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Using the DigCompEdu Framework to Conceptualize Teachers' Digital Literacy

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Abstract: Teachers' literacy has a strong impact on the effectiveness and quality of teaching. Digital literacy has been described as a survival skill, without which citizens can not acquire the knowledge and skills necessary for life in the 21st century. Digital literacy has become essential to teachers' overall quality and is significant for teachers' ongoing professional development in the digital age. This article begins with the introduction and comparison of different definitions of digital literacy. Then it adopts the European Framework for the Digital Competence of Educators (DigCompEdu) to conceptualize teachers' digital literacy to elaborate on the concept. The framework demonstrates a set of digital competences specific to teachers to be able to seize the potential of digital technologies for enhancing and innovating education. These competences include professional engagement, digital resources, teaching and learning, assessment, empowering learners, and facilitating learners' digital competence. Meanwhile, a model of digital competence proficiency in a cumulative progression through six levels has also been introduced, which begins with Remembering and Understanding, goes through Applying and Analyzing, and finally Evaluating and Creating. Moreover, existing literature on research using this framework has been reviewed to show how the framework could be employed to understand and develop teachers' digital literacy in practice. Finally, research gaps are identified and suggestions for future research are provided.

Keywords: Digital Literacy, DigCompEdu, Teacher Development

1. Introduction

Digital literacy has been described as a "survival skill" for life in the 21st century [14]. Currently, globalized conditions enforce individuals to equip themselves with digital literacy skills to utilize technology to interact with others and/or among themselves. Compared with other study fields, digital literacy has become a central enabling agent in the educational enterprise [26] because, in a digital age, teachers must have digital literacy to handle their teaching and provide more opportunities for learners to develop their digital literacy [1]. The Ministry of Education of China issued *The Education Industry Standard of Digital Literacy of Teachers (2022)* to call for the promotion of national digital strategic action and the upgrading of teachers' awareness, ability, and responsibility to use digital technology to optimize and innovate educational activities. Against such a background, this study aims to identify a useful framework to conceptualize and develop teachers' digital literacy. This study can enrich the theoretical research on teachers' digital literacy in China. Specifically, this study uses the development of digital literacy as an entry point to provide a new perspective for research on teacher education and training.

The concept of digital literacy, as it is now generally used, was first proposed by Paul Gilster, which referred to the ability to derive and use information from various sources in the digital age [15]. The phrase "digital literacy" had been applied through the 1990s by many authors who used it to mean essentially an ability to read and comprehend information items in the hypertext or multimedia formats that were becoming available [4]. Like any fashionable term, digital literacy has gained a wide range of uses in literature [14], from reference to technical aspects [6, 41, 2], to cognitive or sociological meanings [33, 22]. A conceptual framework for digital literacy proposed by Eshet-Alkalai [14] incorporated

five types of literacy: (a) photo-visual literacy; (b) reproduction literacy; (c) information literacy; (d) branching literacy; and (e) socio-emotional literacy. Martin [28] offered his version of the concept of digital literacy, which indicated that people possessed the ability, attitude, and awareness to use digital devices in a proper way to handle the digital resources first and then create new knowledge and expressions to make communications with others and make meaningful social actions. Chan [10] introduced another definition of this term, which referred to the ability to understand and use information in various formats, highlighting the role of critical thinking rather than a simplistic grasp of Information and Communication Technology (ICT) skills.

These definitions can be roughly divided into two categories. One is mainly focusing on technical skills; the other is paying more attention to the mastery of ideas [34]. With the development of modern technology, the connotation of digital literacy is constantly modified and expanded. To further clarify the connotation as well as the extension of digital literacy and scientifically guide the development of citizens' digital literacy, UNESCO, the European Union, the United Kingdom, and the United States have successively developed a framework system for digital literacy [13]. Among them, in 2018, the Council of The European Union suggested that digital literacy refers to the ability to use digital technologies confidently, critically, and responsibly in learning, work, and social engagement, including information literacy, data literacy, communication and collaboration, media literacy, digital content creation, security, intellectual property-related issues, problem-solving, and critical thinking.

Most of the above definitions are general, but a few researchers are trying to narrow down the definition to emphasize teachers [1, 18, 24]. Almås and Krumsvik [1] have put forward that digital literacy of in-service teachers, which refers to the ability to incorporate digital artifacts as an integrated part of their pedagogical content knowledge and to be aware of how this affects teaching, learning strategies, and building aspects. Such narrow definitions merely focus on the technical (ability to use) and cognitive (pedagogic knowledge and awareness) aspects, while the general definitions contain elements of technical, cognitive, and social aspects of digital literacy [23]. Hall et al. [18], furthermore, have included the social aspect of the definition: teachers' digital literacy refers to the knowledge, skills, and attitudes necessary for educators to support teaching and learning in a highly digital world. Digitally literate educators must have the capacity to utilize technology to improve and transform classroom practices and to enhance their own professional development and identity. Moreover, researchers have consciously used "educators" instead of "teachers" in some definitions or conceptual frameworks, a change that not only implies an expansion of the target, but also emphasizes that future teacher development is not just about becoming a transmitter of knowledge, but it requires teachers to become educators who empower students to grow up [43].

2. The European Framework for the Digital Competence of Educators (DigCompEdu)

The continuous development of digital society is also redefining the 21st century talent standards [43]. Digital competence is one of the eight key competencies for "life-long learning" suggested by the European Commission [29]. To scientifically instruct citizens on the development of literacy, except for the above definition elicited by the EU (2018), they have also officially proposed A Framework for Developing and Understanding Digital Competence in Europe (DigComp 1.0). After two revisions, they released versions 2.0 (DigComp 2.0: The Digital Competence Framework for Citizens) and 2.1 [39]. Moreover, the European digital competence system was developed thanks to the synergy with the European Commission's Joint Research Centre (JRC) and included different outcomes: the European Framework for Digitally Competent Educational Organizations (DigCompOrg: 2015); and the Digital Competence Framework for Citizens: Call for contributions (DigComp 2.2: revision started in January 2021 to be concluded in 2022).

Although there have been frameworks for improving citizens' digital literacy, elementary and secondary school teachers deserve particular attention because they are not only digital citizens, but also nurturers of digital citizens, which requires teachers to be equipped with digital literacy beyond what is expected of ordinary citizens [13]. Developing teachers' digital literacy has become the key to adapting learners to the future of society and becoming competitive digital citizens [43]. Given the decisive role of teachers in the digital education environment [31], in the report published by JRC, Redecker [37] presented the European Framework for the Digital Competence of Educators (DigCompEdu) for the development of educators' digital competence in Europe, which aims to help Member States to promote the digital competence of their citizens and boost innovation in education through national, regional, and local efforts in fostering educators' digital competence. DigCompEdu responds to the growing awareness that European educators need a set of digital competencies specific to their profession to be able to seize the potential of digital technologies for enhancing and innovating education [37]. As one of the research results of the project Learning and Skills for Digital Era, DigCompEdu has gone through three stages: theoretical research, initial framework construction, and conceptual framework revision and validation, and has become a three-dimensional universal framework for all educators [8].

DigCompEdu proposes six areas intertwined between the professional and pedagogical competencies of educators and learners, which are (a) professional engagement; (b) digital resources; (c) teaching and learning; (d) assessment; (e) empowering learners; (f) facilitating learners' digital competence, and these areas comprise 22 connected competences [37]. The structure and content of DigCompEdu are presented in Figure 1. According to E*uropean Framework*

for the Digital Competence for Educators [37] published by JRC, area 1 addresses the broader professional context in which educators use digital technologies in their interactions with colleagues, learners, parents, and other stakeholders, for their own professional development and for the collective benefit of their organization. Area 2 focuses on the competencies needed to use, create, and share digital learning resources effectively and responsibly. Area 3 is concerned with managing and coordinating the use of digital technologies in teaching and learning. Area 4 deals with the use of digital strategies to enhance assessment. Area 5 concentrates on the potential of digital technologies for learner-centered instructional strategies. Area 6 details the specific pedagogic competencies necessary to facilitate students' digital competence.

Based on Bloom's taxonomy of educational objectives, DigCompEdu also proposes a model of digital competence proficiency in a cumulative progression through six levels, which starts with "Remembering" (A1) and "Understanding" (A2), going through "Applying" (B1) and "Analyzing" (B2), and finally "Evaluating" (C1) and "Creating" (C2) (Mattar, Ramos, & Lucas, 2022). In DigCompEdu, each proficiency level is accompanied by a motivating performance descriptor: A1 corresponds to the descriptor of "Newcomer", A2 to "Explorer", B1 to "Integrator", B2 to "Expert", C1 to "Leader" and C2 to "Pioneer" [27], represented in Figure 2.

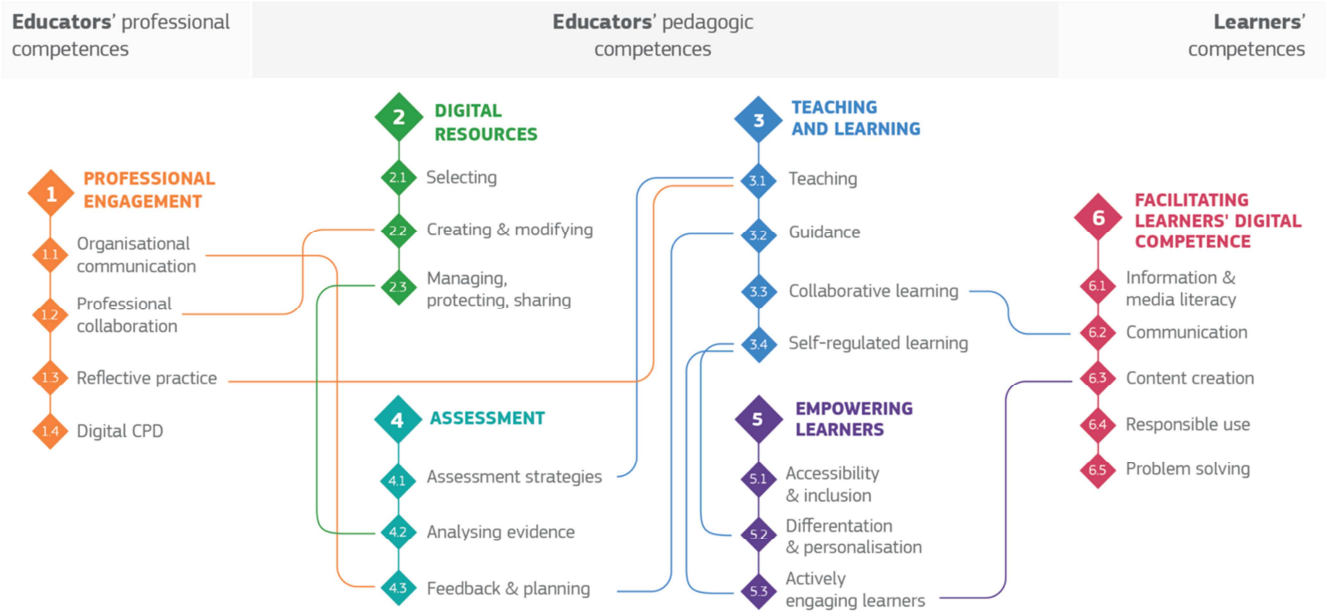

Figure 1. *DigCompEdu Competences and Their Connections (Redecker, 2017).*

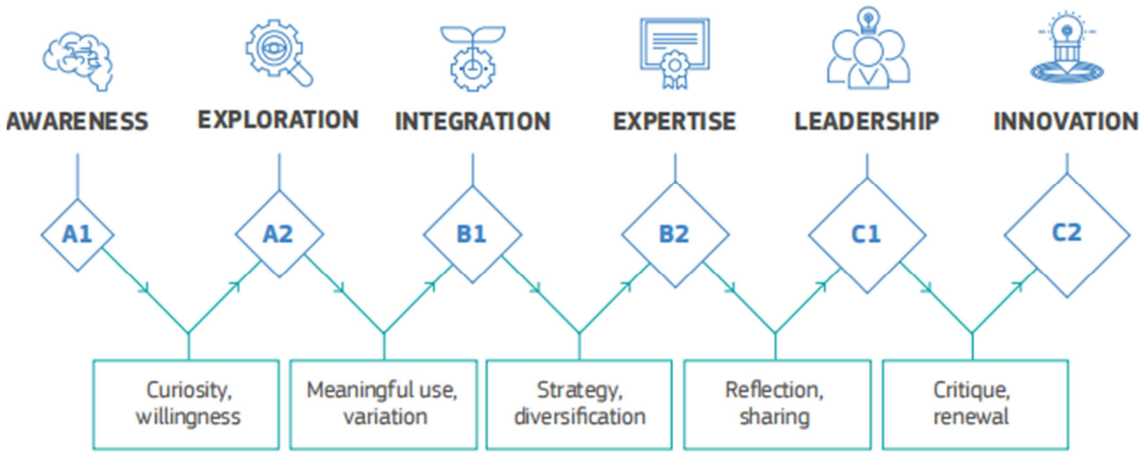

Figure 2. *DigCompEdu Profession Model (Redecker, 2017).*

Guided by this theoretical system, DigCompEdu Check-In, a digital literacy assessment tool for educators, has been developed by integrating the 22 literacy elements with the teaching practice context [13]. Moreover, after reviewing the empirical evidence provided in their research, Du and Huang [13] recommended that this assessment tool has good reliability and validity and is somewhat suitable for measuring the digital literacy of teachers in China.

Considering that the EU has used the term digital competence in the frameworks, it is worth mentioning that the term "literacy" refers to basic or common abilities, while the term "competence" refers to comprehensive, competitive,

prerequisite, and necessary competencies to perform specific jobs [43]. Buckingham [7] notes that the term literacy signifies a more holistic, humanistic perception, close to the German concept of "Bildung". According to research trends from 1999 to 2018, digital literacy and digital competence were used differently in China and abroad. The current trend (after 2018) is that the concept of digital competence is mostly used abroad while the concept of digital literacy is mostly used in China [43]. Digital competence and digital literacy can be used as synonymous terms to describe the skills and abilities to use digital technology [19, 3]. The translation of two terms is nearly equivalent in domestic literature, where digital competence and digital literacy are used interchangeably [13, 25, 35]. In this paper, we also comply with the above principle in China.

3. Research on DigCompEdu

Redecker [37] claimed that the assessment of teachers' digital literacy helps to anticipate training needs or to interpret teacher competence in the educational context. Assessment is a complex process because of the dizzying emergence of technologies in society [32]. In response, scholars have formulated and tested diverse types of frameworks and instruments to assess teacher digital literacy in substantial educational contexts [36]. In the early years, Martin and Grudziecki [28] developed the DigEuLit framework and tools for European countries and proposed three levels (digital competence, use, and transformation) for the enhancement of digital literacy. In Africa, the ICT-enhanced Teacher Standards framework proposed by International Institute for Capacity Building in Africa (2012) was designed for African countries.

Moreover, on the basis of three integration levels in ICT (technology literacy, knowledge deepening, and knowledge creation), UNESCO (2013) designed the ICT Competency Framework for Teachers (ICT-CFT) to support policy-makers in assessing teachers' ICT competency. The International Society for Technology in Education (ISTE) also developed a framework for teacher competence, aiming to upgrade teachers' practice with technology, enhance collaboration among learners, and foster autonomy among learners [11, 20]. DigCompEdu, a descriptive framework, evolved from DigComp [9], mandating the specific digital competencies necessary for the teaching profession and needed by teachers at all levels of education. DigCompEdu not only adopted multiple skills from valuable frameworks but also complemented the comprehensive aspects of the 21st century competencies necessary for teachers [30]. The useful tool DigCompEdu Check-In derived from this framework supports the assessment of educators [27]. As the result of a series of consultations and decisions among experts and practitioners, DigCompEdu synthesizes all existing models and instruments into one generic framework as a common frame of reference [5]. This framework has been widely recognized [30].

One attractive topic of the extant literature on DigCompEdu is sorting out its content, components, framework, and significance. For instance, Caena and Redecker [8] pointed out that, to align teacher competencies to 21st century challenges, this framework represents a paradigmatic example of this endeavor, and then described in detail the formation process, content, structure, and implementation of this framework. Other research directions on DigCompEdu have arisen in the context of the epidemic and online learning. Based on the DigCompEdu typology, Walter and Pyzalski [42] focused on teaching competencies that have changed or become particularly relevant in the context of the crisis e-learning experience during the COVID-19 pandemic. In his paper, Siddiq [38] compared the vision, goals, and content characteristics of digital competencies in the online curricula of two Nordic countries (Norway and Sweden) and inspect the extent to which they align with the DigCompEdu as it represents and provides important information emphasized by international authorities.

In terms of the Chinese context, few domestic articles have been published with "DigCompEdu" as the theme. Several of them have unpacked the content and characteristic of DigCompEdu and elaborated on the implications of this framework for the improvement of the digital literacy of teachers in China [21, 25, 43, 40]. To be specific, domestic researchers have described the evolution of DigCompEdu, its general structure, and specific content, and reviewed the six levels of educators' digital literacy as well as assessment tools [17]. An innovative insight is that Zheng et al. [43] believe that domestic research is still focused on digital literacy, while research on digital competence is an international trend that domestic researchers should promote research theme from digital literacy to digital competence and advocates the construction of China's own digital assessment standards of teachers. Except for teachers, drawing on DigCompEdu, Guo [17] has analyzed the content of digital literacy for Chinese librarians in detail and developed a cultivation program for them to improve their digital literacy. However, most of them are theoretical studies and lack empirical evidence.

4. Conclusion

To conclude, DigCompEdu can be employed as a useful framework to conceptualize teachers' digital literacy. However, to date, there is still a lack of scientific and systematic understanding of the digital literacy of teachers at all education levels in China [16]. Accordingly, it is of great significance to study teachers' digital literacy in China in the context of Education Informatization. Secondly, as topics on the level of teachers' digital literacy [26, 12] are becoming increasingly popular, applying the successful concept of DigCompEdu can promote the research and practices of teachers' digital literacy in China [43]. Thus, it would be appropriate to investigate Chinese teachers' digital literacy using DigCompEdu. To bridge the gap, future studies should draw on the concept of DigCompEdu to explore the status quo of teachers' digital literacy in China and put forward improvement pathways.

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