Development of LINOSIAPPS as teaching materials to enhance information literacy of elementary school students based on Pantura local wisdom

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KEYWORDS	ABSTRACT
Elementary School Students Information Literacy Indonesian LINOSIAPPS Local Wisdom	This study aims to develop LINOSIAPPS teaching materials to enhance information literacy of elementary school students based on Pantura local wisdom. The method used is Research and Development with the ADDIE model, including analysis, design, development, implementation, and evaluation. The research subjects were fourth-grade students of SD 1 Kesambi as the experiment and SD 2 Kesambi as the control, each with 22 students. The research instruments included expert validated questionnaires, teacher and student practicality questionnaires, and information literacy tests. The validation results showed that LINOSIAPPS was a very valid media (the average percentage of media expert validity was 90% and material expert 86.6%). The practicality test showed 96.5% student responses and 93.3% teacher responses, a very practical category. The effectiveness test using an independent t-test showed a significant difference (Sig. 0.000 <0.05) between the experimental and control groups, so LINOSIAPPS was effective in improving students' information literacy skills. The advantage of this media lies in the integration of e-module materials, interactive assessments, learning videos, and educational games that highlight the local wisdom of the Pantura area of Kudus, Pati, and Rembang. LINOSIAPPS supports contextual, engaging, and responsive Indonesian language learning to meet students' needs, while fostering local cultural awareness. Thus, LINOSIAPPS has proven valid, practical, and effective as an innovative teaching materials for strengthening information literacy in elementary school students.

Introduction

Literacy education is a fundamental aspect in developing elementary school students' competencies. Literacy is the ability to understand information obtained from various sources or media, whether printed, oral, or digital (Hanifah et al., 2025). Literacy is an important part because it is the basis for mastering critical thinking skills, the ability to understand information, and the ability to communicate effectively, both orally and in writing (Goodsett, 2020; Jesson, 2020; Svensson et al., 2022). Strong literacy is also the foundation for academic success and character building of students (Nugroho & Nursikin, 2025; Sari et al., 2021). However, literacy learning practices in elementary schools still face challenges, especially in improving literacy skills.

The results of a preliminary study conducted at SD 1 Kesambi in the fourth grade of the odd semester of 2025/2026 indicate that students' information literacy skills are not optimal, especially in understanding information content, summarizing information, and critically communicating the content. Literacy learning is still dominated by the use of one-way textbooks and worksheets, and the use of technology-based media and local cultural contexts is not optimal. This condition causes students to be less actively involved in the literacy process. This finding is in line with the research team's previous research that found that elementary school students' literacy comprehension skills are relatively low due to, among other things, the use of one-way textual teaching materials, the lack of technology integration, and the failure to address local cultural contexts that are close to students' experiences (Setiawaty et al., 2025; Hanifah et al., 2025). The limitations of contextual and technology-based learning media are one of the factors contributing to low student literacy (Arjaya et al., 2024; Erman & Wakhidah, 2023).

The development of LINOSIAPPS (App-based Information Literacy) is designed as a solution to answer these needs by providing interactive teaching materials and assessments that are relevant to students' lives and integrated into one learning application system. This solution is in line with Anwari et al. (2016) & Nugroho et al. (2019) that local wisdom can make learning more contextual, relevant, and accessible to students. On the other hand, technological support enables multimodal presentation of information, which encourages students to think critically and creatively through more varied literacy activities (Cayabas & Sumeg-Ang, 2023; Hanifa et al., 2024; Sriyulianingsih et al., 2023).

Theoretically, the integration of local wisdom and technology in learning is based on a culturally responsive teaching approach which emphasizes the importance of linking learning materials to students' cultural backgrounds and social experiences (Bayraklı, 2026; Ialuna et al., 2024). Learning content based on local culture provides meaningful learning experiences, so that students not only receive information abstractly but are able to relate it to the social realities they are familiar with. This is in line with Uge & Neolaka (2019); Asmayawati et al. (2024); &Kwangmuang et al. (2026) that local wisdom-based learning with technology support can increase students' relevance and understanding of the material and encourage critical and creative thinking skills.

The development of interactive Indonesian language teaching materials and assessments for elementary schools containing local wisdom of Pantura (North Coast of Java which includes Pati, Kudus, and Rembang) combined with digital technology based on the LINOSIAPPS application is an innovative approach to address the challenges of low student information literacy and minimal engagement in learning. The LINOSIAPPS application not only provides Indonesian language learning materials in digital form, but also combines various interactive learning platforms, such as Heyzine-based E-Modules as interesting enrichment materials and combines interactive edugame assessments (such as Educaplay, Wordwall, and Edpuzzle) in the form of quizzes, matching games, and interactive videos. This combination is designed to make learning more fun, contextual, and supports the strengthening of information literacy through a technology-based approach.

Research into the development of informative Indonesian language teaching materials for elementary schools has been widely conducted, such as e-modules to improve student literacy (Handayani et al., 2022; Lestari et al., 2025; Maulina et al., 2018; Priyono, 2023; Ramadani et al., 2025; Ulia et al., 2019; Wahyuni et al., 2022; Wijayanti et al., 2022). In addition, educational games based on local culture have also been proven to improve students' literacy understanding and engagement (Ahyati, 2024; Khasanah et al., 2023; Supriyaddin et al., 2023). The research has proven effective in increasing student engagement and understanding. However, most studies still develop media separately, either in the form of e-modules or educational games, and have not integrated the two into a complete learning application ecosystem. Furthermore, the learning content in previous studies has not specifically highlighted the local wisdom of Pantura as a means of strengthening information literacy. This gap is the background to the development of LINOSIAPPS, an application that integrates e-modules, edugames, interactive assessments, and local wisdom content in a single learning system.

The urgency of this research is to develop interactive Indonesian language teaching materials and assessments for elementary school students containing Pantura local wisdom integrated into the LINOSIAPPS application, which has never been developed before. This product was developed focusing on information on Pantura local wisdom presented in the form of descriptive, expository, narrative, and procedural texts, specifically for grade IV according to the problem. Meanwhile, local wisdomThe Pantura chosen focuses on local wisdom in the Pati, Kudus, and Rembang areas.

The selection of fourth grade in this study was based on pedagogical and curricular considerations. Cognitively, fourth grade students are at the concrete operational phase, where the ability to understand information, group ideas, and draw conclusions begins to develop systematically. At this phase, students begin to be able to read informational texts more analytically, beyond simply recognizing words or sentences. Furthermore, in the Indonesian Language curriculum, informational texts begin to be taught

more intensively in fourth grade, such as descriptive, expository, narrative, and procedural texts. These conditions make fourth grade an appropriate phase for developing students' information literacy through contextual and interactive learning media.

Information literacy indicators include the ability to identify information needs, search for and find information, analyze and evaluate the quality and relevance of information, and then use information effectively and ethically (Svensson et al., 2022). In addition, information literacy can also be operationalized through the skills of identifying, evaluating, and synthesizing information to support students' reading comprehension and writing skills, so that the indicators used can be measured in the learning context (Robinson et al., 2021). The information literacy indicators in this study are specified as (1) indicators of finding important information in text, (2) understanding the meaning of information words and sentences, (3) concluding the contents of information readings, and (4) understanding the contents of information texts according to the values of local wisdom of Pantura. These indicators are used as the basis for measuring information literacy in this study, so that the literacy concept used is not general, but operational and measurable.

The development of LINOSIAPPS is not positioned as a learning center, but rather as a supporting medium for the information literacy process. Teachers act as facilitators, guiding students in exploring information, guiding discussions, and assisting them in evaluating the information they obtain. Meanwhile, students play an active role as learning subjects, seeking, understanding, and presenting information through in-app activities. This interaction pattern aligns with a student-centered learning approach that emphasizes exploratory and collaborative activities in the literacy process.

Based on the problems above, the focus of this research is (1) to develop interactive Indonesian language teaching materials and assessments for elementary school students containing local wisdom of Pantura based on LINOSIAPPS. (2) to test the validity of LINOSIAPPS. (3) to test the practicality of LINOSIAPPS in learning Indonesian language in elementary school. (4) to test the effectiveness of LINOSIAPPS in improving information literacy of elementary school students. The novelty of this research lies in the integration of e-modules, edugames, interactive assessments, and local wisdom in one integrated LINOSIAPPS ecosystem, there by supporting students' information literacy experiences in a sustainable manner.

Method

This research uses the Research and Development method with the ADDIE model which includes Analysis, Design, Development, Implementation, and Evaluation developed by Robert Maribe Branch (Branch, 2009). Figure 1 is a picture of the phase of development of the ADDIE model used in this study.

Fig. 1. Research phase according to the Robert Maribe Branch model

The research phase according to Figure 1 are as follows: First, the analysis phase. This includes needs analysis, student characteristics, and curriculum. The needs analysis was conducted through teacher interviews and learning observations to identify information literacy issues and media limitations. The student characteristics analysis encompassed initial literacy and digital literacy skills, while the curriculum analysis focused on fourth-grade information text learning outcomes. The output of this phase was the formulation of measurable information literacy indicators, including (1) finding important information in the text, (2) understanding the meaning of words and sentences in the information, (3) concluding the contents of the information, and (4) understanding the truth of the contents of the information according to the values of local wisdom of Pantura. In addition, initial specifications for the development of LINOSIAPPS which include the structure of information materials, application features, and integration of local wisdom.

Second, design phase, namely material selection, planning and designing the LINOSIAPPS Application which contains interactive teaching materials and assessments based on PANTURA local wisdom (specifically Kudus-Pati-Rembang local wisdom). The materials developed include information materials in the form of descriptive, expository, narrative, and procedural texts.

Third, the development phase, namely realizing the product design plan into reality and conducting product validation. Validation involves two groups of validators: material experts who are lecturers with expertise in the field of Indonesian language learning for elementary schools and experienced in research and development of teaching materials. Meanwhile, media experts are lecturers or practitioners of educational technology who have competence in digital learning media design and learning application development. The flowchart of the design and development phase of LINOSIAPPS is presented in Figure 2.
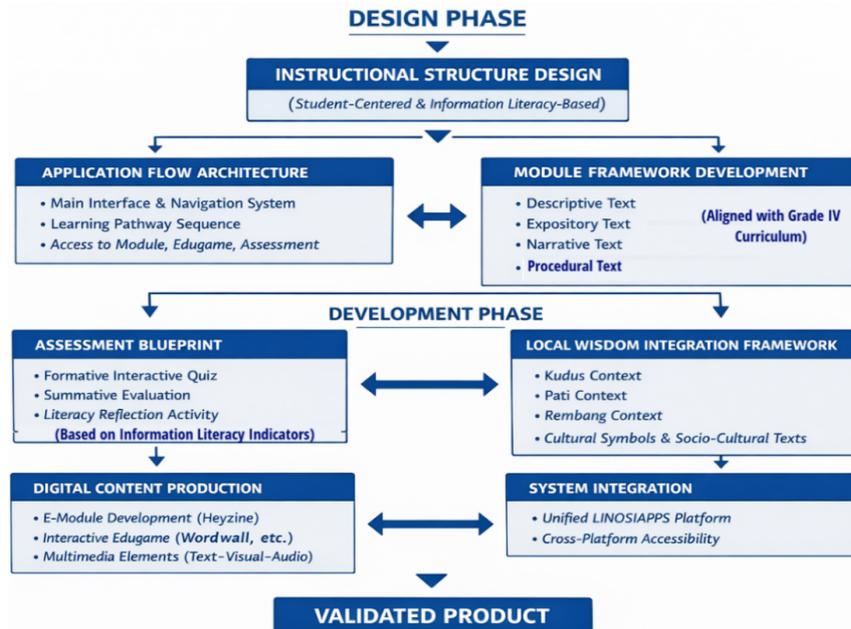

Fig. 2. LINOSIAPPS design and development phase specifications

Fourth, the implementation phase, namely a limited and wide-scale product trial. The trial was conducted on a portion of 10 fourth-grade students for two meetings (2 × 35 minutes). This phase aims to identify the clarity of the material, the ease of use of the application, and the students' initial responses to LINOSIAPPS. The data obtained at this phase were used as a basis for revising and refining the product before being tested more widely. After the revision, a wide trial was conducted on all 22 students for four meetings (4 × 35 minutes). At this phase, LINOSIAPPS was fully implemented at SD 1 Kesambi in learning information texts. Fifth, the evaluation phase, namely evaluation through the results of information literacy tests and student and teacher response questionnaires on the developed product to see the effectiveness of the product.

This research trial used fourth-grade students at SD N 1 Kesambi, Kudus Regency, as the experimental group, and fourth-grade students at SD 2 Kesambi as the control group. The sampling technique used saturated sampling with 22 students from each school. Saturated sampling was chosen because the population size was relatively small and all members of the population were used as research samples, so random sampling was not carried out. The selection of the two schools was based on the similarity of academic characteristics and learning environments, such as school accreditation, curriculum used, students' social backgrounds, and relatively equivalent Indonesian language learning achievements based on previous grade data.

Data collection techniques used questionnaires, documentation, and interviews. The research instruments included interview sheets, questionnaires, and information literacy test questions. The interview instrument was used to obtain needs analysis data. The questionnaire instrument was used to obtain validation data from media experts and material experts. In addition, the questionnaire was also used to obtain teacher and student responses. The test instrument was used to obtain data to determine the effectiveness of the developed product.

The research questionnaire instrument used a Likert scale of 1-5, created in the form of a checklist. The Likert scale was used to convert expert judgment and practicality scores into percentages. After validation, the next step was to test the practicality through teacher and student responses. The results were in the form of scores that were converted into percentages. The expert assessment results were analyzed using the following formula.

$$P = \frac{f}{N} \ X \ 100 \ \%$$

The explanation of the formula above can be explained as follows; The symbol P is the final value, the symbol f is the score obtained and the symbol N is the maximum number of scores. After the results are known, an interpretation of the validity and practicality of the product is given by referring to the criteria in the following table. The level of validity to determine the suitability of the media according to the guidelines according to Arikunto (2019).

Table 1. Validity Criteria

Interval	Category	Information
<21%	Totally Invalid	Totally unworthy
21-40%	Invalid	Not feasible
41-60%	Quite Valid	Quite decent
61-80%	Valid	Worthy
81-100%	Very Valid	Very worthy

The level of practicality of the products developed is calculated based on teacher and student responses using an assessment formula according to Riduwan & Sunarto (2017).

Table 2. Product Practicality Criteria

Interval	Category	Information
81-100%	Very Practical	No improvement
61-80%	Practical	A little improvement
41-60%	Quite Practical	A little improvement
21-40%	Less practical	Needs improvement
0-20%	Impractical	Needs improvement

The effectiveness of LINOSIAPPS can be determined through a quantitative quasi-experimental design approach with a nonequivalent control group design. The two groups were not selected randomly but had relatively equivalent characteristics. The main instrument used in data collection was an information literacy test that included (1) indicators of finding important information in the text, (2) understanding the meaning of information words and sentences, (3) summarizing the contents of information readings, and (4) understanding the contents of information texts according to the values of local wisdom of Pantura.

The test is structured in the form of multiple choice consisting of 10 questions which are then validated by testing.Pearson Product Moment correlation techniqueAndreliability test with Cronbach's Alpha formula. Next, dThe test results were analyzed using an independent sample t-test to determine the difference in the average information literacy ability scores between the experimental and control groups. Before the t-test was conducted, the data were first tested for normality to ensure that the data distribution met the parametric statistical assumptions. The effectiveness of LINOSIAPPS was determined based on two criteria, namely (1) a significance value (Sig.) <0.05 which indicates a difference in learning outcomes between the experimental and control groups, and (2) an effect size value (Partial Eta Squared/η^2). The interpretation of the effect size refers to Cohen's criteria, namely 0.01 (small), 0.06 (medium), and 0.14 (large) (Lakens, 2013). A product is declared effective if it meets the significance criteria and has a minimal effect size in a large category.

This research was conducted after obtaining official permission from the principals of SD N 1 Kesambi (experimental class) and SD 2 Kesambi (control class). Informed consent was obtained from the class teachers and principals before the research activities were carried out. The researchers guaranteed the confidentiality of students' identities by not including their names or personal information in the research report.

Results and Discussion

Needs Analysis Results

The first phase is a needs analysis. This phase aims to identify potential, problems, and needs in the field as a basis for designing relevant and contextual learning media. The results of the needs analysis are presented in Tables 1 and 2, which contain findings regarding current learning conditions, desired ideal conditions, and the need for learning media development in elementary schools.

Table 3. Analysis of LINOSIAPPS Development Feature Needs Based on Learning Aspects

Aspects/Indicators	Expected Conditions	Existing Conditions	Need
Aspects of Digital Teaching Materials			
1. Digital teaching materials	Available in full and interactive	There isn't any	Required
2. Learning applications	Can be used independently by students	There isn't any	Required
3. Local wisdom-based materials	Integrating local values and wisdom of Pantura	Inadequate	Required
4. Learning multimedia	Contains text, images, audio and video in one medium	There isn't any yet	Required
Information Literacy Aspects			
1. Ability to find information	Students are able to search for and select relevant information	Inadequate	Required
2. Ability to understand information	Students can understand the contents of the information correctly	Inadequate	Required
3. Ability to evaluate information	Students can assess the truth and accuracy of sources	There isn't any	Required
4. Ability to use information	Students can apply information ethically and effectively	There isn't any	Required
Assessment Aspects and Educational Games			
1. Interactive assessment	Measure understanding through digital quizzes or exercises	There isn't any	Required
2. Educational video games	Contains elements of games and information literacy learning	There isn't any	Required

Table 4. Analysis of the Needs for Using LINOSIAPPS in Elementary School Environments

No.	Observed Aspects	Observation Results
1	Availability of digital-based learning media	Learning in elementary schools still relies on printed materials and worksheets. Interactive digital media to support students' information literacy is lacking.
2	Availability of interactive e-modules in learning applications	There is currently no application that contains interactive e-modules that students can access digitally. The e-modules in LINOSIAPPS are expected to present local wisdom-based materials, exercises, and activities in a single platform.
3	Availability of interactive digital assessments	Learning evaluations are still conducted conventionally. There are no automated digital assessments that can provide direct feedback to students.
4	Game-based learning media (educational games)	There are currently no game-based media used to increase learning motivation. Locally-based educational games within LINOSIAPPS are needed to foster students' interest in learning.
5	Utilization of local wisdom in learning media	The local cultural values of Pantura have not been optimally integrated into digital learning materials or media.
6	Teacher and student readiness in using digital applications	Teachers are not yet fully accustomed to using digital media in their lessons. Students are highly enthusiastic about technology but have not yet been directed towards app-based learning activities.
7	The need for an integrated learning and assessment platform	A single integrated application containing e-modules, interactive assessments, and educational games based on local wisdom was needed. LINOSIAPPS was developed to address this need.

Based on tables 3 and tables 4, there is a gap between ideal conditions and learning practices in the field. Interactive digital teaching materials, automated assessments, educational games, and integration of local wisdom are not yet available, so information literacy skills are not optimally facilitated. Learning is still dominated by printed materials and conventional evaluations without the support of an integrated platform. In line with the results of observations and interviews with classroom teachers, there are limitations in the learning system that does not provide support for interactive digital media, automated assessments, and structured integration of local wisdom. The absence of digital teaching materials and learning applications means that students are not accustomed to searching for, understanding, evaluating, and using information through digital sources critically and independently.

This condition indicates a gap between the demands of 21st-century learning and learning practices in the field, which still make minimal use of digital media and interactive assessments. The implications of

this finding point to the need to develop LINOSIAPPS as an integrated media containing Indonesian language materials based on local wisdom. The development of LINOSIAPPS is urgently needed to support Indonesian language learning in elementary schools (SD), especially in the aspect of information literacy. The three main aspects that are the focus are: (1) the provision of interactive digital teaching materials based on local wisdom, (2) improving elementary school students' abilities in Indonesian language information literacy, namely the ability to search for, understand, evaluate, and use information appropriately, and (3) the development of digital assessments and educational games. This solution is relevant to the opinion Salam et al. (2024) that interactive digital media based on local wisdom has proven effective in increasing elementary school students' interest and understanding in reading and comprehending Indonesian language texts. Furthermore, Ratnasari et al. (2025) revealed that teachers' need for digital learning applications is very high, especially to support students' literacy skills in Indonesian language lessons which are currently still taught conventionally.

LINOSIAPPS Design Results

Second phase, design. LINOSIAPPS is developed by utilizing various integrated digital platforms. LINOSIAPPS design by using Canva as the primary tool for designing the interface's appearance and layout. The design generated from Canva is in the form of an interactive PDF, then converted into an Android application with the help of AppsGeyser, so it can be installed on mobile devices and shared via WhatsApp. LINOSIAPPS contains Indonesian language material for descriptive, narrative, expository, and procedural texts based on e-modules, digital assessments, and videogames. The e-modules are presented online using the Heyzine platform, while interactive assessments are presented in the form of Edugames such as Wordwall, Educaplay, and Google Forms. Meanwhile, interactive learning videos use Edpuzzle. In addition, this application also provides information literacy questions that allow students to immediately know whether the answers are correct or incorrect, making learning more engaging, independent, and responsive to the learning needs of elementary school students. This application can be downloaded via the following link: *https://bit.ly/LinosiApps.*
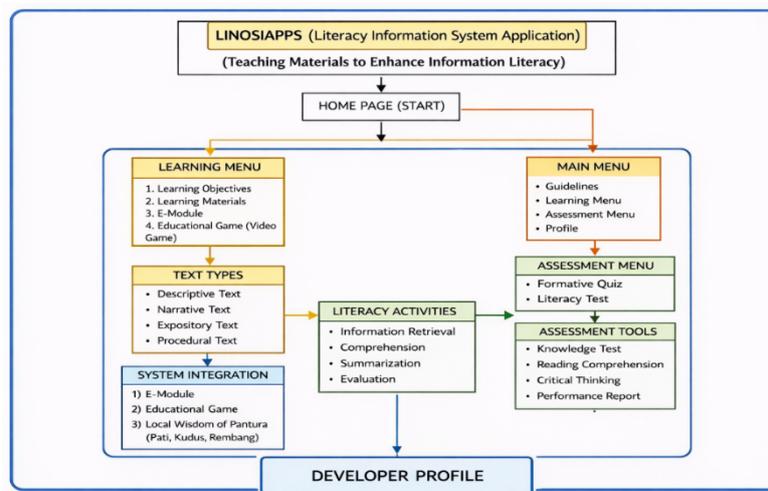

Fig. 3. LINOSIAPPS Design Flowchart

LINOSIAPPS Development Results

The third phase, Development of LINOSIAPPS. The development of Indonesian language interactive teaching materials and assessments in LINOSIAPPS is based on information literacy indicators and the main theoretical foundations, namely Culturally Responsive Teaching (CRT) and Multimedia Learning Theory. The CRT principle is used to integrate Pantura local wisdom into materials and assessments so that learning is more relevant and contextual for students. Meanwhile, the Multimedia Learning principle is applied through a combination of text, visuals, and interactive elements in e-modules, digital assessments, and edugames to improve students' cognitive processing and understanding of information literacy.

The main focus of development is directed at informational text materials, specifically descriptive, expository, narrative, and procedural texts for fourth-grade elementary school students. The context of local wisdom raised focuses on the Pantura culture, especially Pati, Kudus, and Rembang areas. Descriptive and procedural texts are presented based on Kudus local wisdom, narrative texts are based on Pati local wisdom, and expository texts are presented based on Rembang local wisdom. Local values such as

community traditions, folklore, culinary specialties, local tourism, and tangible cultural heritage such as batik are used as the basis for compiling materials, assessments, and digital learning activities can be seen in Figure 4 and 5.
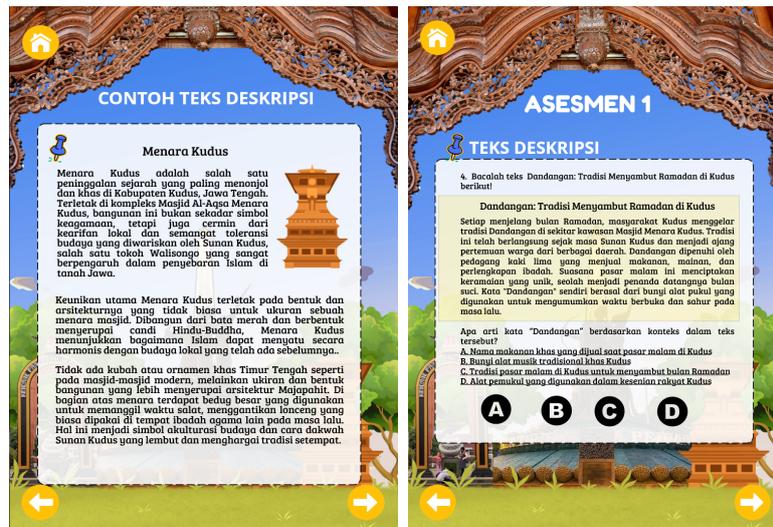

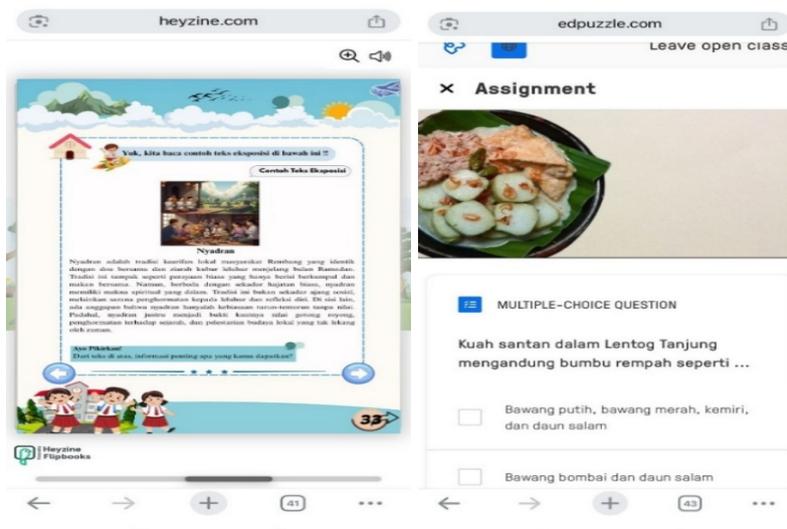**Fig. 4.** The appearance of materials and assessments in LINOSIAPPS contains local wisdom of PANTURA

Fig. 5. Display of E-Module material and Videogame assessment onLINOSIAPPS

At this development phase, the product's feasibility was tested through a validation process by two media experts and two content experts. Validation was conducted to assess the quality of the display, ease of use, and the suitability of the visual elements in the learning application. The assessment results from the two media experts showed an average percentage of 90% (very valid category), indicating that the media has an attractive display, is easy to use, and is appropriate for the characteristics of elementary school students. In terms of ease of use of the application, an average score of 4.5 indicates that the application's navigation and features are easy for users to operate. In terms of layout and button functions, both validators gave a perfect score (5.0), indicating that the placement of interface elements is appropriate and responsive. The size, text, and font aspects received an average score of 3.5, indicating the need for minor adjustments to make the text display more consistent and well-readable. The clarity aspect of the display elements received an average score of 4.5, indicating that all visual components are easily recognized and function as intended. Furthermore, the image and animation aspects and the colors used received the highest score (an average of 4.75), indicating that the media visuals are harmonious, attractive, and support a pleasant learning atmosphere for elementary school students.

Meanwhile, the validation results from material experts showed a percentage of 86.6% (very valid category). The aspects of curriculum relevance and content accuracy each received a score of 4.0, indicating

that the material was in accordance with basic competencies and Indonesian language rules. The aspect of the integration of learning objectives received an average score of 4.0, while the integration of local wisdom and the level of difficulty received a score of 4.5. The highest assessment was given to the clarity of content (score 5.0), indicating that the presentation of the material was systematic and easy for students to understand.

Qualitatively, the media validator suggested increasing the font size in some sections of the material and clarifying the text color contrast to improve readability for elementary school students. Furthermore, consistent navigation icons were recommended on each page to make the application flow more intuitive. Qualitatively, the material validator suggested adding more text examples to enrich the local context and adding reflective questions at the end of the material to strengthen students' information evaluation skills. These suggestions served as the basis for revisions before the product was implemented. After revisions were made based on these suggestions, the final results of the expert judgment validation showed that the LINOSIAPPS product developed was highly feasible and could be used to improve elementary school students' information literacy can be seen in Figure 6 and 7.
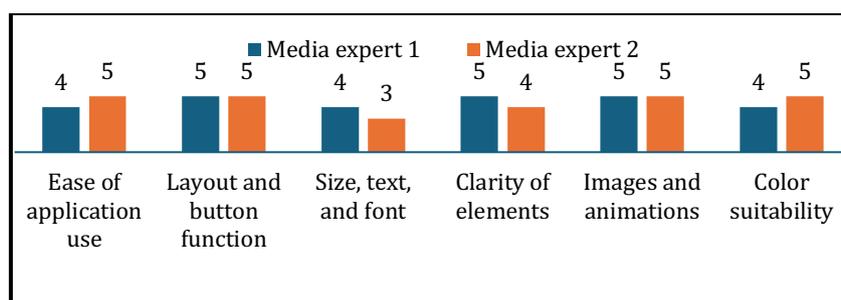

Fig. 6. Media Expert Validation Results 1 and 2
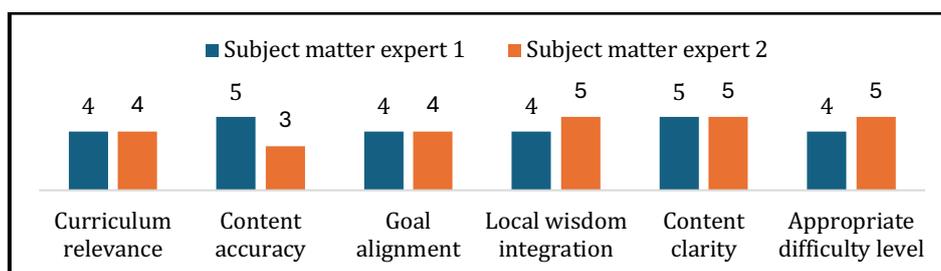

Fig. 7. Validation results of material experts 1 and 2

LINOSIAPPS Implementation Results

Fourth phase, Product implementation. This phase was conducted to test the application's practicality through trials on fourth-grade students and teachers at SD 1 Kesambi. Based on student and teacher responses to the use of LINOSIAPPS, the results are presented in Table 5.

Table 5. Student and Teacher Response Results to LINOSIAPPS

Assessment Indicators	Student Response		Teacher Response	
	Average score	Percentage (%)	Average score	Percentage (%)
Likes of the app	4.86	97.2	5	100
The attractiveness of the application	4.81	96.3	4	80
Benefits of the application	4.77	95.4	5	100
Ease of use	4.72	94.5	5	100
Growing motivation	4.9	98.1	4	80
Helping with information literacy lessons	4.86	97.2	5	100
Total Average	4.82	96.5	4.66	93.3

Based on the results of the effectiveness of LINOSIAPPS which were carried out using validity tests, reliability tests, normality tests, homogeneity tests, and independent t-tests with the help of SPSS Statistics 26, Table 6 and 7 were obtained.

Table 6. Question validation results

Question		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
total	Pearson Correlation	.730**	.504*	.573**	.773**	.756**	.665**	.573**	.641**	.490*	.772**
	Sig. (2-tailed)	.000	.017	.005	.000	.000	.001	.005	.001	.021	.000
	Conclusion	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid

Table 7. Reliability Statistics

Cronbach's Alpha	N of Items
.762	10

Table 6 above can be concluded that the results of the instrument validity test using the Pearson Product Moment correlation technique, obtained a correlation coefficient value (r count) between 0.490 to 0.773 with a significance value below 0.05. Because all r count values are greater than r table (0.361), then all statement items are declared valid. These results indicate that each question item has a strong relationship with the total score, so it can be said that the information literacy text instrument has good validity and is suitable for use. Meanwhile, the results of the reliability test using the Cronbach's Alpha formula as in table 7, obtained α = 0.762 > 0.60, so the instrument is declared reliable. This means that each item of the test instrument has a strong relationship with each other and is able to measure the same construct (variable) consistently. The results of the normality test can be seen in Table 8.

Table 8. Shapiro-Wilk Tests of Normality

	Group	Shapiro-Wilk Statistics	df	Sig.
Information Literacy Results	Experimental Group	.915	22	.061
	Control Group	.918	22	.069

Based on the results of the normality test using Shapiro-Wilk in Table 8, the significance value (Sig.) for the experimental group was 0.061 and the control group was 0.069. Since both values are greater than 0.05, it can be concluded that the information literacy data in both groups are normally distributed. Independent sample test can be seen in Table 9.

Table 9. Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Standard Error Difference		Lower	Upper
Information Literacy Results	Equal variances assumed	3,715	.061	7,683	42	.000	34.09091	4.43702		25.13664	43.04517
	Equal variances not assumed			7,683	36,790	.000	34.09091	4.43702		25.09892	43.08289

Table 9 shows the results of the Independent Samples t-test, obtained a Sig. (2-tailed) value of 0.000 (<0.05) and the data is homogeneous with a Sig. Levene's Test value of 0.061 (>0.05). Thus, it can be concluded that there is a significant difference between the information literacy results of the experimental class and the control class. These results indicate that the LINOSIAPPS treatment or intervention given to the experimental class is effective in improving students' information literacy skills. Tests of between-subjects effects can be seen in Table 10.

Table 10. Tests of Between-Subjects Effects

Dependent Variable: Result						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	12784.091a	1	12784.091	59,033	.000	.584
Intercept	189820.455	1	189820.455	876,532	.000	.954
Class	12784.091	1	12784.091	59,033	.000	.584
Error	9095.455	42	216,558			
Total	211700.000	44				
Corrected Total	21879.545	43				
a. R Squared = .584 (Adjusted R Squared = .574)						

Based on the Tests of Between-Subjects Effects test, it shows that the use of LINOSIAPPS has a significant effect on improving students' information literacy, as indicated by the value of F (1,42) = 59.033 with a significance of 0.000 (<0.05). Furthermore, the Partial Eta Squared value of 0.584 indicates that 58.4% of the variation in students' information literacy results is influenced by the use of LINOSIAPPS. This value is included in the very large effect category, which indicates that the intervention given has a high power of influence in practice.

The large effect size indicates that integrating digital learning materials, interactive assessments, and Pantura local wisdom within a single app ecosystem provides a more meaningful learning experience than conventional learning. Furthermore, integrating Pantura local wisdom into learning content strengthens the material's contextual relevance to students' social experiences.

LINOSIAPPS Evaluation Results

Fifth phase, Evaluation. Validity, reliability, normality, and independent t-test obtained results that LINOSIAPPS is able to improve students' information literacy skills. These findings strengthen that teaching materials based on local wisdom and digital technology are not only valid and practical, but also effective and sustainable to be applied to Indonesian language learning in elementary schools.

DISCUSSION

The results of this study indicate that the development of LINOSIAPPS as an interactive Indonesian language teaching and assessment material based on Pantura local wisdom has proven valid, practical, and effective in improving elementary school students' information literacy skills. This success is inseparable from the integration of three main components in the learning design, namely the use of interactive digital media, strengthening the context of local wisdom, and an applicable information literacy approach. However, this study has limitations in the number and scope of research subjects. The implementation phase of LINOSIAPPS only involved one school with 22 students in the experimental group, so the level of generalizability of the research results is still limited. This condition causes the findings of LINOSIAPPS effectiveness to better reflect the local context where the research was conducted and cannot be generalized widely to a more diverse elementary school population.

Media and Material Suitability

The validation results from media experts and material experts showed very high percentages, 90% and 86.6%, respectively, indicating that LINOSIAPPS is suitable for use in Indonesian language learning for elementary school students for information literacy content. This high validity value reinforces the view that media development oriented towards user needs and student characteristics will produce products that are pedagogically and technologically appropriate (Amaliyah, 2023; Du Plooy et al., 2024; Wang, 2020; Weinhandl et al., 2024). LINOSIAPPS is designed according to the principles of multimedia learning, namely combining text, images, videos, and digital assessments to help students build multimodal understanding (Fjørtoft, 2020; Rahmanu & Molnár, 2024). This makes learning more interesting, easier to understand, and contextual for elementary school students.

In terms of material substance, LINOSIAPPS is categorized as very valid and has met the eligibility standards for Indonesian language learning in elementary schools. The suitability of the material to basic competencies, the accuracy of the content, and the integration of learning objectives indicate that the material development was carried out systematically and aligned with the applicable curriculum. The integration of local wisdom of the Pantura and adjustment of the difficulty level also demonstrate attention to the socio-cultural context and student developmental characteristics. These findings confirm that the material in LINOSIAPPS has met the principles of curriculum alignment and constructive alignment. These

results are relevant to previous research that stated that objectives, materials, and assessments are designed in harmony to strengthen student competency achievement (Asmayawati et al., 2024; Atuhurra & Kaffenberger, 2022; Rajadurai et al., 2025).

Practicality or User Response

The practicality test results showed a student response rate of 96.5% and a teacher response rate of 93.3%, which falls into the very practical category. These figures indicate that the application is easy to use, engaging, and relevant to students' learning needs. The most prominent aspects were learning motivation and liking for the application, which reached 98.1% and 97.2%, respectively. These findings align with research's Praheto et al. (2025) and Hanifah et al. (2025) that interactive media can improve students' reading literacy skills. In addition, the integration of edugames and digital assessments in the application strengthens the principle of game-based learning that playing activities can encourage students to learn through exploration, challenges, and direct feedback (Li et al., 2024).

The Effectiveness of LINOSIAPPS in Improving Information Literacy

The results of the independent samples t-test show a Sig. (2-tailed) value of 0.000 (< 0.05) with the effect size value of Partial Eta Squared of 0.584 or 58.4%. This result indicates thatthere is a significant difference between the information literacy results of students in the experimental and control classes andincluding the category of very large effect sizes. These findings confirm that the use of LINOSIAPPS is effective in improving students' information literacy skills. These skills were measured across various aspects finding important information in the text, understanding the meaning of words and sentences, summarizing the content of the reading, and understanding the content of the text according to local wisdom values. This significant improvement indicates that learning with contextual digital media enables students not only to understand the content of the text, but also to assess the accuracy of the information and relate it to the local context. These results support the statement's Hanifah et al. (2025) and Mahayani et al. (2024) that strong literacy develops through meaningful, contextual, and technology-integrated learning experiences. Research's Hanifah et al. (2025) producing literacy teaching materials based on local wisdom in Kuningan has proven effective in improving the literacy of elementary school students, especially in learning to write poetry.

Integration of Pantura Local Wisdom in Indonesian Language Learning

The advantage of LINOSIAPPS lies in its integration with the local wisdom of Pantura, which includescommunity traditions, folk tales, culinary specialties, local tourism, and tangible culturein the Kudus, Pati, and Rembang area. Kudus local wisdom is arranged in the form of descriptive texts such as the Descriptive Text "Menara Kudus", "Dandangan Tradition", "Bulusan Tradition", and arranged in the form of procedural texts such as "Soto Kudus", "Jenang Kudus", "Lentog Tanjung". Pati local wisdom is arranged in narrative texts including informative narratives "Biography of Saridin ", "Meron Tradition," Barongan Tradition," "Batik Bakaran", and "Sedekah Bumi Tradition". Meanwhile, Rembang local wisdom is arranged in the form of expository texts covering "Karangjahe Beach", "Caruban Beach", "Batik Lasem", "Troso Rembang", "Nyadran Tradition", "Sedekah Laut Tradition, "Tongklek Tradition", "Panthol Sarang Art", "Traditional Salt Making Activities of the Rembang Community", and Rembang's typical culinary "Lontong Tuyuhan".

The use of local wisdom has been proven to make learning more relevant and meaningful because students can relate the material to their everyday experiences. Furthermore, learning based on local wisdom fosters a sense of identity, pride, and closeness to one's own culture, while also serving as a means of character development (Arta et al., 2023; Badeni & Saparahayuningsih, 2023; Sakti et al., 2024; Sriyati et al., 2021). In this context, LINOSIAPPS serves not only as a digital literacy medium but also as a vehicle for preserving local cultural values in a modern and interactive way. Integrating local culture with technology is an effective strategy for bridging local wisdom and digital literacy in the 21st-century learning era.

Implementation of LINOSIAPPS in Indonesian Language Learning

The implementation phase of LINOSIAPPS was conducted through a limited trial in an experimental class at SD 1 Kesambi with 22 students. In the context of Indonesian language learning, this application was used for informational text materials presented in the form of descriptive, expository, narrative, and procedural texts. In its implementation, teachers utilized the interactive e-module feature to present the material multimodally through a combination of text, images, and relevant visual elements. After the reading activity, students completed interactive assessments in the form of quizzes and evaluative activities

that provided immediate feedback. This process enabled teachers to monitor the development of students' information literacy skills more systematically and efficiently than conventional paper-based evaluations.

Based on the results of observations, it shows that students are more enthusiastic and active in reading, identifying important information, understanding the meaning of words and sentences, and summarizing the content of the text through the available e-module and interactive assessment features. Teachers assessed that the use of LINOSIAPPS helps manage learning more efficiently, especially in monitoring and assessing students' information literacy skills directly through digital quizzes and automatic feedback. This shows that LINOSIAPPS is not only technically valid but also pedagogically relevant in supporting information literacy-based Indonesian language learning. This finding is in line with Martín-Sómer et al. (2024) which shows that interactive applications are able to increase student participation and engagement, which ultimately contributes to improved learning outcomes.

Practical and Theoretical Implications of the Development of LINOSIAPPS

In practice, the implementation of LINOSIAPPS provides a solution for Indonesian language teachers in integrating digital teaching materials, interactive assessments, and content based on local wisdom from the Pantura area into one integrated application. Through contextual text presentation and evaluative activities, students are trained tofind important information, understand the meaning of words and information sentences, summarize the contents of the reading, and understand the contents of the information text according to the values of local wisdom of Pantura. Thus, information literacy provides benefits to students to better understand, find, and use the information they obtain through literacy activities.

Theoretically, the results of the LINOSIAPPS development can strengthen the integration of the Culturally Responsive Teaching approach and the principles of Multimedia Learning. The Culturally Responsive Teaching approach emphasizes the importance of linking learning materials to students' cultural contexts to increase relevance and engagement in learning. These results are similar to Adler et al., (2025) which discusses technological support for developing culturally responsive practices/pedagogies. Meanwhile, the principles of Multimedia Learning explain that the use of a combination of text, visuals, and interactive elements strengthens cognitive processing of information and reading comprehension (Agung et al., 2020; Mayer, 2021). The results of the LINOSIAPPS development research support the research's Khasawneh & Belton (2025) that the use of digital assessments with automated feedback supports the evaluation process and learning engagement more efficiently. This is also similar to Chen et al. (2022) who developed a web-based inquiry learning mode with the support of a collaborative digital reading annotation system and found improvements in information literacy learning.

Conclusion

Based on the findings, it can be concluded that First, the development results show that LINOSIAPPS is capable of being a contextual, interesting, and appropriate interactive teaching and assessment material for elementary school students. Second, the results of the validity test by media and material experts indicate that LINOSIAPPS is classified as very valid for use in learning. Third, the results of the practicality test show that teachers and students gave positive responses to the ease of use, attractive appearance, and usefulness of the features in the application. Fourth, the results of the effectiveness test show that the use of LINOSIAPPS has a significant effect on improving students' information literacy. This study provides an important practical contribution, namely providing innovative learning media based on Pantura local wisdom to improve information literacy in elementary schools. Theoretically, this study confirms the role of application-based technology in facilitating relevant and contextual learning.

The novelty of this research lies in the systematic integration of local Pantura wisdom approaches into materials, assessments, and educational games to strengthen information literacy outcomes through contexts close to students' lives. This local context directly contributes to improved literacy because students find it easier tofind important information, understand the meaning of words and information sentences, summarize the contents of the reading, and understand the contents of the information text according to the values of local wisdom of Pantura. Thus, information literacy provides benefits to students to better understand, find, and use the information they obtain through literacy activities.

Limitations of this study include the limited sample size, relatively short implementation duration, and the limited context of the study, which was conducted within a specific school. Therefore, generalization of the results requires caution. Future research is recommended to develop more adaptive features, test them across a wider range of grade levels, and measure the long-term impact on students' information literacy.

Declarations

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