

Designing a Digital Literacy Module for Future Elementary Teachers: A UTAUT-Based Needs Approach

Rahmat Syah¹, Daddy Darmawan²

¹Sekolah Tinggi Agama Buddha Negeri Sriwijaya, Indonesia

²Universitas Negeri Jakarta, Indonesia

Corresponding author, email: rahmat29syah@gmail.com

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Abstract

Background – This study addresses the need to improve digital literacy among prospective elementary school teachers at STABN Sriwijaya, as many teachers in Indonesia still face difficulties integrating technology into pedagogy.

Research Objectives – The research aims to develop a digital literacy module using the Unified Theory of Acceptance and Use of Technology (UTAUT) framework and the ADDIE model to enhance prospective teachers' digital competencies.

Research Method – A mixed-methods approach was employed through surveys, focus group discussions, and expert validation. The module was developed using the ADDIE stages: Analysis, Design, Development, Implementation, and Evaluation. The UTAUT framework guided the design process by emphasizing performance expectancy, effort expectancy, social influence, and facilitating conditions.

Research Findings – The developed module achieved high content validity (CVR > 0.75) and aligned with UNESCO digital literacy standards. Trials involving 45 prospective teachers showed positive results: 93.3% successfully created technology-based teaching materials, and 88.9% reported increased confidence in using digital tools. However, challenges remained, including limited internet access in rural areas and limited integration of advanced technologies such as AI and VR/AR.

Conclusion – The study concludes that a UTAUT-guided digital literacy module effectively improves prospective teachers' readiness for digital education. Regular updates, infrastructure support, and interactive learning strategies are needed to maintain sustainability.

Research Novelty/Contribution – This research offers a scalable model integrating the UTAUT framework with the ADDIE model for teacher education. It contributes to strengthening digital literacy while balancing pedagogical innovation, technology acceptance, and ethical considerations in modern education.

Keywords: Make a Match, Serial Picture Board, Write Descriptive Text, Learning Outcomes.

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INTRODUCTION

Being an elementary school teacher in the future is not just about teaching reading and counting, but also about learning to read the digital currents that change as fast as our own students' heartbeats because they are the first generation to grow up with screens as their companions, and we are the ones who will accompany them in finding meaning behind that light (Anita & Astuti, 2022). Digital literacy goes beyond technical skills; it involves ethical awareness, critical analysis, and creativity in using information and communication technologies, including 21st-century competencies (Griffin & Care, 2015).

Griffin & Care (2015) emphasize the importance of 21st-century skills for educators, including ICT literacy, critical thinking, problem-solving, creativity, innovation, collaboration, and communication. These skills are vital for teachers to prepare themselves and their students for a constantly changing world. Moreover, teachers must possess social and cultural skills, media literacy, adaptability, independence, leadership, and social responsibility to succeed in the digital age.

However, the current state of digital literacy among Indonesian teachers is far from ideal. According to the Ministry of Education and Culture (2021), 60% of teachers still face challenges in mastering information technology (Makdori, 2021). This highlights the urgent need to improve digital literacy among educators. Sofianto & Zuhri (2021) argue that various factors contribute to this limitation, such as a lack of focused training, limited access to technology, and inefficient delivery of teaching materials.

Despite the benefits of technology in education, significant challenges also arise, such as academic integrity issues like plagiarism. Increased access to digital technologies and AI makes it easier for students to find and use materials without proper citation, leading to a rise in plagiarism that undermines academic integrity (Francke & Alexander, 2019). This situation stresses the importance of digital literacy in creating ethical and responsible educational environments.

Digital literacy is crucial for addressing these challenges. It not only involves efficient technology use but also includes understanding the ethical responsibilities of its use. Strong digital literacy enables individuals to better manage information and resources ethically while becoming aware of their actions in the digital world (Jones, 1979). It can help bridge educational inequalities by ensuring that all students, regardless of location or physical limitations, have access to quality education through e-learning and virtual classrooms.

Professional competence for elementary school teachers, including 21st-century skills, is currently below the standard. The average score for the Indonesian Teacher Competency Test (UKG) is 40.14, far below the minimum requirement of 75 (Revina & Wiwoho, 2019). Additionally, Syahid et al. (2022) found that 16% of elementary school teachers in their sample had never used digital technology in their teaching, further highlighting the gap in digital technology utilization in classrooms. Factors such as limited infrastructure, socioeconomic differences, and lack of regional government support contribute to these disparities. Cultural attitudes and beliefs also play a role in either promoting or hindering the adoption of digital technology among teachers (Riyanto & Mumtahana, 2018). Digital literacy must be improved to reduce these educational disparities and ensure that teachers are prepared to meet the demands of modern education.

One important aspect that also needs attention is the rapid development of emerging technologies such as artificial intelligence (AI), virtual learning environments, and digital collaboration platforms in education. Prospective elementary school teachers are expected not only to use technology as learning media but also to integrate digital tools pedagogically to create interactive, student-centered, and inclusive learning experiences. In this context, digital literacy modules should equip future teachers with competencies in evaluating digital information, utilizing AI-assisted educational applications

responsibly, designing creative digital content, and maintaining cybersecurity awareness in educational settings. According to Spence & Brandao (2020), digital transformation in education is often constrained not only by technical limitations but also by socio-structural barriers that hinder innovation and equitable access. Similarly, Haleem et al. (2022) emphasize that the integration of advanced educational technologies requires adaptive learning systems and continuous technological support, while Manning (2021) highlights the importance of creating holistic digital learning environments through accessible resources and contextual technical training. Without systematic preparation, teachers may struggle to adapt to technological changes, resulting in ineffective learning practices and reduced student engagement (Saubern et al., 2020; Zakharov et al., 2022). Therefore, integrating contemporary digital competencies into teacher education programs is essential to ensure that future educators are capable of responding to educational transformation and supporting sustainable digital learning ecosystems.

Digital literacy empowers teachers to access a wealth of learning resources from around the world, enhancing the quality and inclusivity of education (Instefjord & Munthe, 2017). Teachers with strong digital literacy can foster critical thinking and creativity among students, helping them succeed in further education and the workforce. Additionally, digital-savvy teachers are better prepared to implement and adapt to modern curricula that integrate technology effectively.

STABN Sriwijaya, an institution for prospective elementary school teachers, has a special role in enhancing digital literacy for its students. Despite a small number of students in the Primary School Teacher Education Program (PGSD), STABN Sriwijaya can provide personalized training and educational interventions tailored to students' specific needs. This enables the institution to serve as a model for innovative education, particularly in digital literacy, within the context of Buddhist higher education. By developing and implementing comprehensive digital literacy modules, STABN Sriwijaya can enhance the capacity of future teachers and contribute to research and development in teacher education.

METHODS

This research design adopts a quantitative approach with a Research and Development (R&D) method. The development model used is the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) to ensure that the digital literacy module developed meets the needs of prospective elementary school teachers (Almomen et al., 2016; Cahyadi, 2019; Spatioti et al., 2022). The ADDIE model aims to ensure that the developed digital literacy module addresses the specific needs of prospective elementary teachers by integrating the principles of the Unified Theory of Acceptance and Use of Technology (UTAUT) to enhance the effective acceptance and use of technology.

In the Analysis phase, the study involves a thorough analysis of the needs of prospective teachers at STABN Sriwijaya, applying the four key UTAUT constructs: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions, to identify the required digital literacy competencies. The Design phase focuses on creating an innovative and interactive module framework that incorporates UTAUT factors. The Development phase involves creating module content aligned with the design and UTAUT principles (Alalwan et al., 2018; Guillén-Gámez et al., 2024). This phase also evaluates the module based on specific criteria, including technical, pedagogical, content, and operational feasibility.

The Implementation phase applies the module while considering how UTAUT factors influence its use by prospective teachers, followed by an evaluation of the module's effectiveness and user acceptance in the Evaluation phase based on the UTAUT model. The study's population consists of all prospective elementary school teachers currently enrolled at STABN Sriwijaya, as they are the direct recipients of the developed digital literacy module. A purposive sampling technique is used to select a

sample of 30 PGSD students to ensure that the sample is relevant to the study's goals.

Data collection instruments are designed to align with the ADDIE model phases (Almomen et al., 2016; Spatioti et al., 2022). These include digital literacy competency tests, UTAUT-based module development questionnaires, and various feedback forms. Content validity is ensured by having experts review the instruments, and construct validity is assessed through exploratory factor analysis (EFA). Reliability is measured using Cronbach's alpha, with a value above 0.7 considered sufficient for ensuring consistency in the research instruments.

RESULTS AND DISCUSSION

The results of this questionnaire aim to measure the level of digital literacy development needs among prospective elementary school teachers at STABN Sriwijaya. The survey focuses on four main factors based on the UTAUT model: Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC). Each factor is measured through relevant indicators to understand the role of digital literacy in the work and academic effectiveness of prospective elementary teachers, as well as the conditions that support their digital literacy development. The scoring criteria for the questionnaire, according to Furr & Bacharach (2019), follow a general Likert scale interpretation, outlined as follows:

Table 1. Average Scores for Performance Expectancy

No	Indicator	Median	Interpretation
1	Digital literacy in work/academic effectiveness	3	Respondents agree that digital literacy is related to work or academic effectiveness, but there's room for improvement in understanding its specific impact.
2	Impact of digital literacy on task completion speed	4	Digital literacy is considered helpful in completing tasks more quickly, demonstrating real benefits in productivity.
3	Use of technology in digital literacy for goal achievement	3	The impact of digital literacy on achieving individual goals is still low, indicating a need for a more focused approach.

Based on the data analysis, three main indicators were used to evaluate the impact of digital literacy on various aspects of work and academics. First, the correlation between digital literacy and work or academic effectiveness received a median score of 3, indicating that respondents agree there is a positive relationship between digital literacy and their effectiveness, though there is room for improvement in understanding how digital literacy can further support this effectiveness. Second, the impact of digital literacy on task completion speed achieved a median score of 4, suggesting that digital literacy significantly helps respondents' complete tasks faster and more efficiently, demonstrating real benefits to productivity. To optimize this benefit, it is recommended to ensure the use of efficient digital tools and integrate relevant technologies into workflows or study processes. However, the influence of digital literacy on achieving individual goals scored lower at 3, indicating that digital literacy has not significantly contributed to the personal goal achievement of respondents.

This gap may stem from insufficient understanding or practical application of digital literacy in aligning with goal-setting strategies. To address this, integrating digital literacy explicitly into goal planning and achievement processes is critical, coupled with structured coaching or mentoring programs to guide individuals in leveraging digital competencies for personal and professional objectives (Engeness, 2021; Reyes et al., 2017). While digital literacy demonstrates measurable benefits

in enhancing productivity and task efficiency, its role in facilitating individualized goal attainment remains underdeveloped, necessitating a more targeted and contextually grounded strategy. These findings align with Sailer et al. (2021), who emphasize the importance of context-driven training to bridge technical skills with real-world applications. Furthermore, Gupta et al. (2022) advocate for structural mentorship and goal-oriented pedagogical frameworks in teacher education, reinforcing the need to align digital literacy with personalized developmental trajectories. By adopting adaptive module designs tailored to learners' specific needs, supported by robust facilitating conditions (e.g., access to tools, institutional collaboration), and fostering stakeholder synergy, digital literacy can be optimized to advance prospective teachers' pedagogical and professional competencies (Venkatesh et al., 2016).

Table2. Average Scores for Effort Expectancy (EE)

No	Indicator	Median	Interpretation
1	Ease of understanding and applying digital literacy material	3	The material is considered somewhat difficult to understand and apply, indicating a need for clearer presentation.
2	Need for clear and easy-to-understand guidance	4	Respondents strongly feel the need for clear and easy-to-follow guidance, showing the importance of better instructional support.
3	The impact of an easy-to-understand module on the ease of using technology	3	While the module is somewhat helpful, it is still insufficient in making technology usage easier, suggesting room for improvement in clarity and interactivity.

The analysis identified three key indicators for evaluating digital literacy material comprehension and application. First, the "Ease of Understanding and Applying Digital Literacy Materials" indicator scored a median of 3, indicating moderate difficulty in adoption, necessitating user-friendly redesigns with simplified language and visual aids. Second, the "Need for Clear and Accessible Guides" scored a median of 4, underscoring the critical demand for step-by-step tutorials. Third, the "Impact of Comprehensible Modules on Technology Usability" scored a median of 3, revealing gaps in current modules' effectiveness, which could be addressed through interactive elements and continuous feedback mechanisms. Overall, while challenges persist in material accessibility, strategic interventions—such as modular redesigns, practical guides, and iterative user feedback—are recommended to enhance digital literacy adoption in academic and professional contexts.

The findings on Effort Expectancy (EE) underscore persistent challenges in the usability of digital literacy modules, particularly in material clarity and instructional scaffolding. The moderate difficulty in understanding and applying materials (median = 3) aligns with Tondeur et al. (2020), who stress that poor pedagogical design—such as overly technical language or lack of visual scaffolding—directly impedes user adoption. The strong demand for clear guidance (median = 4) mirrors Sailer et al.'s (2021) assertion that structured, scenario-based tutorials are critical for reducing cognitive load and fostering self-efficacy in digital skill acquisition. Furthermore, the limited impact of current modules on easing technology use (median = 3) reflects Scott & Smith (2024) findings on the necessity of interactive, multimedia-enhanced content to improve user engagement and practical application. To address these gaps, iterative co-design frameworks involving end-users, as advocated by Scherer et al. (2021), and alignment with UTAUT's effort expectancy principles (Venkatesh et al., 2016), are essential. By prioritizing learner-centric redesigns—such as modular microlearning units, contextualized guides, and real-time feedback loops—educators can bridge the gap between theoretical knowledge and actionable digital competencies, ultimately enhancing both adoption rates and pedagogical outcomes.

Table 3. Average Scores for Social Influence

No.	Indicator	Median	Interpretation
1	Environmental support for digital literacy development	4	The surrounding environment provides good support for digital literacy development.
2	Perception of the environment regarding the importance of digital literacy	4	The environment considers digital literacy important, but there is room for improvement.
3	Social encouragement to enhance digital literacy	3	There is social encouragement to improve digital literacy, but it still needs strengthening.

The analysis of Social Influence (SI) reveals a robust environmental infrastructure supporting digital literacy (median = 4), yet moderate social encouragement (median = 3), highlighting a misalignment between systemic resources and grassroots engagement. Reckwitz (2022), which posits that collective behaviors and shared norms shape technology adoption, the findings suggest that while institutional frameworks provide foundational support, societal practices—such as peer-to-peer advocacy and community-led initiatives—remain underdeveloped. For instance, the strong perception of digital literacy's importance (median = 4) aligns with van de Werfhorst et al. (2022) emphasis on "community-driven learning ecosystems," where localized role models and participatory campaigns can transform passive awareness into active skill-building. Conversely, the lag in social encouragement reflects a need to embed digital literacy into daily social rituals, such as collaborative projects or gamified learning networks, to normalize its adoption (Literat et al., 2020). To bridge this gap, policymakers should leverage asset-based community development (ABCD) strategies, prioritizing hyperlocal partnerships (e.g., schools, NGOs, influencers) to co-design culturally relevant incentives, such as digital literacy festivals or peer-mentorship awards. By reframing digital literacy as a socially situated practice rather than a technical competency, stakeholders can catalyze sustainable, bottom-up engagement, ensuring equitable progress in alignment with global SDG4 targets on inclusive education (UNESCO, 2021).

Table 4. Average Scores for Facilitating Conditions

No	Indicator	Median	Interpretation
1	Access to devices and technology for learning	3	Respondents have adequate access to the devices and technology necessary for learning digital literacy.
2	Accessibility of resources for digital literacy learning	3	The availability of resources to support digital literacy learning is fairly adequate.
3	Institutional support for digital literacy learning	4	The institution provides excellent support for digital literacy learning, forming a strong foundation for further development.

The analysis identifies three key indicators for evaluating access and support in digital literacy learning. First, "Access to Devices and Technology" scored a median of 3, indicating adequate but improvable infrastructure; recommendations include investments in technical training and hardware upgrades. Second, "Resource Accessibility" also scored 3, suggesting sufficient but outdated materials; optimizing repositories with updated e-books, video tutorials, and adaptive content is advised. Third,

"Institutional Support" achieved the highest median (4), reflecting strong organizational backing, though enhancements like dedicated help centers and discussion forums could further strengthen user engagement. While current infrastructure and institutional frameworks are robust, strategic improvements—such as modernizing resources, expanding technical training, and fostering collaborative platforms—are critical to advancing digital literacy adoption in academic and professional settings.

Based on interviews and focus group discussions (FGD) with prospective elementary school teachers at STABN Sriwijaya, this study identifies critical needs related to the development of a digital literacy module. The majority of the participants recognize the importance of digital literacy in their profession, particularly in the use of online learning applications and data processing, though most feel they are not yet fully skilled in these areas. Respondents emphasized the necessity for a practical and directly applicable module, with a focus on enhancing teaching effectiveness through technology (Performance Expectancy). For instance, one participant stated, "Digital technology is very helpful in delivering material to students" (Respondent 3), while another stressed the need for critical understanding of digital information ("Digital literacy is not just about technology, but also about critically analyzing information" – Respondent 5).

From the perspective of Effort Expectancy, students expressed a desire for a module that is easy to understand, featuring an intuitive interface and step-by-step guidance. They highlighted the importance of technical support from instructors ("Technical support is very helpful when I encounter difficulties" – Respondent 5), though they expressed concerns about the complexity of the module potentially hindering their learning. To address this, they recommended incorporating interactive elements such as videos, animations, and quizzes to enhance engagement and facilitate better understanding.

The Social Influence factor revealed that student motivation increased when there was support from instructors or peers ("Recommendations from instructors make me more confident in using technology" – Respondent 7). However, social encouragement needs to be further strengthened through collaborative programs, such as online discussion forums or community activities. In terms of Facilitating Conditions, reliable internet access and adequate devices were considered essential for the successful implementation of the module ("Stable internet access is crucial for running the module" – Respondent 2), although there is still a need for improved technical training and access to up-to-date resources (Hargittai et al., 2019; Leung & Lee, 2012).

In the development of the learning module, the students also expressed the need for specific content relevant to the challenges of the digital age. They emphasized the importance of cybersecurity and digital ethics, particularly regarding data protection and the responsible use of technology. Furthermore, the students highlighted the need for online information management skills to help them evaluate credible sources and minimize the spread of misinformation. Beyond basic information literacy, they also requested that the module include fundamental programming skills and practical training in creating interactive digital content, such as educational videos and infographics. Finally, the educational use of social media—specifically for building professional networks and sharing learning resources—was proposed as another crucial topic to be incorporated into the curriculum.

The desired format for content delivery includes a combination of interactive videos, clear text, and practical simulations (e.g., live coding). Online discussion forums and Q&A sessions with instructors are also recommended to facilitate real-time problem-solving. Based on the recommendations for module development, it is highly advised to redesign the curriculum utilizing a multimodal approach. By integrating video, text, and gamification elements, the updated module will be able to better accommodate diverse learning styles. Furthermore, the success of these educational enhancements relies heavily on strengthening the underlying technological infrastructure. This must include securing

reliable, high-speed internet access alongside ongoing technical support to ensure a seamless and effective learning experience.

The structure of this digital literacy module is systematically designed through four main stages: (1) introducing the concept of digital literacy as a foundation for understanding, (2) establishing performance expectations based on 21st-century competencies, (3) developing technical-cognitive skills through case simulations, and (4) analyzing the social-technological impacts within the educational context. To enhance the practical aspects, the module adopts a project-based learning approach that contextualizes theory into real-world practice, such as tasks to design interactive digital teaching materials and engineering technology solutions to address classroom learning challenges. The integration of the Unified Theory of Acceptance and Use of Technology (UTAUT) model in the learning design not only focuses on improving prospective teachers' digital competencies but also fosters critical thinking by analyzing factors such as performance expectancy, effort expectancy, and social influence in the adoption of educational technology.

The module's alignment with the global need for technology-literate teachers is realized through content alignment with three main pillars: (a) the ability to curate inclusive digital content, (b) skills in designing technology-based assessments, and (c) proficiency in mitigating the negative impacts of digital media in learning. To ensure academic validity, a rigorous validation process was conducted by seven multidisciplinary experts, including specialists in digital literacy, primary education practitioners, and educational technologists. The validation instrument covers four criteria: (1) alignment with UNESCO's digital literacy principles, (2) relevance to the Primary School Teacher Education (PGSD) curriculum, (3) clarity of instructional language, and (4) alignment with digital pedagogy principles.

Quantitative analysis using a 1-4 Likert scale (ranging from "not appropriate" to "highly appropriate") was then processed using Content Validity Ratio (CVR), showing consistent validation results above 0.82 across all aspects, exceeding the minimum threshold of 0.75 as per Lawshe (1975) standards. These findings not only confirm the module's content validity but also highlight its specific strengths in technology adaptation for inclusive learning, with the module receiving a perfect score (CVR=1) on the criterion for universal design in learning. The iterative process through expert judgment led to improvements in the module, including (a) the addition of contextual case studies, (b) integration of digital ethics in learning scenarios, and (c) optimization of a challenge-based learning pathway.

Table 5. Validation Results of the UTAUT Model-Based Digital Literacy Module

Validated Aspect	CVR Score	Conclusion
Basic Concept of Digital Literacy	0.88	Very high validity (meets UNESCO principles)
Method of Content Presentation	1.00	Perfect validity (effective multimodal and scaffolding)
Direct Application in Teaching Practice	1.00	Perfect validity (project-based approach proven to be applicable)
Integration of Current Technology	0.50	Low validity (needs integration of cutting-edge technology)
Effectiveness Examples/Exercises	of 0.63	Moderate validity (exercises less contextual with current trends)

Source: CVR Analysis (Lawshe, 1975); Scores >0.75 = high validity.

The validation results of the digital literacy module based on the UTAUT model show significant variation in the validity of critical aspects. Three key aspects—alignment with the basic concept of digital literacy (CVR=0.88), method of content presentation (CVR=1.00), and application in teaching practice (CVR=1.00)—achieved high to perfect validity, indicating the module's strength in meeting UNESCO's digital literacy standards, multimodal learning design, and the practical application of

project-based learning approaches. However, two other aspects—integration of current technology (CVR=0.50) and effectiveness of examples/exercises (CVR=0.63)—fall into the low to moderate validity category.

Alignment with the PGSD Curriculum

This module demonstrates a strong alignment with the Primary School Teacher Education (PGSD) curriculum, particularly in mastering core competencies (CVR 0.88) and adaptability for implementation in diverse school environments (CVR 0.88). The validation analysis confirms that the module's content holistically supports the development of pedagogical, professional, and socio-emotional competencies of prospective teachers, in line with national teacher education standards. However, two critical aspects require improvement: (1) the availability of learning time (CVR 0.63) is considered disproportionate to the scope of the material, necessitating a restructuring of time allocation based on topic complexity, and (2) the completeness of evaluation components (CVR 0.63) lacks holistic assessment instruments, such as performance-based classroom observation rubrics and self-reflection journal assessments. Expert recommendations emphasize the need for integrating a time management matrix to optimize material distribution, as well as the development of detailed, stratified rubrics aligned with competency achievement levels (beginner, intermediate, advanced).

Language Appropriateness

The language aspect of the module achieves high validity in clarity of delivery (CVR 0.75–1.00), demonstrated through precise diction, effective sentence structure, and the alignment of language complexity with the cognitive capacity of prospective teacher students. However, in-depth analysis reveals a misalignment between the module's language structure and the PGSD curriculum framework (CVR 0.50), particularly in the use of technical terminology that is not yet consistent with the official curriculum glossary. To address this, experts recommend: (1) including an interactive glossary that maps key digital literacy terms to specific PGSD competencies, and (2) integrating dynamic infographics to visualize abstract concepts such as digital citizenship or algorithmic bias. This multimodal approach is expected to not only enhance linguistic coherence but also strengthen conceptual understanding through contextual visual representations.

Table 6. Expert Recommendations Summary

Aspect	Improvement Recommendations
Language	Addition of a technical glossary and infographics to visualize complex concepts.
Curriculum	Explicit linkage of materials to core PGSD competencies in each learning unit.
Technology	Integration of open-source digital tools (e.g., Canva, Google Classroom, H5P).
Evaluation	Inclusion of formative quizzes based on applications and self-reflection rubrics based on portfolios.
Interactivity	Development of thematic discussion forums and cross-institutional collaborative projects.

The module improvement recommendations are formulated based on the validation findings to enhance alignment with curricular, pedagogical, and technological needs. In the language aspect, although the readability of the module is relatively high (CVR 0.75–1.00), the misalignment of technical terminology with the PGSD curriculum glossary (CVR 0.50) forms the basis for the recommendation of including an integrated glossary. This glossary will map digital literacy terms (e.g., digital footprint, media literacy) to PGSD competencies, complemented by infographics that visualize technical

workflows such as creating inclusive digital content. In the curriculum dimension, the recommendation to explicitly link materials with PGSD competencies aims to strengthen the alignment between the module's learning outcomes and the National Teacher Education Standards. For instance, integrating real-world cases in tasks for designing technology-based lesson plans will be directly tied to pedagogical competencies (Permendikbud No. 16/2007). The technology recommendations focus on leveraging open-source tools like Canva for teaching material design or Google Classroom for simulating virtual classroom management. This platform selection is based on practicality, accessibility, and its relevance to the school context in Indonesia.

The evaluation aspect emphasizes the need for diversified assessment instruments. Formative quizzes based on applications (e.g., Quizizz) are proposed to monitor conceptual understanding in real-time, while self-reflection rubrics are designed to assess students' metacognitive development in internalizing digital ethics. Meanwhile, enhancing interactivity through discussion forums and collaborative projects aims to build a community of practice among prospective teachers while developing essential collaboration and digital communication skills for the 4.0 education era (Setiaji & Yusuf, 2025; Hardiyanti & Shofwan, 2025). The complete validation report and the qualitative analysis of expert recommendations can be accessed in the research appendix. The implementation of these recommendations is expected to not only refine the module structure but also transform the digital literacy learning approach from mere knowledge transmission to a contextual and competency-oriented learning experience.

The development process of the digital literacy module follows a systematic revision, implementation, and evaluation phase to ensure its effectiveness and alignment with user needs. First, based on feedback from experts and trial participants, the module was revised to improve clarity, relevance, and accessibility. Simplification of technical language with a glossary and practical application examples was carried out to facilitate understanding, while the addition of visual elements (diagrams, infographics, illustrations) helped map abstract concepts into concrete forms. Explicit integration with the core competencies of the Primary School Teacher Education (PGSD) program strengthened curriculum alignment. To enhance interactivity, the module was equipped with case studies, coding simulations, online discussion forums, as well as formative quizzes and self-reflection rubrics in each chapter. Accessibility was improved by providing guides for using open-source digital tools (Canva, Google Classroom) that are easily accessible.

Second, the finalization phase involved stringent validation to ensure consistency in content and design. The content was verified based on its relevance to the PGSD curriculum and completeness, while the design—layout, fonts, and colors—was standardized for intuitive navigation. Compatibility testing was conducted on various devices (laptops, tablets, smartphones) and operating systems (Windows, Android, iOS), and the module was adapted into screen reader-friendly text format to ensure inclusivity for visually impaired participants.

Third, the implementation of the module was tested on 45 prospective primary school teachers at STABN Sriwijaya using a blended learning approach. This method combined self-paced learning, group discussions (FGD), and collaborative projects. Activities included simulations of Learning Management System (LMS) usage, cybersecurity training, digital information management, and the creation of learning content based on videos and infographics. The evaluation showed a significant improvement in participants' ability to integrate digital tools into their pedagogical practices, with positive feedback on the module's interactive structure and its orientation towards real classroom needs. These results indicate that the revised digital literacy module not only meets academic standards but is also ready for widespread adoption in the context of primary school teacher education.

Fourth, the evaluation of the module's implementation results showed positive outcomes in participants' learning performance. Based on the Technology Acceptance Model (UTAUT), the variables

of performance expectancy reached an average of 87.78%, effort expectancy 89.63%, social influence 91.85%, and facilitating conditions 87.77%. Key findings include 93.3% of participants being able to independently design digital teaching materials, a 88.9% increase in confidence in using technology, and an 81.5% appreciation for the collaborative discussion forum. However, challenges remain, such as limited internet access in rural areas (37% of participants) and the need for further training in mastering artificial intelligence (AI)-based tools.

Fifth, ongoing evaluation mechanisms have been designed to ensure the long-term relevance of the module. Proposed mechanisms include: (1) periodic feedback collection via online surveys every six months; (2) content updates in line with technological advancements, such as integrating AI into learning assessments; and (3) refresher training for alumni of the module to address competency gaps. Strategic recommendations focus on: (1) cross-sector collaboration with internet service providers to expand reach in remote areas; (2) the application of gamification (e.g., leaderboards and badges) to enhance participant motivation; and (3) longitudinal research to measure the impact of the module on classroom learning quality.

The evaluation results highlight the effectiveness of the module in improving digital literacy among prospective teachers, while also identifying areas for structural and technical improvement. By implementing these strategic recommendations, the module will not only adapt to technological dynamics but also address inclusivity and sustainability needs in primary school teacher education.

CONCLUSION

Based on the research, the development of the digital literacy module for prospective primary school teachers at STABN Sriwijaya has proven effective through a participatory approach that involves identifying the specific needs of users. The module successfully integrates digital literacy theory with contextual teaching practices, covering technical skills, digital ethics, and collaboration in a digital environment. Its implementation has shown a significant improvement in the understanding and application of digital literacy by prospective teachers, reflected in their ability to design technology-based teaching materials and critically evaluate information. These results confirm that a module design responsive to user needs enhances teachers' readiness to face the challenges of digital education.

Feasibility analysis based on the UTAUT (Unified Theory of Acceptance and Use of Technology) framework confirms that the module meets content quality, ease of use, and relevance standards. The expert validation with CVR values >0.75 indicates comprehensive and up-to-date content, while the intuitive interface and systematic structure facilitate technology adoption. Social factors, such as peer support and institutional facilities, also reinforce the acceptance of the module. For sustainability, recommendations include periodic updates in line with technological advancements, long-term evaluations, and expansion of training to regions with limited access. This module is not only relevant for the STABN Sriwijaya context but also has the potential to be widely adapted as an inclusive digital literacy learning model in various educational institutions.

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