

DIGITAL COMPETENCIES FOR ONLINE TEACHERS

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ABSTRACT

The COVID-19 crisis forced most educational institutes worldwide to deliver teaching via the internet. However, neither teachers nor students were prepared for such an abrupt disruption. Specifically, many teachers lacked the appropriate digital competencies to effectively teach online. So, what are the necessary digital competencies that teachers should have in order to effectively teach online via the internet? This study proposes a framework of such digital competencies for online teaching that outlines the essential digital competencies needed for online teachers to effectively implement the Online Teaching Preparation, Deliver, Evaluation, and Revision (Online Teaching PDER) framework. Based on this framework, online teachers can self-reflect on their digital competencies in a systematic way and then take appropriate training to enhance their skills. Also, educational institutes can be informed by this framework to prepare the appropriate syllabus and educational material for educating future teachers as well as training in-service teachers.

Keywords: *online educator, online teacher, online teaching, teachers' professional development, teach online*

INTRODUCTION

The COVID-19 pandemic caused a major disruption in the educational process worldwide. This crisis has forced us to rethink the ways that courses are organized and delivered across all levels of education. In fact, there is a massive shift from traditional face-to-face education to fully online teaching and learning. A number of reports and surveys (i.e., European Commission, 2020; School Education Gateway, 2020; OECD, 2020; United Nations, 2020; UNESCO, 2020a, 2010b) have been published recently by official European and International organizations to provide support and guidance to educational professionals, learners, and key educational stakeholders responding to the new challenges that the COVID-19 crisis brought to education worldwide.

However, most educational systems were not prepared for online teaching and learning. Neither teachers nor students had sufficient digital skills for online teaching and learning (e.g., Di Pietro et al., 2020; OECD, 2019a, 2019b, 2020; Perifanou et al., 2021; Perifanou et al., 2022; School Education Gateway, 2020; United Nations, 2020). More specifically, teachers had inefficient online teaching skills (OECD, 2020) and they lacked digital

pedagogy skills, online instructional design skills, and online assessment skills (e.g., Ferri et al., 2020; Korkmaz & Toraman, 2020; School Education Gateway, 2020). Moreover, about one-fourth of teachers identified the main online distance teaching challenges as the following: converting activities and content into online distance learning, preparing content for online distance learning, assessing students' progress, overcoming their low levels of their pedagogical digital skills, and addressing the low levels of students' digital skills (School Education Gateway, 2020). However, only 60% of teachers had received training in information and communication technologies during the last year before the survey, while 18% of teachers believed that they urgently needed to upgrade their digital skills (OECD, 2019a, 2019b). Also, only one-third of teachers had participated in online courses or training seminars during the last year before the survey.

So, the need to train teachers in online teaching is evident (e.g., Badiozaman et al., 2022; Coswatte Mohr & Shelton, 2017; Joshi et al., 2021; Perifanou et al., 2021; Perifanou et al., 2022; Phan & Dang, 2017). First, it is important to determine what the necessary digital competencies are for online

teaching, then appropriate training programs can be developed to provide online teachers with the appropriate digital competencies. To that end, this study will investigate the necessary digital competencies for teachers to efficiently teach online.

Most previous studies regarding online teachers' competencies focused on higher education instructors (e.g., Abdous, 2011; Alvarez et al., 2009; Badiozaman et al., 2022; Baran & Correia, 2014; Coswatte Mohr & Shelton, 2017; Cutri et al., 2020; Darabi et al., 2006; Gay, 2016; Guasch et al., 2010; Martin, Budhrani et al., 2019; Martin, Wang et al., 2019; Phan & Dang, 2017; Thomas & Graham, 2017, 2019). However, during the pandemic teachers and students at all educational levels had to move to online teaching and learning. So, this study investigates the essential digital competencies for any online educator.

METHODOLOGY

Recognizing the importance of digital competencies for online educators, we integrated previous research into a unified framework for our study. Previous studies have considered important digital competencies for online educators from a variety of perspectives. For example, some studies investigated the teacher's digital competencies as a part of all competencies needed by a teacher (including, for example, competencies for school's administration, management, or meeting with parents) or included competencies regarding the teacher's specific discipline (i.e., subject). We focused on the essential digital competencies for online teaching.

Our study follows the popular methodology proposed by Jabareen (2009) for developing conceptual frameworks. We conceptualized digital competencies for online educators as a conceptual framework of interrelated concepts that together provide a holistic understanding of the whole. Each concept plays an integral role and is linked to the rest of the concepts (Jabareen, 2009). Conceptual frameworks provide the following important advantages: (a) Flexibility, since they are based on flexible concepts rather than fixed theoretical variables and causal relations; (b) Capacity for modification, since they can be modified according to new developments; and (c) Understanding, since they aim to help understand phenomena rather than to predict them (Jabareen, 2009).

The methodology by Jabareen (2009) includes

the following research phases: (1) mapping the selected data sources; (2) reviewing the literature and categorizing the selected data; (3) identifying and naming the concepts; (4) deconstructing and categorizing the concepts; (5) integrating the concepts; and (6) synthesis, resynthesis, and making it all make sense.

During the first phase, we identified previous studies that described the digital competencies of online educators. Making an extensive search for articles in Google Scholar and Scopus, we searched for articles with the following keywords in the title: ((digital AND competency) OR (digital AND competencies) OR (digital AND skills) OR (digital AND competence) OR (digital AND competences)) AND online AND (teachers OR educators)). Google Scholar gave one result and Scopus gave six results. Extending the search using the following keywords in the title: ((digital AND competency) OR (digital AND competencies) OR (digital AND skills) OR (digital AND competence) OR (digital AND competences)) AND online AND (teacher OR teachers OR educator OR educators OR faculty OR instructor OR instructors OR teaching)), Google Scholar gave nine results and Scopus gave 10 results. Further extending the search to include the following keywords in the title: ((competency OR competencies OR skills OR competence OR competences) AND online AND (teacher OR teachers OR educator OR educators OR faculty OR instructor OR instructors OR teaching)), Scholar Google gave 389 results and Scopus gave 185 results. Crosschecking the results for identical articles and removing irrelevant or short articles, we identified initially a total of 46 articles. After carefully reading these articles, we selected a total of 21 important articles. These articles proposed essential digital competencies (as well as other competencies) for any online educators.

During the second phase, we reviewed and categorized the selected articles. During the third phase, we identified the specific digital competencies described by these previous studies. During the fourth phase, we deconstructed each digital competency to identify its main characteristics and categorized its components according to their characteristics. The aim of the fifth phase was to integrate and group together similar components, while the aim of the sixth phase was to synthesize the digital competencies into a unified framework.

These 21 articles propose a variety of teachers' competencies for online teaching (see Table 1). Some of these articles are literature reviews (e.g., Alvarez et al., 2009; Farmer & Ramsdale, 2016; Pulham & Graham, 2018; Smith, 2005; Thomas & Graham, 2017), other articles propose frameworks (e.g., Abdous, 2011; Alvarez et al., 2009; Baran & Correia, 2014; Berge, 2008; Powell et al., 2014), and the rest analyze teachers' opinions about the needed competencies for online teaching. These articles do not explicitly investigate online teachers' digital competencies; rather, they consider all possible competencies that teachers need in order to organize efficiently their online teaching. During the description of these competencies, these articles complementarily refer to digital

competencies. Half of the articles (e.g., Alvarez et al., 2009; Badiozaman et al., 2022; Bigatel et al., 2012; Farmer & Ramsdale, 2016; Martin, Budhrani et al., 2019; Martin, Wang et al., 2019; Powell et al., 2014; Pulham & Graham, 2018; Thomas & Graham, 2017, 2019) name the digital competency as a specific category of competencies, while the rest imply the need for digital competency in order to achieve online teaching. Each of these articles proposes tasks that a digitally competent teacher should be able to do using digital technologies. The result of our exhaustive analysis of these articles, the extracted tasks/components of digital competencies, are presented in Table 1.

Table 1. Competences and Digital Competencies' Tasks/Components for Online Teaching Proposed by Previous Studies

Source	Competencies	Digital Competencies' Tasks/ Components
Abdous (2011)	Preparing & Designing; Facilitating, Interacting, and Providing/Seeking Feedback; Reflecting and Drawing Lessons.	Plan and design the online course; Use learning management systems, videoconferencing and other software tools; Facilitate learners; Interact and communicate with learners online; Foster academic integrity and prevent plagiarism; Provide online feedback; Monitor learners' progress; Review course; Reflect on the educational process; Revise and update course.
Alvarez et al. (2009)	Plan and Design; Social; Cognitive; Technological; Managerial.	Plan the resources and assessment in a virtual context; Create online interactive content with interactive activities; Manage online interaction with learners; Communicate in virtual rooms; Tutor in a distance learning environment; Use online platform tools, applications, and learning management systems; Manage a virtual classroom and shared mailboxes; Assess the process; Evaluate the web-based teaching; Provide feedback.
Badiozaman et al. (2022)	Course Design; Course Communication; Time Management; Technical.	Plan and design the online course; Create instructional videos, online quizzes, tests, assignments, and discussion forums; Use time management tools; Interact and communicate with students online; Use email, web conferencing, learning management systems, and online collaborative tools; Manage grades online; Share open educational resources.
Baran & Correia (2014)	Organization; Community; Teaching (Technology, Pedagogy, Content).	Use technology platforms; Structure the online course; Troubleshoot and set up technological infrastructure.
Bawane & Spector (2009)	Design instructional strategies; Develop appropriate learning resources; Implement instructional strategies; Facilitate participation among students; Sustain students' motivation.	Identify students' learning needs; Identify and sequence learning content and activities; Develop learning resources; Encourage interaction and collaboration; Provide effective feedback.
Berge (2008)	Pedagogical; Social; Management; Technical.	Facilitate learners regarding hardware and software; Arrange the virtual meeting space; Enable virtual groupwork; Enforce virtual classroom etiquette; Provide feedback to students in virtual words.
Bigatel et al. (2012)	Active Learning; Administration/Leadership; Active Teaching/Responsiveness; Multimedia Technology; Classroom Decorum; Technological; Policy Enforcement.	Manage and use the online learning classroom; Use a variety of multimedia and course management systems; Communicate with students; Encourage students' interaction, discussions, and sharing.

Coswatte Mohr & Shelton, 2017; Mohr & Shelton (2017)	Classroom Design; Learning process; Understanding legal Issues in the Online Classroom.	Plan, structure, and organize an online classroom; Develop online discussions, assessments, and grading; Manage the online learning classroom; Enforce academic integrity and copyrights; Provide feedback.
Darabi et al. (2006)	Manage logistical aspects of the course; Exhibit effective written, verbal, and/or visual communication skills; Provide learners with course-level guidelines; Assess learner's learning based on stated learning goals and objectives; Create a friendly and open environment; Facilitate productive discussions; Stimulate learners' critical skills; Employ appropriate types of interaction; Provide timely and informative feedback; Identify when and how to use various methods of distance education; Monitor learner progress; Employ appropriate presentation strategies to ensure learning; Ensure appropriate communication behavior within the given environment; Assist learners in becoming acclimated to the given environment; Encourage learners to become self-directed and disciplined in their educational pursuits; Foster a learning community; Use relevant technology effectively; Accommodate problems with technology; Improve professional knowledge, skills, and abilities as necessary.	Select delivery media and tools; Use computers and software; Troubleshoot technical problems; Plan online activities; Share learning resources; Promote interaction and discussions; Assess learners; Ensure testing security; Provide directions for assignments; Assist learners; Provide timely and informative feedback to learners; Monitor learners' progress; Evaluate and review the course.
Farmer & Ramsdale (2016)	Community and Netiquette; Active Teaching/Facilitating; Instructional Design; Tools and Technology; Leadership and Instruction.	Implement online strategies; Use learning management systems, multimedia, and tools; Design, develop, and update learning resources; Modify learning materials; Encourage collaboration and sharing; Provide support, advice, and feedback to learners; Assess students; Evaluate the online programs and materials.
Graham et al. (2019)	Foundational knowledge, skills, and dispositions; Instructional Planning; Instructional Methods and Strategies; Assessment and Evaluation; Management.	Manage the online learning classroom; Create online activities, materials, and assessments; Present content; Interact and communicate with students online; Deliver valid and reliable assessments, projects, and assignments; Facilitate student-student, teacher-student, and student-content interactions; Support students; Personalize instruction; Evaluate students' performance, teachers' online instruction, online educational materials, and assessments.
Guasch et al. (2010)	Designing/Planning; Social; Instructive; Technological; Management.	Design collaborative activities for virtual learning environments; Analyze technological resources; Handle the virtual classroom; Manage communication channels and spaces; Present content using technological tools; Use multimedia and educational software.
Hung (2016)	Communication; Self-directed learning; Learning transfer.	Interact and communicate with students online.
Martin, Budhrani et al. (2019)	Technical; Willingness to learn; Knowledge of how people learn; Content expertise; Course design; Assess student learning.	Structure and organize an online course; Find and select content; Sequence materials; Enforce netiquette; Develop materials and activities; Design assessments; Interact with students; Provide feedback; Evaluate and revise assessments; Review and revise previous course.
Martin, Wang et al. (2019)	Course Design; Course Communication; Time Management; Technical.	Design the course; Time management; Interact and communicate with students online; Use technological tools.

Powell et al. (2014)	Mindsets; Qualities; Adaptive Skills; Technical Skills (Data Practices, Instructional Strategies, Management, Instructional Tools).	Understand individual skills, gaps, strengths, weaknesses, interests, and aspirations of each student; Enable and promote cooperation and collaboration among students; Assess student progress; Evaluate technologies, tools, and instructional strategies; Create personalized content, learning paths, and instruction; Promote online collaboration; Manage the learning environment; Use learning management system and/or other online collaborative tools; Support students.
Pulham & Graham (2018)	Pedagogy; Management; Assessment; Technology; Instructional Design; Dispositions; Improvement.	Curate online learning activities; Use and manage online data, content, software, and learning management systems; Facilitate online discussions; Deliver assessments and feedback.
Reyes-Fournier et al. (2020)	Presence; Expertise; Engagement; Facilitation.	Interact and communicate with students online; Provide timely feedback.
Smith (2005)	Before the Course; During the Course; After the Course.	Create online syllabus; Use technology; Make transition to online learning environment; Prepare students for online learning; Set up a course site; Translate content for online delivery; Manage the course; Network with others involved in online education; Provide feedback; Evaluate students.
Thomas & Graham (2017)	Learner-instructor interaction; Instructor expertise; Student-student interaction; Assignments are meaningful; Clear expectations and instructions; Technical concerns; Visual design and function of the course; Effective use of technological tools.	Course design; Use technological tools; Personalize instruction; Interact and communicate with students online; Deliver meaningful assignments.
Thomas & Graham (2019)	Active Learning; Administration/Leadership; Active Teaching/Responsiveness; Multimedia Technology; Classroom Decorum; Technological Competence; Policy enforcement; Other.	Use multimedia and course management system; Manage class; Enforce academic integrity; Foster an online learning community and interaction; Deliver group/team assignments and peer assessment.

Inspired by Smith's (2005) categorization of teachers' competencies before, during, and after the course as well as the process-oriented framework of Abdous (2011), we categorized the tasks/components of digital competencies (proposed by the 21 articles) along four phases of the online teaching process: 1) Online Teaching Preparation; 2) Online Teaching Delivery; 3) Online Teaching Evaluation; and 4) Revision. Note that we have included an extra phase, Revision, because we consider it important to reconsider and possibly revise everything at every teaching cycle. Then we integrated and grouped together similar, associated, and linked digital competencies' tasks/components into generic digital competencies (Table 2). For example, during the initial Online Teaching Preparation phase, the teacher performs several preparation activities such as identifying the online learners' profiles and the digital learning materials, developing any digital learning materials that are not available, sequencing the learning material, and so on. Considering the tasks that a teacher has to do during the Online Teaching Preparation phase, the following digital competencies emerge:

Mapping; Exploration; Development; and Planning. During the Online Teaching Delivery phase, the following digital competencies come out: Class Management and Orchestration; Lecturing; Interaction, Communication, and Collaboration; Formative Assessment; Monitoring; Guidance and Feedback; Reflection; and Adaptation, Adjustment, and Personalization. During the Online Teaching Evaluation, the following digital competency emerges: Evaluation of the Learners, Content, Teaching, Infrastructure and More. Finally, during the Online Teaching Revision, the following digital competencies emerge: Revision of Online Teaching Preparation, Delivery, and Evaluation.

Table 2 presents the digital competencies during the whole process of online teaching. Our study takes a holistic approach and analyzes the essential digital competencies across all stages that an online teacher follows in order to effectively teach a subject online. The next section further describes the needed digital competencies that an online teacher should have at each stage.

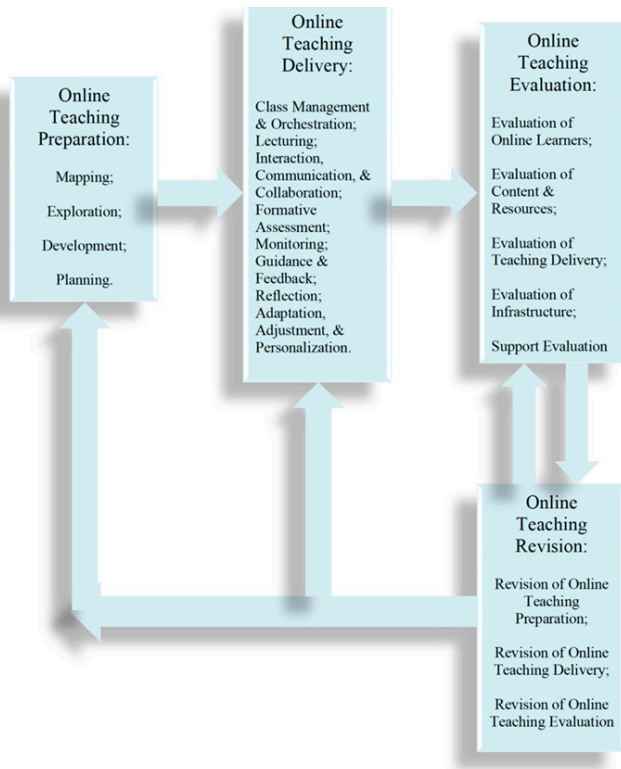
Table 2. Digital Competencies by Grouping Together Related Digital Competencies' Tasks/Components

Digital Competency	Digital Competencies' tasks/components proposed by previous studies
Online Teaching Preparation	
Mapping	identify students' online learning needs (Bawane & Spector, 2009); understand individual digital skills of each student (Powell et al., 2014).
Exploration	identify, evaluate, and select appropriate digital learning materials, tools, strategies, and resources (Bawane & Spector, 2009; Farmer & Ramsdale, 2016; Powell et al., 2014).
Development	modify digital learning materials (Farmer & Ramsdale, 2016); create online interactive content (Alvarez et al., 2009); develop online learning activities and resources (Bawane & Spector, 2009; Martin, Budhrani et al., 2019).
Planning	plan and design the online course (Abdous, 2011; Badiozaman et al., 2022; Guash et al., 2010; Martin, Budhrani et al., 2019; Martin, Wang et al., 2019; Powell et al., 2014; Pulham & Graham, 2018); structure and sequence the online activities (Alvarez et al., 2009; Bawane & Spector, 2009; Farmer & Ramsdale, 2016).
Online Teaching Delivery	
Class Management & Orchestration	manage the online learning classroom (Alvarez et al., 2009; Bigatel et al., 2012; Coswatte Mohr & Shelton, 2017; Graham et al., 2019; Powell et al., 2014; Pulham & Graham, 2018) and time (Badiozaman et al., 2022; Martin, Wang et al., 2019; Pulham & Graham, 2018); enforce academic online integrity, copyrights, netiquette, and ethical behavior (Bigatel et al., 2012; Coswatte Mohr & Shelton, 2017; Farmer & Ramsdale, 2016; Pulham & Graham, 2018; Thomas & Graham, 2019).
Lecturing	present online content (Alvarez et al., 2009; Graham et al., 2019; Martin, Budhrani et al., 2019); apply online instructional strategies (Bawane & Spector, 2009; Coswatte Mohr & Shelton, 2017; Darabi et al., 2006; Reyes-Fournier et al., 2020).
Interaction, Communication & Collaboration	interact and communicate with students online (Abdous, 2011; Alvarez et al., 2009; Badiozaman et al., 2022; Bigatel et al., 2012; Darabi et al., 2006; Graham et al., 2019; Hung, 2016; Martin, Budhrani et al., 2019; Martin, Wang et al., 2019; Reyes-Fournier et al., 2020; Thomas & Graham, 2017); foster an online learning community (Darabi et al., 2006; Farmer & Ramsdale, 2016; Pulham & Graham, 2018; Thomas & Graham, 2019); enable and promote online cooperation and collaboration among students (Alvarez et al., 2009; Bawane & Spector, 2009; Bigatel et al., 2012; Darabi et al., 2006; Farmer & Ramsdale, 2016; Powell et al., 2014; Pulham & Graham, 2018; Thomas & Graham, 2019).
Formative Assessment	continually assess students' progress online (Powell et al., 2014); deliver online assessments, projects, and assignments (Alvarez et al., 2009; Darabi et al., 2006; Graham et al., 2019; Powell et al., 2014; Pulham & Graham, 2018; Thomas & Graham, 2017); deliver online group/team assignments and peer assessment (Thomas & Graham, 2019).
Monitoring	monitor online learners' progress (Darabi et al., 2006) using data from multiple sources (Powell et al., 2014).
Guidance & Feedback	support online students (Graham et al., 2019; Pulham & Graham, 2018); provide online feedback (Abdous, 2011; Coswatte Mohr & Shelton, 2017; Farmer & Ramsdale, 2016; Gay, 2016; Martin, Budhrani et al., 2019) that is timely (Darabi et al., 2006; Martin, Wang et al., 2019; Reyes-Fournier et al., 2020), explanatory (Alvarez et al., 2009), caring, encouraging, and motivating (Alvarez et al., 2009; Bawane & Spector, 2009; Darabi et al., 2006; Thomas & Graham, 2019) as well as prompt, helpful, clear, and detailed regarding online assignments and exams (Thomas & Graham, 2019).
Reflection	reflect on the online educational process (Abdous, 2011; Pulham & Graham, 2018).
Adaptation, Adjustment & Personalization	personalize online instruction (Graham et al., 2019; Powell et al., 2014; Pulham & Graham, 2018); create customized online content, learning pathways and learning experiences according to the individual student's learning goals, needs, preferences, interests, and performance level (Powell et al., 2014).
Online Teaching Evaluation	
Evaluation	Evaluate the online teaching (Alvarez et al., 2009; Farmer & Ramsdale, 2016; Pulham & Graham, 2018), the effectiveness of the online course (Darabi et al., 2006), and online students' performance (Graham et al., 2019).
Online Teaching Revision	
Revision	modify the online educational materials (Farmer & Ramsdale, 2016) and review and revise previous online course offerings (Martin, Budhrani et al., 2019).

DIGITAL COMPETENCIES FOR ONLINE TEACHING

The digital competencies outlined in Table 2 are a guide to the phases of the online teaching cycle, i.e., Online Teaching Preparation, Online Teaching Delivery, Online Teaching Evaluation, and Online Teaching Revision (Figure 1).

Figure 1. The Online Teaching DPER Framework



More specifically, an online teacher needs digital competencies to effectively implement the following phases and their corresponding stages: Online Teaching Preparation, Online Teaching Delivery, Online Teaching Evaluation, and Online Teaching Revision. The following terms will be used in the analysis and are defined in the Appendix: Class Elements, Content, Do Online, Initial Elements, Instructional Strategies, Learner's Profile, Resources (Educational & Technological), Smart Device, and Social Media.

Online Teaching Preparation

The Online Teaching Preparation phase consists of four stages: 1) Mapping, 2) Exploration, 3) Development, and 4) Planning.

In the online **Mapping Stage**, the online teacher searches and identifies the 'Initial Elements' (what is available and given), as well as

analyzes and diagnoses what is needed to be done using online tools and methods. For example, the online teacher determines the available online tools and infrastructure for the online Teaching as well as the online 'Learners' Profiles.'

In the online **Exploration Stage**, the online teacher explores, searches, finds, discovers, retrieves, and evaluates various options for the Resources (Educational & Technological) that could be useful in online teaching using various online tools and methods (e.g., search engines, educational repositories, databases, test banks, and ecommunities). For example, the online teacher discovers and evaluates Open Educational Resources (OERs) in open repositories (e.g., Merlot, MIT OCW, OER Commons, OpenLearn).

In the online **Development Stage**, the online teacher a) develops (creates, builds, constructs, generates) new appropriate Resources (Educational & Technological), b) modifies (transforms, converts, changes, adapts, translates) and b) integrates (combines, synthesizes, composes, assembles) appropriately existing Resources (Educational & Technological) using various online tools and methods (e.g., software applications for creating, editing, and modifying text, presentations, graphics, video, multimedia, extended reality, games, blogs, wikis, websites, quizzes, and assessments). For example, the online teacher designs new online activities (e.g., webquests, collaborative projects) and creates new online peer assessments.

In the online **Planning Stage**, the online teacher a) selects, and then b) organizes, plans, and structures then c) sequences and d) schedules (in time) the most appropriate Resources (Educational & Technological) using various online tools and methods (e.g., digital calendars, project management, scheduling software). Note also that in this stage, the online teacher installs and uploads (in the cloud or on a Learning Management System) the appropriate educational resources. The online teacher organizes and schedules the educational material in flexible learning paths (sequences); selects the most appropriate Instructional Strategies for online teaching, communicating with, guiding, and assessing the learners; and aligns the online learning objectives with the learning activities and the learning outcomes.

Online Teaching Delivery

The Online Teaching Delivery phase consists of

eight stages: 1) Class Management & Orchestration, 2) Lecturing, 3) Interaction, Communication, & Collaboration (learning by communication and collaboration), 4) Formative Assessment (learning by doing, learning by assessment), 5) Monitoring, 6) Guidance & Feedback (learning by guidance, feedback, support, help, assistance, recommendation, advise, encouragement, motivation, etc.), 7) Reflection (learning by self-reflection), and 8) Adaptation, Adjustment, & Personalization. All these stages interact, affect each other, and are interrelated.

In the online **Class Management & Orchestration Stage**, the online teacher manages the Class Elements using various online tools and methods (e.g., software for project management and class management, the learning management system, plagiarism checkers, and security control). For example, the online teacher controls (prevents, detects, and responds to) online learners' misbehavior (e.g., plagiarism, bullying).

In the online **Lecturing Stage**, the online teacher lectures (presents, demonstrates, describes, explains, etc.) the subject using various online tools and methods (e.g., software for presentations, live streaming, webinars, webconferencing, webcasting, digital distribution and sharing tools, virtual tours, simulations and serious games, online labs, and virtual experiments). For example, the online teacher presents the educational material using presentation tools, interactive whiteboards, and videoconferencing.

In the online **Interaction, Communication, & Collaboration Stage** (learning by communication and collaboration), the online teacher interacts, communicates, and collaborates with the learners and others (e.g., colleagues, tutors, administrators, parents) using various online tools and methods (e.g., asynchronous and synchronous communications, web conferencing, digital distribution and sharing, mind mapping tools, student response tools, collaboration tools, interactive whiteboards, project management tools, wiki tools, as well as social media and collaborative games). For example, the online teacher communicates with the learners using a class-dedicated Facebook group.

In the online **Formative Assessment Stage** (learning by doing, learning by assessment), the online teacher assesses (asks, questions, tasks) the learners using various online tools and methods

(e.g., online quizzes, polls, tests, assessments, portfolios, storytelling, inquiries, webquests, projects, quiz games). For example, the online teacher assigns online assignments, activities, exercises, problems, projects, tests, etc. to the online learners and asks them to do these assignments and answer the online tests.

In the online **Monitoring Stage**, the online teacher monitors themselves and the online learners' behavior, emotions, interactions, activities, answers, and outcomes using various online tools and methods (e.g., digital monitoring tools, learning analytics, project management, learning management systems, remote control) during the whole teaching process. For example, the online teacher receives and inspects on their personal dashboard learning analytics data from the learning management system regarding the online learners' access times and log-in durations.

In the online **Guidance & Feedback Stage** (learning by guidance and feedback), the online teacher guides and provides feedback (supports, facilitates, helps, assists, enables, recommends, advises, encourages, motivates, stimulates) the learners using various online tools and methods (e.g., email, messaging, chatbots, avatars, spelling and grammar checkers, language translators, reminders, learning management systems, annotation, digital distribution and sharing tools). The feedback can be Cognitive, Emotional, or Motivational. For example, a virtual avatar would motivate and help the online learners to complete the assignment.

In the online **Reflection Stage** (learning by self-reflection), the online teacher and the online learners critically reflect and discuss their thoughts, actions, behaviors, and experiences as well as the consequences, results, and outputs using various online tools and methods (e.g., online diaries, blogs, note taking, voice/audio, photo, video recording, assessments, visualizations) during the whole teaching process. For example, during an online trip in an online museum with exhibits and artifacts, the online learners can interact with the exhibits and discuss their thoughts and feelings with their peers and teacher. They can also make recommendations to the museum's administrators how to better exhibit the artifacts.

In the online **Adaptation, Adjustment, & Personalization Stage**, the online teacher adjusts

and adapts the other seven stages of the Online Teaching Delivery phase using various online tools and methods (e.g., adaptive learning management systems, ALEKS). The Adaptation is based on the results of the Formative Assessment, the Monitoring, and the Reflection. For example, Adaptation can be based on the online learners' behavior, engagement, activities, emotions, and assessment outcomes, the available infrastructure and the current environment. The online teacher can adjust the online class project deadline in case of an unforeseen event, increase the online interaction and communication frequency with isolated learners, modify the items of an online assessment on economics to fit the current state of the economy, and show empathy to low performing online learners.

Online Teaching Evaluation

The Online Teaching Evaluation phase consists of five stages: 1) Evaluation of Online Learners (Summative Assessment), 2) Evaluation of Online Content and Resources (Educational & Technological), 3) Evaluation of Teaching Delivery, 4) Evaluation of Infrastructure, and 5) Evaluation of the Support Staff (e.g., tutors, administrators, and technicians).

In the online **Evaluation of Online Learners Stage** (Summative Assessment), the online teacher evaluates the learner's performance, knowledge, skills, progress, behavior, satisfaction, usefulness, motivation, self-efficacy, attitude, etc., using various online tools and methods (e.g., digital tools for summative assessments, learning management systems, school management tools). The online teacher can evaluate every learner alone or a group of learners, or even ask the learners to evaluate each other. For example, the online teacher can ask the learners to solve a problem, implement a collaborative project, or create an eportfolio.

In the online **Evaluation of Content & Resources (Educational & Technological) Stage**, the online teacher evaluates the quality of the Content and Resources (Educational & Technological) using various online tools and methods (e.g., rubrics, OERs quality models). For example, the online teacher may use online questionnaires to select the learners' opinions about the clarity, appropriateness, usefulness, and practicality of the educational material. Also, the online teacher can communicate online with colleagues

to critique the credibility and value of some online tools, OER, or case studies.

In the online **Evaluation of Teaching Delivery Stage**, the online teacher evaluates the class management, lecturing, communication and collaboration, guidance and feedback, assessments, adjustment and adaptation using various online tools and methods (e.g., a learning management system, class management system). For example, the online teacher can evaluate the tutors' responsiveness to learners' questions and compare the success rate or grades distribution of the year's summative assessment to those of previous years.

In the online **Evaluation of Infrastructure Stage**, the online teacher evaluates the infrastructure, hardware, software, and networks using various online tools and methods (e.g., hardware, software, network and security evaluation tools, web analytics tools). For example, the online teacher can evaluate the response times of the Wi-Fi network and the server that hosts the learning management system.

In the online **Evaluation of the Support Staff** (e.g., tutors, administrators, and technicians), the online teacher evaluates the staff using various online tools and methods (e.g., the school management system, quality management system). For example, the online teacher can evaluate the response times of the technical support to online inquiries by students, tutors, or even the online teacher themselves.

Online Teaching Revision

In the Online Teaching Revision phase, the online teacher revises the previous stages taking into consideration the results and outcomes of the Evaluation as well as of the Reflection. The Teaching Revision phase consists of three stages: 1) Revision of Online Teaching Preparation, 2) Revision of Online Teaching Delivery, and 3) Revision of Online Teaching Evaluation. The Revision phase is very important since it affects all stages.

In the **Revision of Online Teaching Preparation Stage**, the online teacher revises the Mapping of the Initial Elements, the Exploration, Development, and Planning of the Resources (Educational & Technological) using various online tools and methods. For example, the online teacher should reconsider the Learners' Profiles that may have changed since last time they were used. The online teacher may modify the keywords

when searching online for Resources (Educational & Technological) and the criteria for selecting the appropriate Resources (Educational & Technological). Further, the online teacher may change the sequence of the online educational material and activities in case there are knowledge gaps for online learners in some educational modules.

In the **Revision of Online Teaching Delivery Stage**, the online teacher revises the eight stages of the online Teaching Delivery phase using various online tools and methods. For example, the online teacher revises the online Lecturing based on the online learners' behavior, performance, and formative assessment outcomes.

In the **Revision of Online Teaching Evaluation Stage**, the online teacher revises the five online

Teaching Evaluation stages using various online tools and methods. For example, the online teacher can revise the evaluation criteria and methods for online evaluating the online learners, the online content, or the infrastructure's performance.

Table 3 summarizes the teacher's digital competencies to teach a subject online. The online teacher should be able to use online tools and methods to perform efficiently at all stages of the Online Teaching Preparation, Deliver, Evaluation, and Revision (Online Teaching PDER) framework. All the online actions at every stage could be done by the online teacher alone (teacher-centered education) or in collaboration with colleagues or even the learners themselves (learner-centered education, autonomy-enabled education).

Table 3. Online Teaching PDER framework of Digital Competencies

Phase	<i>Digital Competencies for Online Teaching (using online tools and methods)</i>
1	<p>Online Teaching Preparation</p> <ol style="list-style-type: none"> 1. Map, identify, and analyze the Initial Elements. 2. Explore, search, find, discover, retrieve, and evaluate various options for the Resources (edu/tech). 3. Develop (create, build) new appropriate Resources (edu/tech), modify (transform, adapt) and integrate (combine, synthesize) appropriately existing Resources (edu/tech). 4. Plan, organize, sequence, and schedule the most appropriate Resources (edu/tech).
2	<p>Online Teaching Delivery</p> <ol style="list-style-type: none"> 1. Manage the Class Elements. 2. Lecture (e.g., present, demonstrate, explain, share) the subject to the learners. 3. Interact, communicate, and collaborate with the learners. 4. Assess periodically (formative assessment) the learners. 5. Monitor the learners, teachers, and others as well as the instruction process (e.g., teaching pace, content coverage, class dynamics). 6. Guide and support the learners. 7. Reflect on own and learners' behavior, performance, and competencies during all stages. 8. Adjust all stages of the Online Teaching Delivery phase.
3	<p>Online Teaching Evaluation</p> <ol style="list-style-type: none"> 1. Evaluate the Online Learners. 2. Evaluate the Content & Resources. 3. Evaluate the Online Teaching Delivery. 4. Evaluate the Infrastructure. 5. Evaluate the Support Staff.
4	<p>Online Teaching Revision</p> <ol style="list-style-type: none"> 1. Revise the Online Teaching Preparation. 2. Revise the Online Teaching Delivery. 3. Revise the Online Teaching Evaluation.

In order to effectively teach online, a teacher should have the digital competencies that are described in the Online Teaching PDER framework (Table 3). We arrived at the following definition:

Digital competencies for online teaching include the teacher's abilities to efficiently use online tools and methods in order to map the initial elements, explore and discover various options for resources (edu/tech), develop new resources (edu/tech), modify and integrate existing resources (edu/tech), select, plan, and schedule appropriate resources (edu/tech), manage the class elements, adapt, evaluate, self-reflect on, and revise the teaching and educational resources as well as teach, interact, communicate, collaborate, guide, monitor, and assess the learners towards achieving specific educational objectives.

However, as with any kind of competencies there are multiple proficiency levels. The next section describes the different proficiency levels of digital competencies.

PROFICIENCY LEVELS OF DIGITAL COMPETENCIES FOR ONLINE TEACHERS

Only one previous study (Farmer & Ramsdale, 2016) provided proficiency levels for online teaching competency (three levels: emerging, developing, proficient). Our study proposes the following seven proficiency levels of digital competencies for an online teacher (here “teach” and “teaching” involve all stages of the Online Teaching PDER framework; see Figure 2):

1. Beginner (Novice): has the knowledge and understanding of how to teach online.
2. Elementary (Basic): has the skills to teach online.
3. Intermediate: efficiently and confidently teaches online.
4. Advanced: collaboratively (with colleagues and/or learners) teaches online.
5. Leader (Trainer): trains other teachers how to teach online.
6. Proficient: is committed, self-motivated, and self-develops their online teaching.
7. Expert (Pioneer, Innovator, Inventor): innovates the online teaching.

Figure 2. Proficiency Levels of Digital Competencies for Online Teachers



At the first level (Beginner, Novice), the online teacher has the theoretical knowledge and understanding of how to teach online, but they do not actually apply them. The online teacher is just starting to explore the integration of online tools in the teaching practice and need close support and guidance. “I know and understand how to teach online.”

At the second level (Elementary, Basic), the online teacher has the skills to teach online and has passed relevant exams and proved they have these skills. They can teach online but do not feel confident to exploit online tools in class yet and still need some guided support. “I can (am able to) teach online.”

At the third level (Intermediate), the online teacher is efficiently online teaching and is actually applying these skills in their everyday class. However, they follow pre-established rules, protocols, and guidelines on how to teach online. “I efficiently and confidently teach online every day.”

At the fourth level (Advanced), the online teacher teaches online easily and efficiently using a variety of online tools. They are comfortable and fluent with online tools in teaching daily and act online both autonomously and collaboratively with other online teachers or even the online learners in preparing, delivering, and evaluating teaching. “I efficiently collaborate with other online teachers and/or learners in online teaching.”

At the fifth level (Leader, Trainer) the online teacher is able to train and guide (support, advise, mentor, etc.) other teachers on how to teach online.

They develop and advance the ability of other teachers to use online tools in education. They have a thorough and holistic view regarding the exploitation of online tools in education. “I efficiently train online other teachers on how to teach online.”

At the sixth level (Proficient), the online teacher is committed to online teaching. They already have great knowledge, skills, and experience in online teaching. In addition, they are self-motivated and strive to develop and advance further their online teaching. They are a zealous advocate and promoter of online teaching and autonomous and self-directed. They challenge themselves and explore various new online educational resources, methodologies, technologies, and systems. They know the latest developments in technology, pedagogy, and their subject field and easily adapt to new unknown situations and creates their own online teaching rules. “I am committed to and strive to develop the online teaching.”

At the seventh level (Expert, Pioneer, Innovator, Inventor), the online teacher experiments and innovates the use of online tools in education. They open new directions and pioneer the exploitation of online tools in education. They think out-of-the-box and extend the current state of the art. They

can produce research results that are presented at conferences and published in prestigious journals. They develop new advanced educational resources (e.g., a new educational data mining algorithm), methodologies (e.g., a new mobile collaborative project-based learning), technologies (e.g., a new internet-of-things-based serious game), and systems (e.g., a new adaptive learning management system) and can patent their innovation. “I innovate (pioneer) online educational resources, methodologies, technologies, and systems.”

Table 4 presents these proficiency levels according to various attributes.

CONCLUSION

In order to effectively teach online, teachers should have certain digital competencies. This study presents the Online Teaching PDER framework that shows all the stages that an online teacher needs to follow to prepare, deliver, evaluate, and revise their online teaching. More specifically, this study describes the necessary digital competencies using the following phases and stages: 1) Online Teaching Preparation (mapping, exploration, development, planning); 2) Online Teaching Delivery (class management, lecturing, communication and collaboration, assessment,

Table 4. Proficiency Levels' Attributes of Digital Competencies for Online Teachers

Teacher's Proficiency levels	Confidence in using online tools in teaching	Quantity, variety, and sophistication of online tools used in teaching	Extent and duration of online teaching	Guidance vs Autonomy/ Self-direction	Innovativeness
1. Beginner (Novice)	Very low	Few	Limited	Needs close and direct support	None
2. Elementary (Basic)	Low	Only the Necessary	Limited	Needs some guided support	Uses suggested Resources
3. Intermediate	Average	Adequate, Sufficient	Average	Follows rules	Applies existing Resources
4. Advanced	High	More than Adequate	Average	Autonomous	Creates new Resources
5. Leader (Trainer)	High	Plenty	Large	Autonomous guiding others	Creates new Resources
6. Proficient	Very high	Many, the state-of-the-art	Very Large	Autonomous guiding and inspiring others	Creates new Resources
7. Expert (Pioneer, Innovator, Inventor)	Very high	Massive, pioneers and develops new tools	Unlimited	Autonomous opening new paths	Innovates and Pioneers

monitoring, feedback, reflection, adaptation); 3) Online Teaching Evaluation; and 4) Online Teaching Revision. The International Society for Technology Education Standards for Educators (ISTE, 2021) describe the teachers' competencies for learning, teaching, and leading in the digital society. They include the following standards: Learner, Leader, Citizen, Collaborator, Designer, Facilitator, and Analyst. Comparing the Online Teaching PDER framework to ISTE Standards for Educators, the online Exploration is related to the Learner and Leader standards; the online Interaction, Communication, & Collaboration is related to the Collaborator standard; the online Development, the online Planning, and the online Adaptation, Adjustment, & Personalization are related to the Designer standard; the online Class Management & Orchestration is related to the Citizen and Facilitator standards; while the online Formative Assessment, the online Monitoring, the online Reflection, and the online Evaluation of online learners (Summative Assessment) are related to the Analyst standard.

A popular framework that describes the essential elements of a successful online higher education learning experience is the Community of Inquiry (CoI) (Arbaugh et al., 2008; Garrison & Arbaugh 2007). According to CoI, learning experience occurs at the intersection of Social Presence, Teaching Presence, and Cognitive Presence. Comparing the Online Teaching PDER framework to CoI, the online Interaction, Communication, & Collaboration is related to the Social Presence, the online Teaching, Formative Assessment, and the online Reflection are related to the Teaching Presence, while the online Guidance & Feedback and the online Interaction, Communication, & Collaboration are related to the Cognitive Presence of the CoI. The Online Teaching PDER framework is focused on the essential digital competencies for teachers at each of its stages. Finally, this study describes seven proficiencies levels of digital competencies for online teachers from Beginner to Expert.

The Online Teaching PDER framework could be used by teachers, educational organizations, software companies, and other researchers. Teachers could use it for self-assessment and self-reflection to identify their weaknesses and plan appropriate self-development training in the

corresponding online competencies areas. They could exploit online tools in every stage of their online teaching.

Educational organizations could use the framework to assess and identify the digital competencies levels of their online teaching staff (Perifanou et al., 2021; Perifanou et al., 2022); to design, develop, and implement curricula for their online teaching staff professional development; to measure the progress of their online teaching staff digital competencies' levels; to provide incentives to their online teaching staff in order to improve their digital competency' proficiency; and to recruit online teachers with specified digital competencies.

Finally, the proposed framework could guide software companies to develop educational software in specific stages of the framework that will help online teachers. The Online Teaching PDER framework provides an alternative view that may influence the advancement of existing and new frameworks. We hope it will trigger a dialogue on the essential digital competencies for online teachers and establish a common and shared conceptual basis for the development of new frameworks.

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APPENDIX

Class Elements:

1. class policies and rules (regarding behavior, academic integrity, nondiscrimination, deadlines, interaction, communication & collaboration, assignments, assessments, etc.);
2. time and deadlines;
3. resources and technologies;
4. learners and groups of learners, interactions, relationships, class atmosphere, behaviors, including:
 - discipline, responsibility, and ethics,
 - openness, inclusion, and nondiscrimination,
 - legal and legitimate behavior (e.g., respect to copyrights, integrity),
 - security and safety,
 - privacy, empathic, caring, and supportive relationships, and
 - misbehavior (harassment, bullying, hate, plagiarism, misinformation);
 - outsiders and intruders.

Content: data, information, knowledge, news, messages, articles, pictures, photos, audios, songs, videos, movies, maps, infographics, presentations, books, reports, spreadsheets, databases, blogs, websites, educational materials, open educational resources (OERs), open educational practices (OEPs), courses, webinars, tutorials, syllabus, lesson plans, tasks, activities, assignments, examples, case studies, experiences, laboratories, experiments, projects, exercises, tests, quizzes, assessments, exams, assessment criteria, evaluation criteria, grades, badges, credentials, certificates, guidance, feedback, advice, recommendations, educational multimedia (including augmented reality, virtual reality, immersive reality, mixed reality), educational games, simulations, artifacts, encyclopedias, bibliographies, glossaries, tools, etc.

Do Online: act (e.g., search, select, use, manage, communicate, feedback, collaborate, share, create, protect, etc.) online using the internet.

Initial Elements: educational subject, course goals, learners' profiles (e.g., age, language, previous experiences, needs, interests, existing knowledge, skills, etc.), other participants' profiles (e.g., tutors, advisors, staff), prerequisites,

national and school educational policies, available resources, infrastructure, context, time, place, budget, and constraints. (Usually, the Initial Elements are known before teaching begins.)

Instructional Strategies: strategies and methods regarding teaching, learning, communication, collaboration, guidance and feedback, adaptation, assessment, evaluation, grading, reporting, and any Online Doing.

Learner's Profile: age, gender, language, culture, personality, knowledge, abilities, skills, competencies, needs, expectations, preferences, behavior, attitudes, motives, emotions, mood, insights, ideas, opinions, misconceptions, misuses, strategies, performance, achievements, results, strengths, weaknesses, activity, progress, etc.

Resources (Educational & Technological): learning objectives, learning outcomes, assessment outcomes (levels, knowledge, skills, attitude, etc.), course policies, Content, Instructional Strategies and Methods, instructional/ content sequences (learning paths), schedules, Social Media, software, Smart Devices, networks, products, services, other resources and tools, etc.

Smart Devices: smartphone, tablet, laptop, desktop, server, equipment, 3D printer, camera, video projector, interactive whiteboard, navigator, game console, smart glass, smartwatch, smart TV, drone, router, switch, etc.

Social Media: social network, blog (also, microblog), forum, wiki, collaborative project, instant messaging, content sharing (distribution, publishing), online community, conferencing, social bookmarking, multiplayer game (virtual game world), virtual social world, etc.