Digital literacy competency of elementary school teachers: A systematic literature review

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Article Info	**ABSTRACT**

The article presents a literature review on the digital literacy competencies of elementary school teachers. The method used is a systematic literature review with the process of determining objectives, searching for literature, selecting articles by reading abstracts and keywords, reading articles as a whole, abstracting data, and presenting the results of analysis of recent articles using the publish or perish 7, Mendeley, VOSviewer, and NVIVO 12 Plus applications. The search for articles in Scopus-indexed journals is limited to 2018-2022. From searching articles through publish or perish 7, there were 259 pieces. Then 259 articles were selected into 50 articles according to relevance to research questions. The results of the topic findings in the 50 articles through the help of the VOSviewer are the use of devices in learning, use of digital media in learning, the impact of digital literacy in learning, digital literacy, digital competence, digital literacy ability, digital collaboration, digital technology, literacy, technology, computer literacy, and others. The selected articles were analyzed according to the research questions through the NVIVO 12 plus and described in narrative form. This article contributed to future research and became a study for the theme of digital literacy competence.

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1. INTRODUCTION

Several studies reveal that the development of digital technology has a significant impact on education [1], [2], and learning requires teachers to have digital literacy competencies [3], [4]. The reality is that students and teachers lack mastery of digital technology [5], [6]. Technological devices support successful learning through hardware, software, and applications. All learning requires cyber-based digital technology, digital games, and cloud-based [7], [8]. Mastering digital technology in learning is not enough. Teachers must have digital literacy competencies, design learning with information and communication technology (ICT)-based strategies, and be critical of technology [9]. Mastering digital literacy in learning should fulfill students' academic needs, interests, and satisfaction with virtual learning [10]. Mastery of digital devices must be balanced with teachers' critical thinking about ICT in learning [11], [12]. The concept of digital literacy has been developed since the 1980s, which refers to the concept of digital literacy [13], [14]. According to its development, digital literacy competence in teachers refers to media literacy or media education [15], [16], the development of computer-based learning, websites, applications, software, and digital multimedia as learning resources [17]. Digital literacy competency is the ability of teachers to create and produce ICT-based information [18], [19] and communicate information by

ensuring the value of validity, credibility, and reliability so that it can be accepted by students [20]. Digital competence is the teachers' skills, creativity, and attitude in using digital media in learning [21].

Learning more systematically about digital literacy competencies in elementary school teachers in the latest literature according to the times is important [22]. Almost all governments in the world are promoting digital literacy that must be mastered by elementary school teachers in this digital era [23], [24]. However, indicators of digital literacy competence in elementary school teachers are still minimally researched because digital literacy strengthening activities in some countries are still based on a training project [25] and have both positive and negative effects [26]. Based on these studies, a literature study is needed that reveals in detail the digital literacy competencies of elementary school teachers.

This introduction explores an overview of articles on digital literacy competencies of elementary school teachers in the digital era that is reviewed and analyzed using the systematic literature review method. The result provides a conceptual framework for elementary school teachers' digital literacy competencies. Although there has been previous research, this research aims to answer the concept of digital literacy competencies according to the latest research. The study asked the main research question, how does the current literature inform the digital literacy competencies of elementary school teachers? The specific research questions are: i) How is the digital literacy competence of elementary school teachers?; ii) How is the use of digital media in learning?; and iii) How is the impact of digital literacy on learning?

2.   RESEARCH METHOD

The systematic literature review method was employed in this study. Researchers explore, evaluate, and translate research findings that are relevant to research questions and the theme of digital literacy competencies for elementary school teachers [27], [28]. The literature review aims to find out the latest literature and build a basis for academic inquiry related to the digital literacy competencies of elementary school teachers in the latest articles reviewed [29], [30]. This research reviews articles in Scopus-indexed journals in 2018-2022 through the publish or perish 7 applications. Enter databases and map articles' relevance, substance, and analysis using the Mendeley application and VOSviewer [31], [32]. The search results contained 259 Scopus-indexed articles. The criteria for articles published in January 2018 to January 2022, in English, published in journals, international seminar proceedings, and relevant to the topic of digital literacy competencies of elementary school teachers. The keyword "elementary school teacher digital literacy" contained 59 articles, and "digital literacy competence" included 200 articles. Then, the articles according to the theme were selected; 209 articles were not relevant to the criteria and were not used, while 50 articles according to the theme were analyzed with NVIVO 12 Plus and concluded [33]. The stages of this systematic literature review research apply a scheme starting from goal-setting, literature searches, selecting articles by reading abstracts and keywords, reading the whole article, data abstractions, and presentation of analysis results described in Figure 1.
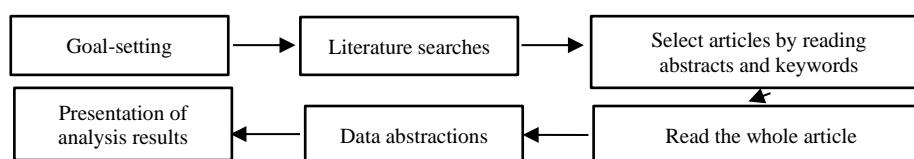

Figure 1. Systematic review procedure [34]

The scheme is the basis for setting objectives, searching the literature, selecting articles, reading their entirety, data abstraction, and presenting the analysis results. For an in-depth analysis of the articles to be used systematic literature review is required to answer the research questions and improve the associated research arguments. Figure 2 shows how the authors used VOSviewer to initial check thematic associations.

The visualization of interconnections between articles in Figure 2 provides information that digital literacy competence as the main theme is most widely used in all articles. Other themes emerged as a development of the main issue, namely the use of devices in learning, use of digital media in learning, the impact of digital literacy in learning, digital literacy, digital competence, digital literacy ability, digital collaboration, digital technology, literacy, technology, computer literacy, digital literacy ability, blended learning, student, character education, industry 4.0, and others. The most widely applied sub-discussion is to relate the issue of digital literacy competence with the use of devices in learning, the use of digital media in learning, and the impact of digital literacy in learning. This visualization mapping is the basis for conducting the next step of the literature review.
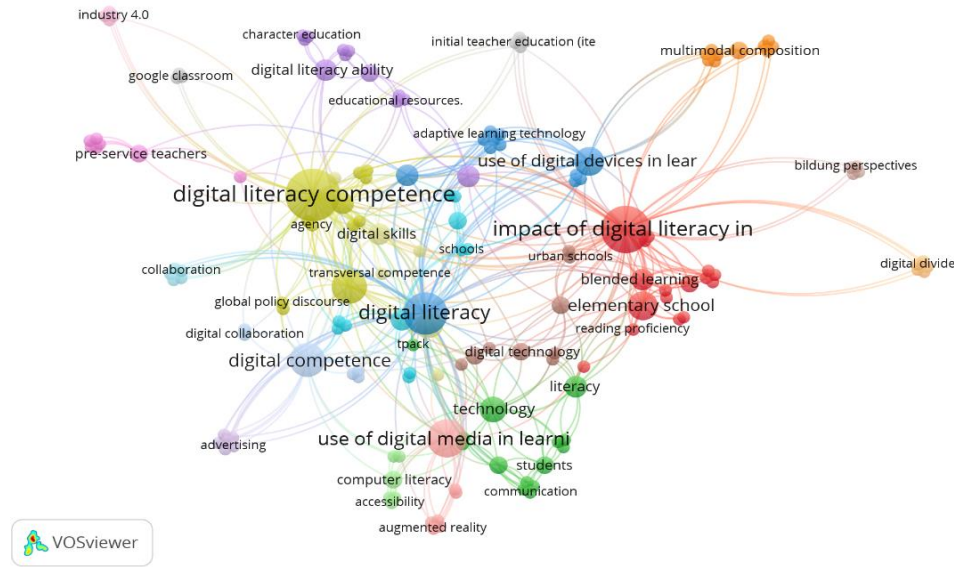
Figure 2. Initial network visualization from the VOSviewer application

3.   RESULTS AND DISCUSSION

The results describe the findings of the data synthesis evaluation to answer research questions based on the initial mapping of the visualization of interconnections between articles. The results of mapping based on year of publication, methodology, and relevance to three research questions (RQ), namely i) Digital literacy competencies of elementary school teachers (RQ 1); ii) Use of digital media in learning (RQ 2); and iii) The impact of digital literacy in learning. The presentation of this is presented in Table 1.

Table 1 Findings of Scopus indexed articles based on keywords relevant to the research question

No.	Year	Methodology	RQ	No.	Year	Methodology	RQ
1	2018	Design-based research project	RQ 1 [35]	26	2021	Cultural-historical research approach	RQ 2 [60]
2	2020	Case study methodology	RQ 2 [36]	27	2019	Qualitative	RQ 3 [61]
3	2018	Online survey and a group meeting	RQ 2 [37]	28	2021	Questioner	RQ 1 [62]
4	2020	Quantitative	RQ 2 [38]	29	2019	Qualitative	RQ 1 [63]
5	2018	Ethnographic	RQ 3 [39]	30	2021	Quantitative (exploratory-correlational)	RQ 1 [64]
6	2020	Mixed approach	RQ 3 [40]	31	2019	Qualitative	RQ 1 [65]
7	2018	Mixed-method case study	RQ 2 [41]	32	2021	Quantitative	RQ 1 [66]
8	2020	Qualitative case study	RQ 3 [42]	33	2019	Ethnographic study and mediated discourse analysis	RQ 2 [67]
9	2018	Trailing research	RQ 2 [43]	34	2021	Questionnaire	RQ 1 [68]
10	2020	Quantitative	RQ 3 [44]	35	2019	Qualitative exploratory case study	RQ 2 [69]
11	2018	Explanatory sequential design	RQ 1 [45]	36	2022	Descriptive qualitative	RQ 2 [70]
12	2020	Qualitative and quantitative	RQ 2 [46]	37	2020	Quasi-experimental research design	RQ 3 [71]
13	2018	Mixed-methods	RQ 1 [47]	38	2022	Descriptive analysis	RQ 3 [72]
14	2020	Case study	RQ 1 [48]	39	2020	Qualitative description	RQ 2 [73]
15	2018	Qualitative and online questionnaire	RQ 1 [49]	40	2022	Descriptive analysis	RQ 3 [74]
16	2020	Conceptual framework	RQ 1 [50]	41	2020	Research and development	RQ 1 [75]
17	2018	Mixed-methods	RQ 2 [51]	42	2022	Case study	RQ 1 [76]
18	2021	Mixed method	RQ 1 [52]	43	2020	Research and development	RQ 3 [77]
19	2018	What's the problem represented	RQ 1 [53]	44	2022	Case study	RQ 1 [78]
20	2021	Quantitative	RQ 1 [54]	45	2020	Descriptive	RQ 3 [79]
21	2019	Ethnography	RQ 2 [55]	46	2022	Qualitative	RQ 3 [80]
22	2021	Constructivist and socio-cultural	RQ 1 [56]	47	2020	Quantitative	RQ 1 [81]
23	2019	Qualitative	RQ 2 [57]	48	2022	Qualitative	RQ 3 [82]
24	2021	A systematic review approach	RQ 3 [58]	49	2020	Quasi-experimental	RQ 3 [83]
25	2019	Case study	RQ 1 [59]	50	2022	Data analysis and survey	RQ 2 [84]

3.1. Digital literacy competence for elementary school teachers

A study in Denmark mentioned that creating digital literacy competencies for elementary school teachers is done through online teacher professional development (OTPD). Teachers are trained to design learning videos and digital stories, identify challenges, and develop digital learning tools [35]. In responding to the digital revolution, all European and global teachers must master digital literacy competencies and digital media in innovating school programs and integrating digital competencies in elementary schools [45]. Digital competencies are several key components involving ICT performance and information processing [47]. Elementary teachers' digital literacy competencies are taught through technology in the classroom [49]. Indicators of digital literacy competence of elementary school teachers are the ability, skills, and behavior to operate digital tools in learning. Digital behavior is adapted to pedagogy, curriculum design, and cultural competence [53]. Digital literacy competencies and digital competencies go hand in hand. Digital competencies do not require critical reasoning, while digital literacy competencies require teachers to reason critically. Digital competencies are simply digital learning across contexts in the academic community. Digital literacy competencies require responsibility, ethics, and critical individual development reflected in the digital context [59].

Elementary teachers' digital literacy competence is evidenced by integrating ICT in learning and developing digital learning models [65]. In addition to online learning, teachers' digital literacy competencies must develop a blended learning model. Teachers must integrate ICT while controlling students' learning place, path, time, and pace [75]. Digital literacy competence in elementary school teachers is the ability to process, analyze, and evaluate hoax news and determine what is appropriate and what is not. Digital literacy competencies are realized in internet information search activities, hypertextual navigation, knowledge assembly, and content evaluation [81].

Research on several elementary schools in the State of Mexico, informs that digital literacy competence is determined by the development of teacher competence using ICT. The indicators are that teachers design classes more dynamically, clearly, and interestingly, utilize the internet, promote social interaction, and facilitate ICT-based self-learning [48]. Digital literacy competency is a combination of academic and ICT knowledge that is integrated into learning. [50], responsibility, ability to prevent and reduce the risk of excessive internet use in students [52]. Teachers' digital literacy competencies, namely critical thinking, creative, and problem-solving skills [54], digital communication, and collaboration [56]. For teachers and prospective teachers, mastering digital literacy competencies is a necessity. These competencies include information literacy, application of digital safety standards, digitalization, virtual collaboration, and reflective assessment in a digital environment [62].

Research in Spain, Italy, and Ecuador recommends the development of digital literacy through the selection of digital learning resources, ICT, digital communication, and forming a digital soul [64]. Mastery of digital literacy competencies is realized in the didactics of augmented reality (AR), which offers science fields to facilitate learning [66]. Research among 155 teachers in Spain cited digital literacy skills such as using mobile devices in the classroom, learning innovation skills, designing virtual discussions, and mobile-based learning innovations [68]. Digital literacy competencies have been incorporated into the Norwegian curriculum at all elementary and secondary education levels regarding concrete abilities to search, process, create and communicate critically through digital media [76]. Although digital literacy competency is a necessity, teachers must have the ability to think when, where, and with what traditional learning will be done [78].

3.2. The use of digital media in learning

Teachers' digital competence is proven through their ability to use digital media and ICT in learning, such as computers, applications, clickers, and gamification, which directs students to focus on learning [51]. Teachers use digital media through moving still images, text, sound, animation, and music appealing to students [41]. The use of ICT in elementary school students in the form of using digital communication tools, media literacy, and computers that that be directed by the teacher [43]. The use of digital media such as the internet is useful for students to dispel hoax news and prevent plagiarism. Teachers make students wise and smart using digital media, networks, or communication tools [51].

Digital media-based learning directs learners to search for digital reading materials. Learning with digital media will be more meaningful because it invites learners to surf in cyberspace [55]. Research on 144 teachers acknowledged that using the internet in learning must be based on responsibility, prioritizing benefits, and minimizing risks in internet use [57]. Digital media in learning is realized with videos, photos, multimedia, animations, and Edmodo applications, which are integrated into real objects through the screen of mobile devices connected to the internet [67]. Implementation digital media in elementary school strengthens literacy, multiliteracy, and new literacy skills [69].

Digital media or digital technology in elementary school in the form of desktop computers, tablet personal computers, wireless broadband, cell phones, social media [73], and Technological Pedagogic Content Knowledge (TPACK) through planning, modeling, opportunities, and guided practice [36]. Learning in the new literacy era must construct new knowledge for elementary school students. The use of ICT in elementary schools answers to the conditions and achievements of students who require learning through digital platforms [38]. The use of digital media in schools is not always good. This research found that ICT in schools is still limited to consuming information, not at the level of information production [46]. The use of digital media received a variety of student responses. Teachers must create pedagogical awareness in students, not just the practical principle of using ICT [60]. Although the digital literacy curriculum is not yet included in the national curriculum as a compulsory subject, several elementary schools in Indonesia are implementing digital media based on ICT and media literacy [70]. According to previous study, the use of digital media in schools can foster information literacy and better ethics in the use of information [84].

3.3. The impact of digital literacy on learning

The impact of digital literacy on elementary school learning is diverse. ICT integration in learning requires teachers to master TPACK. The real impact is building new knowledge about digital tools in learning, integrating pedagogy with digital tools (digital pedagogy), and building confidence in the importance of integrating digital literacy [39]. Discipline and creativity in using ICT in the classroom positively impact digital literacy [61]. Digital devices impact digital risks, law, ethics, and social media that hinder students from doing schoolwork, the accuracy of digital learning resources, bullying, and student complaints. When teachers have digital literacy, they will answer the challenges of the digital era that directly impact [63]. ICT allows teachers to differentiate their teaching to diverse groups of students by utilizing active and creative approaches. Digital technologies can help give all learners the ability to access the curriculum and can offer a range of strategies to achieve specific learning objectives that may otherwise be difficult to achieve [71].

Digital literacy competencies in teachers have an impact on increasing digital-based learning to take place not only at school but at home for both elementary and early childhood. This implies that digital literacy learning extends the learning of digital citizenship competencies, digital footprint, internet safety, and media balance [77]. In blended learning, the role of teachers in mastering digital literacy is very important. Teachers direct elementary students to digital devices with various time, place, and internet network variants. This activity requires teachers to design interesting learning because it has an impact on learning success, meeting students' individual needs, and the risk of student academic failure [79].

Curricula around the world have not all implemented digital literacy. With the advancement of ICT in the 21st century, digital literacy is included in the curriculum, which includes theory and practice [83]. Teachers' digital literacy skills can organize and guide students' knowledge and skills [40]. Digital literacy in teachers has the potential to transform traditional learning into digital [42]. Blended learning requires teachers to direct students to engage in the classroom to utilize ICT and digital literacy [44].

Over the past decade, ICT has become urgent in the education curriculum. Digital literacy-based learning has continued despite its lack of fit with existing curricula [56]. Teachers' mastery of digital literacy will lead to meaningful learning for elementary school students [72]. The mastery of professional digital competence impacts digital literacy in learning. It is influenced by pedagogical knowledge, use and utilization, confidence, and inclusive understanding of ICT [74]. Research on elementary school teachers in Norway stated that digital literacy increases awareness of the role of ICT in learning. Teacher professionalism in learning is determined by using ICT and digital literacy [80]. Based on research in Poland, digital literacy is said to have a digital divide. The solution offered in this research is digital inclusion which can be done through developing educators' competencies and lifelong learning [82].

4. CONCLUSION

The digital literacy competence of elementary school teachers, in general, is the ability, skills, and behavior to operate information and communication technology and digital devices in learning. Digital competence refers to teachers' knowledge to bring learners into a global society and the combination of pedagogical and ICT skills for learning. The use of digital media in learning includes the utilization of ICT, computers, applications, gamification, videos, multimedia, animations, and other digital devices in learning. The impact of digital literacy in learning includes requiring teachers to master TPACK, digital pedagogy, teacher discipline and creativity, digital-based curriculum innovation, prevention of negative risks such as hoax news, bullying, student complaints, and the accuracy of digital learning resources. Future researchers need to follow up with a literature review or field research related to the digital literacy competencies of elementary school teachers.

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