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Profile of Digital Competencies of Primary School Teachers in Pekanbaru: A Six-Dimensional Study Based on DigComp-DigCompEdu

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ABSTRACT

Technological developments in education require primary school teachers to possess sufficient digital skills to effectively integrate technology into the learning process. Teachers' digital competence is typically assessed as a comprehensive overview, whereas analysis by dimension remains limited. This study aimed to map the digital competence of primary school teachers using six dimensions, based on DigComp 2.2 and DigCompEdu. A descriptive quantitative study was conducted among 120 primary school teachers in Pekanbaru, selected via simple random sampling. Data were collected using a 30-item Likert-based questionnaire (six dimensions, five items per dimension) and analyzed descriptively. The teachers' digital competence fell into the high category (M = 3.81; SD = 0.62), with 74.17% of the teachers falling into the high or very high category. Information and data literacy scored the highest (M = 4.12), while technology-driven problem-solving ability scored the lowest (M = 3.49), only 0.08 above the lower limit of the high category. The originality of this study lies in mapping six DigComp-DigCompEdu-based dimensions among primary school teachers in Pekanbaru. The findings indicate relatively good, but uneven, digital readiness across the different dimensions. This calls for differentiated training focusing on digital safety and solving technical problems.

Keywords: Digital Competence of Teachers, Primary School Teachers, DigCompEdu, Professional Development, Indonesia

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INTRODUCTION

The development of digital technology has transformed the way teaching is conducted in primary education. Technology is no longer merely a tool, but has become an integral part of the learning environment for accessing resources, developing media, conducting assessments, and communication. This change requires teachers to possess digital skills that go beyond simply operating devices (Syahid et al., 2022) . Information and communication technology competencies determine how effectively teachers use digital devices and media in education (Putra et al., 2023) , while digital literacy is necessary for teachers to adapt to the increasingly widespread flow of technology and information in primary education (Juwairiyah et al., 2024) . Teachers must therefore deploy technology critically, creatively, safely, and in accordance with pedagogical needs.

The desired situation is that primary school teachers can integrate technology meaningfully into the entire learning cycle, including the implementation of the independent curriculum, which requires adjustments in teaching practice (Triwahyuni et al., 2025) . However, empirical evidence shows that the actual situation is different. The use of technology in primary education still faces challenges regarding teacher readiness and adaptability (Mustika et al., 2026) , and teachers often work with limited technological resources (Zakariah et al., 2026) . Teacher competence is a determining factor in the implementation of digital education (Silvester et al., 2023) , and the effectiveness of digital transformation in education is closely linked to teachers' ability to use digital platforms (Faiz et al., 2025) . During the period of distance learning in 2020, the Ministry of Education and Culture indicated that approximately 60% of teachers still did not possess optimal skills (Bisnis.com, 2020) . This gap between expected and actual conditions must be mapped in a measurable way.

The digital competence of teachers encompasses a broader range of skills than just computer, smartphone, or application skills. It includes the ability to use, understand, evaluate, and manage digital information for professional tasks (Aini & Nuro, 2023) and is influenced by the use of ICT, collaboration skills, and support from school infrastructure (Ismoyo & Bernarto, 2024) . This research is based on two European Union reference frameworks. DigComp 2.2 defines the digital competence of citizens in five areas:

information and data literacy, communication and collaboration, creating digital content, security, and problem-solving (Vuorikari et al., 2022) . DigCompEdu supplements this with competencies specific to teachers, including teaching and learning with technology (Redecker, 2017) . The six dimensions in this study – digital information and data, digital communication and collaboration, digital content, digital security, technology-driven problem-solving, and technology integration in learning – are structured by integrating the five areas of DigComp 2.2 with the learning and teaching areas of DigCompEdu. This combination was chosen so that the instrument covers both the basic digital competencies and the pedagogical skills of primary school teachers. These six dimensions are consistently used throughout the entire methodology section of the instrument.

Previous research in Indonesia shows a recurring pattern. Studies on digital literacy indicate that teachers must be able to access, understand, evaluate, and use digital information (Asfaraini & Nuroh, 2025) , and that this proficiency is linked to the implementation of digital education in public primary schools (Kartika & Hidayat, 2025) . Consistent findings emerge from studies demonstrating that teachers' professionalism and digital competence continue to play a role in supporting effective learning, despite limited facilities (Zakariah et al., 2026) , and from studies positioning teachers' digital competence as a driving force behind the transformation of learning (Sauri et al., 2026) . Conversely, challenges in the use of technology remain linked to teachers' willingness to adapt (Mustika et al., 2026) . In general, these studies agree that teachers' digital competence is an important factor, but most highlight a specific aspect (literacy, implementation, or professionalism) and have not mapped competence across multiple dimensions.

Studies have also been conducted to map the digital competence levels of teachers. In Indonesia, Syahid et al. (2022) and Ibda (2023) investigated the digital competence of primary school teachers, with Ibda focusing on teachers in the city of Semarang in the multivariate analysis. Internationally, Suzer and Koc (2024) mapped the digital competencies of teachers using DigCompEdu in a major city in Turkey and compared them based on various variables; Tzafilkou et al. (2023) developed an instrument that combines pedagogical and professional elements for teachers in primary and secondary education; and Ábalos-Aguilera et al. (2026) analyzed the self-perception of primary school teachers in Andalusia, Spain, in a multidimensional manner. However, these studies have limitations as a reference for this research. International studies were conducted in education systems and with different infrastructural conditions than in Indonesia; some did not specifically focus on primary school teachers and used frameworks and instruments that differed from the six dimensions used in this study. However, national studies have several limitations. Syahid et al. (2022) involved 70 primary school teachers and reported the intensity of digital device use, the types of applications used, and mastery of eight application skills as percentages. The study did not map competencies based on the dimensions of a reference framework, did not report average scores, and did not compare competencies based on education, age, or years of service, although data on employment status, age, and years of service were collected. Ibda (2023) involved 35 teachers in one city and compared digital skills based on education and certification experience using MANOVA, using four skill aspects as the dependent variable instead of the six dimensions in this study, resulting in a more limited scope and sample size.

Based on this literature review, there are few studies that map the digital competencies of primary school teachers in Pekanbaru based on six dimensions combining DigComp 2.2 and DigCompEdu. The originality of this study lies in the presentation of competency profiles per dimension as a basis for designing targeted training. The contribution is both empirical, namely a description of competencies that distinguish strong and weak dimensions, and theoretical, namely the application of the DigComp-DigCompEdu framework to the context of primary school teachers in Indonesia. This study answers two questions: (1) what is the general level of digital competence of primary school teachers; and (2) which dimensions score the highest and the lowest. In line with this, this study analyzes the level of digital competence of primary school teachers based on six dimensions.

METHOD

This study uses a quantitative approach with a descriptive survey design to obtain an empirical picture of the digital competence of primary school teachers, without treatment or intervention on the research variables.

The study was conducted in Pekanbaru in September 2026. The study population consisted of 150 primary school teachers from 5 schools in the region. A sample of 120 teachers was selected using a simple random sampling method. According to the table by Isaac and Michael (Isaac & Michael, 1981) , for a

population of 150 individuals with a margin of error of 5%, the minimum required sample size is 105 respondents. In this study, the researchers successfully collected data from 120 respondents. The sample size therefore met and exceeded the minimum accuracy threshold required by Isaac and Michael, resulting in high data representativeness. The inclusion criteria were teachers who are still actively teaching in primary schools and are willing to participate in the study. Data collection took place via a digital questionnaire (Google Forms) distributed directly to the schools, with a response rate of 100% (120 teachers). The collected characteristics of the respondents include gender, age, duration of teaching, educational level, and experience participating in technology training or digital learning.

Data were collected using a questionnaire on teachers' digital competencies, consisting of 30 closed questions representing six dimensions, each with five items (Table 1). The six dimensions are: (1) digital information and data, (2) digital communication and collaboration, (3) digital content, (4) digital security, (5) technology-driven problem-solving, and (6) technology integration in learning. The instrument is adapted from DigComp 2.2 (Vuorikari et al., 2022) and DigCompEdu (Redecker, 2017) . The suitability of the content of the items was assessed by two experts using Aiken's V-index (Aiken, 1985) , which met the validity criteria. Each item was answered on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). The agreement scale was chosen because this study captures competence as experienced by teachers (self-assessment), whereby the scores reflect perceived competence and not actual performance. Details of the indicators for each dimension are presented in Table 1. The implications of this scale choice are discussed in the section on limitations.

Table 1. Grid of instruments for measuring teachers' digital competencies.

Dimensions	Indicators (reference framework)	Number of items
Digital information and data	Searching and filtering information; assessing the credibility of information; managing digital data and content (DigComp 2.2, Area 1)	5
Digital communication and collaboration	Interaction and sharing via technology; digital collaboration; maintaining digital ethics and identity (DigComp 2.2, Area 2)	5
Digital content	Creating and editing content; integrating and adapting digital resources; paying attention to copyright and licenses (DigComp 2.2, Part 3)	5
Digital security	Protection of personal devices and data; preservation of privacy; insight into digital risks and well-being (DigComp 2.2, Area 4)	5
Technology-driven problem solving	Solving technical problems; selecting technological solutions based on needs; recognizing competence development needs (DigComp 2.2, area 5)	5
Integration of technology into the learning process	Selecting technology based on objectives and materials; applying it in learning strategies; promoting student engagement (DigCompEdu, education and learning)	5
Quantity		30

The instrument trial was conducted with 25 primary school teachers who were not included in the main sample but did have homogeneous characteristics (active primary school teachers in the vicinity of the research location). Item validity was tested using item total correlation with the criterion of calculated r > table r (table r for the pilot sample n = 25, df = 23, two-sided significance level of 0.05 is 0.396). Based on the trial results, all dimensions of the instrument were considered valid, as they had a calculated r-value between 0.574 and 0.834 (higher than 0.396). Reliability testing with Cronbach's Alpha showed that this instrument was reliable, with Alpha values ranging from 0.803 to 0.856 (all ≥ 0.70). The results of the validity and reliability tests for each dimension are presented in Table 2. The construct validity of the six dimensions was not tested using confirmatory factor analysis (CFA) or Rasch analysis, and this is acknowledged as a limitation of the study. The instrument's testing procedure follows common practices in studies on the development of scales for teachers' digital competencies (Gao et al., 2024; Gümüş & Kukul, 2023; Sofyan et al., 2023) .

Table 2. Results of the validity and reliability tests of the instrument.

Dimensions	Number of items	Range of r-count	Cronbach's alpha	Information
Digital information and data	5	0.612–0.781	0.821	Valid and reliable
Digital communication and collaboration	5	0.634–0.806	0.838	Valid and reliable
Digital content	5	0.598–0.792	0.815	Valid and reliable

Dimensions	Number of items	Range of r-count	Cronbach's alpha	Information
Digital security	5	0.621–0.817	0.842	Valid and reliable
Technology-driven problem solving	5	0.574–0.768	0.803	Valid and reliable
Integration of technology into the learning process	5	0.646–0.834	0.856	Valid and reliable

Participation in the study was voluntary. Respondents received an explanation of the research objectives and provided their *informed consent* before completing the questionnaire. All collected data were processed anonymously (without personal identification) and confidentiality was guaranteed. The data were used exclusively for the limited purposes of this research analysis.

The data were analyzed using descriptive statistics (frequency, percentage, mean, and standard deviation) with SPSS version 22. The average score was interpreted into five categories with an interval width of 0.80, calculated using the formula (maximum score − minimum score) / number of categories = (5 − 1) / 5 = 0.80. This resulted in the categories very low (1.00–1.80), low (1.81–2.60), average (2.61–3.40), high (3.41–4.20), and very high (4.21–5.00) (Sugiyono, 2019) . The distribution of competence levels is presented in frequency and percentage.

RESULTS AND DISCUSSION

Table 3. Characteristics of the respondents of the study

Features	Category	Frequency (n)	Percentage (%)
Gender	Male	32	26.67
	Female	88	73.33
Age	≤30 years	25	20.83
	31-40 years	42	35.00
	41-50 years	34	28.33
	>50 years	19	15.83
Educational qualification	Diploma	5	4.17
	S1	104	86.67
	S2	11	9.17
Teaching experience	<5 years	22	18.33
	5-10 years	31	25.83
	11-20 years	43	35.83
	>20 years	24	20.00
Digital training	Once	83	69.17
	Never	37	30.83

Table 3 shows that the study included 120 primary school teachers, the majority of whom were female (88 respondents) (73.33%). The largest age group was 31-40 years (42 respondents) (35.00%), while most respondents held a bachelor's degree (104 respondents) (86.67%). The largest group had 11-20 years of teaching experience (43 respondents) (35.83%). In total, 83 teachers (69.17%) had participated in training related to technology or digital learning, while 37 teachers (30.83%) had not.

Overall, teachers' digital competencies scored high, with an average of 3.81 and a standard deviation of 0.62 (Table 4). The digital information and data dimension had the highest average (4.12), followed by digital communication and collaboration (4.06) and technology integration in learning (3.87). The lowest average was found for technology-driven problem-solving (3.49), followed by digital security (3.58).

Table 4. Descriptive statistics of teachers' digital competence based on dimensions.

Dimensions of digital competence	Mean	Standard deviation	Category
Digital information and data	4.12	0.53	High
Digital communication and collaboration	4.06	0.57	High
Digital content	3.71	0.64	High
Digital security	3.58	0.68	High
Technology-driven problem solving	3.49	0.71	High

Dimensions of digital competence	Mean	Standard deviation	Category
Integration of technology into the learning process	3.87	0.61	High
General	3.81	0.62	High

In total, 65 teachers (54.17%) fell into the high category and 24 teachers (20.00%) into the very high category, leaving 89 teachers (74.17%) in the two highest categories (Table 5). The remaining teachers fell into the categories average (25 teachers; 20.83%), low (5 teachers; 4.17%), and very low (1 teacher; 0.83%). This distribution shows that teachers' digital readiness is not evenly distributed.

Table 5. Distribution of teachers' digital competence levels

Category	Score range	Frequency (n)	Percentage (%)
Very low	1.00–1.80	1	0.83
Low	1.81–2.60	5	4.17
Average	2.61–3.40	25	20.83
High	3.41–4.20	65	54.17
Very high	4.21–5.00	24	20.00
Total		120	100.00

Since all dimensions fall into the high category, categorization based on averages alone does not distinguish between the dimensions. It should be emphasized that the average for technology-driven problem-solving ability is only 0.08 above the lower limit of the high category (3.41), and the average for digital security is only 0.17 above that limit, placing both dimensions at the threshold of the average category.

This high level of competence generally corresponds with the findings of Syahid et al. (2022) , who did not report average scores but showed that of the eight application skills, 44% of teachers were highly competent, 29% competent, and 27% not competent (approximately 73% were competent or higher; this comparison is not direct because the measurement instruments were different). These results appear to be higher than those of international studies based on DigCompEdu. Suzer and Koc (2024) found that the average competence was at the integrator level (B1), which is intermediate on the A1-C2 scale, among 368 teachers in a large Turkish city. Ábalos-Aguilera et al. (2026) found low to moderate competence in their study of 78,966 teachers in Andalusia. Ibda (2023) did not report general levels in their summaries, but showed that teachers who had attended training courses or workshops differed only in technical skills. Differences with international studies cannot be interpreted as differences in actual competence. Suzer and Koc (2024) found differences in competence based on gender, field of study, educational background, and location, while Ábalos-Aguilera et al. (2026) reported that age, duration of education, and training hours had a significant effect.

The dimensions digital information and data (4.12) and digital communication and collaboration (4.06) achieved the highest scores. This pattern can be attributed to teachers' professional routines, which increasingly consist of searching for teaching materials on the internet, exchanging documents, and communicating with students, parents, and colleagues via digital media. This relationship is an interpretation by the author and was not directly tested in this study. Syahid et al. (2022) reported a similar trend: 73% of teachers were highly proficient in searching for teaching materials online, and social media was the most used application for communication during learning. The ability to access information must also be accompanied by the ability to assess its credibility, relevance, and suitability for students' needs. Castañeda and Villar-Onrubia (2023) emphasize the need for critical digital competencies that go beyond functional skills, so that teachers can understand the pedagogical and social consequences of technology. Tzafilkou et al. (2023) view teachers' digital competencies as a combination of technological, pedagogical, and professional elements. Teachers' strengths in these areas therefore constitute assets that should be utilized for a more critical and reflective use of digital information.

The integration of technology into learning achieved an average score of 3.87, while digital content achieved a score of 3.71. A high integration score indicates the relative ability of teachers to connect technology with the implementation of the learning process. Bentri et al. (2022) reported that the digital pedagogical competence of primary school teachers is supported by various factors that enable meaningful use of technology. Sofyan et al. (2023) demonstrated the importance of connecting technological, pedagogical, and content knowledge via TPACK–UotI, and Gao et al. (2024) emphasized that digital teaching competence should be measured multidimensionally. The quality and depth of integration can vary among teachers, and this study did not measure this through observation. Lower scores for digital content indicate that teachers are

stronger as users of digital resources than as content developers, since creating content requires the ability to design material, integrate text and multimedia, and adapt it to learning objectives. Pappa et al. (2024) found that the implementation of technology education in primary education is related to teachers' perceptions, barriers, and support needs, and Haşlaman et al. (2024) demonstrated, using the DigCompEdu framework, that digital competence develops through experience and continuous development. The findings of Syahid et al. (2022) align with this interpretation: 44% of teachers indicated being unable to create ICT-based audio and video learning media, develop ICT-based assessment tools, or implement gamification, while only 6% were unable to search for learning materials online.

Digital security (3.58) and technology-driven problem-solving ability (3.49) received the lowest scores and fell into the 'high' category. Digital security encompasses device and data protection, privacy, digital identity management, and risk insight, while problem-solving ability requires the ability to identify obstacles and devise technical solutions. Teacher self-efficacy was not measured in this study, so the low scores cannot be attributed to a lack of self-confidence. It can be concluded that these two dimensions are relatively weaker than the other dimensions, according to teachers' self-assessments. Ábalos-Aguilera et al. (2026) used a multidimensional approach and demonstrated the importance of examining competency profiles per dimension, rather than just a single overall score, so that a high average does not mask weaker dimensions. Strengthening these two dimensions is important because the increasing reliance on technology for learning increases the need for teachers to be able to independently address risks and disruptions.

These findings have implications for the professional development of teachers. Because teachers' competence is high in some areas and low in others, uniform training is less effective. Teachers with average or low competence require reinforcement of basic skills, whereas teachers with high competence can be encouraged in the development of teaching materials, pedagogical innovation, digital security, and solving more complex technical problems. Munawaroh et al. (2022) demonstrated that training in digital competence can improve the competence of primary school teachers, making needs-based training valuable. Digital competence must also be translated into improved learning experiences. Aliyyah et al. (2026) demonstrated the central role of teachers in translating curriculum requirements regarding digital literacy into practice, and Shatri et al. (2026) established a link between teachers' digital competence and the learning motivation of primary school students. Schools can facilitate needs-based training, teacher mentoring, and learning communities to develop teachers' competencies into educational innovations.

This study has several limitations. First, the descriptive survey design describes only the circumstances at the time of data collection and cannot explain cause-and-effect relationships. Second, the data are based on self-assessments using a concordance scale, meaning the scores reflect perceived competence rather than actual performance. Ábalos-Aguilera et al. (2026) also used self-assessments, and Tzafilkou et al. (2023) emphasized the need for instruments that combine pedagogical and professional elements. Third, all data were collected using a single questionnaire completed by the same respondents, creating a potential risk of bias due to the method used. Fourth, social desirability bias may induce respondents to provide answers perceived as positive. Fifth, the study was conducted in a single region, making generalizations to other regions require caution. Sixth, the construct validity of the six dimensions was not tested using confirmatory factor analysis or Rasch analysis. This study also did not compare competence based on training experience and age, although these data were collected. Further research could compare competencies between groups, combine questionnaires with observations, interviews, and performance assessments, include more diverse regions, and use multivariate analysis to identify factors contributing to teachers' digital competencies.

CONCLUSION

The digital competence of primary school teachers in Pekanbaru falls into the high category (M = 3.81; SD = 0.62), with 74.17% of teachers falling into the high or very high category. The dimensions of technology-driven problem-solving ability and digital security scored the lowest and were in the high category, while the dimension of digital information and data and digital communication and collaboration scored the highest. These findings indicate a relatively good digital readiness among teachers, but an uneven distribution across the different dimensions. Professional development should be differentiated and prioritize digital security and technical problem-solving ability.

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