstrates basic to advanced computer skills as required
	Video Camera & Microphone	Efficient use of video cameras and microphones during classes.	Sets up and uses cameras and microphones effectively for optimal communication

	Specialized Equipment	Familiarity with and use of any specialized equipment provided by the school.	Uses any school-provided specialized equipment confidently and appropriately
	Software Platforms	Proficiency in using different video conferencing platforms for online learning.	Shows proficiency in Zoom, Google Meet, Teams, etc., adjusting to each platform as needed
Pedagogical Practices	Constructivist Approach	Engaging in interactive activities to build understanding.	Actively participates in discussions, interactive activities, and learning exercises
	Collaborative Approach	Working effectively with peers in team-based projects and activities.	Engages in group work and peer collaboration in breakout rooms or group discussions
	Integrative Approach	Using various multimedia tools and resources to enhance learning.	Integrates multimedia (videos, images, other resources) into assignments effectively
	Inquiry-Based Approach	Asking questions and conducting research to deepen understanding of topics.	Engages in research, participates in Q&A, and contributes to inquiry-based learning
	Reflective Approach	Reflecting on personal learning experiences and outcomes to improve.	Completes reflections, provides thoughtful feedback, and demonstrates self-assessment skills

Table 6. Video Conferencing Competence Matrix for Students

This matrix outlines key competencies required for effective video conferencing in teaching and provides proficiency levels to guide teachers in assessing and developing their skills. It covers technical, communication, pedagogical, classroom management, and assessment aspects essential for successful integration of video conferencing into teaching practices.

6. Review of instruments and tools for assessing the competence of video conferencing-mediated teaching

6.1 Review of instruments and tools for assessment of digital competence

6.1.1 SELFIE - A tool to assess the use of Innovative Educational Technologies

SELFIE - Tool for Assessing Innovative Educational Technologies: SELFIE is a free tool designed to help schools assess their use of digital technologies in teaching, learning, and assessment. It gathers feedback from students, teachers, and school leaders to generate a report highlighting the strengths and weaknesses of technology use in the school. It is based on research and developed in collaboration with education ministries, schools, and research institutes across Europe.

A tool to support learning in the digital age. SELFIE is a free, easy-to-use, customizable tool to help schools assess where they stand with learning in the digital age. SELFIE (Self-reflection on Effective Learning by Fostering the use of Innovative Educational Technologies) is a free tool designed to help schools embed digital technologies into teaching, learning, and assessment. SELFIE has a strong basis in research and was developed based on the European Commission framework for promoting digital-age learning in educational organizations.

SELFIE anonymously gathers the views of students, teachers and school leaders on how technology is used in their school. This is done using short statements and questions and a simple 1-5 answer scale. The questions and statements take around 20 minutes to complete.

Based on this input, the tool generates a report – a snapshot ('SELFIE' :-)) of a school's strengths and weaknesses in their use of technology.

SELFIE is available for any primary, secondary and vocational schools in Europe and beyond, and in over 30 languages. It can be used by any school – not just those with advanced levels of infrastructure, equipment and technology use. The tool has been developed with a team of experts from schools, education ministries and research institutes across Europe. Partner institutions include the European Training Foundation, the European Center for the Development of Vocational Training (CEDEFOP) and UNESCO's Institute for Information Technologies in Education.
https://publications.jrc.ec.europa.eu/repository/handle/JRC98209

6.1.2 PIX: Digital Skills Assessment Tool - In French

PIX: Digital Skills Assessment Tool: PIX is an online platform used for assessing, developing, and certifying digital skills. It evaluates 16 digital skills across five categories: Information and data, Communication and collaboration, Content creation, Protection and security, and Digital environment. It is based on the digital skills reference framework (CRCN), which defines digital skills and their progressive mastery levels from primary school to university.

Pix (https://pix.fr/) is a French online platform for assessing, developing and certifying digital skills. PIX is an online digital skills assessment tool. PIX assesses 16 digital skills in the following 5 business areas:

Information and data
Communication and Collaboration
Content Creation
Protection and security
Digital environment

These skills are set by the digital skills reference framework (CRCN): Reference framework which brings together the digital skills to be mastered during schooling and in the context of adult training. The digital skills reference framework (CRCN) defines digital skills and their progressive mastery levels throughout schooling, skills that are worked on within all courses. The ministries responsible for national education and higher education have developed a digital skills reference framework (CRCN), inspired by the European framework (DIGCOMP) and valid from primary school to university.

6.1.3 The DC4LT Self-Assessment Tool

The DC4LT Self-Assessment Tool is mapped on the DC4LT Assessment Framework and for that reason its components (Fig.X) are in accordance with the DC4LT Assessment Framework's components.Perifanou (2022).

Figure 9. The DC4LT Self-Assessment Tool Components

8. Conclusion

In conclusion, this document provides a comprehensive analysis of the challenges and needs surrounding the integration of video conferencing tools in teaching practices. By examining the current landscape of digital competence frameworks, including their theoretical foundations and practical applications, we have identified a significant gap in addressing the specific skills required for effective video conferencing in education.

The main contribution of this document lies in its proposal for a Video Conferencing Competence Matrix for Teachers. This matrix outlines key competencies across technical, communication, pedagogical, classroom management, and assessment domains, providing a structured framework for teachers to assess and develop their video conferencing skills. By delineating proficiency levels within each competency area, the matrix offers a roadmap for educators to progress from basic to advanced proficiency in leveraging video conferencing for teaching and learning.

Furthermore, this document underscores the importance of tailored training and support initiatives to bridge the identified gap in teachers' digital competencies related to video conferencing. By acknowledging the need for targeted professional development programs and self-assessment tools, educational institutions can empower teachers to harness the full potential of video conferencing technologies in delivering high-quality, interactive, and engaging remote instruction.

Ultimately, the proposed Video Conferencing Competence Matrix serves as a valuable resource for educators, educational policymakers, and professional development providers seeking to enhance the digital competence of teachers in the rapidly evolving landscape of remote and hybrid learning environments. It is our hope that this contribution will facilitate more effective integration of video conferencing tools in education, leading to improved teaching practices and enhanced student learning outcomes in the digital age.

References

Adov, L. (2022). Predicting teachers' and students' reported mobile device use in STEM education: The role of behavioural intention and attitudes. Thesis https://dspace.ut.ee/ handle/10062/76359.

Georges, F., & Poumay, M. (2020). Rédiger le référentiel de compétences du Bachelor Universitaire de Technologie-Guide d'accompagnement à la rédaction du référentiel de compétences du BUT en contexte d'APC.

Guitert, M., Romeu, T., & Colas, J. F. (2020). Basic digital competences for unemployed citizens: conceptual framework and training model. *Cogent Education*, *7*(1), 1748469.

Falloon, Garry. "From Digital Literacy to Digital Competence: The Teacher Digital Competency (TDC) Framework." *Educational Technology Research and Development* 68, no. 5 (October 1, 2020): 2449–72. https://doi.org/10.1007/s11423-020-09767-4.

Ferrari, A. (2012). *Digital competence in practice: An analysis of frameworks* (p. 82116). Luxembourg: Publications Office of the European Union.

Janssen, J., Stoyanov, S., Ferrari, A., Punie, Y., Pannekeet, K., & Sloep, P. (2013). Experts' views on digital competence: Commonalities and differences. *Computers & education*, *68*, 473-481.

Jin, K. Y., Reichert, F., Cagasan Jr, L. P., de La Torre, J., & Law, N. (2020). Measuring digital literacy across three age cohorts: Exploring test dimensionality and performance differences. *Computers & Education*, *157*, 103968.

Yelubay, Y., Seri, L., Dzhussubaliyeva, D., & Abdigapbarova, U. (2020). Developing future teachers' digital culture: Challenges and perspectives. *2020 IEEE European Technology and Engineering Management Summit (E-TEMS)*, 1-6.

Kampylis, P., Punie, Y. and Devine, J., Promoting Effective Digital-Age Learning: A European Framework for Digitally-Competent Educational Organisations, EUR 27599 EN, Publications Office of the European Union, *Luxembourg, 2015, ISBN 978-92-79-54005-9, doi:10.2791/54070 SMASH, JRC98209.*

Köhler, T. Wollersheim, H. -W. and Igel, C. "Scenarios of Technology Enhanced Learning (TEL) and Technology Enhanced Teaching (TET) in Academic Education A Forecast for the Next Decade and its Consequences for Teaching Staff," *2019 8th International Congress on Advanced Applied Informatics (IIAI-AAI)*, Toyama, Japan, 2019, pp. 240-245, doi: 10.1109/IIAI-AAI.2019.00055.

Li, S. (2016). Exploration on the cultivation of digital learning ability for college students. *Information Systems Engineering*, (5),16-18

Information and communication technology in education A curriculum for schools and programme of teacher development, [online] Available: http://unesdoc.unesco.org/images/0012/001295/129538e.pdf. https://unesdoc.unesco.org/ark:/48223/pf0000129538

Mattar, J., Ramos, D. K., & Lucas, M. R. (2022). DigComp-based digital competence assessment tools: literature review and instrument analysis. *Education and Information Technologies*, *27*(8), 10843-10867.

Muammar,S., Hashin, K.F. & Panthakkan, A. (2023). Evaluation of digital competence level among educators in UAE Higher Education Institutions using Digital Competence of Educators (DigComEdu) framework. *Education and Information Technologies* 28:2485–2508

Nascimbeni, F., & Vosloo, S. (2019). Digital literacy for children: Exploring definitions and frameworks. *Scoping Paper*, *1*.

Newman T. (2008). A review of digital literacy in 0 – 16 year olds: evidence, developmental models, and recommendations. London: Becta. http://www.timmuslimited.co.uk/

OECD. (2019). OECD Future of Education and Skills 2030: OECD Learning Compass 2030. Retrieved May 06, 2024, https://www.oecd.org/education/2030-project/teaching-and-learning/learning/

Quebec Ministry of Higher Education, 2019, [online] Available: https://www.education.gouv.qc.ca/fileadmin/site_web/documents/ministere/Cadre-reference-competence-num-AN.pdf

https://onlinelibrary.wiley.com/doi/epdf/10.1111/ejed.12430

Palczyńska, M., & Rynko, M. (2021). ICT skills measurement in social surveys: Can we trust self-reports?. *Quality & Quantity*, *55*(3), 917-943.

Pedaste, M., Kallas, K. and Baucal , A.(2023). Digital competence test for learning in schools: Development of items and scales. *Computers & Education* 203 (2023) 104830.

Perifanou, M. (2021). Digital Competence Assessment Framework and Tool for Language Teachers.Technical Report · February 2022

Perifanou, M. (2022). "The Digital Competence for Language Teachers (DC4LT) Assessment Framework". In: Proceedings 16th annual International Technology, Education and Development Conference (INTED), IATED.

Porat, E., Blau, I., & Barak, A. (2018). Measuring digital literacies: Junior high-school students' perceived competencies versus actual performance. *Computers & Education*, *126*, 23-36.

Redecker, C. and Punie,Y. *(2017). European Framework for the Digital Competence of Educators DigCompEdu; JRC SCIENCE FOR POLICY REPORT*, 03 2019,Available: https://ec.europa.eu/jrc/en/digcompedu.

Romero, M. (2017). Les compétences pour le XXIe siècle. Usages créatifs du numérique pour l'apprentissage au XXIe siècle, 15-28.

Romero, M., Freiman, V., & Rafalska, M. (2022). Techno-creative problem solving (TCPS) framework for transversal epistemological and didactical positions: the cases of CreaCube and the Tower of Hanoi task. In C. Michelsen, A. Beckmann, V. Freiman, U. Jankvist, and A. Savard (Eds). 15 Years of MACAS (Mathematics and its Connections to the Arts and Sciences) - Mathematics in Interdisciplinary Contexts as a Key for Societal Future Challenges. Springer Nature.

Špernjak, A., & Šorgo, A. (2018, May). Outlines for science digital competence of elementary school students. In *2018 41st International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO)* (pp. 0825-0829). IEEE.

Tondeur, J., Howard, S., Van Zanten, M., Gorissen, P., Van der Neut, I., Uerz, D., & Kral, M. (2023). The HeDiCom framework: Higher Education teachers' digital competencies for the future. *Educational technology research and development*, *71*(1), 33-53.

Tretinjak, M. F., & Anđelić, V. (2016, May). Digital competences for teachers: Classroom practice. In *2016 39th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO)* (pp. 807-811). IEEE.

Siddiq, F., Scherer, R., & Tondeur, J. (2016). Teachers' emphasis on developing students' digital information and communication skills (TEDDICS): A new construct in 21st century education. *Computers & Education*, *92*, 1-14.

van Laar, E., van Deursen, A. J. A. M., van Dijk, J. A. G. M., & de Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behavior, 72,* 577–588. https://doi.org/10.1016/j.chb.2017.03.010

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