





## Investigation of digital competence of elementary school teacher in West Nusa Tenggara: A cross-section survey study

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### ABSTRACT

As educational facilitators, teachers should have good digital competence to successfully integrate technology into the learning process. This cross-sectional survey research method was conducted on the needs of digital elementary teachers in West Nusa Tenggara. Respondents were 213 primary school teachers from 10 districts in West Nusa Tenggara, Indonesia. The data collection process is conducted online and is anonymous to maintain the privacy of respondents using the Google Form platform. The data analysis used was the Mann-Whitney U test, as we wanted to compare the competencies of male and female teachers. Moreover, the researchers also conducted FGDs with Heads of Education Bureau in 10 districts of NTB to verify the results in this area. The results of this study show that the digital competence primary school teachers either man or woman teachers are still low. In addition, the teacher's skills in using computers, the Internet, and software in the classroom are minimal. The opportunities for teachers to use the Internet are quite high, but teachers do not use it for classroom learning. Teachers believe that technology can help them withhold concepts or knowledge from students. However, teachers also fear the negative effects if children interact with Technology too often.

## Introduction

The world of education today must be connected to technology and information. The development of technology and information, which is currently increasing rapidly, ultimately has implications for the learning process in the classroom (Hill, 2018; Means, 2010; Smaldino et al., 2013). Internalizing technology in classroom learning certainly depends on the teacher's digitalization ability as the teacher's spearhead. Revuelta-Domínguez et al. (2022) state that teacher digital competence can be seen from several aspects, namely the ability to make media, the ability to use media, and the ability to evaluate media. Meanwhile, Torres-Hernández & Gallego-Arrufat (2022) established that indicators of teacher digitalization abilities could be seen from pedagogical knowledge, didactic skills, and teachers' attitudes towards technology.

To support this, the Government has provided a technology-based education platform such as the "Learning House", which can be accessed at the link: <https://belajar.kemdikbud.go.id/>. However, not all teachers can access this platform due to limited knowledge of computerization skills (Aini, 2021). The teacher's ability to integrate technology into classroom learning is also considered minimal. Despite the pandemic, many technology-based learning media have supported online learning (Almonacid-Fierro et al., 2021).

To use technology-based learning media in the learning process, teachers and students need to have sufficient understanding and skills in using technology (Visser & Flynn, 2018). First, it will be explained related to the digital skills possessed by the teacher. Smaldino et al. (2013) state that the teacher's digital skills can be seen from the variety of instructional media used in class. One example of digital skills that teachers have is interactive instruction. This interactive learning can be seen from how richly the teacher uses media types. If the media used by the teacher can actively involve students in learning, then the learning process can be interactive. The next example is the Personal Response System (PRS), a learning media that the teacher fully controls, like a PowerPoint run using a remote or guiding students to use GeoGebra software to see a graph of an equation.

Apart from that, there are also other examples, such as Mobile Assessment Tools or using a mobile assessment. In this case, teachers have used mobile devices and abandoned the old (paper-based) way of measuring the success of learning in the classroom. Teachers can use the Quizziz website, Google Forms, or other assessment software to see the success of learning (Mauluda et al., 2020). The last example of digital skills that teachers have is Community of Practice (CoP) or group training. Digitally skilled teachers must be able to involve students cooperatively in learning activities in class (Lo et al., 2011). The coP can also be interpreted as a situation where the teacher provides learning according to the student's abilities (student needs) using technology-based media.

There have been many research results related to teacher competency. In da Silva's research (2019), he produced data on the dimensions of education that are integrated with technology. The dimensions generated in this study are Technological, communicative, pedagogical, management, and research. The method used in this study is a systematic literature review. In addition, Calvert's (2020) & Means's (2010) research results show a relationship between teachers' digital competence and media models used in class. Another study (Karakus, 2019) produced data on teacher perceptions of integrating information technology in classroom learning. The results of this case study research show that teachers' perceptions vary. Not all teachers are open to the inclusion of technology in classroom learning. The main influencing factors are the teacher's age and years of service. In this study, the mapping of teacher digitalization competencies will be carried out using the survey method. This research also focuses on elementary school teachers. Elementary school teachers were chosen because the results of previous studies focused on teachers at the higher education level or at least teachers at the senior high school level.

Thus, it is important to map the competence of elementary school teachers towards the inclusion of technology in the world of education. In line with that, this study aims to investigate the digital competence of elementary school teachers. The implication of this research is as material for reflection on the learning process that has been running so far. In addition, the mapping will be useful for determining what kind of learning media is suitable and appropriate to be integrated by elementary school teachers in class.

## Literature reviews

### Digital competence

Digital competence, often referred to as digital literacy or digital skills, has become an essential aspect of modern education. It encompasses a range of skills and knowledge that individuals need to effectively use digital technologies in various aspects of their lives, including education, work, and personal development. This literature review aims to explore the concept of digital competence, its importance in contemporary society, and the challenges associated with developing and accessing digital competence. Digital competence is crucial in today's information age, where technology permeates every aspect of our daily lives. In the field of education, teachers must possess digital competence to integrate technology effectively into the learning process. Research by Eshet-Alkalai (2004) highlights that digital competence is not limited to technical skills but also encompasses cognitive and socio-emotional aspects. Educators need to be proficient in using computers, the internet, software, and other digital tools to enhance teaching and learning experiences.

Developing digital competence is not without challenges. Barak and Asad (2017) note that many teachers struggle with a lack of training and support in integrating technology into their pedagogy. Furthermore, resistance to change and fear of technology's negative effects on students can hinder the adoption of digital competence among educators (Drossel, 2019). Additionally, the rapid pace of technological advancements makes it challenging for teachers to keep up with the latest tools and trends (Kereluik et al., 2013). Assessing digital competence is a complex task. Digital competence assessment should go beyond measuring technical skills and consider higher-order thinking abilities, problem-solving, and critical evaluation of digital resources (Ferrari, 2012). There is an ongoing debate about how to effectively assess digital competence, with some researchers advocating for performance-based assessments (Richter and McPherson, 2012) while others emphasize the need for self-assessment and reflection (Dudeney, 2007).

In conclusion, digital competence is a multifaceted concept that plays a pivotal role in education and modern society. Teachers must possess digital competence to effectively incorporate technology into the learning process. However, there are various challenges in developing and accessing digital competence, including the need for adequate training, overcoming resistance to change, and addressing the rapid evolution of technology. As technology continues to advance, it is essential to promote digital competence among educators and learners alike to prepare them for the digital age.

### Technology education

Technology education, often referred to as tech ed, is a vital component of modern educational systems. It encompasses the teaching and learning of various technological skills and concepts, aiming to prepare students for the digital and technological challenges of the 21st century. In this literature review, we explore the concept of technology education, its significance today, and some of the key research findings and trends in this field. Technology education plays a pivotal role in equipping students with the skills and knowledge required to thrive in a technologically driven world. As emphasized by Sanders (2001), technology education is not just about using tools and gadgets but also about understanding the principles, processes, and ethical considerations behind technology. It encompasses a wide range of subjects, from computer science and coding to robotics, engineering, and digital literacy, ensuring that students are well-rounded and capable of adapting to an ever-changing technological landscape.

Research in technology education has revealed several noteworthy trends and findings. For instance, according to recent studies (Sunal et al., 2020; Zozimo et al., 2018), hands-on and project-based learning approaches are highly effective in teaching technological skills. These methods encourage students to actively engage with technology, fostering problem-solving abilities and creativity. Furthermore, technology education has been shown to have a positive impact on students' academic performance and future career prospects (Johnson et al., 2019). Despite its importance, technology education faces certain challenges. One significant challenge is the digital divide, where students from disadvantaged backgrounds may not have access to the necessary technology and resources (Warschauer, 2003). This issue highlights the need for equitable access to technology education. Additionally, teacher preparedness and professional development are crucial for the successful implementation of technology education programs (Voogt et al., 2017). Teachers need adequate training and support to effectively integrate technology into their teaching methods.

The future of technology education holds great promise. Emerging technologies like virtual reality (VR), augmented reality (AR), and artificial intelligence (AI) are transforming the way students learn and interact with technology (Kopcha, 2012). These technologies provide innovative opportunities for immersive learning experiences. Moreover, technology education is becoming increasingly interdisciplinary, linking with fields like STEM (science, technology, engineering, and mathematics) to provide holistic and well-rounded education (International Technology and Engineering Educators Association, 2020). In conclusion, technology education is a critical component of contemporary education systems. It prepares students with the skills and knowledge needed to navigate a rapidly evolving technological landscape. Research findings highlight the effectiveness of hands-on learning approaches, and technology education has a positive impact on students' academic achievements and future careers. However, challenges such as the digital divide and teacher preparedness must be addressed to ensure equitable access to technology education. Looking ahead, emerging technologies and interdisciplinary approaches hold promise for the future of technology education.

## **Method**

The research method used is the Unweighted Cross-Section Survey. This survey approach aims to classify the population in the same data collection period. The survey results will be grouped and compared to the tabulated data from Krishnaswamy et al. (2012). This survey was conducted for three weeks, starting from 23 March 2023 to 9 November 2023.

## **Respondents**

Respondents in this study were 213 elementary school teachers from 10 districts in West Nusa Tenggara Province. Respondents were selected based on the teacher's teaching experience, namely at least 2 years of teaching. The next criterion is that teachers are active in teaching during the COVID-19 pandemic (2020-2021). This criterion was determined because the phenomenon of online learning carried out during the pandemic period is likely to affect the resulting survey results.

## **Instrument**

The instrument used in this research is a survey questionnaire. This survey questionnaire about the digital competence of elementary school teachers was developed from the Digital Teacher Competency indicators, which are explained in table 1 below.

**Table 1** Teacher's digital competency indicator

No	Aspects	Operational Indicators
1	Pedagogical Knowledge	Teacher knowledge in using computers in learning
		Teacher knowledge in using the internet in learning
		Teacher knowledge in using software in learning
2	Didactical Skills	The ability of teachers to use computers in learning
		The ability of teachers to use learning resources that come from the internet
		The ability of teachers to use software-based learning media
3	Teacher Attitude	Perceptions of teachers in using the internet
		Teacher acceptance of technology in learning
		The level of security of teachers in using the internet

Source: modified from Torres-Hernández & Gallego-Arrufat (2022)

Experts have validated this instrument in education and technology-based learning media from the University of Mataram. In addition, researchers also used the Pearson product-moment validity test and Cronbach alpha reliability using IBM SPSS version 25. The data tested came from 50 prospective elementary school teaching students who were given a questionnaire instrument by filling out an online survey via Google form. The validity test results are seen by comparing the *r*-count with the *r*-table (Erfan et al., 2020). The *r*-table value for 50 respondents is 0.23. The validity test results showed that only ten of the 21 question items tested were valid. These ten questions were then tested for reliability before being given to the respondents. Question items are said to be reliable when the resulting Cronbach Alpha value is more than 0.6 (Erfan et al., 2020). Based on the results of the reliability test, it was found that the Cronbach Alpha value for the 10 question items was 0.893 or more than 0.6. Thus, the question items have been declared valid and reliable.

### Data collection and analysis

The data in this study were collected online using the Google form platform. The instrument link was distributed via WhatsApp to respondents. The researcher gave three weeks to fill in this digital competency survey link. The data collected will then be tabulated and grouped based on the gender of the teacher. Both population groups will be analysed using the Mann–Whitney U-test to see comparisons between the two population groups (Heale & Twycross, 2015). The test was chosen because the random data groups are different, causing the data to be inhomogeneous. This requires researchers to use non-parametric tests to see differences between the two groups. This test will be carried out using IBM SPSS software version 25. To maintain the validity of the data, the researchers also conducted Focus Group Discussion (FGD) activities with the Heads of the Education Office from the 10 districts where data was collected. This FGD activity aims to cross-check the findings in the field and ensure that the data found can represent what happened in the field.

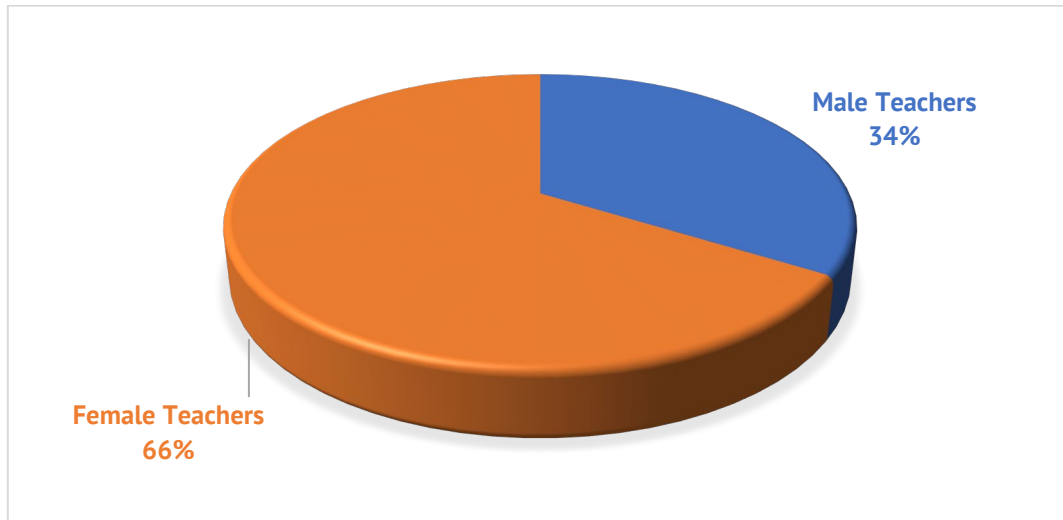
### Ethics code

The survey was compiled in an anonymous format because it would not reveal the respondent's identity. All respondents willing to fill out the survey link are willing to volunteer as research respondents. All collected data will be stored and disguised after the data analysis process.

## Results

### Gender

The results of the study will be grouped into two, namely the male teacher group, and the female teacher group. Of the 213 respondents who filled out the survey, the group distribution is as follows:



**Figure 1** Distribution of data on groups of male teachers and female teachers

Figure 1 shows that 66% (141) of the respondents are female. In contrast, 34% (72) of the respondents were male. This shows that there are more female respondents than male teachers. Next, a Mann–Whitney U-test analysis will be carried out to see if there is a significant difference between the digitalization abilities of male and female teachers. The Mann–Whitney U-test results can be seen in table 2 below:

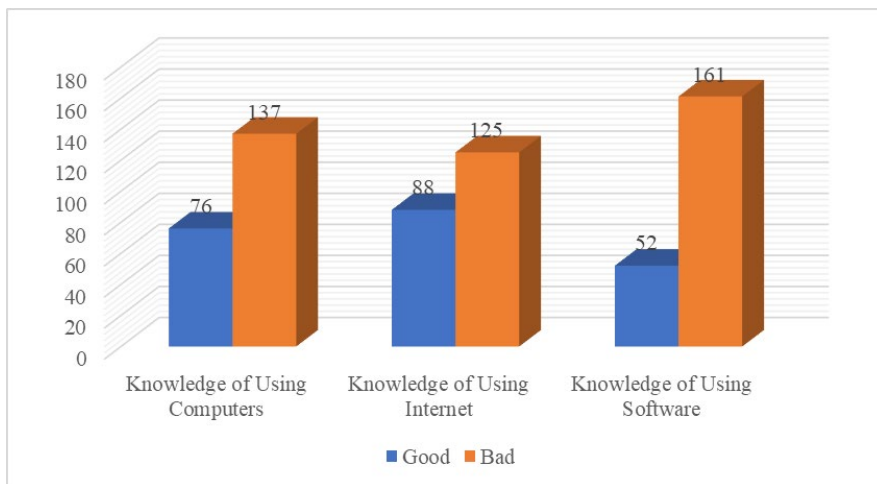
**Table 2** Mann–Whitney U-test result

	Teacher Digital Competences
Mann-Whitney U	4807.500
Wilcoxon W	7435.500
Z	-0.642
p	0.521

The two groups are said to have significant differences when the  $p < 0.05$ . Conversely, if the value  $p > 0.05$ , the two groups are said to have no difference. Based on table 2, the p value is  $0.521 > 0.05$ . Thus, it can be concluded that there is no difference between the two groups or no difference between the digitalization abilities of male and female teachers.

### Pedagogical knowledge

Regarding pedagogical knowledge, the survey results show the digital competence of elementary school teachers as seen from the aspect of knowledge in using computers, the internet, and software in learning. The survey results can be seen in Figure 2 below:

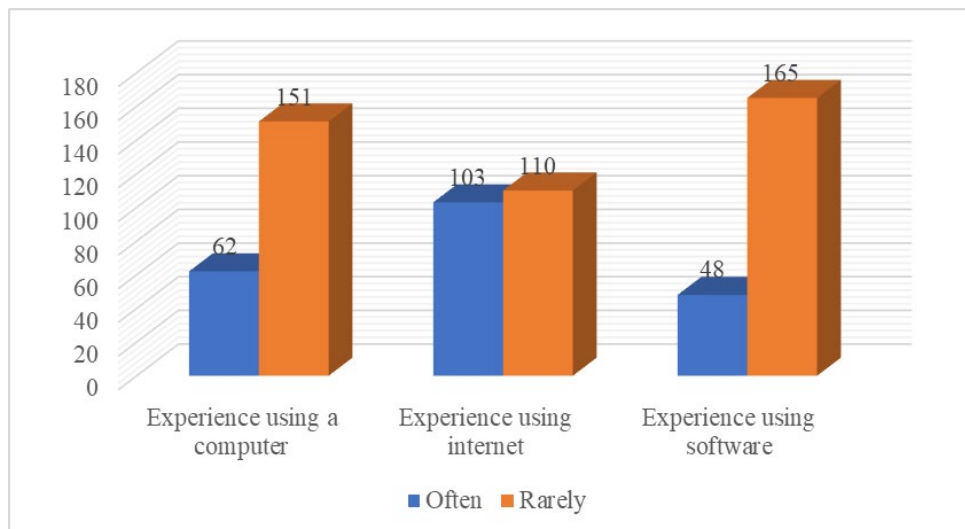


**Figure 2** Survey results on pedagogical knowledge aspect

Figure 2 shows survey data on aspects of pedagogical knowledge. There are 76 teachers have good knowledge of using computers, while 137 teachers lack knowledge of using computers. For knowledge in using the internet, 88 teachers have good skills, and 125 teachers lack knowledge in using the internet. As for knowledge of using software, out of 213 teachers, only 52 had good knowledge, and the remaining 161 teachers lacked knowledge of using the software.

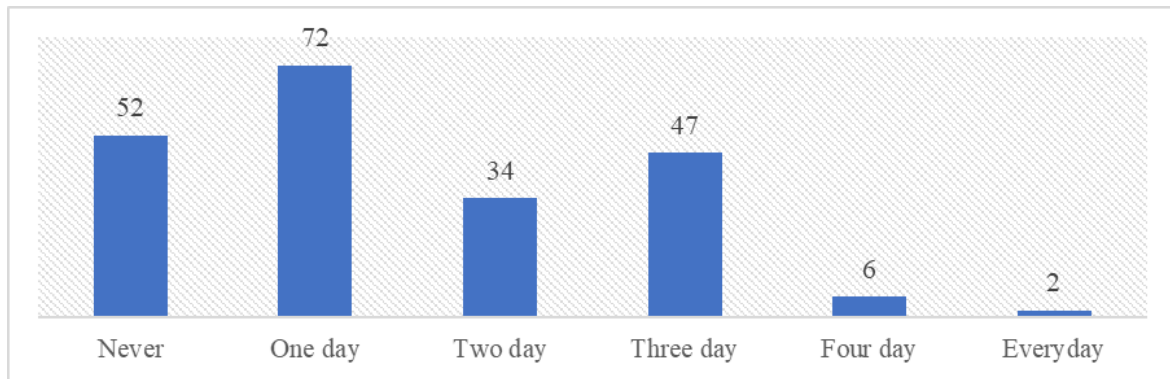
**Didactical skills**

On the aspect of didactic skills, the survey results show the digital competence of elementary school teachers as seen from the frequency aspect of using computers, the internet, and software in learning. The survey results can be seen in Figure 3 below:

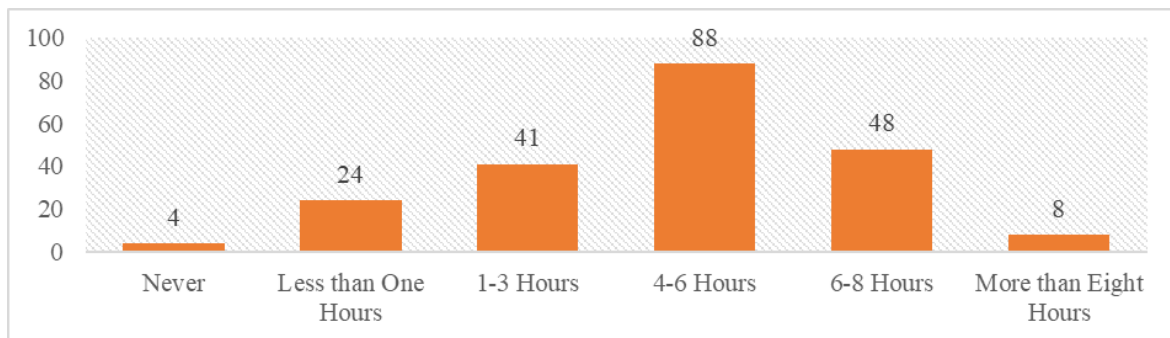


**Figure 3** Survey results on didactical skills aspect

In Figure 3, There is 62 teachers have experience using computers, while 151 teachers lack experience in using computers. For experience in using the internet, 103 teachers often use it, and 110 teachers rarely use the internet. As for experience in using software, out of 213 teachers, only 48 teachers had experience, and the remaining 165 teachers needed to gain experience using the software. This data also aligns with the proportion of computer use in learning (per week) and the proportion of internet use by teachers (per day), presented in Figures 4 & 5 below.



**Figure 4** Proportion of computer use in learning (per week)

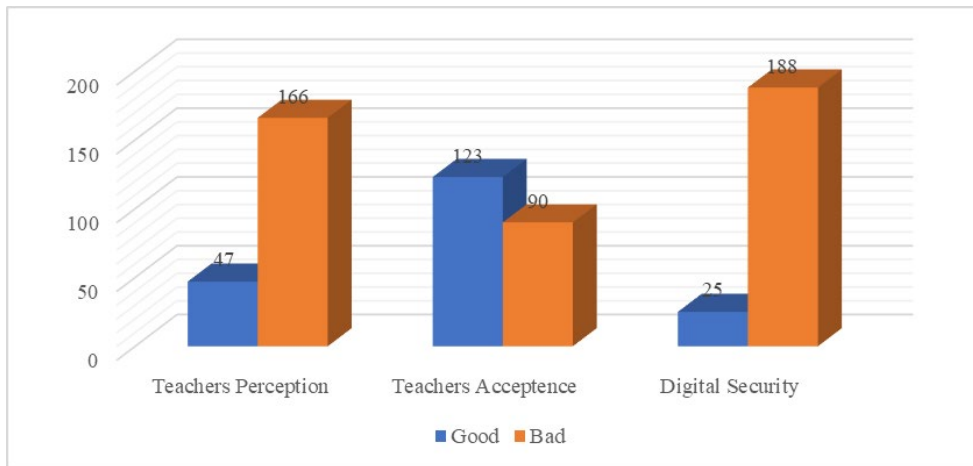


**Figure 5** Proportion of internet usage (per day)

Figures 4 and 5 show the proportion of computer use in learning per week and teachers' use of the internet per day. Teachers are still very minimal in using computers in classroom learning. This can be seen from the percentage of teachers who do not use computers in learning, as many as 52 respondents. In addition, teachers who only use computers one day per week are 72 respondents. On the other hand, teachers who use computers in learning every day are only two respondents. In line with these data, the proportion of teachers using the internet is quite high. Figure 5 shows that most teachers use the internet for 4-6 hours daily (88 respondents). For internet consumption for 6-8 hours per day, there were 48 respondents, and for 1-3 hours per day, as many as 41 respondents. This shows that the teacher's internet penetration is quite good.

### Teacher attitude

Regarding teacher attitude, the survey results show the digital competence of elementary school teachers as seen from the indicators of teacher perception, teacher acceptance, and digital security. The survey results can be seen in Figure 6 below.



**Figure 6** Teacher attitudes towards technology

From Figure 6, there is a contradiction between the teacher's perception and acceptance of technology. Teachers feel that the existence of rapid technological developments can harm children. Most teachers also do not update and only use the internet as a search engine. This can be seen from the 166 respondents who perceive technology poorly. Conversely, in terms of acceptance of technology, 123 respondents stated that technological developments could be implemented in learning. Teachers consider technology to help teachers innovate in the learning process in the classroom. However, from this it can be concluded that teachers want to use technology in learning while still having fears about the impact of using this technology. As for digital security issues, only 25 respondents were already in the good category, for the other 188 they were still in the bad category. This is shown by the fact that many teachers still need e-mail accounts, forget e-mail accounts, forget their passwords, forget their home learning accounts, and use the same password for all accounts on various platforms.

## Discussion

Digital competence possessed by teachers is an important aspect of technology-based learning. Even in the educational paradigm of constructivism, the role of the teacher as a facilitator is crucial in efforts to integrate technology into learning (Revueita-Domínguez et al., 2022). If teachers do not have qualified digital competencies, efforts to integrate technology will also be hampered (McGarr & McDonagh, 2019; Meylina et al., 2021). The results of a survey conducted in the province of West Nusa Tenggara, Indonesia, show that the digital competence of elementary school teachers is still quite low. The data analysis results show that elementary school teachers' low digital competence occurs in both male and female teachers. This finding is inversely proportional to the results of Ottestad et al. (2014), which state that male teachers have better digital competence than female teachers. In this case, differences in data can occur due to differences in supporting infrastructure such as devices, internet networks, and so on in the Province of NTB, which affect teachers' digital competence in that region.

Regarding pedagogical knowledge, teachers' knowledge in accessing educational websites such as "Learning Houses" is still very low. This also follows Aini's research (2021) results that teachers in Indonesia still rarely use educational websites in-class learning. The survey results also indicate teachers' inability to operate computers (laptops) in classroom learning. Even though there are already many media, worksheets, or digital-based visual aids that teachers can use in the learning process in class (Dyson, 2009; Hill, 2018; Lai, 2007). If the teacher's computerization ability is still low, the possibility of using digital media like this is also low.

Regarding didactic skills, teacher experience using media or technology-based learning aids also tends to be low. Teachers very rarely use computers (laptops) in the learning process in class. Even the survey results stated that 124 out of 213 respondents said they had never used a computer or at least only used a computer for one day each week. According to Casey & Hallissy (2014), this phenomenon occurs because many teachers still need help keeping up with technology and information developments. Several factors that influence teacher difficulties are (Syvyi, 2020); (1) Age; (2) Learning Experience; (3) Facilities; and (4) Self-Efficacy.

However, interesting findings can be seen in indicators of teacher internet use. The number of teachers with internet experience was 103, while those with less experience were 110. Although the number of teachers with less experience was still greater, the difference was so small that it could be assumed that the experience of elementary school teachers in NTB in using the internet was quite good. This is also supported by further findings that nearly 80% of teachers use the internet for 4-8 hours every day. This is in line with the research results by Ruth (2015) that internet users in Indonesia continue to increase yearly. According to data from the Central Bureau of Statistics of the Republic of Indonesia from the 2021 Susenas Survey data results, 62.10 % of Indonesia's population will have access to the internet in 2021. This high internet use reflects a climate of information openness and public acceptance of technological developments and changes towards an information society.

Ironically, this is not in line with teachers' perceptions of technological developments. Teachers have a negative perception of the rapid development of technology. This results in the minimal use of technology in the learning process in the classroom. The research results by Gorgorió & Planas (2015) also state that teachers are still reluctant to move from manipulative media to digital-based media that have been widely developed. Even though teachers are aware that integrating technology into the learning process can make learning more innovative, teachers are still afraid to use technology in classroom learning (Ali, 2019).

## **Conclusion**

Based on the survey results, the digital competence of elementary school teachers in NTB still tends to be low. This can be seen from pedagogical knowledge, which shows that teachers lack knowledge in operating computers, accessing educational websites, and utilizing educational software that has been widely provided. In the aspect of didactic skills, teachers still use computers or laptops very minimally in the learning process in class. Teachers still tend to choose the traditional method (blackboard) for learning tools in the classroom. However, the teacher's penetration in using the internet is quite good; it is just that it has not been utilized in the learning process in the classroom. In the aspect of teacher attitude, teachers have the awareness that technological developments can increase learning innovation in class, but teachers also have negative perceptions of technology, so they are reluctant to integrate learning into class. In this study, researchers only limited the subjects to the province of West Nusa Tenggara so that the research results could be generalised in the Province of West Nusa Tenggara. In addition, there are also limitations to education levels which only focus on the digital competence of elementary teachers.

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