Developing Digital Literacy for Teaching and Learning

63

Victoria I. Marín and Linda Castañeda

Contents

Abstract

Digital literacy is a critical competence for empowering citizenship in a digital world. It has become a key element in teaching and learning across the different educational stages that has been addressed since the last decade of the twentieth century within the field of open, distance, and digital education. The literature so far has not agreed on a common definition, but multiple international, national, and even local, frameworks exist to foster digital literacy and to evaluate and certificate it, especially with a focus on educators and students in different educational levels, but also with the citizen perspective. These frameworks are

V. I. Marín (✉)
University of Lleida, Lleida, Spain
e-mail: victoria.marin@udl.cat

L. Castañeda
University of Murcia, Murcia, Spain
e-mail: lindacq@um.es

O. Zawacki-Richter, I. Jung (eds.), *Handbook of Open, Distance and Digital Education*,
https://doi.org/10.1007/978-981-19-2080-6_64

reviewed in this chapter, along with the evolution and conceptualization of digital literacy and some strategies to foster digital literacy in different educational sectors, with a focus on the educator as a key player in this fostering action. The most remarkable challenges for developing digital literacy for teaching and learning include the same conception of digital literacy, which is multiple and situated, the digital divide and the actual consideration of digital literacy as a social practice. Being digital literacy a transversal competency nowadays, clear implications for education can be drawn, such as reshaping organizations to the digital conditions, thinking on digital literacy as a collective effort, and enriching the global discourse through diversity in debates.

Keywords

Digital literacy · Digital competence · Digital teaching competence · Digital literacy frameworks · Digital fluency · Digital citizenship

Introduction

Digital literacy (DL) in teaching and learning is one of the areas of research and practice in the field of open, distance, and digital education with a longer trajectory and evolution in its history. The interest around DL started when the mere reading and writing abilities ceased to be sufficient for participating as full citizens in the new technological and communicative era. Nevertheless, being intimately linked to the development of two amazingly changeable concepts – technology and education – the term "digital literacy" itself is not free from complexity and polemic. This fact cannot be omitted in a chapter such as this one.

Since DL has been studied from a huge number of perspectives since its development in the last decade of the twentieth century, it is difficult to capture the complexity and abundance of information available of DL by doing another review. Instead, this chapter draws upon existing systematic literature reviews to provide a reliable way of representing the essence of the broad range of digital literacy scholarship. For this book chapter, 33 reviews that are indexed in Web of Science during the period 2010–2021 were collected to cover classical, critical, and current definitions, frameworks, and strategies to foster DL in teaching and learning.

What Is "Digital Literacy"?

DL is not presented in the literature as a concept itself but as a kind of ensemble and joining of cultural and historical understandings and practices regarding the use of information, mediated by digital technologies, on any aspect of daily human life (Canchola-Gonzalez & Glasserman Morales, 2020; Cetindamar Kozanoglu & Abedin, 2020; da Silva & Behar, 2019; Nichols & Stornaiuolo, 2019; Reyes &

Avello-Martínez, 2021). Still, authors agree on considering it as a critical competence for personal fulfillment, active citizenship, social inclusion, and employment in the twenty-first century (Guardia et al., 2017; Littlejohn et al., 2012), and as the only way to participate and contribute to the contemporary life (MacLure & Stewart, 2016).

Nevertheless, there is not a clear definition of DL (Esteve-Mon et al., 2020). The rise of the conceptualization of DL is intimately connected not just to the technological evolution itself and the requirements of the new technological scenario (de Paulo Moura, 2019), but also to the transformation of the main aspects that define the way information is produced and shared in multimodal approaches (de Paulo Moura, 2019): the change in the code (from verbal to multimedia), the difference in the main support (from paper to screen), and the change in structure (from a linear-reading structure to a hypertextual and hypermedia) one (Avello Martínez et al., 2013).

The conceptual evolution of DL recognizes the rising importance of integrating not just instrumental components of the new communicational aspects but also the intellectual, informational, and other skills related to the role of information and technologies in people's life. This is also clear from the evolution of the DL's European Union definitions, turning from an almost instrumental perception on the first definitions before 2010 (European Communities, 2007), and becoming more focused on being critical and participating in the most recent approaches (European Commission, 2019).

Instead of a monolithic concept of literacy, specialized literature proposals mention "multiliteracies" – as 'Information Literacy', 'Computer Literacy', 'Media Literacy', 'Communication Literacy', 'Visual Literacy', and 'Technological Literacy' – when authors speak about DL to remark the complex and entangled notion they refer to (Avello Martínez et al., 2013; Manca et al., 2021; Reddy et al., 2020). Moreover, the literature remarks the importance of not considering the new communicative scenarios opposite to the traditional ones, but as more complex and networked (de Paulo Moura, 2019).

DL includes technological, attitudinal, and cognitive components, linked to the need of humans (as individuals and as groups) to express, explore, question, communicate, and understand ideas (Avello Martínez et al., 2013). This need is also historically engaged with the use of technologies to do tasks, solve problems, and communicate (Arango Morales et al., 2021).

The impact and influence of DL over time and contexts include its presence in classical frameworks and programs such as the twenty-first century skills framework (https://www.battelleforkids.org/networks/p21/frameworks-resources), the International Computer and Information Literacy Study, the OECD's Program for the International Assessment of Adult Competencies, the European Commission Key Competences for Lifelong Learning (European Commission, 2019; European Communities, 2007), as well as specific models for areas (e.g., health, see Oh et al., 2021) or countries (e.g., India, see Nedungadi et al., 2018).

In Fig. 1, some of the most important milestones on the conceptual story of DL have been collected to provide a general perspective of the field.

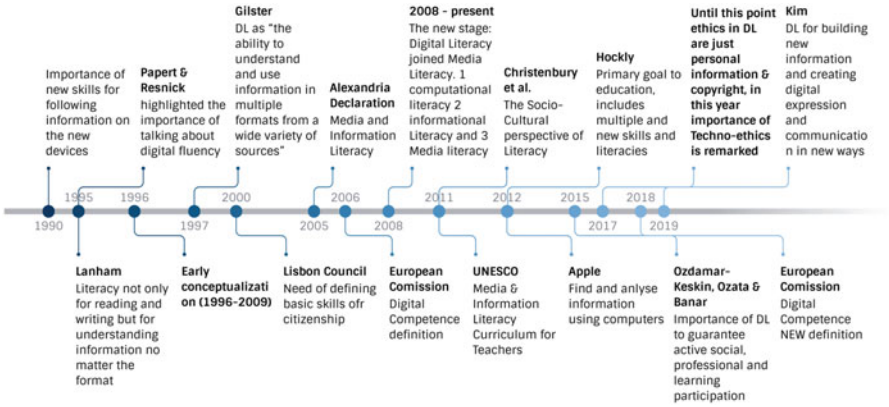

Fig. 1 Timeline for the conceptualization of DL
Note: The dates for the European Union definitions refer to the publication year of the corresponding recommendations (2006 and 2018), being the final publication of the reports a year later, which corresponds to the references cited in the text (European Commission, 2019; European Communities, 2007). This figure has been created based on the information provided by several of the reviews for the conceptualization of DL (Avello Martínez et al., 2013; Canchola-Gonzalez & Glasserman Morales, 2020; Gibson & Smith, 2018; Manca et al., 2021; Perdomo et al., 2020; Reddy et al., 2020; Reis et al., 2019; Reyes & Avello-Martínez, 2021).

DL is considered a situated concept, closely linked to the specific characteristics of people, territories, and historical moments (Avello Martínez et al., 2013; Cetindamar Kozanoglu & Abedin, 2020). At the same time, the way societies understand DL has essential cultural and social connotations (Gonzalez-Martinez et al., 2019). DL is also defined for specific uses, such as the employees' DL (Cetindamar Kozanoglu & Abedin, 2020) or the life-long learners' DL (European Commission, 2019; European Communities, 2007). Both differences and similarities between child and adults' literacy developments exist and should be considered (Esteve-Mon et al., 2020).

The definition of DL may remain elusive and not completely clear. Still, one concept that emerges around the perception and development of the desired levels of DL is the concept of digital fluency. Digital fluency is very popular in institutional implementations and has been included, for example, in the curriculum of New Zealand or Indonesia (Canchola-Gonzalez & Glasserman Morales, 2020). The most cited definition of digital fluency in the specialized literature is the one created by Christian Briggs and Kevin Makice in their 2012 book. This definition refers to the ability to achieve outcomes using digital technology reliably and remarks that a digital fluent person "not only knows what to do with a technology and how to do it but also when and why to use it" (Canchola-Gonzalez & Glasserman Morales, 2020, p. 10). It is worth saying that the concept of fluency appears as an evolving state of literacy, and both fluency and literacy appear to be very close to the notion of competence, a term that is more typically used in Europe (Canchola-Gonzalez & Glasserman Morales, 2020; Dias-Trindade & Ferreira, 2020). The three concepts of

fluency, competence, and literacy include knowledge, skills, and attitudes interacting together. Even if they are not exactly the same concepts, they are used interchangeably in the global specialized literature (Arango Morales et al., 2021; Esteve-Mon et al., 2020; Fernandez-Batanero et al., 2020).

It is remarkable that almost every publication about DL, as well as digital fluency, comments on the importance of institutions and other stakeholders providing resources and conditions to support the development of the DL and digital fluency of individuals – what would be called the agency (Eteläpelto et al., 2013; Jääskelä et al., 2017). Furthermore, these publications also discuss the relevance of other people's fluency to enacting personal fluency (Arango Morales et al., 2021; Canchola-Gonzalez & Glasserman Morales, 2020). In this way, the notion of DL is intimately related to people's right to social inclusion, equity, and access to knowledge (Martinez-Bravo et al., 2020).

In sum, taking all this incredible complexity for defining DL into account, it can be concluded that **DL emerges as a notion of situated multiple integrated skills and practices (conceptual, attitudinal, procedural, and ethical) that empower people (individuals and groups) to participate and communicate efficiently in society.** Consequently, DL is a permanently evolving concept within the communicative environment.

Digital Literacy Frameworks in Education

Developing DL in educational contexts is shaped internationally, nationally, and, even in some cases, locally or institutionally, within frameworks that provide concrete dimensions to understand the concept, organize resources around, foster and evaluate individuals regarding DL. The number of frameworks developed in the last 20 years has been enormous.

In the last few years, some initiatives tried to create global frameworks that integrate and summarize all the skills and literacy competencies that anybody on any condition would need to efficiently face the new technological and social moment. The main argument for doing this is that too many frameworks are already developed (see Fig. 2) and that a global one would help to have a better overview and synthesis. However, the problem of some of those initiatives is that, even if they state to include global perspectives – as the collection in Fig. 2, the reality is that most of them do not include any framework developed outside the Western-North context.

Other approaches try to integrate different frameworks to consolidate global approaches that include intercultural perspectives and different individual interests (teachers, students, families, organizations) (Trujillo Sáez et al., 2020).

Nevertheless, with the ambition of mapping the current overview regarding DL, the most used, adapted, well known, and recognized frameworks for understanding DL are presented below. The skill-oriented operational perspective of know-how is the predominant approach in the DL frameworks due to the initial definition of the concept. Nonetheless, DL frameworks present two other perspectives: the plural

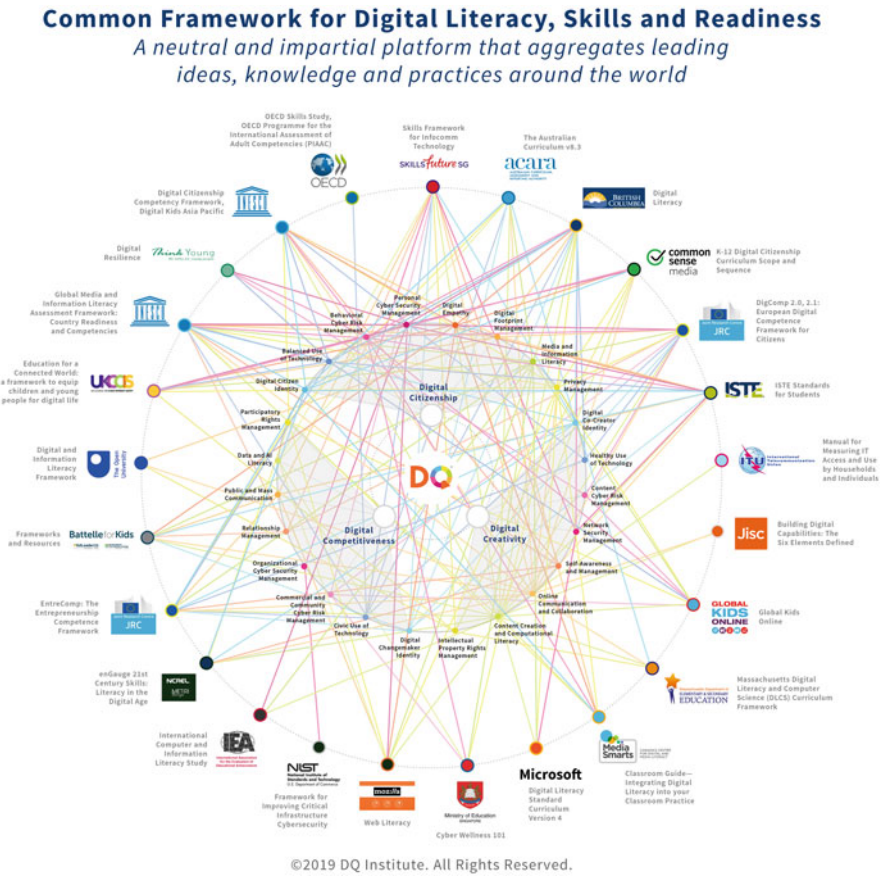

Fig. 2 Collection of 25 DL frameworks developed in the Anglo-Saxon context
Note: With permission of the DQ Institute (https://www.dqinstitute.org/global-standards/). ©2019 DQ Institute

form of DLs that emphasizes the situated nature of the concept and the more critical perspective of digital competence as a reflective approach (Spante et al., 2018).

General Focus (Learners)

With a focus on lifelong learners, the **Digital Competence Framework for Citizens (DigComp)** (https://data.europa.eu/doi/10.2760/38842) developed by the Joint Research Centre (JRC) of the European Commission is the foundation for many other DL frameworks worldwide. The last published version at the moment of writing this book chapter (the 2.1) includes the following five competence areas. Dimension 1 is information and data literacy, communication and collaboration,

digital content creation, safety, and problem-solving. The other four dimensions of the framework include competence descriptors and titles (dimension 2), eight proficiency levels for each competence (dimension 3), knowledge, skills, and attitudes applicable to each competence (dimension 4), and examples of the use of the proficiency levels (dimension 5). A new version of the DigComp framework (2.2) is expected to be published in early 2022. In addition, multiple instruments have been developed to measure or evaluate DL using this framework (e.g., SELFIE, for schools: https://ec.europa.eu/education/schools-go-digital_en).

The **Digital Literacy Global Framework (DLGF)** (http://uis.unesco.org/sites/default/files/documents/ip51-global-framework-reference-digital-literacy-skills-2018-en.pdf) developed by UNESCO emphasizes that "sustainable development and cohesion of society critically depend on this new set of digital competencies" (Manca et al., 2021, p. 4). Using as the reference DigComp and looking beyond it through a systematic search for DL frameworks in targeted regions and countries, this framework proposes the following competence areas: (0) hardware and software operations, (1) information and data literacy, (2) communication and collaboration, (3) digital content creation, (4) safety, (5) problem-solving, and (6) career-related competencies. Competence areas (0) and (6) and the competence 5.5 computational thinking within (5) are the novelties concerning DigComp.

With a focus on students, the **International Society for Technology in Education (ISTE) Standards for Students** (https://www.iste.org/standards/for-students) is the United States (US) framework, which is one of the oldest DL frameworks in the world (since 1998, with different names). The framework includes the following standards: (1) empowered learner, (2) digital citizen, (3) knowledge constructor, (4) innovative designer, (5) computational thinker, (6) creative communicator, and (7) global collaborator.

In the context of the United Kingdom (UK) higher education, a review of DL frameworks found three broad areas of supported capability (Littlejohn et al., 2012, p. 6): (1) academic practice or learning skills, (2) information and media literacies, and (3) ICT skills or techno-literacy. For instance, following the Beetham and Sharpe's pyramid model of DL development model (inspired by Maslow's hierarchy of needs), the **Joint Information Systems Committee (JISC) developed a framework for DLs** (http://web.archive.org/web/20141011143516/http://www.jiscinfonet.ac.uk/infokits/digital-literacies/) with the following elements: information, media, data literacy (critical use), digital identity and well-being (self-actualizing), digital creation, scholarship and innovation (creative production), digital communication, collaboration and participation (participating), and digital learning and personal/professional development (learning). This is one of the few well-known DL frameworks developed by organizations that refer to the plurality and situated nature of the concept.

Looking at nonconventional or noninstitutional frameworks, **Selber**'s (2004) **multiliteracies for a digital age** considers three student positions towards technology critical to DL: users, producers, and questioners. Therefore, three filters need to be used to view those positions: functional literacy (effective use, prerequisite for the others), critical literacy (informed critique), and rhetorical literacy (reflective praxis).

Focus on Educators

The DL focus on teachers appears in the literature under other similar terms as digital teaching competence or digital teaching literacy, and its definition, especially with the aim of training and evaluating teachers worldwide, has been a priority in the educational literature over the last years.

Digital teacher competencies are "the set of skills, attitudes and knowledge required by educators to support student learning in a technologically rich world, design and transform classroom practices and enrich their own professional development" (Esteve-Mon et al., 2020, p. 1). In addition, Tarraga-Minguez et al. (2021, p. 1) sustain that the digital teaching competence "is a complex pedagogical concept that involves a series of dimensions and aspects linked to forms of pedagogical representation of technology in the classroom, learning, and teacher training" and this makes it different from DL.

In the systematic literature review on digital teaching competence of university teachers done by Esteve-Mon et al. (2020, p. 401), the authors identify four common areas in the studies they reviewed (n = 43): (1) basic digital skills, (2) the pedagogical application of digital technologies, (3) the use of technology for continuous professional development, and (4) the ability to further digital competencies for university students. Similarly, the review conducted by Starkey (2020) in the context of pre-service teachers, teacher educators, and the initial teacher education programs identified three complementary ways of interpreting digital competence for teachers: (1) generic digital competence, (2) competence to integrate technologies into teaching practice (using technology for teaching), and (3) critical use of technology and teaching children who are using technology, and professional digital competence (teaching, managing the digital learning environment and professional work of being a teacher).

UNESCO developed for the first time their **ICT Competency Framework for Teachers** (https://unesdoc.unesco.org/ark:/48223/pf0000265721) in 2008 and is in its third version at the time of writing this publication. It refers to six aspects of teacher professional practice in any of the three phases of teacher professional development (pre-service, in-service, and on-going formal and informal pedagogical and technical support): (1) understanding ICT in education policy, (2) curriculum and assessment, (3) pedagogy, (4) application of digital skills, (5) organization and administration, and (6) teacher professional learning. These aspects are organized over three successive stages of teacher development regarding ICT: knowledge acquisition, knowledge deepening, and knowledge creation.

The US version of the DL framework for educators is the **ISTE Standards for Educators** (https://www.iste.org/standards/for-educators), with its first version published in 2000, that includes the following standards, considering the educator as: (1) learner, (2) leader, (3) citizen, (4) collaborator, (5) designer, (6) facilitator, and (7) analyst. In the Latin American context, **ENLACES** is the Chilean Framework for Teachers' Digital Competences (https://bibliotecadigital.mineduc.cl/handle/20.500.12365/2151). ENLACES was one of the first in the geographical area, and that included five dimensions and standards for the teaching profession: educational,

technical, management, social and ethical, and professional development and responsibility.

Addressing the needs of lifelong learners, the JRC of the European Commission developed a specific digital competence framework for educators at all levels of education, the **Digital Competence Framework for Educators (DigCompEdu)** (https://doi.org/10.2760/178382). The framework details 22 competencies organized in 6 areas: professional engagement (educators' professional competencies), digital resources, teaching and learning, assessment, and empowering learners (educators' pedagogic competencies), and facilitating learners' digital competence (learners' competencies). DigCompEdu has inspired other framework developments worldwide, especially in the European sphere of influence (north of Africa and East Europe) and in Latin America.

Similarly, Pozos Pérez and Tejada Fernández (2018) identify six digital competencies that university teachers need to develop in order to meet the current needs in their educational contexts: (a) teaching planning and design in virtual environments, (b) development and implementation of collaborative learning experiences, (c) research, development, and pedagogical innovation with/for the use of ICT, (d) orientation, guidance, and evaluation, (e) management of the growth and professional development with ICT support, (f) diversity, ethics, and responsible use of ICT, and (g) environment, health, and work safety with the use of ICT. Each of these competencies can differ in mastery level or complexity degree and relation to steps related to time (integration phases: access, adoption, adaptation, appropriation, and innovation) ranging from non-developed competency to expert level, going through basic, medium, and high level.

Strategies to Foster Digital Literacy in Education

After the statement of frameworks, the second most important concern related to DL is how to foster it across the different educational stages (and actors). In this section, some of the most relevant strategies are presented.

K-12 and Secondary Education

In their review, Gibson and Smith (2018) found that children develop a mobile literacy – DL regarding the use of mobile phones and tablets – through implicit and explicit scaffolding by their parents and other family members from an early age. The same authors highlight the importance of critical DL, to develop skills to critically examine digital texts and make connections at school against the backdrop of the increase of fake news and the wealth of information available online. Strategies that teachers can apply to do it include: aiding in what young students need to know and where they can find the information, giving time to discuss texts and the choices of their authors, and analyzing practice to explore connections and own online relationships (Gibson & Smith, 2018). These practices, empower children

through participation with others. Accordingly, Kirchoff and Cook (2017) propose digital comics as a way to introduce students to (critical) DL skills, accomplished by skills, accomplished by reading digital texts and creating three types of comics with different digital platforms, coupled with Selber's (2004) framework (functional, critical, and rhetorical literacy development within a digital context).

Also emphasizing the teacher's role, Hadjerrouit (2010) presents a theoretical framework to foster DL in school education by training teachers to design and critically evaluate digital learning resources. The two main factors impacting this action are pedagogical usability and cultural usability (students' preferred choices and ways of learning). Regarding pedagogical usability, the curriculum must integrate DL in all subjects in a goal-oriented way, so that it deeply affects teachers' pedagogy, shifting to constructivist or learner-centered methods (Hadjerrouit, 2010). Also, digital learning resources should add value to the learning process when compared to other materials, and teachers must be made aware that ICT is not value-neutral.

Higher Education

Research of DL in the context of higher education has been extensively done with undergraduate students, especially focusing on their perception and level of DL (Zhao et al., 2021). On the other hand, few studies focus on the pedagogical approaches to foster DL. Those that do generally emphasize teacher education.

The study in the context of UK higher education based on a literature review and an empirical study by Littlejohn et al. (2012) describes three modes of professional services offered to students: modular, freestanding resources to be studied flexibly; outreach, digitally literate individuals acting as ambassadors; and integrated, as a digital and learning skills program. The same authors highlight important considerations for designing strategies that foster DL in higher education. For instance, learners' control and ownership of technologies boosts their confidence to engage in learning; nevertheless, a variety of learners' technological skills and practices needs to be considered. In addition, findings from Littlejohn et al. (2012, p. 8) point towards the need for the process of teaching and learning that includes authentic tasks that suitably integrate digital technologies, time to explore digital academic and professional practices; consideration of the construction of academic communication through media; and recognition of previous student learning practices as resources for learning. In order to support students take ownership of search for information in their academic field, higher education institutions could shorten the duration length of their information make this search shorter and efficient. This could be done through open access journals and open education resources and providing information literacy strategies (Gibson & Smith, 2018).

For the specific, well-researched, context of teacher education programs, there are different approaches to develop DL, especially focusing on the future role of these students in schools (Starkey, 2020): including a course on technology integration, offering pedagogical tools for teaching and learning as subject specific, and by

integrating DL in all subjects. Also, as the author highlights, "developing expertise in generic competencies can occur when technology is embedded in the broader educational and societal context that student teachers and teacher educators have experienced" (Starkey, 2020, p. 13). Multiple studies in this context show that pre-service teachers have developed some technical skills but not the required competence to digitally enrich the teaching-learning processes (Tarraga-Minguez et al., 2021). Howard et al. (2021) suggest an integrated approach to teaching strategies to develop digital competence in teacher education based on the Synthesis of Qualitative Evidence model (SQD), which includes six teaching strategies: (1) teacher educators as role models, (2) opportunities for reflection, (3) learning by design, (4) collaboration, (5) authentic experiences, and (6) providing feedback. Based on data from a validated SQD-scale concerning 931 pre-service teachers from Belgium, Howard et al. (2021) identified four clusters that integrated the six teaching strategies, with a clear greater importance of teacher educators as role models, learning by design and authentic experiences.

To develop critical DLs, academics and teaching staff must explore and share educational approaches (Littlejohn et al., 2012). For example, self-regulated learning strategies and domains such as metacognitive knowledge, resource management, and motivational beliefs are useful to foster DL in higher education and lifelong learning (Anthonysamy et al., 2020). Also, librarians can play an important role supporting DL among faculty and students through novel educational techniques. They may develop tools to support students' interaction in the institutional learning spaces or support faculty in creating course curriculum (Kenton & Blummer, 2010).

Vocational Education

According to a European report on the Vocational Educational Training (VET) sector and its connection to digital competencies (Broek & Buiskool, 2020), the latter are usually best embedded in training delivery but less embedded in learning outcomes and assessment since they are not a formal requirement. Nevertheless, these competencies are considered essential and regarded as transversal in the learning process. However, the same report observes that the most significant impact of policies is on the teacher's digital competence, encouraging teachers to work with digital technologies in education.

An example is the European project EVET2EDU (2012–2014), which aimed to support VET teachers in developing competencies to use eLearning with their students and created a task-based learning online course to do so (Gutiérrez et al., 2017). The authors' report on the course implementation results, demonstrating the improvement of both pedagogical skills and technical skills (89% and 83% of the participants, respectively).

Some countries, at least in the European and Latin American areas, have implemented some modalities of VET that include training at work. In those approaches, the development of DL appears more and more connected with the integration of digital processes and routines in the workplace (Naji, 2018). These

routines do not just affect the formal training of students, but they also affect day-to-day work.

Other initiatives have opted for more global perspectives, such as IKANOS (https://ikanos.eus/en/), an initiative of the Basque Government (Spain) focused on digital competencies that has been especially concerned about DL of workers and students of VET. This initiative developed a methodology to create holistic support on DL, not only for VET students but also for employees. This methodology ranges from raising awareness of the importance of DL for work through DL self-assessment, diagnosis of how to improve DL, and the creation of specific training programs for students, employees, and trainers, not only in generic digital skills but also in digital skills for learning.

Continuing Education

This section refers specifically to the professional development of educators. Unfortunately, there is little reference to continuing education in other professions within the DL literature base.

Pozos Pérez and Tejada Fernández (2018) suggest that digital competence should be considered as a continuous, recurrent, and gradual process for higher education instructors. Also, "pedagogical training is crucial for adequate digital competence of university teachers" (Esteve-Mon et al., 2020, p. 403). However, it is important to balance technical and pedagogical knowledge, both of which are needed to properly solve problems (Perdomo et al., 2020). The same latter authors observe that educators also need assistance to develop metacognition about their same competencies.

Lifelong Learning

The link between theory and practice for DL research in the context of working adults as lifelong learners is not broad.

However, adults are one of the groups that is increasingly taken into account in initiatives to improve DL (Flauzino et al., 2020). Adults are a large and diverse group, including workers, nonworking family members, seniors (older people, some of them retired), and any other type of person that is not covered by other initiatives. This group is not a collective because of their diverse characteristics and contexts. Still, their need to adapt to contemporary digital requirements may be higher than for the rest of the population; some of them have experienced the entire communicative revolution of the last 50 years. Therefore, they need to be able not only to enact their participative citizenship in the new technological moment, but also to set an example for their families (Costa et al., 2015).

In the LIDIA "Literacia Digital de Adultos" project (started in 2014, http://lidia.ie.ulisboa.pt/), some of the project's initiatives focus on the development of materials to be used by educators and trainers who work with adults. In other projects, such as the Initiative Faro Digital (https://farodigital.org/, an NGO that develops DL in Latin

America), the work involves publishing guides for improving specific skills and capabilities. Current projects and initiatives address an increasingly important literacy within DL for citizenship: data literacy (e.g., DALI: https://slate.uib.no/projects/data-literacy-for-citizenship). In addition, many countries have started national programs that integrate DL in the whole infrastructure of citizen services. This is the case in New Zealand, where a strategy for empowering every person in the country to actively participate in the digital world has been developed (https://2020.org.nz/). This strategy includes training for trainers and educators, a digital inclusion map (https://digitalinclusion.nz/) to improve the awareness about the need for inclusion in some zones of the country, as well as specific resources in libraries and other community development centers (https://natlib.govt.nz/schools/digital-literacy), among other initiatives.

For the specific case of workers, Oberlaender et al. (2020, p. 13) define digital competencies at work as "a set of basic knowledge, skills, abilities, and other characteristics that enable people at work to efficiently and successfully accomplish their job tasks regarding digital media at work." Focusing on white-collar workers with office jobs, the same authors identified basic (i.e., needed for everyday tasks) and workplace-specific digital competencies, which also depend on external factors such as the structure and size of the work tasks, and the company's background. Suggested strategies to foster DL in education for the workplace include enhancing talent management programs based on specific digital competencies needed in the workplace (Oberlaender et al., 2020).

Challenges and Future Research

One of the most significant challenges regarding DL is the immense diversity of perspectives about what digital is and what literacy implies. These issues have been mentioned in the various reviews included in this chapter. Therefore, facing DL as a multiple and diverse situated concept must be an achievable goal; trying to identify, more than a global definition of DL, a globally situated framework that would be localized on the different realities of people, as different authors suggest (Avello Martínez et al., 2013; Gonzalez-Martinez et al., 2019).

A common critique of many of the DL frameworks that have been developed so far, and that are included in this book chapter, is that they usually focus on the autonomous and universalist understanding of the DL. Under this perspective about DL, all learners are to be equipped with an uniform set of functional and technical skills so that they can start reading and writing in digital media (Manca et al., 2021). It seems essential to rethink DL frameworks from a more comprehensive perspective, considering the situated nature of DL and taking a proactive standpoint on the development of DL.

As Canchola-Gonzalez and Glasserman Morales (2020) assert, most conceptual approaches to digital fluency, competence, and literacy are from authors from North America and Europe. There are very few conceptual approaches from authors located in regions of Latin America or Africa. However, these regions have a high

level of interest in the topics. Still, nearly half of the reviews included in this chapter (15 out of 33) were led by Spanish-speaking authors, even if only four of the reviews were written in Spanish, and just two other reviews were originally written in Portuguese. This observation highlights an opportunity to open the perspective about DL and contribute to the discussion process and developing thinking regarding DL to integrate knowledge from different cultural and local realities where technology has a different process of implementation, participation, enactment, and appropriation (Manca et al., 2021).

In addition to this, digital practices are present in people's daily lives, especially in screen reading and writing, and in learners' academic lives. As a result, digital literacy can be considered a social practice linked to peoples' day to day lives (Cetindamar Kozanoglu & Abedin, 2020; de Paulo Moura, 2019). DL implies both the appropriation of new languages of the digital medium and related social practices, uniting various media, resources, interfaces, genres, and digital languages. Therefore, DL cannot be conceived just as an academic term to study or as a skill for children or young people, but rather as a reality that intervenes in the daily life of employees, adults, seniors, and families.

Because of its prevalence in everyday life, DL should actively included in the curriculum at every level, in an active way – not just in a transversal way (Hadjerrouit, 2010). The approach to DL education must include not only the instrumental use of digital tools but also the use of digital languages and codes for communicating, for assessing, as well as for understanding the world (de Paulo Moura, 2019; Guardia et al., 2017; Littlejohn et al., 2012). Furthermore, it is important to remark the relevance of effectively integrating DL into different disciplines and subjects, to be able to adapt the DL education to different curricula and organization structures (Guardia et al., 2017), and guarantee the transference of digital capabilities among different contexts (Littlejohn et al., 2012).

In addition, DL is no longer considered an individual issue, rather it is viewed as a collective need. People work and learn in groups, with others, and DL must be a crucial component and an enhancing factor of this shared approach. Therefore, DL should not only be used to make the interaction more fluent but also as a collective competence for empowering groups (Manca et al., 2021). This more generic, but at the same time much more profound perspective, reinforces the significance of both literacy practices and pedagogical practices; both enable new power relations between subjects and with knowledge. Consequently, highlighting profound critical approaches to DL is important in order to emphasize the DL critical component, when understanding and addressing DL (de Paulo Moura, 2019; Kirchoff & Cook, 2017).

Another challenge concerns the interest in developing instruments for efficiently evaluating the DL performance, not just self-perceptions (Perdomo et al., 2020). Even though this lack of appropriate instruments to evaluate DL, the vast majority of authors agree that the greater number of studies are focused on defining the limits of DL to measure and evaluate it, rather than on developing it

(Cetindamar Kozanoglu & Abedin, 2020). Therefore, even though research focuses on the importance of effectively evaluating DL, and many authors are still collecting self-report data, especially from undergraduate students (Zhao et al., 2021). This situation represents a paradox given that authors agree that fostering DL is a highly important issue.

In the case of the approaches that try to improve the DL in institutions and at every educational level, the most common perspective is the understanding of DL as an individual quality that resides in the brain of people (Cetindamar Kozanoglu & Abedin, 2020). For expanding this individual and generalist notion of DL, theories such as the affordance theory or the socio-material theories regarding entanglements (Frauenberger, 2020) would be especially useful. The institutional improvement of DL is considered as something that depends only on the individual effort of the institutional members for improving their own DL. Consequently, the prevailing perspectives ignore the importance of the institutional conditions and resources for people that must be guaranteed to enact the DL; in other words, the relevance of the Agency regarding DL (Castañeda et al., 2022). Only some projects, such as the European project CUTE "Competencies for Universities using Technology in Education" (https://cute.ku.dk/), include the strategic approach to foster the DL as a crucial perspective for holistic development of DL in higher education institutions.

Probably one of the most obvious challenges regarding DL is the one concerning the digital divide. The COVID-19 crisis, and the lockdowns that closed on-site activity in educational institutions and jobs worldwide, faced every society with a desolating scenario of digital exclusion that is even more devastating in some zones of the world that are also traditionally excluded from the intellectual debates. The importance of opening the discourses about DL to voices from other realities that enrich the perspectives about what DL is and how it is developed over the world has been already mentioned. But it is not just a question of discourse and debate, one of the most problematic challenges regarding DL is how to increase DL around the world by being aware about the local approaches. Increasing DL everywhere, considering what citizenry means in each context; the empowerment of governments, societies, and people worldwide, for enacting the DL and maintaining their sovereignty to take decisions about the digital. Unfortunately, it seems that at the moment the only interested parties are companies that are investing a lot of money in implementing technology at some points, or for replacing the national educational systems with remote schools systems based on developing countries (Selwyn, 2018).

Finally, as DL evolves, the importance of understanding the ethical, political, and social dimensions of DL has increased. Renewed definitions of DL and digital competence (as the 2018 of the EU) highlight the importance of citizenship empowerment over the instrumental literacy approach. These new, more ethical approaches, are also being included in teachers' DL frameworks that highlight the importance of the social commitment and the community empowerment as a desirable goal of DL in education (Castañeda et al., 2018).

Conclusion

The world has increasingly become more digital. Indeed, some authors prefer to consider the current situation as a post-digital situation, where "digital" (tools, processes, influence) is everywhere and nothing is "normal" without being digital (de Laat & Bonderup, 2019). In this changeable scenario of the last 30 years, the ambition of DL, as a relevant notion within open, distance, and digital learning, has changed enormously, becoming ever more complex, precisely because the human relationship with technology is also much more complicated.

Technology is not just a set of tools for doing specific things anymore. Technology is a way of thinking, is an incredible market, is a scenario of political debate and fight, is a part of human nature, and is a reality that configures existence in many ways. Technology configures human physical reality to the realities of human relationships (families, love, friendship) until human realities as citizens. Therefore, the ambition of a DL that helps us enact participatory citizenship has changed. In sum, it is time to continue working on DL, especially to further explore how DL can be more fully integrated in teaching and learning contexts.

DL, with all of its different names (i.e., competence, fluency, and so on), has become one of the most transversal competencies. It is an area of increasing interest in open, distance, and digital learning research, as can be seen from the significant number of reviews on the topic. DL is necessary to support both communication and participation as a citizen in contemporary society. In this way, the following suggestions focus on the goal of increasing DL for everyone, with clear implications for open, distance and digital education. First, DL should reshape the contents, subjects, and organizations to the digital moment of schools and educational institutions. Second, at institutions and strategic bodies, a collective effort is needed to develop conditions and resources that support DL. The focus of these initiatives must aim beyond improving digital literacy among individuals, addressing how the education sector can foster the conditions for DL. Finally, for the DL field, the efforts must be concentrated on enriching the global discourse, encouraging diversity in debates, reshaping the contexts of discussions, and integrating minorities and nontraditional contexts and realities.

Above all, the ethical approaches to DL represent the next big step. In a world becoming increasingly datafied, where EdTech moves a billionaire market (Williamson & Hogan, 2021), the determination of how DL is defined, developed, and protected for the citizenry is more relevant than ever. This shift on the definition of DL highlights the importance of a multiple literacies' conception rather than a monolithic one. In addition, this turn speaks to the significance of the critical vision about the human's role in this new world with technology; it means not only how to participate/communicate but also how to enact the human role to its full extension.

Acknowledgments Victoria I. Marín acknowledges the support of the Grant RYC2019-028398-I funded by MCIN/AEI/ 10.13039/501100011033 and FSE "El FSE invierte en tu futuro." Linda Castañeda acknowledges the partial support of the project "Data Competency for Citizenship" DALI, an ERASMUS+ Strategic Partnership (KA204-076492), funded by the European Union.

References

Anthonysamy, L., Koo, A. C., & Hew, S. H. (2020). Self-regulated learning strategies in higher education: Fostering digital literacy for sustainable lifelong learning. *Education and Information Technologies, 25*(4), 2393–2414. https://doi.org/10.1007/s10639-020-10201-8.

Arango Morales, A. J., Tamayo Salcedo, A. L., & Delgado Cruz, A. (2021). Digital competence and professional training in tourism. A literature review. *Cpu-E Revista De Investigación Educativa, 32*, 62–87. https://doi.org/10.25009/cpue.v0i32.2734.

Avello Martínez, R., López Fernández, R., Cañedo Iglesias, M., Álvarez Acosta, H., Granados Romero, J., & Obando Freire, F. (2013). Evolución de la alfabetización digital: Nuevos conceptos y nuevas alfabetizaciones. *MediSur, 11*(4), 450–457. http://ref.scielo.org/jbj78y

Broek, S., & Buiskool, B.-J. (2020). *Adapting the SELFIE tool for work-based learning systems in vocational education and training: A feasibility study.* European Commission. Joint Research Centre. Retrieved from https://data.europa.eu/doi/10.2760/934724

Canchola-Gonzalez, J. A., & Glasserman Morales, L. D. (2020). Digital fluency concept: A systematic review of literature 2010–2020. *Texto Livre-Linguagem E Tecnologia, 13*(3), 25–46. https://doi.org/10.35699/1983-3652.2020.25087.

Castañeda, L., Esteve, F., & Adell, J. (2018). ¿Por qué es necesario repensar la competencia docente para el mundo digital? *Revista de Educación a Distancia (RED), 56*. https://doi.org/10.6018/red/56/6.

Castañeda, L., Esteve-Mon, F., & Postigo-Fuentes, A. Y. (2022). Digital teaching competence development in higher education: key elements for an institutional strategic approach. In R. Sharpe, S. Bennett, & T. Varga-Atkins (Eds.), *Handbook for digital higher education* (pp. 286–298). Edward Elgar Publishing.

Cetindamar Kozanoglu, D., & Abedin, B. (2020). Understanding the role of employees in digital transformation: Conceptualization of digital literacy of employees as a multi-dimensional organizational affordance. *Journal of Enterprise Information Management, 34*(6), 1649–1672. https://doi.org/10.1108/JEIM-01-2020-0010

Costa, F. A., Viana, J., Cruz, E., & Pereira, C. (2015). Digital literacy of adults education needs for the full exercise of citizenship. *International Symposium on Computers in Education (SIIE), 2015*, 92–96. https://doi.org/10.1109/SIIE.2015.7451655.

da Silva, K. K. A., & Behar, P. A. (2019). Competências digitais na educação: Uma discussão acerca do conceito. *Educação Em Revista, 35*, e209940–e209940. https://doi.org/10.1590/0102-4698209940.

de Laat, M., & Bonderup, N. (2019). Is networked learning postdigital education? *Postdigital Science and Education, 1*(1), 17–20. https://doi.org/10.1007/s42438-019-00034-1.

de Paulo Moura, K. M. (2019). Systematic Review on Digital Literacy in Teacher Training. *Texto Livre-Linguagem E Tecnologia, 12*(3), 128–143. https://doi.org/10.17851/1983-3652.12.3.128-143.

Dias-Trindade, S., & Ferreira, A. (2020). Competências digitais docentes: O DigCompEdu CheckIn como processo de evolução da literacia para a fluência digital. *Icono, 14*(18), 162–187. https://doi.org/10.7195/ri14.v18i1.1519.

Esteve-Mon, F. M., Llopis-Nebot, M. A., & Adell-Segura, J. (2020). Digital teaching competence of university teachers: A systematic review of the literature. *IEEE Revista Iberoamericana de Tecnologías Del Aprendizaje, 15*(4), 399–406. https://doi.org/10.1109/RITA.2020.3033225.

Eteläpelto, A., Vähäsantanen, K., Hökkä, P., & Paloniemi, S. (2013). What is agency? Conceptualizing professional agency at work. *Educational Research Review, 10*, 45–65. https://doi.org/10.1016/j.edurev.2013.05.001.

European Commission. (2019). *Key competences for lifelong learning.* Publications Office. Retrieved from https://data.europa.eu/doi/10.2766/569540

European Communities. (2007). *Key competences for lifelong learning*. Office for Official Publications of the European Communities.

Fernandez-Batanero, J. M., Montenegro-Rueda, M., Fernandez-Cerero, J., & Garcia-Martinez, I. (2020). Digital competences for teacher professional development. *Systematic review. European Journal of Teacher Education, 40*(4), 1–20. https://doi.org/10.1080/02619768.2020.1827389.

Flauzino, K. d. L., Pimentel, M. d. G. C., Batistoni, S. S. T., Zaine, I., Vieira, L. O. B., Rodrigues, K. R. d. H., & Cachioni, M. (2020). Digital literacy for older adults: Perceptions about teaching-learning. *Educação & Realidade, 45*(4), e104913. https://doi.org/10.1590/2175-6236104913.

Frauenberger, C. (2020). Entanglement HCI the next wave? *ACM Transactions on Computer-Human Interaction, 27*(1), 1–27. https://doi.org/10.1145/3364998.

Gibson, P. F., & Smith, S. (2018). Digital literacies: Preparing pupils and students for their information journey in the twenty-first century. *Information and Learning Sciences, 119*(12), 733–742. https://doi.org/10.1108/ILS-07-2018-0059.

Gonzalez-Martinez, J., Esteban-Guitart, M., Rostan-Sanchez, C., Serrat-Sellabona, E., & Estebanell-Minguell, M. (2019). What's up with transmedia and education? A literature review. *Digital Education Review, 36*, 207–222. https://doi.org/10.1344/der.2019.36.207-222

Guardia, L., Maina, M., & Julia, A. (2017). Digital competence assessment system: Supporting teachers with the CRISS platform. In V. Strahonja & V. Kirinic (Eds.), *Proceedings of the central European conference on information and intelligent systems* (pp. 77–82). Faculty of Organization and Informatics Varazdin.

Gutiérrez, I., Sánchez, M. M., Castañeda, L., & Prendes, P. (2017). Learning e-learning skills for vocational training using e-learning: The experience piloting the (e)VET2EDU project course. *International Journal of Information and Education Technology, 7*(4), 301–308. https://doi.org/10.18178/ijiet.2017.7.4.885.

Hadjerrouit, S. (2010). A theoretical framework to Foster digital literacy: The case of digital learning resources. In N. Reynolds & M. Turcsányi-Szabó (Eds.), *Key competencies in the knowledge society* (pp. 144–154). Springer. https://doi.org/10.1007/978-3-642-15378-5_14.

Howard, S. K., Tondeur, J., Ma, J., & Yang, J. (2021). What to teach? Strategies for developing digital competency in preservice teacher training. *Computers & Education, 165*, 104149. https://doi.org/10.1016/j.compedu.2021.104149.

Jääskelä, P., Poikkeus, A.-M., Vasalampi, K., Valleala, U. M., & Rasku-Puttonen, H. (2017). Assessing agency of university students: Validation of the AUS scale. *Studies in Higher Education, 42*(11), 2061–2079. https://doi.org/10.1080/03075079.2015.1130693.

Kenton, J., & Blummer, B. (2010). Promoting digital literacy skills: Examples from the literature and implications for academic librarians. *Community & Junior College Libraries, 16*(2), 84–99. https://doi.org/10.1080/02763911003688737.

Kirchoff, J., & Cook, M. P. (2017). Using digital comics to develop digital literacy: Fostering functionally, critically, and rhetorically literate students. *Texas Journal of Literacy Education, 5*(2), 117–129. Retrieved from https://files.eric.ed.gov/fulltext/EJ1162692.pdf

Littlejohn, A., Beetham, H., & McGill, L. (2012). Learning at the digital frontier: A review of digital literacies in theory and practice. *Journal of Computer Assisted Learning, 28*(6), 547–556. https://doi.org/10.1111/j.1365-2729.2011.00474.x.

MacLure, K., & Stewart, D. (2016). Digital literacy knowledge and needs of pharmacy staff: A systematic review. *Journal of Innovation in Health Informatics, 23*(3), 840–840. https://doi.org/10.14236/jhi.v23i3.840.

Manca, S., Bocconi, S., & Gleason, B. (2021). 'Think globally, act locally': A glocal approach to the development of social media literacy. *Computers & Education, 160*, 104025. https://doi.org/10.1016/j.compedu.2020.104025.

Martinez-Bravo, M.-C., Sadaba-Chalezquer, C., & Serrano-Puche, J. (2020). Fifty years of digital literacy studies: A meta-research for interdisciplinary and conceptual

convergence. *Profesional De La Informacion, 29*(4), e290428. https://doi.org/10.3145/epi.2020.jul.28.

Naji, M. J. (2018). Industria 4.0, competencia digital y el nuevo Sistema de Formación Profesional para el empleo. *Relaciones Laborales y Derecho del Empleo, 6*(1) Retrieved from http://ejcls.adapt.it/index.php/rlde_adapt/article/view/555.

Nedungadi, P. P., Menon, R., Gutjahr, G., Erickson, L., & Raman, R. (2018). Towards an inclusive digital literacy framework for digital India. *Education + Training, 60*(6), 516–528. https://doi.org/10.1108/ET-03-2018-0061.

Nichols, T. P., & Stornaiuolo, A. (2019). Assembling "digital literacies": Contingent pasts, possible futures. *Media and Communication, 7*(2), 14–24. https://doi.org/10.17645/mac.v7i2.1946.

Oberlaender, M., Beinicke, A., & Bipp, T. (2020). Digital competencies: A review of the literature and applications in the workplace. *Computers & Education, 146*, 103752. https://doi.org/10.1016/j.compedu.2019.103752.

Oh, S. S., Kim, K.-A., Kim, M., Oh, J., Chu, S. H., & Choi, J. (2021). Measurement of digital literacy among older adults: Systematic review. *Journal of Medical Internet Research, 23*(3). https://doi.org/10.2196/28211.

Perdomo, B., Alberto Gonzalez-Martinez, O., & Barrutia Barreto, I. (2020). Digital competences in faculties: A systematic review. *Edmetic, 9*(2), 92–115. https://doi.org/10.21071/edmetic.v9i2.12796.

Pozos Pérez, K. V., & Tejada Fernández, J. (2018). Competencias Digitales en Docentes de Educación Superior: Niveles de Dominio y Necesidades Formativas. *Revista Digital de Investigación en Docencia Universitaria, 12*(2). https://doi.org/10.19083/ridu.2018.712.

Reddy, P., Sharma, B., & Chaudhary, K. (2020). Digital literacy: A review of literature. *International Journal of Technoethics, 11*(2), 65–94. https://doi.org/10.4018/IJT.20200701.oa1.

Reis, C., Pessoa, T., & Gallego-Arrufat, M. J. (2019). Literacy and digital competence in higher education: A systematic review. *Redu-Revista De Docencia Universitaria, 17*(1), 45–58. https://doi.org/10.4995/redu.2019.11274.

Reyes, C. E. G., & Avello-Martínez, R. (2021). Alfabetización digital en la educación. Revisión sistemática de la producción científica en SCOPUS. *Revista de Educación a Distancia (RED), 21*(66), 21. https://doi.org/10.6018/red.444751.

Selber, S. A. (2004). *Multiliteracies for a digital age*. Southern Illinois University Press.

Selwyn, N. (2018). Technology as a focus of education policy. In R. Papa & S. W. J. Armfield (Eds.), *The Wiley handbook of educational policy* (pp. 457–477). Wiley. https://doi.org/10.1002/9781119218456.ch20.

Spante, M., Hashemi, S. S., Lundin, M., & Algers, A. (2018). Digital competence and digital literacy in higher education research: Systematic review of concept use. *Cogent Education, 5*(1), 1519143. https://doi.org/10.1080/2331186X.2018.1519143.

Starkey, L. (2020). A review of research exploring teacher preparation for the digital age. *Cambridge Journal of Education, 50*(1), 37–56. https://doi.org/10.1080/0305764X.2019.1625867.

Tarraga-Minguez, R., Suarez-Guerrero, C., & Sanz-Cervera, P. (2021). Digital teaching competence evaluation of pre-service teachers in Spain: A review study. *Ieee Revista Iberoamericana De Tecnologias Del Aprendizaje-Ieee Rita, 16*(1), 70–76. https://doi.org/10.1109/RITA.2021.3052848.

Trujillo Sáez, F., Álvarez Jiménez, D., Montes Rodríguez, R., Segura Robles, A., & García San Martín, J. M. (2020). *Learning and educating in the digital age: Frames of reference*. ProFuturo. Retrieved from https://profuturo.education/en/reference-framework/.

Williamson, B., & Hogan, A. (2021). *Pandemic Privatisation in Higher Education: Edtech & University Reform*. Education International. https://eprints.qut.edu.au/216578/

Zhao, Y., Pinto Llorente, A. M., & Sánchez Gómez, M. C. (2021). Digital competence in higher education research: A systematic literature review. *Computers & Education, 168*, 104212. https://doi.org/10.1016/j.compedu.2021.104212.