



## Digital Health Literacy and Cognitive Learning Outcomes Among Pre-Service Primary School Teachers in Indonesia

Elinda Rizkasari<sup>1\*</sup>, Prima Trisna Aji<sup>2</sup>, Arief Shofyan Baidhowy<sup>3</sup>

<sup>1</sup>Department of Primary School Teacher Education, Faculty of Teacher Training and Education, Universitas Slamet Riyadi, Surakarta.  
Jln Sumpah Pemuda No. 18, Kadapiro, Banjarsari, Surakarta, Central Java

<sup>2,3</sup>Medical-Surgical Nursing Specialist Program, Faculty of Nursing and Health Sciences, Universitas Muhammadiyah Semarang.  
Jl. Kedungmundu Raya No. 22, Tembalang, Semarang, Central Java

\*Corresponding e-mail: [elindarizkasari87@gmail.com](mailto:elindarizkasari87@gmail.com), [primatrisnaaji@unimus.ac.id](mailto:primatrisnaaji@unimus.ac.id),  
[ariefshofyan@unimus.ac.id](mailto:ariefshofyan@unimus.ac.id)

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**Abstract: Digital Health Literacy and Cognitive Learning Outcomes Among Pre-Service Primary School Teachers in Indonesia.** Objectives: This study aimed to examine the relationship between digital health literacy and cognitive learning outcomes among pre-service primary school teachers in Indonesia. Methods: A quantitative correlational design was applied to 30 students enrolled in a Primary School Teacher Education program. Digital health literacy was measured using the Digital Health Literacy Instrument (DHLI), while cognitive learning outcomes were obtained from official academic records. Data were analyzed using correlational statistical tests. Results: The findings showed that although both digital health literacy and cognitive learning outcomes were generally high, there was no statistically significant relationship between the two variables. This indicates that higher levels of digital health literacy did not necessarily correspond with higher cognitive achievement within the study population. Conclusion: The absence of a significant relationship suggests that cognitive learning outcomes among pre-service primary school teachers may be influenced by factors beyond digital health literacy alone. These results highlight the need for further research involving larger samples and additional academic and contextual variables to better understand contributors to student learning performance in teacher education settings.

**Keywords:** Digital health literacy; cognitive learning outcomes; pre-service primary school teachers; correlation; teacher education

**Abstrak:** Tujuan: Penelitian ini bertujuan untuk mengkaji hubungan antara literasi kesehatan digital dengan hasil belajar ranah kognitif pada mahasiswa calon guru sekolah dasar di Indonesia. Metode: Desain penelitian yang digunakan adalah kuantitatif korelasional dengan melibatkan 30 mahasiswa pada program Pendidikan Guru Sekolah Dasar. Literasi kesehatan digital diukur menggunakan instrumen Digital Health Literacy Instrument (DHLI), sedangkan hasil belajar kognitif diperoleh dari data nilai akademik resmi. Data dianalisis menggunakan uji korelasi statistik. Hasil: Temuan penelitian menunjukkan bahwa meskipun tingkat literasi kesehatan digital dan hasil belajar kognitif mahasiswa secara umum tergolong tinggi, tidak ditemukan hubungan yang bermakna secara statistik antara kedua variabel tersebut. Hal ini menunjukkan bahwa tingkat literasi kesehatan digital yang lebih tinggi tidak serta-merta berkaitan dengan pencapaian kognitif yang lebih tinggi pada populasi penelitian ini. Kesimpulan: Tidak ditemukannya hubungan yang signifikan mengindikasikan bahwa hasil belajar kognitif pada mahasiswa calon guru sekolah dasar kemungkinan dipengaruhi oleh faktor-

*faktor lain selain literasi kesehatan digital. Temuan ini menegaskan pentingnya penelitian lanjutan dengan jumlah sampel yang lebih besar serta mempertimbangkan variabel akademik dan kontekstual lainnya untuk memperoleh pemahaman yang lebih komprehensif mengenai faktor penentu kinerja belajar mahasiswa dalam pendidikan keguruan.*

**Kata kunci:** literasi kesehatan digital; hasil belajar kognitif; mahasiswa calon guru sekolah dasar; korelasi; pendidikan guru

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## ■ INTRODUCTION

The rapid development of digital technology has brought major changes to various aspects of life, including the fields of education and health. Access to health information, which was previously limited, has now become increasingly easy through a range of digital platforms such as websites, health applications, social media, and educational portals. This condition requires individuals to possess the ability to search for, understand, evaluate, and appropriately use digital health information, a competence known as digital health literacy. Digital health literacy not only contributes to improving an individual's health knowledge, but also influences decision-making related to healthy lifestyle behaviours (Kessel et al., 2022).

In the context of higher education, particularly among pre-service primary school teachers, digital health literacy is becoming an increasingly important competence. Students enrolled in Primary School Teacher Education (PGSD) programs are prepared not only as academic educators, but also as literacy agents for school-aged children, including in the domains of information literacy and health literacy. Teachers with adequate levels of digital health literacy are expected to serve as role models and facilitators in filtering and disseminating accurate health information to students and the wider school community. Therefore, the level of digital health literacy among pre-service primary school teachers is a relevant issue to be examined (Yoon et al., 2025).

At the same time, cognitive learning outcomes constitute one of the key indicators in assessing the success of the educational process in higher education. Cognitive outcomes refer to students' abilities to understand, recall, analyse, and apply knowledge in accordance with predetermined learning objectives. Theoretically, the ability to manage information, including digital information, has the potential to support the development of students' cognitive abilities. Students who are able to process information effectively are assumed to be more capable of achieving better academic performance (Study et al., 2022).

Previous studies have shown that digital literacy and health literacy are associated with learning behaviour, critical thinking skills, and academic achievement. However, most of these studies have been conducted among nursing students, health-related students, or the general population, and have rarely focused on pre-service primary school teachers. Furthermore, studies that specifically analyse digital health literacy as a distinct construct and its association with cognitive learning outcomes in teacher education settings particularly in Indonesia remain very limited. This indicates a clear research gap: the extent to which digital health literacy is related to the cognitive performance of pre-service primary school teachers is still not yet well understood, even though this group will later act as key agents of literacy and health promotion in schools. (Literacy, 2023)

Therefore, the present study was conducted with two main objectives: (1) to describe the level of digital health literacy among students enrolled in a Primary School Teacher Education program, and (2) to examine whether there is a relationship between

digital health literacy and cognitive learning outcomes among pre-service primary school teachers in Indonesia.

## ■ **METHOD**

**Methods:** This study employed a quantitative correlational design to examine the relationship between digital health literacy and cognitive learning outcomes without administering any intervention. Both variables were measured at a single time point and analysed to determine the strength and direction of their statistical association. **Participants and Sampling:** The study population consisted of all students enrolled in the Primary School Teacher Education (PGSD) Program at Universitas Slamet Riyadi, Surakarta. A proportionate stratified random sampling technique based on student cohorts/semesters was applied to ensure that each group was proportionally represented. A total of 30 students participated and completed the research instruments (Elinda Rizkasari; Ifa Hanifa Rahman; Prima Trisna Aji, 2022).

**Instruments: Digital Health Literacy.** Digital health literacy was measured using the Digital Health Literacy Instrument (DHLI), which had been translated and adapted into Indonesian through a forward backward translation procedure. The instrument measures multiple competence domains related to using digital health information. Responses were rated on a 5-point Likert scale, with higher scores indicating higher digital health literacy. The Indonesian version applied in this study demonstrated good internal consistency in previous validation work. Examples of DHLI items used include: “I find it easy to decide whether online health information is reliable” and “I know how to protect my privacy when using online health services.” (Wang et al., 2025).

**Cognitive Learning Outcomes:** Cognitive outcomes were obtained from official academic grades in core courses issued by the study program as objective indicators of cognitive academic achievement. **Data Collection Procedures:** Data were collected using the DHLI questionnaire administered online and offline. Prior to participation, students received information regarding the study purpose and procedures and provided written informed consent. Participation was voluntary and confidentiality was strictly maintained.

**Data Analysis:** Descriptive statistics were used to present means and standard deviations for the study variables. Normality testing determined the choice of correlation analysis. Pearson’s product–moment correlation was applied when data met normality assumptions, while Spearman’s rho was used otherwise. A significance level of  $\alpha = 0.05$  was adopted. **Ethical Considerations:** The study complied with ethical research principles, including voluntary participation, anonymity, and academic integrity. Data were used solely for research purposes, and respondents’ identities were protected throughout the study (Wijaya, 2021).

## ■ **RESULT AND DISCUSSION**

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### ***1. General Characteristics of Respondents***

This study involved 30 students from the Primary School Teacher Education (PGSD) Program at Universitas Slamet Riyadi, Surakarta, as respondents. All respondents met the inclusion criteria, provided consent to participate through informed

consent, and completed the research instruments in full. Therefore, no data were excluded, and all respondents were included in the statistical analysis.

### **2. Description of Cognitive Learning Outcomes**

Cognitive learning outcomes were obtained from the official academic grades of core courses, which reflect students' achievement in the cognitive learning domain. The results of the descriptive analysis showed that the mean academic score of the students was within the high-performance category, with a relatively homogeneous distribution of scores.

**Table 1.** Descriptive Statistics of Cognitive Learning Outcomes (N = 30)

<b>Statistic</b>	<b>Value</b>
Mean (rerate)	94,83
Deviation Standart (SD)	3,42
Minimum Score	90
Maksimum Score	99

Based on Table 1, the mean score of students' cognitive learning outcomes was 94.83. The relatively small standard deviation (SD = 3.42) indicates that the variation in scores among respondents was not large, suggesting that students' cognitive achievement was fairly homogeneous. The minimum score obtained by students was 90, while the maximum score was 99, meaning that all students were classified within the good to excellent performance categories.

### **3. Description of Digital Health Literacy (DHLLI)**

Students' digital health literacy was measured using the Digital Health Literacy Instrument (DHLLI). The results of the descriptive analysis showed that the level of digital health literacy among the students was in the high category.

**Table 2.** Descriptive Statistics of Digital Health Literacy Scores (N = 30)

<b>Statistic</b>	<b>Value</b>
Mean (rerate)	95,27
Deviation Standart (SD)	3,41
Minimum Score	90
Maksimum Score	100

Table 2 shows that the mean DHLLI score of the students was 95.27, with a standard deviation of 3.41. These figures indicate that the majority of students demonstrated good abilities in accessing, understanding, evaluating, and using digital health information. The score range was 90 to 100, meaning that all students were classified as having a high level of digital health literacy. The relatively narrow

distribution of scores also suggests that students' digital health literacy levels were fairly homogeneous.

**4. Relationship Between Digital Health Literacy and Cognitive Learning Outcomes**

To examine the relationship between digital health literacy and cognitive learning outcomes, the Pearson product–moment correlation test was applied, as both variables were normally distributed and measured on a numerical scale. In addition, the Spearman rho correlation test was also performed as a non-parametric alternative.

**Table 3.** Correlation Test Results Between Digital Health Literacy and Cognitive Learning Outcomes (N = 30)

Test type	Correlation Coefficient	P-value	Information
Pearson Product Moment	-0,03	0,893	not significant
Spearman rho	-0,08	0,686	not significant

Based on Table 3, the Pearson correlation coefficient was  $r = -0.03$  with a p-value of 0.893 ( $p > 0.05$ ). This result indicates that there was no significant relationship between digital health literacy and students' cognitive learning outcomes. The magnitude of the coefficient, which is close to zero, suggests that the relationship between the two variables was very weak and not statistically meaningful.

The Spearman rho test produced consistent findings, with a correlation coefficient of  $\rho = -0.08$  and a p-value of 0.686. These results further confirm that digital health literacy was not significantly associated with cognitive learning outcomes among PGSD students in this study

**Summary of Research Findings**

Overall, the findings of this study indicate that students in the Primary School Teacher Education (PGSD) Program at Universitas Slamet Riyadi, Surakarta, demonstrated high levels of digital health literacy and cognitive learning outcomes. This is reflected in the mean digital health literacy score (Mean = 95.27; SD = 3.41) and the mean cognitive learning outcome score (Mean = 94.83; SD = 3.42), both of which fall within the excellent category, with relatively homogeneous score distributions. These results suggest that most students were able to access, understand, evaluate, and utilize digital health information effectively, while also achieving strong academic performance.

However, the correlation analysis revealed that there was no significant relationship between digital health literacy and cognitive learning outcomes. This was evidenced by the Pearson correlation coefficient of  $r = -0.03$  with  $p = 0.893$  ( $p > 0.05$ ), as well as the Spearman rho result of  $\rho = -0.08$  with  $p = 0.686$ . The coefficients, which are close to zero, indicate that the relationship between the two variables was very weak and not statistically meaningful. In other words, higher or lower levels of digital health literacy were not directly associated with higher or lower levels of cognitive learning outcomes among the students.

These findings suggest that the two variables developed relatively independently within the context of this study. Although students demonstrated good levels of digital health literacy, their high academic achievement may be more strongly influenced by

other factors beyond digital health literacy, such as learning motivation, learning strategies, academic environment, lecturer characteristics, and psychological or social factors. Therefore, further studies involving larger sample sizes and incorporating potential mediating or moderating variables are strongly recommended to obtain a more comprehensive understanding of the factors contributing to the cognitive learning outcomes of pre-service primary school teachers. (Ban et al., 2024)

The findings of this study show that students in the Primary School Teacher Education (PGSD) Program at Universitas Slamet Riyadi, Surakarta, demonstrated a high level of digital health literacy, as reflected in the mean DHLI score of 95.27 (SD = 3.41). This indicates that most students were able to access digital health information, understand its content, evaluate its credibility, and utilize it for both personal and academic purposes. This condition is understandable, as today's students are part of a generation that is highly familiar with digital technology, and the use of online media as a source of health information has become an integral part of their daily activities. In addition, learning activities in higher education which make extensive use of internet-based academic resources also contribute to the development of students' digital literacy skills, including digital health literacy. (Rizkasari & Aji, 2023)

At the same time, the results also showed that the students' cognitive learning outcomes were high, with a mean academic score of 94.83 (SD = 3.42). This suggests that the students were able to achieve the intended cognitive competencies outlined in the curriculum and obtained satisfactory academic results. The relatively low standard deviation for both variables indicates a homogeneous distribution of scores, meaning that almost all respondents possessed high levels of digital health literacy as well as strong cognitive learning outcomes.

However, the correlation analysis revealed that there was no significant relationship between digital health literacy and cognitive learning outcomes, as indicated by the Pearson correlation coefficient of  $r = 0.03$ ;  $p = 0.893$ , and the Spearman rho value of  $\rho = -0.08$ ;  $p = 0.686$ . The very small coefficients, which are close to zero, suggest that the relationship between the two variables was extremely weak and statistically insignificant. Thus, a high level of digital health literacy cannot be assumed to indicate high cognitive learning outcomes, and vice versa.

The absence of a significant relationship may be explained by several theoretical considerations. First, both the DHLI scores and the students' academic grades showed relatively low variability. Since the majority of respondents were clustered within the high-performance category, the likelihood of a ceiling effect was considerable. This condition limits the statistical power to detect a meaningful association between variables. Second, cognitive learning outcomes are inherently influenced by multiple complex factors, including learning motivation, learning strategies, academic support, learning readiness, time-management skills, and the quality of instructional processes implemented by lecturers. When these factors play a more dominant role in determining students' academic achievement, the contribution of digital health literacy may become relatively small and therefore not statistically observable. (Andersson & Pisano, 2025)

In addition, digital health literacy among PGSD students may not necessarily be utilized directly to support academic activities. It is highly possible that students more frequently apply their digital health literacy skills for personal health purposes, such as searching for information on healthy lifestyles, exercise, nutrition, or basic medical information, rather than for formal academic learning needs. Therefore, although students

may possess a high level of digital health literacy, this does not automatically translate into improved cognitive learning outcomes (Christova;, 2025).

Nevertheless, the findings of this study illustrate that digital health literacy remains an important competency for PGSD students, even though it was not found to correlate with cognitive learning outcomes. As future teachers, PGSD students have the potential to become literacy agents in primary schools, including in the dissemination of accurate and responsible health information in the digital era. Strengthening digital health literacy is therefore still relevant for supporting the development of professional teacher competencies, particularly in the context of increasing misinformation and health-related hoaxes in society (Mukhtar et al., 2025).

On the other hand, the results of this study also highlight the importance of paying greater attention to other factors that may have a more direct influence on students' cognitive learning outcomes. Study programs may continue to develop student-centred instructional strategies, promote active learning, and enhance students' critical and reflective thinking skills, so that academic achievement is supported not only by access to digital information but also by high-quality teaching and learning processes (Yameogo et al., 2025).

This study, however, has several limitations. The sample size was relatively small, consisting of only 30 students; therefore, caution is needed when generalizing the findings to a broader population. In addition, the homogeneity of scores for both variables resulted in limited data variability, which may have affected the power of the correlational analysis. This study also employed a correlational design, which does not allow causal relationships to be established. Other variables that may contribute to learning outcomes such as learning motivation, self-efficacy, learning styles, or social support were not included in the analysis. Hence, future research with a larger number of respondents, more diverse samples, and multivariate analytical approaches is strongly recommended in order to obtain a more comprehensive understanding of the factors influencing the learning outcomes of PGSD students.

Overall, this study provides empirical evidence that although PGSD students demonstrated high levels of digital health literacy and cognitive learning achievement, the two variables were not significantly correlated within the context of this research. These findings underline that efforts to strengthen digital health literacy remain important; however, initiatives to improve students' cognitive learning outcomes should also focus on broader pedagogical, psychological, and learning-environment factors.

### ***Limitations of the Study***

This study has several limitations that should be taken into consideration when interpreting the findings. First, the sample size was relatively small, consisting of only 30 respondents; therefore, the results of this study cannot be widely generalized to the entire population of PGSD students. In addition, the variability of the scores on both variables tended to be low, as most respondents obtained high scores in both digital health literacy and cognitive learning outcomes. This condition may have led to a potential ceiling effect, in which most scores clustered at the upper end of the scale, thereby reducing the ability to statistically detect relationships between variables (Qiu et al., 2025).

Second, this study employed a correlational design; thus, the findings only describe the association between variables at a single point in time and cannot explain causal relationships. Consequently, the results should not be interpreted as evidence that

digital health literacy directly influences cognitive learning outcomes, or vice versa (Aji et al., 2025).

Third, this study focused only on two main variables digital health literacy and cognitive learning outcomes. Other factors that theoretically may influence learning outcomes, such as learning motivation, self-efficacy, learning strategies, social support, learning climate, and the quality of instructional processes, were not examined in this research. Furthermore, the measurement of digital health literacy relied on a self-report questionnaire, which may be subject to response bias and subjective perceptions (Aji & Sani, 2021).

Despite these limitations, the findings of this study still provide valuable empirical contributions to the field of education, particularly in relation to understanding the profile of digital health literacy among PGSD students and its association with cognitive learning outcomes. Future research with larger sample sizes, stronger methodological designs, and the inclusion of additional relevant variables is highly recommended in order to obtain a more comprehensive understanding of the factors that contribute to students' learning outcomes.

## ■ CONCLUSION

**Conclusion:** This study found that pre-service primary school teachers demonstrated generally high levels of digital health literacy and cognitive learning outcomes. However, no significant relationship was identified between the two variables. These findings suggest that digital health literacy does not necessarily correspond with cognitive academic performance in this context, indicating that other factors may play a more dominant role in shaping students' cognitive achievement.

**Recommendations:** Study programs should continue to strengthen students' digital health literacy to support their roles as future educators and health-information gatekeepers in schools. At the same time, efforts to enhance cognitive learning outcomes should also address factors more closely related to the learning process, such as motivation, learning strategies, and classroom engagement. Future research involving larger and more diverse samples, as well as additional academic and contextual variables, is recommended to provide a deeper understanding of factors influencing student learning outcomes in teacher education.

## ■ REFERENCES

- Aji, P. T., Bhadowy, A. S., & Amanda, C. (2025). NON-PHARMACOLOGICAL INTERVENTION TO REDUCE BLOOD PRESSURE IN ELDERLY HYPERTENSION : *Prosiding Seminar Nasional Ipegeri Jateng (SNIJ)*, 2(2), 1–14.
- Aji, P. T., & Sani, F. N. (2021). Pengaruh Terapi Air Rebusan Daun Salam Terhadap Perubahan Teknan Darah pada Penderita Hipertensi di Wilayaha Tempurejo Jumapolo Karanganyar. In *Jurnal Kesehatan* (Vol. 12, Issue 13, pp. 50–63).
- Andersson, S. W., & Pisano, M. (2025). Digital health literacy — a key factor in realizing the value of digital transformation in healthcare. *Frontiers in Digital Health*, 3(June), 1–7. <https://doi.org/10.3389/fdgth.2025.1461342>
- Ban, S., Kim, Y., & Seomun, G. (2024). Digital health literacy : A concept analysis. *Digital Health*, 10(3), 1–15. <https://doi.org/10.1177/20552076241287894>
- Christova;, M. H. A. G. et all. (2025). *Health Literacy in Physiotherapy Education* (Erasmus (ed.); 3rd ed.). Helpe.

- Elinda Rizkasari; Ifa Hanifa Rahman; Prima Trisna Aji. (2022). Upaya Meningkatkan Kompetensi Pedagogik Guru Sekolah Dasar Dalam Menghadapi Tantangan Pembelajaran Abad 21. *Jurnal Pendidikan Dan Konseling Tuanku Tambusai*, 4(3), 1–6.
- Kessel, R. Van, Li, B., Wong, H., Clemens, T., & Brand, H. (2022). Digital health literacy as a super determinant of health : More than simply the sum of its parts. *Internet Interventions*, 27(23), 1–3. <https://doi.org/10.1016/j.invent.2022.100500>
- Literacy, H. (2023). Digital Health Literacy Related to COVID-19 and Social Media Use among High School Students. *Journal of Health Literacy*, October, 1–13. <https://doi.org/10.22038/jhl.2023.74713.1472>
- Mukhtar, T., Babur, M. N., Abbas, R., Irshad, A., & Kiran, Q. (2025). Digital Health Literacy : A systematic review of interventions and their influence on healthcare access and sustainable development Goal-3 ( SDG-3 ). *PJMS*, 41(3), 1–9.
- Qiu, C. S., Lunova, T., Greenfield, G., & Kerr, G. (2025). Determinants of Digital Health Literacy : International Corresponding Author : *JOURNAL OF MEDICAL INTERNET RESEARCH*, 27(5), 1–13. <https://doi.org/10.2196/66631>
- Rizkasari, E., & Aji, P. T. (2023). Implementasi Pendidikan Karakter Peserta Didik SDN Jumapolo 1 Pasca Pandemi Covid-19. *EduBase : Journal of Basic Education*, 4(5), 1–13.
- Study, C., Ahmed, M. H., Guadie, H. A., & Ngusie, H. S. (2022). Digital Health Literacy During the COVID-19 Pandemic Among Health Care Providers in Resource-Limited Settings : Corresponding Author : *JMIR Nursing*, 5(3), 1–11. <https://doi.org/10.2196/39866>
- Wang, C., Chang, L., Chen, X., Kong, J., & Qi, H. (2025). *eHealth Literacy Assessment Instruments : Scoping Review*. 27(3), 1–16. <https://doi.org/10.2196/66965>
- Wijaya, M. C. (2021). Validity and reliability testing of the Indonesian version of the eHealth Literacy Scale during the COVID-19 pandemic. *Health Informatic Journal*, 4(2), 1–10. <https://doi.org/10.1177/1460458220975466>
- Yameogo, A. R., Carole, D., & Sasseville, M. (2025). Effectiveness of Interventions to Improve Digital Health Literacy in Forced Migrant Populations : Mixed Methods Systematic Review Corresponding Author : *JOURNAL OF MEDICAL INTERNET RESEARCH*, 27(5), 1–18. <https://doi.org/10.2196/69880>
- Yoon, J., Yang, S., Kang, S. J., Lee, M., Kim, D., Park, J., Kim, S. J., Han, J., Joo, J., & Cho, J. (2025). Digital Health Literacy in the General Population : National Cross-Sectional Survey Study. *JOURNAL OF MEDICAL INTERNET RESEARCH*, 27(23), 1–12. <https://doi.org/10.2196/67780>