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Bridging Local Wisdom and Digital Literacy: Development of an Interactive Nearpod Assessment for Junior High School

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ABSTRACT

One of the 21st-century competencies is digital literacy. However, science assessment in junior high schools is less integrated with digital literacy and contextual content. Few studies examine integrating literacy assessment tools with local wisdom and interactive platforms, such as Nearpod. This gap highlights the need for innovative, context-based digital assessment tools. This research aims to develop a digital literacy assessment tool in Nearpod using coconut shell processing on the topic of substances and their transformations. It used a Research and Development (R&D) model modified from the Borg and Gall model, with eight phases: needs analysis, planning, instrument design, expert validation, initial revision, small-scale testing, product revision, and large-scale field testing. The tool included a series of multiple-choice items in an interactive Nearpod format. Findings show very high validity. Out of 50 items, 20 of them were valid in the small-scale test and were all valid in the large-scale test. Items were well discriminated and of equal difficulty. By combining locally relevant content with Nearpod-based assessments, this research highlights a previously underexplored area in science assessment, resulting in a culturally meaningful and digitally engaging instrument for junior high school students.

ARTICLE INFORMATION

Keywords:
assessment instrument; digital literacy; local wisdom; nearpod; science learning

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INTRODUCTION

Digital literacy, as a critical competency in 21st-century education, encompasses not only the ability to use digital devices but also critical evaluation, creation, and the ethical use of information (Arifin et al., 2025). Digital literacy is globally recognized as a key skill for lifelong learning and workforce readiness, particularly amid rapid technological advancements and digital transformation within education systems (Bilad et al., 2024; Law et al., 2018). Students are expected to be actively engaged with the digital environment to develop higher-order thinking skills and to adapt to future challenges. Therefore, digital literacy needs to be integrated into teaching and assessment practices. In Indonesia, students' digital literacy is categorized at a moderate level. According to the Indonesian Digital Literacy Index reports by the Ministry of Communication and Information Technology (Kemkominfo) and the Katadata Insight Center (KIC), the national score of digital literacy in Indonesia is only 3.49 out of 5; this indicates that digital literacy has not yet reached an optimal level (KOMINFO & Katadata Insight Center, 2022). A recent study conducted in Jember Regency shows that junior high school students demonstrate limited competencies in digital literacy, especially when using digital

devices and processing information from digital media (Wahyuni et al., 2022). Several factors contribute to this issue, including a lack of integration of digital literacy into learning activities, inadequate access to digital resources, and a lack of digital-based learning experiences (Gunawan et al., 2024; Suciati et al., 2025). Current school assessment practices tend to rely on conventional methods that do not emphasize digital literacy indicators and limit students' opportunities to develop and demonstrate their competencies in digital literacy (Mahardika et al., 2022). This situation highlights a mismatch between the needs of 21st-century skills and current assessment practices in science education.

Previous studies have focused on developing digital learning materials and technology-based instruction to improve student engagement and understanding (Botturi et al., 2024). Recent data show that digital literacy evaluation continues to be an issue. Results of international tests like the Program for International Student Assessment (PISA) show that even junior high students' scientific literacy was not at a high level, and their digital skills were not at the expected level (OECD, 2023b). Currently, most available assessment tools focus primarily on acquiring cognitive information through static formats, without incorporating interactive technological resources or contextual relevance (Fogel et al., 2025). Currently, available assessment tools are mainly designed to acquire cognitive information statically, without using interactive technological resources or including contextual relevance (Whitworth, 2020). However, research focused on the development of digital literacy assessment instruments built based on local wisdom is still limited (Dini & Kuswanto, 2025; Jusriadi et al., 2025). There is limited research on incorporating local wisdom into digital assessment. This gap underscores the need for creative assessment methods that link to the digital literacy indicators, interactive technology, and local context.

To address this gap, this study developed a digital literacy assessment tool using Nearpod as an interactive platform that integrates local wisdom regarding the processing of coconut shells in the topic of materials and their transformations in science learning. Nearpod, as an assessment tool, provides real-time interaction, immediate feedback, and active student engagement, while the integration of local wisdom adds relevance to contextual content and fosters students' environmental awareness (Putra et al., 2021). To fill this gap, this study introduces a new assessment instrument for digital literacy in science learning developed using an approach that uses local wisdom as a contextual basis, namely coconut shell processing. The objective of this study is to develop and validate a Nearpod-based digital literacy assessment instrument that integrates local wisdom content for science learning in junior high school students. This study differs from previous literacy assessment tools, which view digital tools as simply a delivery system, by making Nearpod part of the assessment process so that students are engaged in real-time interaction and immediate feedback as a way to assess literacy. Thus, the instrument can be seen as a methodologically different contribution: a psychometrically validated and culturally adapted instrument that is interactive in the context of junior high school science education.

METHOD

This study employs a Research and Development (R&D) approach to develop and validate a digital literacy assessment instrument for junior high school students using Nearpod to teach the processing of coconut shells in science lessons. This R&D model is adapted from Borg and Gall, which is widely used in the development of educational products, and has been simplified into eight systematic stages: 1) needs analysis; 2) planning; 3) instrument design; 4) expert validation; 5) initial revision; 6) small-scale pilot test; 7) product revision, and 8) large-scale field test (Gall et al., 2003). This staged procedure ensures that the developed instrument meets essential criteria, including validity, reliability, and practicality in educational assessment (Laksana et al., 2025). The First stage is

needs analysis, carried out in the classroom to monitor students' digital literacy levels, map the shortcomings of current assessments, and review the literature to identify what other researchers have already done. The second stage is the planning phase, to identify the learning objectives, digital literacy indicators, and assessment requirements. The third stage is the design phase, which tests the blueprint and item indicators integrated with the components of digital literacy, including information and data literacy, digital content creation, communication and collaboration, and critical evaluation of digital information, based on the digital literacy framework (Law et al., 2018).

The four-stage process involved content validation conducted by three validators, consisting of science education, educational evaluation, and digital learning media experts, to test the content validity, construct validity, and linguistic clarity of the instrument. The selection of three validators follows the recommended criteria for content validation studies in educational research, as this number ensures adequate coverage of the instrument's content, constructs, and linguistic dimension without creating unnecessary evaluator redundancy (Yusup, 2018). Each validator assessed the instrument using a structured validation sheet that included content validity, construct validity, and language clarity. Content validity was assessed using Aiken's V formula, with a V coefficient ≥ 0.75 as the minimum acceptance threshold.

Participants in this study were selected using purposive sampling, a nonprobability technique appropriate for research contexts in which the population meets certain criteria: junior high school students who were already familiar with digital devices and accessing digital devices (Creswell & Creswell, 2022). This technique was chosen over random sampling because this study required students who were already familiar with digital devices to engage with the Nearpod-based instrument. The first revision was followed by a small implementation test, which included 25 students from the 7th grade of VII C and VII E at SMP Negeri 2 Panti, using purposive sampling, to determine their prior knowledge of processing coconut shells. To facilitate the instrument's broad applicability and create a context for international collaboration, the implementation also included Indonesian students studying abroad at the Indonesian School of Kuala Lumpur, Malaysia. The outcome of this phase, to be utilized to optimize the instrument prior to its application in a field-wide test, is 65 students in VII A, VII B, and VII D in the same school. The Nearpod contains 50 multiple-choice items to promote an interactive assessment, real-time feedback, and student interaction. During Nearpod-based activities, data are gathered and analyzed by observation, questionnaires, expert validation sheets, and student responses.

Content validity, construct validity, and language clarity are assessed using expert validation forms. The primary data in the empirical test were student responses obtained via Nearpod activities (Laksana et al., 2025). The data were analyzed using qualitative and quantitative analysis. Descriptive analysis of qualitative data, in terms of expert feedback and student responses, helped refine the instrument. To test validity, reliability, item difficulty, and discrimination index, Microsoft Excel and SPSS were used to analyze quantitative data. Expert judgment was used to determine content validity, and Aiken's V formula was used to calculate content validity. Reliability was calculated using Cronbach's Alpha coefficient. The point-biserial correlations between the encompassing empirical items and item validity were used to evaluate item validity. The results of this analysis were used to determine the psychometric quality of the developed instrument.

Content validity was determined using Aiken's V coefficient. $V \geq 0.80$ means very high validity, $0.60 \leq V < 0.80$ means high, $0.40 \leq V < 0.60$ means moderate, and $V < 0.40$ means low (Aiken, 1985). Instrument consistency was assessed using Cronbach's Alpha coefficient (α) with the following levels (Hidayat, 2021): very high ($\alpha \geq 0.90$), high ($0.80 \leq \alpha < 0.90$), moderate ($0.70 \leq \alpha < 0.80$), low ($0.60 \leq \alpha < 0.70$), and very low ($\alpha < 0.60$). Item difficulty index (P) was calculated, and difficulty level criteria are interpreted as difficult ($P < 0.30$), moderate ($0.30 \leq P \leq 0.70$), and easy ($P > 0.70$). The

interpretation follows Hidayat (2021). The same source was also followed to assess the Discrimination Index (D) using the upper-lower method; 27% of each group was used in this calculation. The results are interpreted as very good, good, fair, poor, and very poor.

RESULTS AND DISCUSSION

This research had a time constraint, making it impossible to go through the final revision and dissemination phases because the development process only included the revision and large-scale testing stages of the product, as is typical in studies of educational product development (Sugiyono, 2021). To identify problems relevant to science learning assessment practices, a literature analysis and field observations were conducted in SMP Negeri 2 Panti during the first needs analysis. To enhance the theoretical basis of the present study, the literature review synthesized the results of recent studies (Creswell & Creswell, 2022). Some of the major challenges identified during this analysis were the limited use of assessment tools to gauge students' skills effectively, the lack of digital literacy indicators in the assessment questions, and the failure to use local resources as contextual learning material. These results are consistent with recent research that digital literacy measurement is not optimally incorporated into classroom assessment (Ng, 2020). Even though local resources, e.g., coconut shells, are highly applicable to science topics on substances and their changes, they have not been fully utilized in the assessment.

The product planning phase will entail collecting relevant information and aligning the assessment instrument design to the 7th-grade science curriculum (Merdeka Curriculum). The assessment was created by integrating digital literacy indicators without compromising on the learning objectives and achievement indicators, which are crucial skills under the competency-based curriculum framework (OECD, 2023a). The material was centered on substances and their changes, and was presented in the context of real-life phenomena like the use of coconut shells, fire, and physical and chemical changes. Recent studies that reveal the effectiveness of Nearpod in increasing student engagement and interactive learning support the integration of digital platforms like Nearpod (Putra et al., 2021). In response to the findings of the analysis of item validity, 20 items meeting the threshold of validity were picked and reformulated to be tested again in the small-scale test, according to modern psychometric principles in measuring education (Taherdoost, 2016). In total, 50 multiple-choice items were created and first tried out in the small-scale test in classes VII C and VII E. They then incorporated these validated items into the Nearpod platform to be used in the large-scale trial, which included the students of classes VII A, VII B, and VII D. It is advisable to use technology-based assessment platforms to enhance the effectiveness and efficiency of the evaluation processes in digital learning settings (Attalla et al., 2024).

The product design stage led to the creation of important elements, such as a test blueprint and an assessment rubric. The test blueprint included learning objectives, digital literacy indicators, item indicators, cognitive levels, and item formats. Meanwhile, the test items, answer keys, scoring guidelines, and test duration were incorporated into the assessment rubric. These elements ensured that the instrument developed could measure students' digital literacy skills in a contextual, technology-mediated learning setting in a manner that aligns with core tenets of authentic and meaningful assessment (Darling-Hammond et al., 2020). The expert validation process included three validators, including two professors of science education and a middle school science teacher. All evaluated aspects were in the highly valid category, with an overall mean of 90.0%, as presented in Table 1.

Table 1. Expert Validity Results

Aspect Assessed	Percentage of Validators (%)			Percentage (%)	Category
	V1	V2	V3		
Learning Suitability	80.0	89.6	90.8	86.8	Very Valid
Digital Literacy	89.2	91.6	90.0	90.3	Very Valid
Question Item Quality	92.8	90.4	90.8	91.3	Very Valid
Cognitive Level	90.0	90.4	90.8	90.4	Very Valid
Language and Readability	92.4	89.2	90.8	90.8	Very Valid
Average				90.0	Very Valid

The outcomes presented above suggest that the instrument created possesses high standards of content and construct validity so that the assessment can measure the necessary competencies (McDermott et al., 2026). The learning alignment aspect (86.8%) refers to the fact that this instrument is compatible with the curriculum goals and learning indicators. Assessment and curriculum should be aligned to ensure that student performance reflects mastery of expected competencies (Respicio & Bauyot, 2026). A common concern when assessment tasks do not match instructional goals is that students will perform in alignment with test-taking strategies and not true acquisition of competence. This concern is explicitly addressed in this instrument by the design of its items, which are closely linked to the specific indicators of digital literacy (Khan et al., 2025). The digital literacy aspect (90.3%) shows that this tool incorporates the most important aspects of digital literacy, including information processing, information evaluation, and digital communication, which are the fundamentals of 21st-century learning (Law et al., 2018). The aspect of question item quality (91.3%) indicates that the questions are structured and easy to understand, and that they can distinguish between students' ability levels. Good-quality questions are crucial for generating precise and valuable evaluations (Rao & Banerjee, 2023). The cognitive level aspect (90.4%) suggests that this tool involves various aspects of cognitive level, including higher-order thinking skills, which are important in the current context of science education (Darling-Hammond et al., 2020).

In addition, the language and readability factor (90.8%) indicates that the items in the test were written in a clear and easily understandable format. Clear language reduces ambiguity and indicates that students' answers are based on their real capabilities, not on misinterpreting the questions (Lopez, 2023). All these results suggest that the digital literacy assessment tool created using Nearpod is valid and can also be used in the teaching of science. A valid instrument is defined as one that measures what it is supposed to measure and generates consistent and meaningful data (Ramadhan et al., 2024). Several revisions were made based on the validators' suggestions to improve the instrument's quality, as presented in Table 2.

Table 2. Product Revision

Revised Questions	Before Repair	After Repair
2, 3, 5, 8, 10, 11	Several questions are not aligned with the question indicators.	Revise and improve to align with question indicators and cognitive domains.
2, 6, 9, 11, 24, 33, 36	Several questions indicate ambiguous and insufficiently detailed statements.	Clarify questions and make them more detailed.

This revision focused on aligning the items with digital literacy indicators for greater clarity, as shown in Table 2. This iterative refinement process is a critical step in instrument development, ensuring validity and usability in real classroom contexts (Nuryanto et al., 2025). Empirical validity was tested using item-total (point-biserial) correlations through small- and large-scale pilot studies to determine whether each item measured the intended indicator. The small-scale pilot study involved 25 seventh-grade students from classes VII C and VII E. The results are presented in Table 3.

Table 3. The results of the validity test of the items

Class	Question Number	Number	Category
Small-scale test	1, 2, 5, 7, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 25, 26, 27, 29, 30, 31, 33, 34, 38, 40, 43, 44, 45, 48, 49, 50	30	Invalid
	3, 4, 6, 8, 9, 10, 11, 21, 23, 24, 28, 32, 35, 36, 37, 39, 41, 42, 46, 47	20	Valid
Large-scale test	3, 4, 6, 8, 9, 10, 11, 21, 23, 24, 28, 32, 35, 36, 37, 39, 41, 42, 46, 47	20	Valid

Of the 50 items, 20 were deemed valid (r-count > r-table, $\alpha = 0.05$), indicating an acceptable item-total correlation. The 30 items required revision or deletion due to ambiguity or inconsistency with the indicators, a common issue in preliminary trials (Tani & Nchia, 2025). These 20 valid items were then used in a large-scale pilot study involving 65 students (VII A, VII B, VII D). All 20 items remained valid in the large-scale test, showing stable validity across samples. This indicates that the instrument adequately measures students' digital literacy skills and meets empirical validity requirements for classroom assessment (Afandi et al., 2024). Cronbach's Alpha was used to determine the consistency of the developed digital literacy assessment instrument. Reliability is the extent to which an instrument yields consistent results across repeated measurements (Nur et al., 2025). The findings of a pilot study conducted on 25 students on a small scale showed that the multiple-choice instrument has a Cronbach's Alpha coefficient of 0.80. This value is in the high reliability range, which means that there is a high consistency between the test items. A range of 0.70-0.90 is considered acceptable and reflects reliability in educational research (Arbeni et al., 2025). A large-scale reliability test is a way of confirming the consistency of the instrument. According to the answers given by 65 students, the Cronbach's Alpha coefficient was 0.762, which is within the acceptable domain of reliability. These results suggest that the instrument has the same measurement properties in a larger sample and in different classroom circumstances (Hartono et al., 2023).

The instrument has adequate internal consistency and produces reliable measurements. High reliability is crucial in educational assessment to ensure that the scores obtained accurately reflect students' actual abilities, rather than merely random measurement errors (Zhang et al., 2023). Therefore, the Nearpod-based digital literacy assessment instrument can be considered reliable for assessing students' digital literacy skills in the context of science learning, particularly in the processing of coconut shells (Putra et al., 2021). The discrimination index is a key psychometric indicator of an item's ability to distinguish between students with high and low mastery levels. A higher discrimination index indicates that an item is more effective at distinguishing between these two groups, thereby contributing to the overall quality of the assessment instrument (B.R, 2022). In this study, item discrimination was analyzed using the top-and-bottom-groups method, in which the 27% of students with the highest scores were classified as the top group and the 27% with the lowest scores as the bottom group (Irawan et al., 2025). The results of the small-scale discrimination analysis are presented in Table 4.

Table 4. Small-scale test item discrimination index results

Class	Questions Number	Number	Category
Small-scale	1, 2, 5, 12, 13, 14, 15, 16, 18, 19, 20, 22, 25, 27, 30, 31, 33, 34, 40, 42, 43, 44, 48, 50	24	Less
	3, 7, 11, 17, 26, 29, 32, 35, 36, 37, 38, 41, 45, 46, 47, 49	16	Enough
	4, 6, 8, 9, 10, 21, 23, 24, 28, 39	10	Good
	5	1	Less
Large-scale	1, 2, 3, 4, 8, 11, 12, 16, 19	9	Enough
	6, 7, 9, 13, 14, 15, 17, 18, 20	9	Good
	10	1	Very Good

Based on Table 4, the small-scale trial results indicate that 10 items (20%) were categorized as good, 16 items (32%) as enough, and 24 items (48%) as less in discrimination. These results indicate that many of the items originally did not have high power to differentiate between those students with low and high performance. Items with low discrimination indices could be due to ambiguous wording, wrong level of difficulty, or guessing behavior of students (Gyamfi & Wren, 2022). Thus, those items were either updated or removed, and then the large-scale trial was conducted. After item refinement was done, the discrimination analysis was again done in the large-scale trial with 20 items selected. Table 5 displays the results.

The large-scale results demonstrate a significant improvement in item quality, with most items falling into the "good" and "enough" categories, and one item achieving a "very good" discrimination index. Only one item remained in the "less" category. This indicates how effective small-scale analyses are for the revision process, which is a significant step in designing high-quality assessment tools (Rame & Hoinbala, 2024). Overall, the results suggest that most of the items included in the final instrument are associated with an acceptable to high discrimination power, allowing them to effectively distinguish between students in terms of level of digital literacy. The presence of high discrimination indices indicates that the instrument will be able to detect changes in students' abilities and allow the achievement of correct measurement results (Gyamfi & Wren, 2022). However, various factors might affect item discrimination, including students' test-taking behavior, such as guessing and failure to understand questions. All these may decrease the degree of differentiation of some items when comparing ability levels (Chauhan et al., 2023). Thus, it is advisable to keep refining and contextualizing the items to improve the quality of the assessment instrument further. The item difficulty analysis was done to provide the percentage of students who answered a given item correctly, which represents how easy or difficult a question is for the target group. Difficulty Index (p) is the number of correct answers divided by the total number of students, and the higher the index, the easier the question (Fauzie et al., 2021). A well-constructed assessment instrument should have an equal proportion of easy, moderate, and difficult questions, which is normally 30%:50%:20% (Nurhidayati et al., 2022). Table 5 shows the results of the small-scale experiment with 50 items.

Table 5. Results of the Difficulty Level of Test Items

Class	Questions Number	Number	Category
Small-scale	2, 3, 21, 23, 28, 32, 36, 39, 46	9	Easy
	1, 4, 5, 7, 8, 9, 10, 12, 14, 18, 20, 24, 25, 26, 27, 35, 38, 43, 44, 47, 48, 50	22	Moderate
	6, 11, 13, 15, 16, 17, 19, 22, 29, 30, 31, 33, 34, 37, 40, 41, 42, 45, 49	19	Difficult
Large-scale	1, 2, 4, 5, 6, 7	6	Easy
	8, 9, 10, 11, 12, 13, 14, 15, 16, 17	10	Moderate
	3, 18, 19, 20	4	Difficult

In the small-scale, it can be seen that 9 items (18%) were rated as easy, 22 items (44%) as moderate, and 19 items (38%) as difficult. This distribution shows that before revision, the instrument was inclined towards a relatively high percentage of difficult items. Items that are too challenging or too easy can lessen the effectiveness of an assessment in segregating student skills (Dini & Kuswanto, 2025). Therefore, revisions were made to have a more balanced composition. After refining the items, the difficulty analysis was replicated in the large-scale trial that used 20 validated items. The results indicate a balanced item difficulty: 30% easy, 50% moderate, and 20% difficult. This composition meets the suggested requirements of quality assessment tools and suggests that the modified items have been properly calibrated to suit the intended student population (Arfiani et al., 2025). Items of a moderate level of difficulty dominate this assessment tool. These are the questions that are most effective in separating students of different ability levels (B.R, 2022). Meanwhile, both easy and difficult questions ensure a comprehensive assessment of various competencies.

Research results indicate that the Nearpod-based digital literacy assessment instrument possesses strong psychometric qualities (high validity, reliability, balanced difficulty levels, and adequate discrimination), indicating that it can accurately measure students' digital literacy in science learning. Nearpod makes a significant contribution, particularly in the interactive aspect, which increases engagement, participation, and higher-order thinking. An interactive platform makes the assessment experience more two-way, involving students in the process with opportunities for immediate feedback and interaction with multimedia stimuli. This is consistent with earlier studies, which showed that technology-based assessment has the potential to increase student motivation to learn and to provide immediate feedback for formative assessment (Prasetyo & Andayani, 2024; Putra et al., 2021). In terms of implications, the instrument not only measures conceptual understanding but also indicates students' access to, analysis of, and evaluation of digital information, reflecting 21st-century competencies (Mejías-Acosta et al., 2024). This instrument can discriminate between students' abilities as indicated by a balanced difficulty profile (Rame & Hoinbala, 2024).

Overall, the findings indicate that the developed instrument has an adequate level of difficulty and can support the effectiveness of assessing students' digital literacy skills. This instrument demonstrates strong psychometric qualities when combined with the results of validity, reliability, and discrimination analyses. Nearpod's use of digital literacy as a performative competency, demonstrated through interaction, and its local wisdom content provides the performative aspect of digital literacy while making it ecologically valid, contextually meaningful, and culturally responsive. This integrated design responds to a critique that many digital literacy assessments in developing educational contexts focus on how familiar a student is with technology rather than the critical, evaluative, and creative aspects of literacy that constitute digital competence. This aligns with a study that explains the integration of Nearpod influences assessment and provides technology-based

interactive evaluation in contemporary education (Prasetyo & Andayani, 2024). The integration of local wisdom, coconut shell processing, strengthens contextual learning by linking scientific concepts with students' real-life experiences. This approach enhances conceptual understanding, engagement, and environmental awareness, aligning with studies emphasizing the importance of contextual and meaningful learning in science education (Ferreira et al., 2022; Sakul et al., 2025).

CONCLUSION

This study created and tested a digital literacy assessment tool through the application of Nearpod in the implementation of instructional science about coconut shell processing for Grade VII students in Junior High School, where the topic of substances and their transformations is the subject. It was developed and psychometrically tested in two experimental stages of trial with expert review using the 8 phases of the R&D model developed by Borg and Gall. The instrument was found to have good psychometric properties, namely content validity, reliability, item difficulty balance, and discrimination, which means that students' digital literacy competencies in science learning could be measured with the instrument. These psychometric attributes show that this instrument is suitable for measuring the digital literacy of junior high school students in science learning. This study has several limitations. First, the development process did not reach the dissemination stage because of time and resource limitations, which restricts conclusions about the instrument's effectiveness on a larger scale. Second, the sample was selected from one school, which may limit the generalisability of the results to other schools with different demographics and infrastructure characteristics. Third, this research emphasized psychometric validation and failed to assess the instrument's sensitivity to changes in learning over time. Future research should focus on the instrument's use in other school contexts, its responsiveness to instructional interventions to foster digital literacy, and its use in broader formative assessment. It is also advised that this tool be extended to other science topics and local wisdom contexts.

DECLARATION OF GENERATIVE AI

The authors declare that no generative AI or AI-assisted technologies were used in the writing process of this manuscript.

CONFLICTING INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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