Al-Ishlah: Jurnal Pendidikan
Vol.17, 2 (June, 2025), pp. 2923-2937
ISSN: 2087-9490 EISSN: 2597-940X, DOI: 10.35445/alishlah.v17i2.7741

Developing and Validating a Digital Literacy Assessment Tool for Indonesian Primary Education

Alfian[1], Imam Santosa,[2] Deny Surya Saputra[3]

[1] Universitas Esa Unggul, Indonesia; alfian@esaunggul.ac.id
[2] Universitas Esa Unggul, Indonesia; imam.santosa@esaunggul.ac.id
[2] Universitas Esa Unggul, Indonesia; deny.surya@esaunggul.ac.id

ARTICLE INFO

Keywords:

Digital literacy;
Instrument development;
Elementary education;
digital skills;
Educational technology

Article history:

Received 2025-04-11
Revised 2025-05-13
Accepted 2025-06-29

ABSTRACT

The integration of digital technology into education requires valid and reliable tools to assess digital literacy, particularly at the primary school level, where foundational skills are formed. This study aimed to develop and validate a digital literacy assessment instrument tailored for Indonesian primary school teachers and students. Using a Research and Development (R&D) approach based on the Borg and Gall model, the instrument was designed to measure four core dimensions: Technical Skills, Digital Information Evaluation, Digital Ethics, and Digital Collaboration. A total of 427 participants—213 teachers and 214 students—from six provinces across Indonesia participated in the validation process. Content validity was assessed using Aiken's V, while construct validity and reliability were evaluated through Confirmatory Factor Analysis (CFA) and composite reliability measures. The findings demonstrated strong psychometric properties. Aiken's V values were all ≥ 0.85, indicating high content validity. CFA results showed satisfactory factor loadings (≥ 0.60) and acceptable model fit indices (CFI ≥ 0.90; RMSEA ≤ 0.08). All four dimensions achieved composite reliability scores exceeding 0.70. The instrument proved to be a valid and reliable measure of digital literacy among primary school stakeholders. Although the study was limited to a specific sample, the results suggest potential for broader implementation. The tool offers practical value for educators and policymakers seeking to evaluate and enhance digital literacy, contributing to more inclusive, future-ready educational practices.

Corresponding Author:
Alfian
Universitas Esa Unggul, Indonesia; alfian@esaunggul.ac.id

1. INTRODUCTION

The rapid advancement of digital technologies has profoundly transformed various aspects of human life, particularly in the field of education. In the context of 21st-century learning, digital literacy is no longer regarded as an extraordinary skill but as a fundamental competency necessary for all individuals. It encompasses the ability to access, evaluate, and utilize digital information effectively, ethically, and responsibly (Ng, 2012). Beyond technical proficiency, digital literacy integrates critical thinking, communication, collaboration, and creativity, which are increasingly acknowledged as vital for academic success and future workforce readiness (Lazonder et al., 2020). This aligns with the findings of the *Digital Literacy Status in Indonesia* report conducted by the Ministry of Communication and Information in 2022, which emphasized four key pillars: Digital Skills, Digital Ethics, Digital Safety, and Digital Culture (Komenkominfo, 2022). Cultivating these competencies from an early age is essential, as it lays the groundwork for advanced digital engagement and cognitive development.

At the elementary school level, the development of digital literacy is particularly crucial for establishing foundational skills that support future learning, especially as children at this stage are in the concrete operational phase—where they begin to comprehend more abstract and logical concepts. According to Aesaert and Van Braak (2014), the appropriate use of digital technologies during this developmental stage can enhance students' understanding and facilitate cognitive growth. Schrier (2018), further highlights that digital literacy among elementary school children fosters critical thinking, problem-solving, and collaboration—skills essential for future success. Children who are introduced to digital literacy early are better equipped to access, analyze, and use information in a responsible and ethical manner. Moreover, Greene et al. (2014) emphasize that early digital literacy skills are critical for helping students identify accurate and trustworthy information in an era where misinformation is widespread.

Despite its recognized importance, the development of appropriate instruments to assess digital literacy remains a persistent challenge in educational research. Many existing tools are designed for older students, particularly in secondary or higher education, and often lack sensitivity to the developmental stages and cognitive capabilities of younger learners (Lukitasari et al., 2022). At the elementary level, digital literacy plays a strategic role not only in developing students' foundational skills but also in enhancing teachers' capacity to implement technology-integrated instruction. However, current assessment instruments tend to narrowly focus on technical proficiency, while neglecting essential aspects such as critical evaluation of information, digital collaboration, online safety, and ethical digital behavior (Calvani et al., 2008; Ng, 2012).

Internationally, researchers have raised concerns about the need for a nuanced understanding of digital literacy's competency structure to support the development of authentic and developmentally appropriate assessment tools. For instance, Reichert et al. (2020) argue that such understanding is necessary to ensure valid measurement practices. In Spain, Moreno-Morilla et al. (2021) observed a significant disconnect between students' digitally rich out-of-school experiences and the largely print-based instructional methods used in primary education. Similarly, Nguyen et al. (2024), through a systematic review, noted that assessments of teacher digital competence often focus on four key domains: use of educational technologies, instructional practices, professional development, and learner support. However, the implementation of digital literacy in elementary schools continues to face multiple challenges. Siddiq et al. (2016), for example, identified significant disparities in technology access between urban and rural students, which hampers equitable digital literacy development.

This gap is particularly evident in the Indonesian context. While the national curriculum has begun to integrate digital elements, the instruments used to assess digital literacy remain underdeveloped and inconsistently applied across schools (Lukitasari et al., 2022). Moreover, Afandi et al. (2024) emphasize that without age-sensitive and contextually appropriate instruments, it becomes difficult to accurately gauge the digital readiness and learning needs of elementary students. It is in line with Masyhura (2021), proposing that the implementation of digital literacy in elementary schools is still less than optimal. Furthermore, research by Wijayanti et al. (2024) highlights systemic challenges, including limited

digital competence among educators and students, and inadequate technological infrastructure, which inhibit the implementation of effective digital literacy programs.

Given these challenges, Indonesia has a critical need for the development of assessment instruments that not only reflect global best practices but are also tailored to local educational realities. The lack of context-specific tools hinders efforts to ensure cultural relevance and pedagogical appropriateness, particularly in diverse classroom settings (Hutagalung & Purbani, 2021). Expressing digital literacy through teachable and measurable indicators is essential for its meaningful integration into the curriculum (Narmanlıoğlu & Bayrakcı, 2021). The development of digital literacy assessment instruments at the elementary school level requires a comprehensive approach that encompasses cognitive, technical, and social dimensions. In line with this, Ridsdale et al. (2015) emphasize that an ideal instrument should be capable of measuring technical skills (use of devices), cognitive abilities (understanding of information), and social competencies (ethical and responsible use of information). A valid and reliable instrument is crucial for determining the extent of students' digital skills and for guiding the development of targeted teaching strategies.

Moreover, recent studies have highlighted the necessity of embedding 21st century competencies such as critical thinking, collaboration, communication, and creativity into digital literacy frameworks (Kusumasari, 2024). These competencies must be reflected in any assessment tool to align with the evolving demands of digital engagement. Lestari et al. (2024) developed a digital literacy instrument for teachers and found that more than 70% of its items demonstrated high validity and acceptable internal consistency. While promising, this research focused on teachers, and therefore does not fully address the unique challenges of measuring digital literacy at the elementary student level, where learners vary greatly in their ability to access and use technology. Chetty et al. (2018) underscore that disparities in access to technology and internet connectivity remain key factors influencing digital literacy development, particularly in marginalized or underserved communities.

In response to this clearly identified research gap—namely, the scarcity of valid, reliable, and developmentally appropriate digital literacy assessment tools tailored to elementary school students—this study aims to develop and validate a comprehensive instrument specifically designed for use in elementary education settings. The objective of this research is to contribute to educational measurement by producing a contextually relevant and practically applicable tool that can guide instruction, inform policy, and support the cultivation of essential digital skills from an early age. Given the major challenges in developing instruments that capture the full range of digital literacy competencies in younger learners, and the notable absence of such studies at the elementary level (Afandi et al., 2024; Lee & Kang, 2021; Sajidan et al., 2023), this study seeks to fill a critical void in the literature. The pilot instrument for both teachers and students is expected to function not only as a diagnostic tool for assessing digital competencies but also as a strategic support for educators and policymakers in building inclusive and future-ready learning ecosystems within elementary education.

2. METHODS

This study employed a Research and Development (R&D) approach based on the Borg and Gall model, which is suitable for producing and validating educational instruments (Gustiani, 2019) and for developing and validating products in the field of education (Winaryati et al., 2021). The research was conducted at SDN Benda, Tangerang City, involving 100 participants consisting of 30 teachers and 70 students selected through purposive sampling. The selection aimed to capture a diverse representation of digital literacy levels among the targeted population.

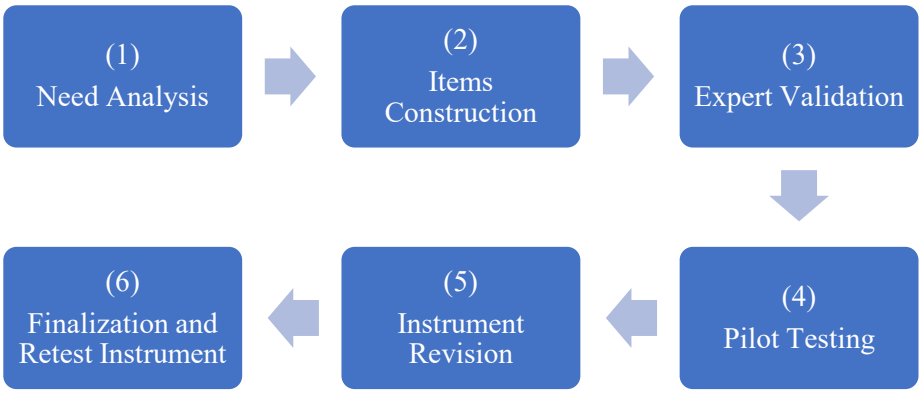

Figure 1. Research Procedure adopted from Borg and Gall R&D model

The initial stage of the research focused on identifying the digital literacy needs of elementary school students and teachers. This process involved a literature review, analysis of the existing curriculum, and a brief survey administered to 10 teachers and 20 students. The findings revealed a significant gap in the availability of valid and developmentally appropriate tools for measuring digital literacy at the elementary level. Teachers expressed difficulty in evaluating students' competencies beyond technical usage, particularly in areas such as digital ethics, collaboration, and information evaluation. This aligns with the observations of Afandi and Kusumaningrum (Afandi, Alia Nur Hasan; Pristiani, Riska; Kusumaningrum, Shirly Rizki; Dewi, 2024), who emphasized that elementary-level digital literacy instruments must integrate students' developmental needs and educational environments. These insights guided the conceptual framework and dimension selection for the instrument, ensuring that it addresses not only technical skills but also higher-order digital competencies relevant to children's learning experiences (Reichert et al., 2020).

Based on further needs analysis obtained through classroom observations and interviews with several teachers at SDN Benda, additional key concerns were identified. With regard to technological facilities, a comprehensive mapping is needed to assess how effectively existing digital tools support learning. The application of digital technology in teaching remains inconsistent, influenced by accessibility and teacher readiness. Moreover, the frequency of digital device usage among students must be examined to evaluate their exposure to educational technology. A significant challenge noted was the lack of sufficient teacher training in digital literacy instruction. Many teachers admitted their limited understanding of digital literacy concepts, which hinders effective pedagogical integration. Other barriers, such as inadequate devices and limited internet infrastructure, further complicate implementation efforts.

Teachers' interpretations of digital literacy varied. However, common themes included the importance of responsible technology use, digital safety awareness, and the ability to distinguish valid information from hoaxes. They suggested that key indicators should include comprehension of digital content, digital tool usage, and ethical online behavior. While some students demonstrated basic digital skills, many struggled with evaluating information credibility and identifying misinformation. Teachers recommended the development of a structured digital literacy instrument, increased teacher training, and curriculum integration. Additionally, improved infrastructure, including stable internet and sufficient technological devices, was considered essential to support the successful implementation of digital literacy in schools (Ilomäki et al., 2016; Siddiq et al., 2017). Limited access to reliable technology remains a critical barrier to equitable digital literacy development, particularly in underserved educational contexts.

The instrument was designed using a five-point Likert scale to assess digital literacy across three core dimensions: technical competence, cognitive skills (such as evaluating and synthesizing information), and socio-emotional competence (including ethical behaviour and collaboration). Data were collected through self-administered questionnaires for students and teachers. Quantitative data analysis was conducted

using SPSS to calculate reliability coefficients, while qualitative feedback was used to refine item wording and structure. Items Construction was structured using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree), covering four domains: technical skills, digital information evaluation, digital ethics, and digital collaboration. Students and teachers Digital Literacy Instruments can be seen below.

Table 1. Students Digital Literacy Instrument

No	Dimension	Indicators	Number of Items	Item Numbers
1.	Technical Skills	- Operating digital devices - Using educational apps/tools - Navigating the internet - Typing and file management	10	1–10
2.	Digital Information Evaluation	- Searching for reliable digital sources - Comparing online information - Identifying hoaxes or misinformation	8	11–18
3.	Digital Ethics	- Respecting online privacy - Avoiding plagiarism - Practicing safe and respectful behavior in digital interactions	8	19–26
4.	Digital Collaboration	- Participating in group chats or forums - Sharing tasks digitally - Communicating effectively and responsibly in online collaboration	9	27–35

Table 1 presents the structure of the digital literacy instrument for elementary school students, which is divided into four main dimensions, each with a proportional number of items and clearly defined indicators. The Technical Skills dimension consists of 10 items (numbers 1–10), covering basic abilities such as operating digital devices, using educational apps, navigating the internet, and performing typing and file management. The Digital Information Evaluation dimension comprises 8 items (numbers 11–18), assessing students' ability to search for reliable digital sources, compare information, and identify hoaxes or misinformation. The Digital Ethics dimension also includes 8 items (numbers 19–26), focusing on students' ethical behavior when using technology, such as respecting online privacy, avoiding plagiarism, and practicing safe and respectful digital interactions. Meanwhile, the Digital Collaboration dimension consists of 9 items (numbers 27–35), evaluating students' ability to participate in group chats or online forums, share tasks digitally, and communicate effectively and responsibly in collaborative online settings. With a total of 35 items, this instrument is designed to comprehensively measure digital literacy—including technical, cognitive, social, and ethical aspects—while also serving as a practical guide for teachers to design learning strategies aligned with 21st-century digital competencies.

The content validity test was conducted using Aiken's V index to assess the relevance of each item to the construct being measured. Aiken's V index measures the level of agreement among experts regarding the alignment of each item with the intended construct. The assessment was carried out by a group of experts with relevant expertise in the field.

The calculation results of Aiken's V indicate that the majority of the items in this instrument are valid, with 18 out of 35 items having an Aiken's V value above 0.90, meaning they are considered highly valid by the experts. The remaining items, with Aiken's V values ranging from 0.70 to 0.89, are also considered valid, although there is some disagreement among the experts. Overall, this instrument demonstrates a high level of validity, with many items being approved as highly relevant, reflecting the good quality of the tested items. The next section presents the digital literacy instrument for teachers, which has been developed based on the results of the validity test. Table 3 below is an overview of the instrument:

Table 3. Teacher Digital Literacy Instrument

No	Dimension	Indicators	Number of Items	Item Numbers
1.	Technical Skills	- Operating projectors, computers, and smartboards - Using productivity tools (Word, PowerPoint, Excel) - Managing online learning platforms	11	1–11
2.	Digital Information Evaluation	- Identifying credible teaching materials online - Evaluating content for accuracy and relevance - Filtering out misinformation	7	12–18
3.	Digital Ethics	- Respecting students' digital privacy - Promoting responsible digital behavior - Avoiding copyright infringement	13	19-31
4.	Digital Collaboration	- Using online collaboration tools (e.g., Google Docs, Zoom, LMS) - Engaging in virtual teacher communities - Co-creating digital content	10	32–41

Table 3 presents the Teacher Digital Literacy Instrument, which is organized into four key dimensions, with each dimension containing specific items. The first dimension, Technical Skills (Items 1–11), covers the ability to use essential digital tools such as operating projectors, computers, smartboards, and productivity tools like Word, PowerPoint, and Excel. It also includes managing online learning platforms. These skills are vital for teachers to integrate technology effectively into their teaching practices. The second dimension, Digital Information Evaluation (Items 12–18), focuses on the teacher's ability to critically assess online content. This includes identifying credible teaching materials, evaluating content for accuracy and relevance, and filtering out misinformation. These skills help ensure that teachers use trustworthy and relevant materials in their lessons. The third dimension, Digital Ethics (Items 19–31), emphasizes responsible online behavior. It includes respecting students' digital privacy, promoting ethical digital conduct, and avoiding copyright violations. Understanding these principles is crucial for creating a safe and respectful digital environment for students. Lastly, the Digital Collaboration (Items 32–41) dimension looks at the teacher's ability to collaborate in digital spaces. This includes using online tools like Google Docs, Zoom, and Learning Management Systems (LMS), as well as engaging in virtual teacher communities and co-creating digital content. These skills help foster collaboration and connectivity in a modern, tech-driven educational setting. Overall, this instrument covers a comprehensive range of digital competencies, empowering teachers to navigate and utilize digital tools effectively in their teaching. Content validation was conducted using Aiken's V index to ensure the instrument's validity.

The calculation results of Aiken's V indicate that the majority of the items in this instrument have excellent validity. A total of 19 items (out of 41 items) have an Aiken's V value above 0.90, meaning these items are considered highly valid by the experts. Meanwhile, the remaining 22 items, with Aiken's V values ranging from 0.85 to 0.89, are still considered valid, although there is some disagreement among the experts. Overall, this instrument demonstrates high validity, with the majority of items being relevant and aligned with the measurement objectives, reflecting the solid quality of the instrument.

3. FINDINGS

3.1 Model Fit Indices

Table 5 presents the model fit indices for both the student and teacher instruments. These indices are used to assess the overall goodness of fit of the measurement models, with each index providing insight into how well the data aligns with the hypothesized model. The values in the table include the Chi-square/df ratio, Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). The criteria (cut-off) values are provided for comparison, helping to determine whether the model fits the data adequately. The results show that both the student and teacher instruments meet the required thresholds for good model fit.

Table 5. Model Fit Indices

Fit Indices	Student Instrument Value	Teacher Instrument Value	Criterion Cut-off
Chi-square/df	1.98	2.04	< 3.00
CFI	0.936	0.948	≥ 0.90
TLI	0.921	0.931	≥ 0.90
RMSEA	0.052	0.056	≤ 0.08
SRMR	0.045	0.041	≤ 0.08

Table 5 presents the results of the model fit testing for the instruments measured on students and teachers, based on several commonly used fit indices in Structural Equation Modeling (SEM). The Chi-square/df values for both instruments are below the criterion threshold of < 3.00, indicating good model fit. Both the CFI and TLI values are higher than 0.90, suggesting that the model fits very well for both groups. The RMSEA values for the student (0.052) and teacher (0.056) instruments are also below the recommended threshold of ≤ 0.08, indicating that the model has small measurement errors. Additionally, the SRMR values for both instruments are below 0.08, showing that the model fits well with no issues in residuals. Overall, these results indicate that the model used demonstrates an excellent fit for both instruments, students, and teachers.

Following the fit indices reported in Table 5, further insights into the structural model can be obtained by examining its measurement component, as illustrated in Figure 2, which presents the onfirmatory Factor Analysis (CFA) results for the Student Digital Literacy Instrument.

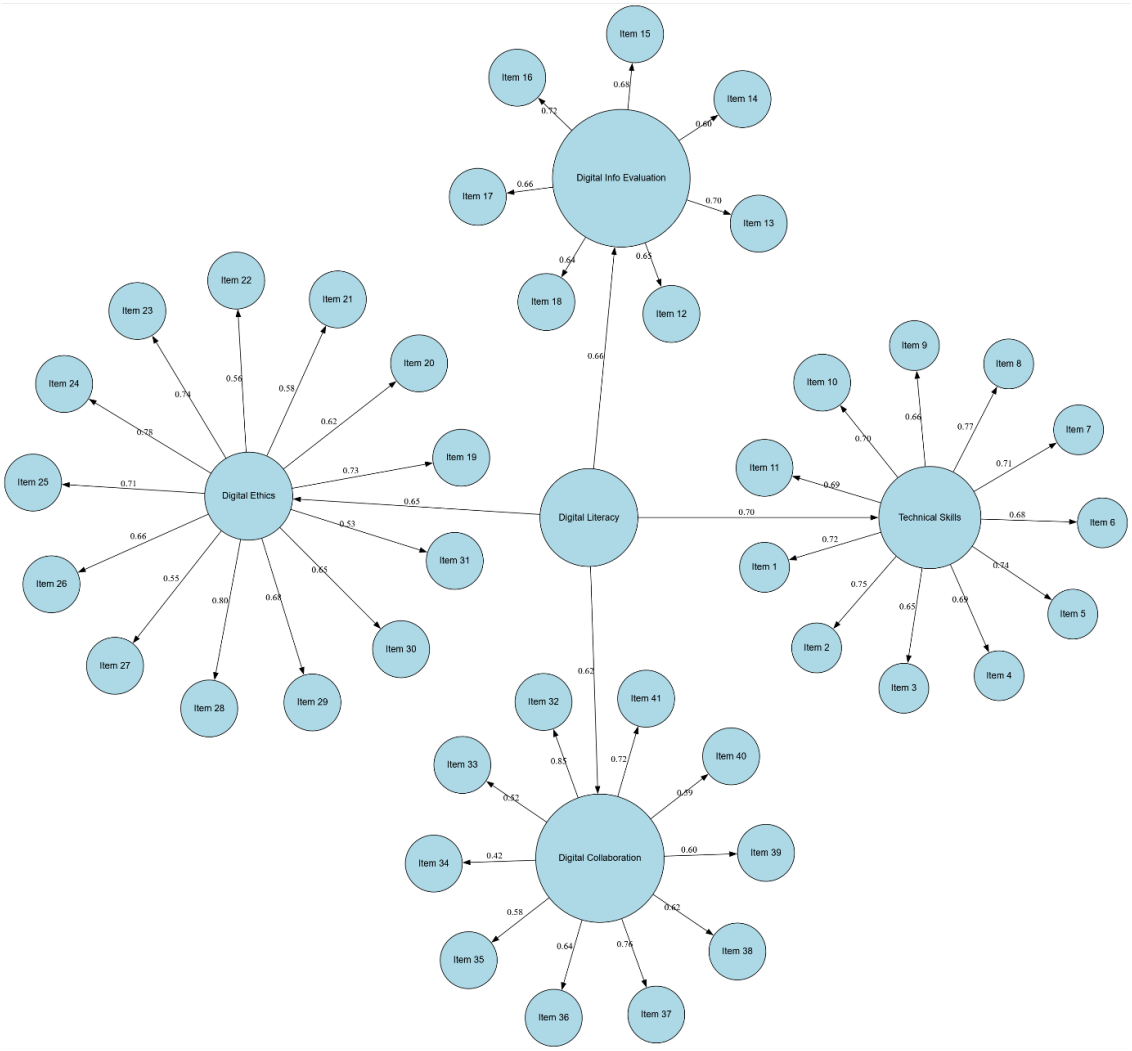

Figure 2. Measurement Model of Digital Literacy for Students Based on CFA

Figure 2 above shows that the factor loading values range from 0.58 to 0.79, indicating that each item adequately represents the construct it is intended to measure. Items under the Technical Skills dimension demonstrate strong consistency, with loading values ranging from 0.65 to 0.79. This suggests that teachers possess a solid understanding and proficiency in operating technological devices, using productivity software, and managing online learning platforms.

The Digital Information Evaluation dimension also exhibits high loading values, ranging from 0.66 to 0.78. These results reflect teachers' ability to assess the credibility of digital information and to discern accurate and relevant content. This skill is critical in 21st-century learning environments, which are saturated with information from diverse sources. For the Digital Ethics dimension, loading values range from 0.60 to 0.73. Although slightly lower than the two previous dimensions, these values remain within acceptable limits. This indicates that most teachers have developed ethical awareness and behaviors in digital environments, including respecting students' digital privacy, adhering to online communication norms, and avoiding copyright violations. Meanwhile, the Digital Collaboration dimension shows factor loadings between 0.58 and 0.77, suggesting that teachers are reasonably capable of using technology to collaborate online—whether with colleagues or students—through platforms such as LMSs, teacher communities, or cloud-based applications. At the second-order factor level, the CFA results indicate that the four dimensions are strongly associated with the overarching construct of Digital Literacy, with factor loadings ranging from 0.71 to 0.82. This provides strong

evidence that the developed dimensions significantly contribute to the overall formation of teachers' digital literacy.

In summary, the factor structure of this instrument demonstrates good construct validity, and each dimension successfully represents a critical aspect of teachers' digital literacy. The instrument can thus be used to comprehensively assess teachers' digital competence within the context of technology-enhanced learning.

Subsequently, Figure 3 presents the Confirmatory Factor Analysis (CFA) results for the Teacher Digital Literacy Instrument, providing a detailed overview of how each observed item loads onto its respective latent construct.

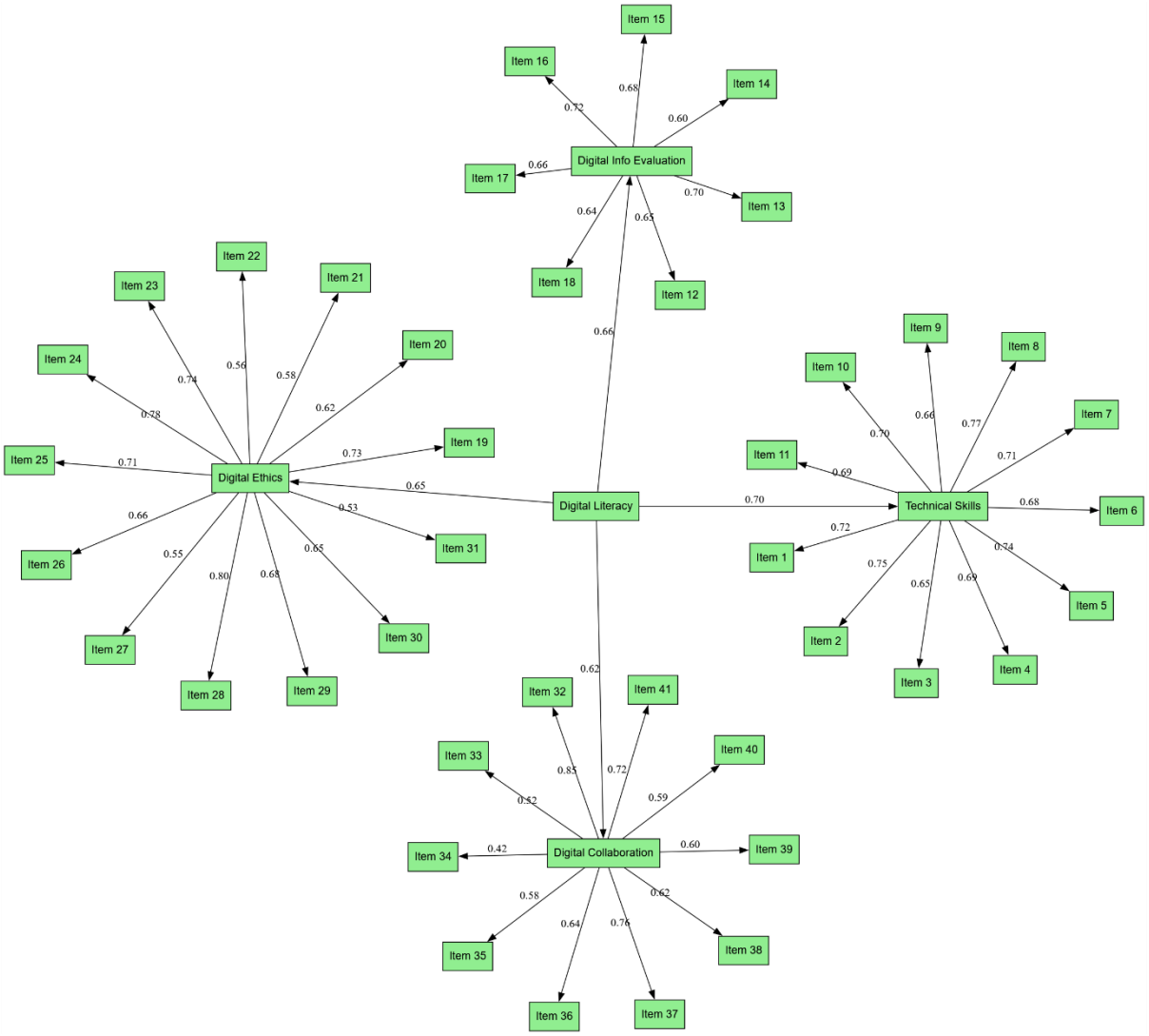

Figure 3. Measurement Model of Digital Literacy for Teachers Based on CFA

Figure 3 above illustrates that Digital Literacy functions as a higher-order construct composed of four key dimensions: Technical Skills, Digital Information Evaluation, Digital Ethics, and Digital Collaboration. These four dimensions are arranged radially around the core concept, with directional arrows indicating the direction of contribution, and numerical values representing the strength of correlations between constructs.

The Technical Skills dimension comprises 11 indicators (Items 1–11), with correlation values ranging from 0.64 to 0.77. This indicates that technical proficiency in using digital tools serves as a strong foundational component in shaping digital literacy. The Digital Information Evaluation dimension includes 7 indicators (Items 12–18), with correlations ranging from 0.60 to 0.72, highlighting the essential role of critical information evaluation skills in an era overwhelmed by digital content.

The Digital Ethics dimension consists of 13 indicators (Items 19–31), with correlation values varying from 0.53 to 0.80. This variation suggests that ethical values in digital contexts contribute significantly, albeit unevenly, to the construct. It may indicate that participants are more adept in certain areas, such as privacy awareness or responsible information sharing, compared to others.

Meanwhile, the Digital Collaboration dimension comprises 10 indicators (Items 32–41), with correlations ranging from 0.42 to 0.85. These values underscore the vital role of online collaboration skills in shaping digital literacy, particularly amid the ongoing shift toward digital modes of interaction.

Overall, the visual structure of this circular graph not only illustrates the hierarchical relationship between the construct, its dimensions, and their respective indicators, but also provides a comprehensive overview of the relative strength of each dimension in forming a holistic digital literacy construct. This representation is highly valuable for developing assessment instruments, designing curricula, and formulating targeted strategies for enhancing digital literacy based on empirical data.

3.2 Validity and Reliability Analysis of Constructs

Table 6 below presents the results of the validity and reliability analysis of the constructs for four key factors measured in this study: *Technical Skills*, *Digital Information Evaluation*, *Digital Ethics*, and *Digital Collaboration*. The Average Variance Extracted (AVE) value is used to assess how well each construct explains the variance in its indicators, with higher AVE values indicating better construct validity. The Composite Reliability (CR) value reflects the internal consistency or reliability of the construct, with CR values above 0.7 considered to indicate good reliability. This table provides an overview of the extent to which each construct demonstrates adequate validity and reliability for further measurement.

Table 6. Validity and Reliability Analysis of Constructs of Digital Literacy for Student and Teacher

Factor	Student		Teacher	
	AVE	**CR**	**AVE**	**CR**
Technical Skills	0.608	0.86	0.640	0.92
Digital Information Evaluation	0.578	0.84	0.608	0.90
Digital Ethics	0.548	0.82	0.624	0.91
Digital Collaboration	0.593	0.85	0.672	0.91

Table 6 presents the validity and reliability analysis for the constructs of Digital Literacy for both students and teachers. The analysis is based on two main criteria: Average Variance Extracted (AVE) and Composite Reliability (CR), which help evaluate the validity and reliability of each construct.

For the Technical Skills factor, students have an AVE of 0.608 and a CR of 0.86, indicating that the construct has good validity and reliability for measuring technical skills. For teachers, the AVE is slightly higher at 0.640, and the CR increases to 0.92, suggesting even stronger reliability and validity in measuring technical skills among teachers compared to students. The Digital Information Evaluation factor for students has an AVE of 0.578 and a CR of 0.84. Although the AVE is slightly lower than the other constructs, the CR indicates that this construct is still reliable. For teachers, the AVE improves to 0.608, and the CR increases to 0.90, reflecting better validity and reliability in evaluating digital information among teachers compared to students. Regarding the Digital Ethics factor, the students have an AVE of 0.548 and a CR of 0.82. Although the AVE is the lowest among all factors, the CR value suggests that the construct still holds a reliable measurement for digital ethics. For teachers, the AVE increases to 0.624, and the CR rises to 0.91, showing stronger validity and reliability in measuring digital

ethics among teachers. Finally, the Digital Collaboration factor shows an AVE of 0.593 and a CR of 0.85 for students, indicating acceptable validity and reliability for measuring digital collaboration. For teachers, the AVE increases to 0.672, and the CR improves to 0.91, indicating higher validity and reliability in the measurement of digital collaboration.

Overall, the analysis shows that all constructs for both students and teachers exhibit good reliability, with CR values consistently above 0.80. While some AVE values are slightly lower, they still indicate adequate construct validity, with teachers generally showing slightly better values in terms of both validity and reliability compared to students. This suggests that the constructs are effectively measuring the intended aspects of digital literacy for both groups, with teachers demonstrating slightly stronger performance across the factors.

Discussion

The development of the digital literacy instrument in this study offers both theoretical and practical contributions to the field of primary education. Theoretically, the instrument reaffirms digital literacy as a multidimensional construct that integrates technical skills, information evaluation, ethical awareness, and collaborative capabilities. This comprehensive approach aligns with internationally recognized frameworks such as DIGCOMP and China's Digital Literacy Framework, which emphasize the importance of cognitive, socio-emotional, and ethical competencies alongside technical proficiency (Chang & Kuo, 2025; Dou & Zhao, 2023). Construct validity was confirmed through Confirmatory Factor Analysis (CFA), with model fit indices including RMSEA, CFI, and TLI all meeting recommended thresholds (CFI ≥ 0.90; RMSEA ≤ 0.08), thus ensuring the instrument's empirical robustness (Qu et al., 2025). The strength of the factor loadings also demonstrates the structural coherence of each dimension, confirming that the instrument adequately captures the complexity of digital literacy beyond basic operational skills and contributes to the theoretical enrichment of digital education constructs at the primary level.

From a practical standpoint, the instrument is highly applicable for both educators and policymakers. Teachers may use it to assess students' digital literacy levels, tailor instructional strategies, and monitor digital learning progress over time. Policymakers, in turn, can adopt the instrument as a diagnostic tool to support data-driven decision-making related to digital education initiatives in elementary schools. Given its clarity, multidimensional structure, and empirical rigor, the instrument responds well to the educational demands of the 21st century and is well-positioned to support Indonesia's digital education transformation (Bravo et al., 2021; Tsortanidou et al., 2022). The instrument is also aligned with innovative pedagogical practices such as formative assessment, interactive learning, and adaptive instructional design, which enhance digital engagement and foster deeper student learning (Parveen et al., 2024). Its practical alignment with internationally tested frameworks such as digilitFJ and the DigiLit Leicester framework—both of which have improved digital equity and teacher capability—further reinforces its relevance in both local and global educational contexts (Reddy et al., 2023).

Nonetheless, several limitations should be acknowledged. First, the study did not assess criterion-related validity due to the absence of an established external benchmark for digital literacy at the elementary level. As a result, it remains unclear how well the instrument correlates with students' actual digital performance in real-life tasks. Future research should aim to explore concurrent validity using observational data or performance-based assessments to enhance interpretative accuracy (Akib & Ghafar, 2015; Malik et al., 2019). Second, the use of self-reported data—especially from young learners—may introduce bias, as students may unintentionally overestimate or underestimate their digital abilities (Reichert et al., 2020). While self-reporting remains a common approach in digital literacy research (Pérez-Escoda et al., 2019), incorporating triangulated data from teacher evaluations or real-time digital tasks would strengthen future assessments. Furthermore, although content validity was supported by high Aiken's V coefficients, with most items scoring above 0.85 (Marsa et al., 2021; Wahyuni et al., 2024), the study's sampling was geographically limited, which constrains

generalizability. Additional validation across diverse cultural and educational settings would be essential to ensure the instrument's broader applicability (Ding et al., 2024; Jin et al., 2020).

In conclusion, this study offers a theoretically sound and empirically validated instrument that addresses the pressing need to assess digital literacy in elementary education. The instrument is not only well-grounded in contemporary theory but also provides practical value for improving teaching practices and informing policy decisions aimed at preparing students to thrive in an increasingly digital society.

4. CONCLUSION

This study has successfully developed a valid and reliable digital literacy assessment instrument for elementary education, covering four interrelated dimensions: Technical Skills, Digital Information Evaluation, Digital Ethics, and Digital Collaboration. These dimensions reflect the multidimensional nature of digital literacy and align with both national educational needs and international frameworks. The instrument demonstrated strong psychometric properties, including content and construct validity, as well as internal consistency, making it suitable for educational diagnosis, instructional planning, and policy formulation. Despite these strengths, the study is not without limitations. Most notably, the sampling scope was geographically limited, and the validation was conducted only within a single national context. To enhance the instrument's generalizability and cross-cultural applicability, future research should involve broader and more diverse samples. Comparative validation studies incorporating international digital literacy instruments—such as DIGCOMP, DigiLit Leicester, or the Chinese Digital Literacy Framework—are also recommended. These efforts would support more robust benchmarking and facilitate cross-national comparisons. Overall, with continued refinement and international validation, the instrument holds considerable promise for advancing equitable digital literacy assessment practices and supporting digital competence development at the primary education level.

REFERENCES

Aesaert, K., & Van Braak, J. (2014). Exploring factors related to primary school pupils' ICT self-efficacy: A multilevel approach. *Computers in Human Behavior*, *41*, 327–341. https://doi.org/10.1016/j.chb.2014.10.006

Afandi, Alia Nur Hasan; Pristiani, Riska; Kusumaningrum, Shirly Rizki; Dewi, R. S. I. (2024). Digital Literacy Questionnaire Instrument: Based on the Integration of Elementary School Students' Characteristics. *International Journal of Elementary Education*, *8*(2), 344–353.

Akib, E., & Ghafar, M. N. A. (2015). Assessment for learning instrumentation in higher education. *International Education Studies*, *8*(4), 166–172. https://doi.org/10.5539/ies.v8n4p166

Berganio, M. E. C., Tanpoco, M. R., & Dumagay, A. H. (2024). Pre-service Teachers' Perceived Level of Digital Literacy: A Quantitative Study from a Developing Country. In M. S. & B. B. (Eds.), *Lecture Notes in Networks and Systems: Vol. 1101 LNNS* (pp. 158–167). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/978-3-031-68675-7_16

Bravo, M. C. M., Chalezquer, C. S., & Serrano-Puche, J. (2021). Meta-framework of digital literacy: Comparative analysis of 21st century skills frameworks. *Revista Latina de Comunicacion Social*, *2021*(79), 76–110. https://doi.org/10.4185/RLCS-2021-1508

Calvani, A., Cartelli, A., Fini, A., & Ranieri, M. (2008). Models and Instruments for Assessing Digital Competence at School. *Journal of E-Learning and Knowledge Society*, *4*(3), 183–193. https://doi.org/10.20368/1971-8829/288

Chang, C.-Y., & Kuo, H.-C. (2025). The development and validation of the digital literacy questionnaire and the evaluation of students' digital literacy. *Education and Information Technologies*.

https://doi.org/10.1007/s10639-024-13216-7

Chetty, K., Qigui, L., Gcora, N., Josie, J., Wenwei, L., & Fang, C. (2018). *Bridging the digital divide: measuring digital literacy*. *12*, 2018.

Ding, S., Zhang, Y., Huang, H., Chen, D., & Gao, Z. (2024). The relationship between digital literacy and K-12 students' academic performance: Mediation effects of problem-solving ability. In C. K.T., H. Y.K., Y. D., L. L.-K., W. L.-P., & R. B.L. (Eds.), *Proceedings - 2024 International Symposium on Educational Technology, ISET 2024* (pp. 132–136). Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.1109/ISET61814.2024.00034

Dou, J., & Zhao, X. (2023). Chinas Teacher Digital Literacy Framework and Development of an Evaluation System. *ACM International Conference Proceeding Series*, 588–593. https://doi.org/10.1145/3660043.3660148

Greene, J. A., Yu, S. B., & Copeland, D. Z. (2014). Measuring critical components of digital literacy and their relationships with learning. *Computers and Education*, *76*, 55–69. https://doi.org/10.1016/j.compedu.2014.03.008

Gustiani, S. (2019). Research and Development (R&D) Method as a Model Design in Educational Research and Its Alternatives. *Holistics Journal*, *11*(2), 12–22.

Hana Lestari, & Ima Rahmawati. (2024). Pengembangan Instrumen Asesmen Literasi Digital dalam Pembelajaran untuk Guru Madrasah Ibtidaiyah. *EduInovasi: Journal of Basic Educational Studies*, *4*(2), 865–880. https://doi.org/10.47467/edu.v4i2.2345

Hutagalung, B., & Purbani, W. (2021). The Ability of Digital Literacy for Elementary School Teachers. *JPI (Jurnal Pendidikan Indonesia)*, *10*(4), 710–721. https://doi.org/10.23887/jpi-undiksha.v10i4.32938

Ilomäki, L., Paavola, S., Lakkala, M., & Kantosalo, A. (2016). Digital competence – an emergent boundary concept for policy and educational research. *Education and Information Technologies*, *21*(3), 655–679. https://doi.org/10.1007/s10639-014-9346-4

Jin, K.-Y., Reichert, F., Cagasan, L. P., de la Torre, J., & Law, N. (2020). Measuring digital literacy across three age cohorts: Exploring test dimensionality and performance differences. *Computers and Education*, *157*. https://doi.org/10.1016/j.compedu.2020.103968

Kömeçoglu, Y., Muftuoglu, Z., Umay, C., Tasdelen, A., & Ozdemir, S. (2019). Importance of data management in Digital Media Literacy: Integration of cultural elements in children with deep learning techniques. In *Handbook of Research on Media Literacy Research and Applications Across Disciplines* (pp. 235–247). IGI Global. https://doi.org/10.4018/978-1-5225-9261-7.ch015

Komenkominfo. (2022). Status Literasi Digtal di Indonesia. In *Kominfo* (Issue November).

Kusumasari, E. D. (2024). *Meningkatkan Kemampuan Berpikir Kritis Siswa Sekolah Dasar pada Pembelajaran Bahasa Indonesia Berbasis Literasi Digital pada Kurikulum Merdeka*. *3*(1), 22–29.

Lazonder, A. W., Walraven, A., Gijlers, H., & Janssen, N. (2020). Longitudinal assessment of digital literacy in children: Findings from a large Dutch single-school study. *Computers and Education*, *143*, 103681. https://doi.org/10.1016/j.compedu.2019.103681

Lee, S., & Kang, D. (2021). Development and Verification of Digital Literacy Test Tool for Elementary School Students. *Journal of The Korean Association of Information Education*, *25*(1), 59–69. https://doi.org/10.14352/jkaie.2021.25.1.59

Lukitasari, M., Murtafiah, W., Ramdiah, S., Hasan, R., & Sukri, A. (2022). Constructing Digital Literacy Instrument and its Effect on College Students' Learning Outcomes. *International Journal of Instruction*, *15*(2), 171–188. https://doi.org/10.29333/iji.2022.15210a

Malik, A. A., Khan, R. A., Malik, H. N., Humayun, A., Butt, N. S., & Baig, M. (2019). Assessing reliability and validity of revised biggs two-factor study process questionnaire to measure learning approaches among undergraduate medical students in Lahore, Pakistan. *Journal of the Pakistan Medical Association*, *69*(3), 337–342. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85062421576&partnerID=40&md5=615ef5f789a970aa7c1d2206af1b34ff

Marsa, P. B., Novisya, D., & Hamida, S. (2021). Development of instruments to measuring feasibility of context-based videos of sound. *Journal of Physics: Conference Series*, *1816*(1).

https://doi.org/10.1088/1742-6596/1816/1/012033

Masyhura, N., & Ramadan, Z. H. (2021). Implementation of Digital Literacy in Elementary Schools. *International Journal of Elementary Education*, *5*(4), 639. https://doi.org/10.23887/ijee.v5i4.39480

Moreno-Morilla, C., Guzmán-Simón, F., & García-Jiménez, E. (2021). Digital and information literacy inside and outside Spanish primary education schools. *Learning, Culture and Social Interaction*, *28*(March). https://doi.org/10.1016/j.lcsi.2020.100455

Narmanlıoğlu, H., & Bayrakcı, S. (2021). Digital literacy as whole of digital competences: scale development study tt - digital literacy as whole of digital competences: scale development study. *Düşünce ve Toplum Sosyal Bilimler Dergisi*, *4*, 1–30.

Ng, W. (2012). Can we teach digital natives digital literacy? *Computers and Education*, *59*(3), 1065–1078. https://doi.org/10.1016/j.compedu.2012.04.016

Nguyen, L. A. T., & Habók, A. (2024). Tools for assessing teacher digital literacy: a review. In *Journal of Computers in Education* (Vol. 11, Issue 1). Springer Berlin Heidelberg. https://doi.org/10.1007/s40692-022-00257-5

Parveen, A., Bashir, F., Nazir, A., Zimik, P., & Jan, S. (2024). Pedagogical strategies for developing digital literacy. In *Digital Literacy at the Intersection of Equity, Inclusion, and Technology* (pp. 251–269). IGI Global. https://doi.org/10.4018/979-8-3693-2591-9.ch011

Pérez-Escoda, A., García-Ruiz, R., & Aguaded, I. (2019). Dimensions of digital literacy based on five models of development. *Cultura y Educacion*, *31*(2), 232–266. https://doi.org/10.1080/11356405.2019.1603274

Popov, E. V. (2023). FEATURES OF DIGITAL LITERACY MEASUREMENT IN RUSSIA. *Sotsiologicheskie Issledovaniya*, *2023*(11), 51–61. https://doi.org/10.31857/S013216250028532-8

Qu, Z., Wu, J., Kueh, Y. C., Ye, D., & Kuan, G. (2025). Psychometric properties of the Chinese version physical literacy assessment questionnaire among high school students in Gansu, China. *PeerJ*, *13*(4). https://doi.org/10.7717/peerj.19093

Reddy, P., Chaudhary, K., & Hussein, S. (2023). A digital literacy model to narrow the digital literacy skills gap. *Heliyon*, *9*(4). https://doi.org/10.1016/j.heliyon.2023.e14878

Reichert, F., Zhang, D. (James), Law, N. W. Y., Wong, G. K. W., & de la Torre, J. (2020). Exploring the structure of digital literacy competence assessed using authentic software applications. *Educational Technology Research and Development*, *68*(6), 2991–3013. https://doi.org/10.1007/s11423-020-09825-x

Ridsdale, C., Rothwell, J., Smit, M., Ali-Hassan, H., Bliemel, M., Irvine, D., Wuetherick, B. (2015). Strategies and Best Practices for Data Literacy Education. *Knowledge Synthesis Report*, *151*, 10–17. https://doi.org/10.13140/RG.2.1.1922.5044

Sajidan, S., Maret, U. S., Java, C., Ragil, I., Atmojo, W., Maret, U. S., Desstya, A., Surakarta, U. M., Yani, J. A., Java, C., Parmin, P., Semarang, U. N., Saputri, D. Y., Maret, U. S., Java, C., Salimi, M., Maret, U. S., Java, C., & Nicosia, N. (2023). *Educational Technology : Current Issues*. *15*(1), 59–71.

Schrier, K. (2018). *Guiding Questions for Game-Based Learning*. 1–20. https://doi.org/10.1007/978-3-319-53803-7_59-1

Siddiq, F., Gochyyev, P., & Wilson, M. (2017). Learning in Digital Networks – ICT literacy: A novel assessment of students' 21st century skills. *Computers and Education*, *109*, 11–37. https://doi.org/10.1016/j.compedu.2017.01.014

Siddiq, F., Scherer, R., & Tondeur, J. (2016). Teachers' emphasis on developing students' digital information and communication skills (TEDDICS): A new construct in 21st century education. *Computers and Education*, *92–93*, 1–14. https://doi.org/10.1016/j.compedu.2015.10.006

Tsortanidou, X., Daradoumis, T., & Barberá-Gregori, E. (2022). Convergence among imagination, social-emotional learning and media literacy: an integrative literature review. *Early Child Development and Care*, *192*(2), 173–186. https://doi.org/10.1080/03004430.2020.1753720

Wahyuni, T., Rahayu, W., & Naga, D. S. (2024). Validity and reliability of the situational judgment test instrument for assessing the 'Pancasila' student profile. *Cogent Education*, *11*(1).

https://doi.org/10.1080/2331186X.2024.2439157

Wijayanti, A., Dwiningrum, S. I. A., & Saptono, B. (2024). Digital Literacy in Elementary Schools Post COVID-19: A Systematic Literature Review. *International Journal of Learning, Teaching and Educational Research*, *23*(12), 96–112. https://doi.org/10.26803/ijlter.23.12.6

Winaryati, E., Munsarif, M., & Mardiana. (2021). *Cercular Model of RD&D (Model RD&D Pendidikan dan Sosial)*. Penerbit KBM Indonesia.

Zhang, S., Mingyue Gu, M., Sun, W., & Jin, T. (2024). Digital literacy competence, digital literacy practices and teacher identity among pre-service teachers. *Journal of Education for Teaching*, *50*(3), 464–478. https://doi.org/10.1080/02607476.2023.2283426