# The Role of Digital Competence for Pre-Service Teachers in Higher Education Indonesia

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| ARTICLE INFO | ABSTRACT |
|---|---|
| | Progress in the digital era has accelerated in the past few years, including its impact on education, which must prepare competent human resources. Teachers are expected to have competencies that can meet the demands of the times. This study aims to describe the role of digital competence on pre-service teachers in Indonesia. Using the Systematic Literature Review (SLR), this article examines the results of research related to Digital Competence which raises the subject of students taking education department in Indonesia. The literature review was obtained from the "lens.org", "scholar.google.com", "eric.ed.gov" "link.springer.com", and "sciencedirect.com" websites using the keyword "kompetensi digital" and "digital competence" with filter for the 2015-2021 years range. After that, it is filtered with the open-access journal option and language restrictions in English and Indonesian. The analysis is based on research objectives that support providing an overview of the role of digital competence in pre-service teachers from selected articles. After being reviewed through inclusion and exclusion criteria evaluated by quality assessments, five articles published are analysed. The result shows that digital competence plays a role in being an indicator in measuring literacy levels, improving pre-service teacher's learning outcomes, and contributing to the teaching process.<br><br> |

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## 1.  INTRODUCTION

Digitalization has caused an era of disruption in various aspects. Education is one of the sectors worst affected by the sudden need to teach and learn from face-to-face interactions to small structures (Sá et al., 2021). Today's, in the world of work, digitalization is emerging as a key to maintaining the link between the needs and nature of our education system to fulfil life skills. The ability to use digital technology is also considered an essential life skill for every citizen when they are present as part of a digital society.

Therefore, education faces a challenge to provide individuals with the life necessary to survive and be expected to thrive in society (Cristiana, 2021).

Education has challenges and opportunities that are believed to be strongest in aspects of the use of technology in learning (Khotimah et al., 2020). Different technology can improve the quality of the learning process. Students can also explore more knowledge, and teaching can take place through gadgets. But it also generates challenges such as gaps in internet access for students and teachers, unequal infrastructure, and costs for using digital devices. To produce progress of national education, digitalization is expected to assist education actors in the continuity of the teaching and learning process in an even and optimal manner. Following the times, the digitalization of education is presented and implemented with the intention that education can still produce learning under its direction and purpose. Understanding this situation, managing digitalization intelligently and appropriately becomes one of the new challenges present in the world of education so that learning activities can still be carried out, especially during the distance learning period (Cristiana, 2021). With digitalization, education can be carried out more efficiently at a distance and in time.

The digital learning environment is a contemporary learning need. The utilization of technology in the field of education makes learning activities more effective and efficient to attract students' interest in learning. Current and future learning increasingly lead to digital devices (Purwodani & Praherdhiono, 2018). Technology does have not only positive impacts on schools but also negative ones. This digitalization era requires online integration between several entities. This online integration will provide room for individual violations, even substantially harm producers, and even damage the institution's reputation (Muktiarni et al., 2019) because it needs education for digital users of all users.

The use of digital tools can also cause anxiety and self-efficacy levels. Computer anxiety and high levels of computer self-efficacy are important affective factors that drive students' academic success in today's digital era (Katsarou, 2021). Therefore, it is necessary to have mastery of digital technology.

Introducing new technologies in modern education is not just distributing information but also changing learning methods. The support of these statements again emphasizes the need to implement educational activities in new and different ways. This technology allows quick access and easy access to information, but the efficiency of research, selection, evaluation, and use of appropriate details requires additional abilities (Grncharovska et al., 2016).

In 2017, the European Commission published a digital competency framework to create standards for evaluating the digital competencies of educators in Europe (Muktiarni et al., 2019). Digital Competence (DigComp) is a flexible reference framework that can be adapted to support the development and understanding of digital competence in any setting. DigComp can be used by educators and any other actors interested in developing and understanding digital competencies by people (Comisión Europea, 2019). The rapid increase in the number of different digital competency frameworks, models, and strategies has dramatically shifted the focus from the operational aspects of measuring and interpreting digital competencies to factors related to definitions, indicators, and indexes (Sillat et al., 2021).

Another important thing is to prepare human resources, especially teacher candidates. This is because Generation Z, who recently inhabits the majority of students, is closely related to digital devices that are not compatible with the previous generation (Br Sitepu et al., 2020). It is most effective when providing digital education to Generation Z and newer generations. That is why researchers recommend that pre-service teacher education programs should be concentrated on digital competence (Reisoğlu & Çebi, 2020). There has been much previous research discussing the issue of digital competence in developed countries, but it is very rare for developing countries to research digital competence. In contrast, some performed the analysis of the digital competence of teachers (Fibrianaa et al., 2018; Hibana & Surahman, 2021). None has specifically reviewed the role of digital competence for the pre-service teacher. This review aims to get an overview of the development and role of digital competence with a focus on pre-service teachers candidates in higher education in Indonesia systematically through research questions:

RQ 1. What dimensions are used in the application of digital competence?

RQ 2. What is the purpose of the study on digital competency research with the subject of pre-service teachers in Indonesia?

RQ 3. What are the results of digital competency research in the context of pre-service teachers in Indonesia?

## 2. METHODS

This study uses a Systematic Literature Review (SLR) with a meta-synthesis model. This systematic literature review uses the "lens.org", "scholar.google.com", "eric.ed.gov", "link.springer.com", and "sciencedirect.com" website databases. The keywords used in the search are "kompetensi digital" and the keyword "digital competence" with limitations on the type of document journal articles, and conference proceedings articles. As well as open access restrictions, we limit the article year to the last seven years, namely between 2015-and 2021. This limitation is a strategy to focus publication articles for reading and increase the accuracy of information search.

Before being ready for use in this result, each article was evaluated against the following inclusion and exclusion criteria in table 1.

**Table 1. Inclusion and exclusion criteria**

| Inclusion criteria |
|---|
| The research work is related to the digital competence of pre-service teachers or students of the education department. |
| The research subjects were taken from Indonesia. |
| The publication includes the definition of digital competence. |
| Research papers are published between 2015 and 2021. |
| Exclusion criteria |
| The research work is not related to the digital competence of pre-service teachers or students of the education department. |
| The research subjects were not taken from Indonesia. |
| The publication does not include the definition of digital competence. |
| Research papers are not published between 2015 and 2021. |

This research was analyzed using a meta-synthesis technique. Refers to Perry's (2002) meta-synthesis analysis technique is a technique to combine existing data to obtain data new concepts or deeper understanding (Perry & Hammond, 2002).

## 3. FINDINGS AND DISCUSSION

The filtering results found that five articles in the last 7 years were included in the criteria because they raised the topic of digital competence and issues related to pre-service teachers in Indonesia. Five articles were obtained and then read and analyzed. Furthermore, selection flow articles as data for this paper are presented in Figure 1. when obtained. The final selection article is then read and analyzed. This section presents three results that follow the research question.
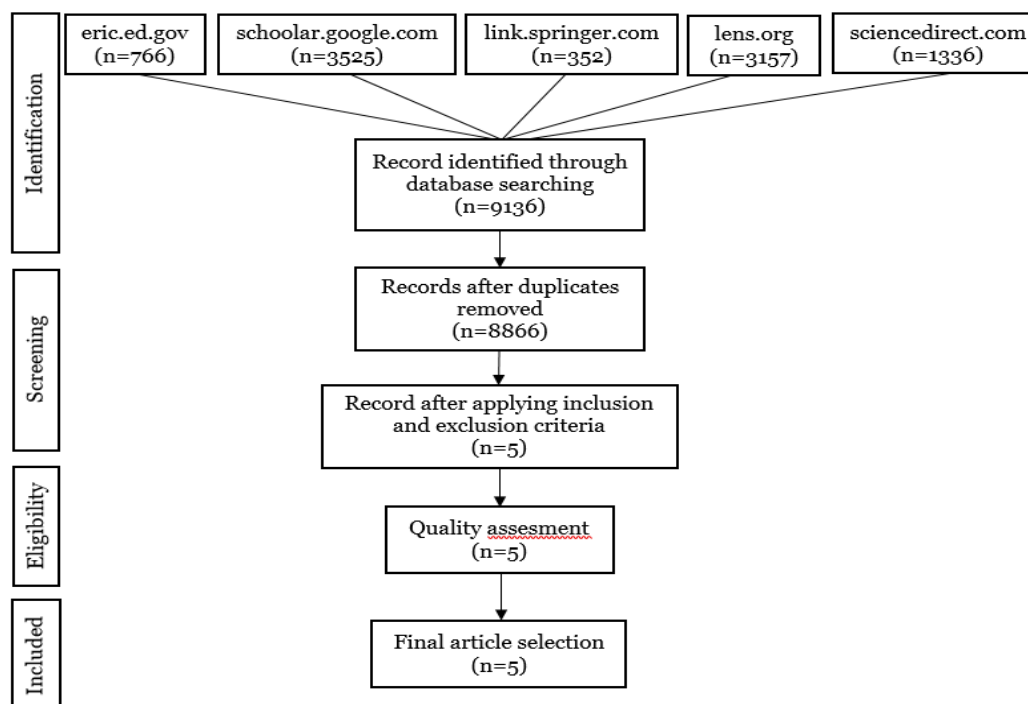
**Figure. 1. PRISMA flow: data extraction procedure**

### *What dimensions are used in the application of digital competence?*

The various instruments selected according to the dimensions of digital competence are included in Table 2.

**Table 2. Dimension of Digital Competence Uses in Selected Article**

| Author | Title | Dimension of Digital Competence | | | | |
|---|---|---|---|---|---|---|
| | | Information and Data Literacy | Communi cation and Collaborat ion | Digital Content Creation | Safety | Problem Solving |
| Makiyah, Y. Nana Mahmudah, I, R. | Korelasi antara kompetensi digital dan keterampilan berpikir kreatif mahasiswa pendidikan fisika | | | ✓ | | |
| Cahyani, V. Ilhamsyah. Mutiah, N. | Analisis Tingkat Literasi Digital pada Generasi Z dengan Menggunakan Digital Competence Framework 2.1 (Studi Kasus: Mahasiswa FMIPA UNTAN) | ✓ | | | | |
| Prayogi, R, D. Estetika, Rio | Kecakapan Abad 21: Kompetensi Digital Pendidik Masa Depan | ✓ | ✓ | ✓ | ✓ | ✓ |
| Shomedran | Menakar Kompetensi dan Profesi Lulusan Pendidikan Luar Sekolah di Era Digital | ✓ | ✓ | ✓ | ✓ | ✓ |

| Andina, D, M. Cahyono, B, Y. Widiati, U. | How English Foreign Language Students' Autonomy and Digital Competence Relate to Their Writing Achievement | ✓ |
|---|---|---|

Makiyah (2020) used digital competence with digital content creation dimensions by measuring four aspects of the assessment, namely, (1) the use of digital applications to carry out learning for students, (2) the use of digital applications to create media and evaluation, (3) developing an understanding of the use of digital applications for school administration work, (4) a sense of ethics related to the use of social media (Makiyah et al., 2020).

In Cahyani's paper (2021), the eight dimensions of information data and literacy are used to map indicators based on digital literacy levels starting from Foundation, namely level 1 to High Specialized, namely level 8 (Cahyani et al., 2021). In his paper, Prayogi (2019) researches 21st-century skills and their relationship with educators and raises various dimensions of digital competence in teaching to be associated with 21st-century skills (Prayogi & Estetika, 2019). Shomedran (2020) discusses digital competence as one of the competencies that Out of School Education graduates must possess by examining the five dimensions of digital competence. In the article written by Andina (2020) was mentioned that it was students who integrated the use of technology in writing. It can be said that the writer uses the digital literacy dimension (Andina et al., 2020).

### What is the purpose of the study on digital competency research with the subject of pre-service teachers in Indonesia?

Furthermore, reviewing and analyzing the research objectives of the selected publications. The various objectives of the selected manuscripts are grouped into the following three categories: First, involvement of digital competencies in the teaching process. Second, involvement of digital competence in pedagogy. Third, digital competence is an indicator. The results are presented in Table 3.

**Table 3.** Results of Category Research Objectives

| Indicator | Learning Achievement | Teaching process |
|---|---|---|
| 20% | 40% | 40% |

Digital competence is used as an indicator has one paper. Cahyani's (2021) research objective is to measure Generation Z's level of literacy skills through the digital competence framework 2.1 indicator (Cahyani et al., 2021). Then two publications stated goals related to learning achievement. First, the research is written by Makiyah (2020) and then aims to determine the relationship between digital competence and creative thinking skills (Makiyah et al., 2020).

The research written by Andina (2020) has two objectives that discuss digital competence, namely to prove a correlation between the digital competence of English Foreign Language students and their writing achievement. The second objective is to determine the relationship between the combination of the level of autonomy of English Foreign Language students and competence in digital and writing of their English Foreign Language (Andina et al., 2020).

Finally, the researcher's goal in investigating the importance of digital competence for teaching is that two of five publications were selected in this category. Shomedran's (2020) Perception provides an overview of the competencies and professions of Out School Education graduates in today's digital era (Shomedran, 2020). Some studies confirm the positive relationship between digital competence and pre-service teachers' academic performance (Mehrvarz et al., 2021; Yazon et al., 2019). Mehrvanz (2021) acquiring result that digital competence allows students to obtain technical, cognitive, and ethical skills and knowledge. Also, digital competence helps students design their plan or schedule related to their scientific needs, solve software problems by searching online, communicate rationally with others

online, and find the answer to their scientific questions and problems with the help of their digital competence (Mehrvarz et al., 2021).

Paper by Prayogi (2019) aims to comprehensively find the discourse of 21st-century skills and its interrelationships as the basis for the teacher development profession in teaching students according to the demands of the times (Prayogi & Estetika, 2019). The importance of training teachers in the digital environment and its close relationship with the quality of education in the 21st century have been made clear in different reports published by international institutions (Comisión Europea, 2019). progress makes it difficult to determine the direction of further changes. In the 21st century, all areas of social life are changing dynamically due to the progressing process of digitization. Digital competencies are becoming necessary to adapt to life in a world created by increasingly improved IT and telecommunication tools (Nowak, 2019). In order not to be digitally excluded, pre-service teachers have to adapt successively to these changes.

### What are the results of digital competency research in the context of pre-service teachers in Indonesia?

First, analyze articles related to indicators (Table 3). The students of the Mathematics and Natural Sciences Faculty who became the research subjects showed that the response to measuring digital literacy from students from various levels was most striking at the advanced-intermediate level. Digital literacy indicator's is based on the digital competence indicator of the European Commission's DigCom 2.1 (Cahyani et al., 2021). It can be used as a reference for pre-service teachers in deepening and improving their digital literacy skills.

Next, two studies discuss the relationship of digital competence with learning achievement. First, an article discusses the correlation between digital competence and the thinking skills which subject is students in Physics Education Department. The higher the digital competence of pre-service teachers, the higher their creative thinking skills (Makiyah et al., 2020). Being able to use various digital applications can help pre-service teachers create more diverse teaching content.

Andina's (2020) research explains a relationship between students' ability to use technology and their writing scores. It is assumed that digitally literate students can use appropriate technology to assist them in writing a composition. This suggests that students who can navigate educational technology for writing are more likely to achieve outstanding achievements in writing. Given the correlation between students' independence and writing achievement, the moderate correlation between digital competence and writing achievement, and the significant relationship between learner autonomy and digital competence on writing achievement indicate that students get better with digital tools. They can experiment more with the writing style and thus become a better writer (Andina et al., 2020).

Subsequent research showed results related to teaching. Shomedran's analysis (2020) said that information and data literacy competence is beneficial for pre-service teacher graduates. Everyone can process information and data in general and correctly to support aspects of life in a positive and targeted way sense—the importance of information and communication skills. Literacy in the world of work produces information in the form of documents per year, world publications continue to increase, and in general, every worker must have time to read (Shomedran, 2020).

Furthermore, in communication and collaboration competencies, each pre-service teacher has competence in communicating, conveying something, processing messages, interacting, and collaborating with others when entering the world of work. Then the ability to create digital content, where pre-service teachers are required to understand how to use digital devices to make digital learning content. Next, competencies related to security include ensuring the protection of data and confidentiality, health, and the environment that must be owned. Pre-service teachers are required to provide data confidentiality, protect personal data and be responsible for paying attention to environmental aspects of teaching. Finally, problem-solving competence is where cognitive abilities and skills contribute to solving problems by formulating several rules, which are more than just simple

applications of previously learned practices in a rational, straightforward and thorough manner. It requires students to systematically, logically, regularly, and thoroughly on digital sources to master concepts, principles and generalizations and insights using scientific methods or thinking (Shomedran, 2020).

Research from Prayogi (2019) presents the alignment of digital profiles and competencies in the learning process. By looking at the design of 21st-century learning based on products and problem solving, it is essential for active collaboration of students, especially in creating and innovating high-value product creativity and systematic and easy problem solving for students. From this, through the profile of 21st-century educators and their alignment with digital competencies, which then leads to the formation of product creativity and problem-solving, it is very young to provide digital-based learning by fulfilling the skills of 21st-century students (Prayogi & Estetika, 2019).

The ability of prospective teachers to use technology in a good way is expected to encourage students to reflect on personal use. And the teacher must also pay attention to the pedagogical aspect because the teacher must simultaneously and continuously make pedagogic-didactic assessments that focus on how ICT can be improved learning for students in lessons (Heuling et al., 2021).

## 4. CONCLUSION

This Systematic Literature Review provides an overview of developments in Indonesia by selecting the subject of pre-service teachers in the last 7 years. We chose the subject of pre-service teachers because most of the students are Generation Z, who are easy-to-use digital tools and teachers are the vanguard who are very influential and need to be prepared to face the digitalization of education.

The result shows that digital competence plays a role in being an indicator in measuring literacy levels(Cahyani et al., 2021), improve pre-service teacher's learning outcome (Andina et al., 2020; Makiyah et al., 2020), and contribute to the teaching process (Prayogi & Estetika, 2019; Shomedran, 2020). This systematic review identifies digital competence from the European Commission. Hence, further research can be done by comparing other definitions of digital competence to get more views.

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