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Development of an integrated learning device Wordwall application: An elementary school student's science literacy skills

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Abstract. The low skills of science teachers, who often lack adequate education levels, mastery of the subject matter, and effective teaching techniques, negatively impact literacy. Therefore, this study aims to develop an integrated learning tool for Wordwall applications to enhance students' scientific literacy skills, ensuring validity, practicality, and effectiveness. This study employed a research and development approach with a four-dimensional (4D) model design. We conducted this research at Public Elementary School 02 Wonokerso. The data collection instruments used were validity sheets, student worksheets, teacher and student response questionnaires, and assessment questions. The study's findings indicated that the learning tools met valid criteria, with the module assessment, student worksheet, and assessment question scores being 82.41, 84.09, and 84.17, respectively. Practicality tests from student and teacher questionnaires meet practical criteria (92.52 and 93.75), respectively. The learning tools are helpful because the "Paired Samples Correlations" (Sig. value of 0.00) and the results of the N-Gain Test fall into the moderate category (average 0.384 and 0.222). Therefore, it is concluded that the proposed integrated Wordwall learning device is valid, practical, and effective. Teachers can use Wordwall's interactive activities to improve primary school science literacy. Wordwall promotes active, fun learning in groups and individually, creating a dynamic learning environment.

Introduction

Scientific literacy is the ability to comprehend scientific concepts and processes, as well as to apply scientific knowledge in addressing everyday challenges (Al Sultan et al., 2021; Ke et al., 2021; Rediani, 2024). PISA defines science literacy as the capacity to apply scientific knowledge, formulate questions, and draw conclusions from scientific evidence to comprehend and make informed decisions about nature and its alterations resulting from human activities (Lederman et al., 2024; Ustun et al., 2022). Meanwhile, according to the National Science Teacher Association, science literacy is understood when an individual can apply scientific concepts, can evaluate everyday decisions in relation to others and their environment, and comprehends how society, technology, and science interact with one another, including social and economic developments (Almeida et al., 2023; Pujana et al., 2022; Purnadewi & Widana, 2023).

Scientific literacy is essential for students as it equips them to comprehend the environment, health, economics, and the issues of contemporary society, which is significantly dependent on technology, progress, and scientific advancements (Bórquez-Sánchez, 2025; Fortus et al., 2022; Queiruga-Dios et al., 2020; Kriswinahyu & Kastuhandani, 2024). The scientific literacy competencies of students in Indonesia remain inadequate (Widana & Ratnaya, 2021; Salsabila & Apoko, 2025). The results of PISA and TIMSS corroborate this assertion. The 2018 PISA results indicated that Indonesia's students exhibited low scientific literacy skills, ranking 70th out of 78 nations with a score of 396, compared to the average international score of 489 (Marmoah et al., 2021). In 2015, TIMSS data indicated that Indonesian students' scientific literacy ranked 45th out of 48 nations, with a score of 397, which remained below the international average score of 500 (Hasbi et al., 2019; Pujana et al., 2022).

Low science Literacy is influenced by the teacher's ability to teach science, which is still not optimal in several factors, such as education level, mastery of teaching modules, and teaching methodology (Lestari et al., 2023; Suárez-Mesa & Gómez, 2024; Widiana et al., 2020; Yao & Guo, 2018). A similar situation also occurred at Wonokerso 02 Public Elementary School. According to the 2023 Education Report Card, the literacy ability score remained at 65%. This result occurs because students are not accustomed to answering literacy-based questions, which reduces their understanding of the questions. Teachers only offer supplementary literacy lessons prior to the computer-based assessment activity. Students have not been able to identify and take explicit information contained in or make simple interpretations. This belief is supported by the results of interviews with Grade V teachers, which indicate that literacy skills remain inadequate. Information was obtained that students were unable to understand questions with long literary passages, as they were unable to examine the meaning of the questions. Many students also received material without receiving criticism or being asked questions during the learning process. Students in the learning process are still teacher-centred because they still use the lecture model, and assignments have not been implemented in the learning model. The teacher's monotonous teaching style prevents students from being actively involved in the learning process. Students are only listeners in learning. Additionally, teachers have not utilised interactive media to engage students in answering the teacher's questions.

Learning that encourages student participation can overcome the problem of scientific literacy in education (Çalik & Wiyarsi, 2025; Valladares, 2021). The teacher plays a crucial role in developing learning materials and refining their thinking skills to innovate in teaching modules (Gashoot et al., 2023; Saryadi & Sulisworo, 2023). Therefore, the development of learning devices is a crucial pedagogical competency for teachers. This is to ensure that the teacher's methods are practical and efficient and do not stray from the topic of achievement indicators (Yasa et al., 2023).

Integrating learning devices with learning media effectively activates students' engagement in the learning process (Kowitlawakul et al., 2022; Yuniarti et al., 2024). Current technological advances have led to various systems and work methods becoming more efficient and effective. One of these systems is the education system (Alenezi, 2023; Alenezi et al., 2023; Haleem et al., 2022). Tech professionals highlight the potential of technology in various fields, including education, to support teachers in instructing students. Technology now plays a crucial role in the learning process, aiding in the resolution of students' learning challenges (Garlinska et al., 2023; Tlili et al., 2021).

The media presented is intended to increase students' motivation to learn and make lessons more enjoyable (David & Weinstein, 2024; Magdalena et al., 2021). Therefore, teachers must develop new methods for incorporating media into their teaching. Wordwall is one of the technological media used. We created this application to enhance learning through the use of technology. It is particularly suitable for students who wish to learn and teach using modern methods (Setyorini et

al., 2023; Yustin et al., 2025). Media makes learning easier for students and makes it easier for teachers (Liono et al., 2021). Students can play this media at any time to improve their abilities. Students are more interested in evaluating the lessons given. Students exhibit increased motivation to revisit the lessons they have learned. They are also more active in seeking information from various sources (Kervin et al., 2017; Evi Yupani & Widana, 2023).

Additionally, Wordwall is an online platform that enables teachers to create a variety of interactive learning activities, including quizzes, puzzles, and games, for use across multiple subjects and grade levels. Its main advantage is its ability to engage students through a playful approach, making learning materials more engaging. However, Wordwall also has several limitations, including a reliance on an internet connection, limited features in the free version, and the potential for distractions that can distract students from the material. Furthermore, the most appropriate learning model to maximise the function of Wordwall media is Game-Based Learning (GBL). Wordwall is specifically designed to provide a variety of educational games, which perfectly align with GBL's principles of leveraging the joy of play to facilitate learning.

This study references several previous studies related to integrated learning devices for Wordwall applications and students' literacy skills. The research includes a study conducted by Abdillah and Syaban (2023), which found that the development of Wordwall applications will have a positive learning effect, making learning itself more enjoyable. Furthermore, research by Putri et al. (2021) and Sung et al. (2016) found that the learning tools created, such as the syllabus, lesson plan, and student worksheet, were efficient and straightforward to use. The difference between this study and the previous one lies in the type of device developed. Several previous studies focused more on the development of WordWall media without considering integration in science literacy learning. Therefore, to fill this gap, this study tries to develop a device in the form of an integrated Wordwall module for science literacy learning.

Therefore, this research formulates the problem as developing a valid, practical, and effective learning tool oriented towards the Wordwall application to enhance students' scientific literacy skills. Building upon preliminary studies and descriptions of previous research, this study aims to develop an integrated learning tool in the form of an interactive word wall module to strengthen the science literacy skills of elementary school students in the science subject. We expect this research to significantly enhance students' scientific literacy skills in comparison to traditional learning methods. Furthermore, students who used the Wordwall application-oriented learning tool had higher scientific literacy skills than those who did not use it.

Method

This type of research is a development approach utilising a research design based on the 4D model, specifically defining, designing, developing, and disseminating. The goal of this research is to create an integrated word wall module. The subjects of this study were at the fifth-grade Public Elementary School Wonokerso 02. The following is a 4-D model research design presented in Image 1 (Hasbi & Fitri, 2024).

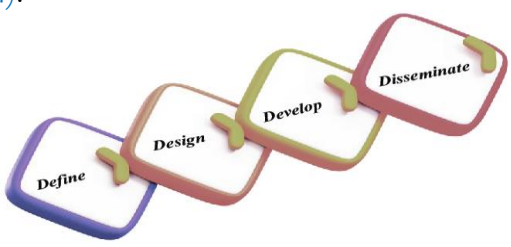

Image 1. 4-D Model Research Design

Define Stage: At this stage, the activities carried out involve identifying problems encountered in the learning process related to the material "Harmony and Ecosystem". Additionally, we conduct a review of the available teaching modules. We use the results of this analysis as a foundation to develop integrated WordWall learning devices. The activities involve gathering information from teachers to identify the characteristics of students at Public Elementary School 02 Wonokerso, including their cognitive background, academic abilities, and skills. We consider the analysis results when designing integrated Wordwall teaching modules. Additionally, at this stage, the activities carried out involve compiling indicators of learning achievement that are adjusted to the material analysis and task analysis previously conducted. The formulation of learning objectives in the material "Harmony and Ecosystem" is the basis for making learning designs and compiling tests for the material "Harmony and Ecosystem".

Design Stage: Activities at this stage include designing test grids, designing test items, and compiling scoring guidelines and answer keys based on the results of formulating learning objectives in the material "Harmony and Ecosystem." This test is a tool for measuring the validity, reliability, and sensitivity of the test items. Additionally, media selection, learning format selection, and the initial design of the product being developed are carried out.

Develop Stage: At this stage, expert validation is conducted to gather input, comments, or assessments from experts on the format, content, language aspects, and illustrations of the teaching module. We then make revisions to Draft I to obtain Draft II, based on the assessment, corrections, input, and suggestions of the validators. Additionally, we conduct a trial of the teaching module.

Dissemination Stage: This stage is carried out on a limited basis, specifically distributing the material to one class, apart from the trial class at Public Elementary School 02 Wonokerso, to determine the Effectiveness of learning using a quality teaching module developed during the previous stage. The research design used is the one-group pretest-posttest design. The researcher will conduct an initial measurement (pretest) on the object to be studied, then carry out the treatment, and finally conduct the final measurement (post-test).

The data collection instruments used were validity sheets for media experts, material experts, and practitioners on teaching modules, student worksheets, and assessment questions; teacher and student response questionnaires; and pretest and post-test questions on scientific literacy skills. The data collection techniques employed included tests, questionnaires, interviews, and documentation. The data analysis techniques employed included normality tests, homogeneity tests, independent sample t-tests (paired samples correlations), and n-gain tests. The normality and homogeneity tests were analysed using the SPSS 29 application program. The decision-making process requires that if the Sig. Value$\geq \alpha$, then Ho is accepted. If the Sig. Value $< \alpha$, then Ho is rejected. If all assumptions are met, the next step is to proceed with an independent sample t-test to test the research hypothesis. The independent sample t-test is used to determine whether there is a difference in the use of the Learning Devices Wordwall Application. In the independent sample t-tests, if the output result, "Independent Sample Correlations," is obtained, the sign. Value is 0, which is less than 0.05.

In this study, a learning device is considered valid if the validator's evaluation of each part of the device meets the minimum standard; specifically, a score of 70 or above means the module is valid and meets the required criteria. A learning device is practical if the feedback from students, teachers, and peers indicates that it is easy to use, with more than 70% of responses falling into the positive category. Additionally, the device is effective if it achieves the learning goals (as determined by the independent sample T-test) and successfully utilises applications to improve fifth-grade

students' science literacy skills, provided that at least 75% of the students achieve an N-Gain value of 0.3 or higher. Image 2 illustrates a WordWall model used in learning.

Image 2. WordWall Model Used in Learning

Results and Discussion

The results of this study are based on the design steps of the 4D model. However, the results of the study are presented in accordance with its objectives, namely to determine the level of validity, practicality, and effectiveness of the developed device. We present the results of the study, which developed an integrated word wall learning device, below.

Validity of Integrated Learning Device Wordwall
Define
Define is the stage of establishing and defining the requirements needed to develop the learning process. Front-end analysis is the basic process carried out to identify learning problems that require solutions. In this case, the problem requiring a solution is the low scientific literacy of fifth-grade students at Wonokerso Elementary School 02. At this stage, the researcher also analysed the students' economic status, physical condition, skills, and level of motivation to learn. The students' economic status is classified as lower-middle class. Their parents work as fishermen, construction workers, and some factory workers. The students are physically healthy and have no special needs. Students' high learning motivation is evident from their consistent attendance and active class participation.

Based on the analysis results, the subject matter used is fifth-grade science with the topic "Harmony in Ecosystems." In Phase C, students are introduced to systems, which are sets of interconnected elements that operate according to specific rules to carry out certain functions, particularly those related to the interconnection of nature and social life within the context of diversity. Students carry out an action, make a decision, or solve a problem related to daily life based on their understanding of the material they have studied. In addition, the learning objectives used are: (1) students can identify food chains and food webs, (2) Students can identify patterns of organism interaction, (3) Students can explain the food pyramid, (4) Students can explain energy transfer, (5) Students can provide examples of human activities that lead to ecosystem imbalance, (6) Students can identify and describe efforts to preserve the ecosystem.

Design

The design stage involves creating learning tools tailored to meet specific needs. First, standardised tests are developed to measure achievement after learning activities using media. At this stage, researchers develop an instrument to measure scientific literacy skills. The instrument used is a multiple-choice test consisting of 30 questions. The questions incorporate scientific literacy indicators to align precisely with the competencies being developed. Second, media are selected based on student characteristics and competencies in the selected material. The selected media must be effective and aligned with student analysis, concepts, and assignments to achieve the desired competencies. This study used a Wordwall learning tool. This word wall is used to answer questions in a fun, game-like manner.

The initial design is to create a learning tool integrated with a Wordwall application to enhance scientific literacy skills. This initial design was then reviewed with the supervising lecturer, and suggestions for any necessary improvements were made before proceeding to the next step. The initial design can be referred to as draft 1. This study has developed several learning devices, which are listed below. Image 3 shows the cover design and identity of the developed teaching module. Image 4 presents learning activities for Meetings 1 and 2, the assessment, and student worksheets.

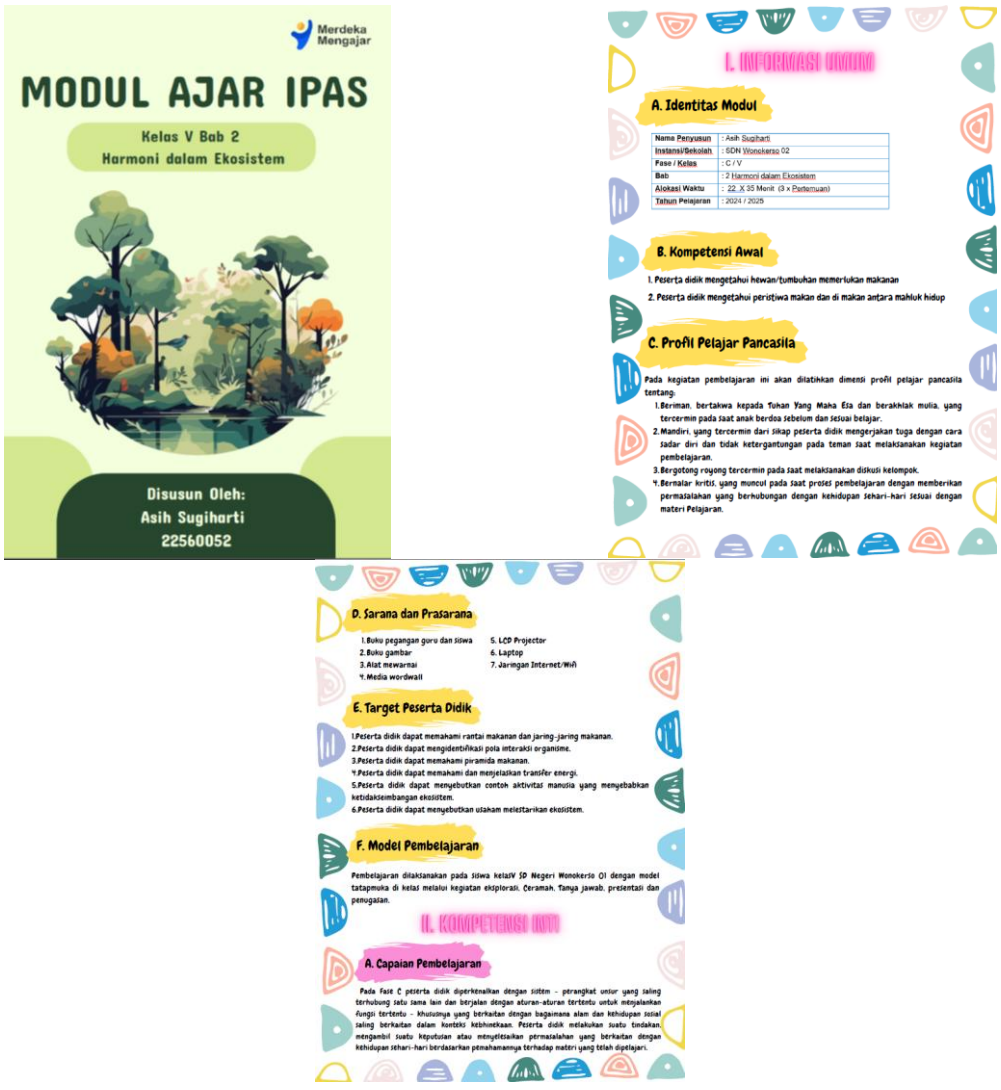

Image 3. Cover And Identity Teaching Module

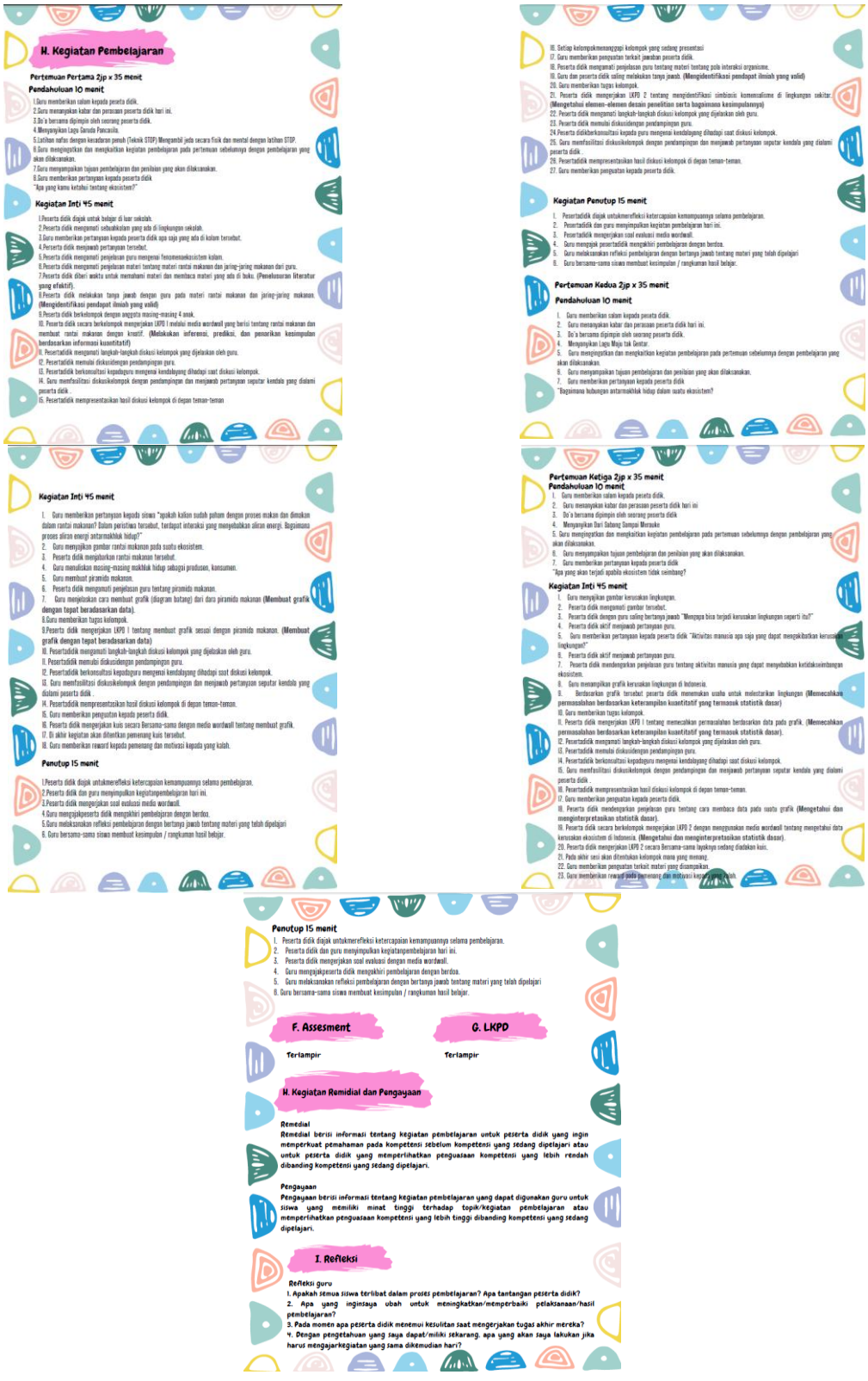

Image 4. Learning Activities for Meeting 1, Meeting 2, Assessment and Student Worksheets

Develop

The development phase aims to produce a learning tool integrated with a Wordwall application. The steps in this phase include expert validation and testing. The developed learning tool is then

validated by expert material and media validators to determine its validity. During the validation process, suggestions for improvements are provided to refine the developed media. Two lecturers and one practitioner validated the learning tool. The following are the validation results for the learning tool (teaching module, student worksheet, and assessment questions). The following is a summary of the validity results provided by experts in Table 1.

Table 1. Summary of Expert Validity Results

Learning Tools	Validator					
	Matter Expert	Category	Practitioner	Category	Media Expert	Category
Teaching Module	82.41	Valid	86.11	Very Valid	100	Very Valid
Student Worksheets	84.09	Valid	88.64	Very Valid	93.75	Very Valid
Assessment Questions	84.17	Valid	90	Very Valid	84.09	Very Valid

The results of the expert assessments, referred to as validators 1, 2, and 3, indicate that the teaching module received 82.41% from validators 1 and 2 and 100% from validator 3. Meanwhile, the results of the expert assessments, hereinafter referred to as validators 1, 2, and 3, for the student worksheet, received 84.09% from validators 1 and 2 and 93.75% from validator 3. Furthermore, the assessment questions assessed for validity by the material and media experts were assessment questions integrated with a Wordwall medium, meaning the questions were displayed in Wordwall format. The results showed valid and very valid scores of 84.17 and 84.09, respectively.

The integrated learning tool, the Wordwall application (teaching module, student worksheet, and assessment questions), which has been validated, can be used for a limited trial phase to determine the implementation of the integrated learning tool, the Wordwall application, through measuring student learning outcomes in the social sciences (IPAS). The trial design provides an initial overview of the product trial, which consists of an integrated learning tool, a Wordwall application that has been developed. The trial phase was conducted after the integrated learning tool, a Wordwall application, was validated by subject matter and media experts. The trial was conducted with a small group, specifically fifth-grade students at Wonokerso 1 Elementary School, to test the practicality of the learning tool further.

The results of the above study are reinforced by research conducted by Wahid et al. (2024), which found that the study on the validity of learning devices yielded valid results. Logan et al. (2021) assert that teachers can utilise valid teaching modules as a guide to facilitate the learning process. Proper and suitable student worksheet products facilitate students' ability to solve their learning problems and assignments, thereby reducing conceptual errors (Nurkhasanah & Rohaeti, 2024).

Building upon the results and discussion of validity, it can be concluded that the development of learning devices has been proven to be valid and suitable for enhancing students' scientific literacy skills.

Practicality of Integrated Learning Devices Wordwall

The results of the practicality test were obtained from student and teacher response questionnaires. The student response questionnaire is an instrument designed to assess the development of the learning tool. The instrument was designed to include indicators such as 1) ease of use of teaching materials, 2) ease of understanding the story content through the use of language, 3) accuracy in the use of terms, 4) politeness in language use and compliance with the Educational Standards for the Indonesian Language, 5) selection of attractive font types and sizes appropriate to students' understanding levels, 6) The design of the reading book is interesting, 7) The presentation of images is attractive and proportional, 8) There is congruence between the story content and the images.

The following is a summary of the results of student responses to the practicality of the learning tool. Table 2 presents the results of the student response questionnaire.

Table 2. Results of Student Responses to Learning Tools

No	Name	Value	Category
1	Respondent 1	92.31	Very Practical
2	Respondent 2	88.46	Very Practical
3	Respondent 3	96.15	Very Practical
4	Respondent 4	92.31	Very Practical
5	Respondent 5	98.08	Very Practical
6	Respondent 6	92.31	Very Practical
7	Respondent 7	92.31	Very Practical
8	Respondent 8	90.38	Very Practical
9	Respondent 9	90.38	Very Practical
Average		92.52	Very Practical

The results of Table 2 indicate that the integrated word wall learning tool developed to improve elementary school students' scientific literacy skills was deemed practical by students, with an average score of 92.52, categorised as very practical.

Furthermore, the teacher response questionnaire was an instrument administered to teaching staff and colleagues to determine the readability/practicality of the developed teaching materials. The teacher and peer response questionnaire utilised the practicality instrument for practitioners, which is detailed in the appendix. The instrument was designed to cover several aspects, including 1) material presentation, 2) material suitability to the curriculum, 3) material content presentation, and 4) language and readability. The results of the teacher and peer response questionnaire are shown in Table 3 below.

Table 3. Results of Teacher and Peer Responses

No	Name	Value	Category
1	Class Teacher	93.75	Very Practical
2	Colleague	92.50	Very Practical

The learning tools developed based on the data in the table above show that, according to the practicality/readability responses of practitioners by classroom teachers and colleagues, the aspects of material presentation, curriculum suitability, material content presentation, and language and readability of the teaching materials received a score of 93.75 according to teachers and 92.50 according to colleagues, categorized as very satisfactory. Therefore, we can conclude that the integrated word wall learning tool is efficient for enhancing scientific literacy skills.

Ananda and Usmeldi (2023) stated that in testing the level of practicality of a teaching module, one must consider whether the product is attractive and usable. This theory is also supported by Agustyaningrum and Gusmania (2017), who conclude that practicality refers to the level of usability or ease of use of a teaching module for students, encompassing both ease of use and aspects of presentation. The aspect of ease of use includes the ease of understanding the material and language used in the module. The presentation aspect concentrates on how the module looks.

According to Mustami et al. (2019), a developed learning device is considered practical if it has undergone expert assessment and is applicable in real-life scenarios. Additionally, Ananda and Usmeldi (2023) stated that aspects that can be investigated in the practicality of the product include readability, ease of accessing the necessary information, the structure of each icon, and others. The

indicators used to measure this practicality are instructions, content, and ease of use of e-learning-based learning materials.

Integrated Wordwall learning devices are considered practical because they are simple for students to understand and concise in their implementation, making it easier for both teachers and students to achieve learning objectives. Well-packaged learning devices pique readers' interest in further reading and study (Jensen & McConchie, 2020; Sudarsono et al., 2020; Widiari et al., 2023).

Effectiveness of Teaching Materials

Disseminate

Effectiveness is a measure of the success of developing an integrated learning tool using a Wordwall application to improve scientific literacy skills. This study used two schools: elementary school Wonokerso 02 as the experimental class and elementary school Wonokerso 01 as the control class, each with 20 students for limited distribution. Prior to the learning process, students completed a pretest in both the experimental and control classes. The pretest was conducted to determine their initial scientific literacy skills before the learning tool was implemented. The experimental class utilised the integrated learning tool, which included a word wall, while the control class employed the standard learning tool. The post-test was used to determine students' scientific literacy skills after the treatment. The following table presents the pretest and post-test scores for the experimental and control classes.

Table 4. Description of Pretest and Posttest Values

No	Activity	Maximum Value	Minimum Value	Average
Experimental Class				
1	Pretest	64	84	75.00
2	Post-test	72	92	84.60
Control Class				
1	Pretest	64	88	76.00
2	Post-test	72	88	82.00

The effectiveness of the learning tool on students' scientific literacy skills can be assessed using Analysis of Variance (ANOVA). Analysis using ANOVA requires several prerequisites, including: 1) Data from a population with a multivariate normal distribution, 2) Equality of variance and covariance across populations. To meet these requirements, several assumption tests were conducted: 1) Normality Test, 2) Homogeneity Test of Equality of Variance and Covariance. Since the degrees of freedom (df) were less than 50, the decision regarding normality relied on the results from the Shapiro-Wilk table. Based on the results of the normality test for the pretest and post-test questions, the Sig. values for both groups were >0.05, thus concluding that the pretest and post-test questions were normally distributed. A summary of the normality test results for the pretest and post-test scores is presented in Table 5 below.

Table 5. Normality Test on Pretest and Posttest Values

No	Activities	Normality Test Results
1	Experimental class pretest	0.106
	Control class pretest	0.432
2	Experimental class post-test	0.113
	Control class post-test	0.063

The homogeneity test used was Levene's test, performed in SPSS, to determine whether the sample data had equal variance (homogeneity). Based on the results of the homogeneity test for the pretest

scores for the experimental and control classes, the Sig. values were 0.133 > 0.05. Therefore, H0 was accepted, meaning the variances of the two population groups were equal (homogeneous). The results of the homogeneity test for the post-test scores for the experimental and control classes also showed Sig. values of 0.897 > 0.05; then H0 is accepted, meaning the variances of the two data populations are the same (homogeneous). Using SPSS, the results are as shown in Table 6 below.

Table 6. Homogeneity Test on Pretest and Posttest Values

No	Homogeneity Test	Sign Value	Interpretation
1	Pretest	0.133	Homogeneous
2	Posttest	0.897	Homogeneous

Furthermore, an independent sample t-test was conducted using the SPSS program to determine whether there was a difference in the use of teaching materials to improve students' problem-solving skills. H0: If the significance value (Sig.) is greater than 0.05, then there is no average difference between the pretest and post-test learning outcomes. H1: If the significance value (Sig.) is less than 0.05, then there is an average difference between the pretest and post-test learning outcomes. Based on the output results of the "Independent Samples Correlations," it was found that the significance level was Sig. value is 0.000 < 0.05; then H0 is rejected and H1 is accepted. There is an average difference between the pretest and post-test learning outcomes, indicating that the use of learning tools is effective in improving students' scientific literacy skills.

Additionally, the effectiveness of the learning tool development was analysed using the n-gain test. The n-gain test is used to calculate the extent of improvement in students' scientific literacy skills. This improvement is evident from the students' n-gain scores, as shown in the table. The recapitulation of the n-gain test results for the pretest and post-test of fifth-grade students at elementary school Wonokerso 02, as the experimental class, and elementary school Wonokerso 01, as the control class, can be seen in Table 7.

Table 7. N-Gain Results of Experimental and Control Classes

Class	N-Gain Value	Category
Experiment	0.384	Medium
Control	0.222	Low

The results of the N-gain analysis indicated that students' scientific literacy skills improved, as evidenced by their pretest and post-test scores in the experimental class. The normality analysis of the gain of fifth-grade students in the experimental class showed an average n-gain of 0.384, categorised as moderate. In the control class, the average n-gain was 0.222, which is categorised as low. A higher increase was found in the experimental class. Based on these results, it can be concluded that learning with integrated Wordwall learning tools is efficacious in improving scientific literacy (Ulliva & Prodjosantoso, 2025).

The increase in science literacy scores obtained by students differs from one another. We attribute the variations in literacy score increases to the diverse characteristics of students who actively engage and demonstrate enthusiasm in their learning. This finding aligns with Yusuf's assertion that factors such as student characteristics, interests, self-concepts, and learning strategies can impact students' science literacy. The use of integrated word wall learning devices has been shown to positively influence students' science literacy skills (Windari et al., 2023; Widana et al., 2023). This learning device provides an overview of the influence of science on students.

This opinion is supported by Bybee, who stated that connecting science concepts with technology and the daily environment will facilitate students' knowledge building and development of scientific reasoning (Takda et al., 2022; Thuan & Son, 2025; Wahono et al., 2021). By designing learning scenarios based on teaching modules, we facilitate student interaction and centre the learning process around them.

The use of Wordwall media can also increase student activity during learning. Wordwall enhances students' scientific literacy by showcasing videos, images, tables, and written content to meet scientific literacy benchmarks (Windari et al., 2023). Wordwall is a website that offers various educational games designed to serve as a fun assessment tool and evaluation for students (Auliya et al., 2021). It is also easy to use, as students can access it via their respective smartphones and laptops. Several studies related to this Wordwall educational game include Musyarifah et al. (2023) the results are that the Wordwall educational game is effective in conveying material or assessing students. Additionally, Yusuf et al. (2024) note that Wordwall streamlines the process for educators to assess students' final learning outcomes.

Practical Implications: Implementation of Integrated Learning Tools. This study can provide an example of the effective implementation of integrated learning tools, utilising the Wordwall application, to enhance elementary school students' scientific literacy skills. Curriculum Development: The results of this study can serve as a reference for developing a more effective curriculum to enhance elementary school students' scientific literacy skills. Teacher Training: This study can provide valuable insights for teachers to enhance their skills in developing and implementing integrated learning tools using the Wordwall application.

Theoretical Implications: Development of Learning Theories. This study can contribute to the development of more effective learning theories that improve elementary school students' scientific literacy skills. Application of technology in learning: The results of this study can provide an example of the practical application of technology in learning to improve elementary school students' scientific literacy skills. Development of Scientific Literacy Skills: This study can provide valuable insights into how to develop elementary school students' scientific literacy skills through the implementation of integrated learning tools using the Wordwall application. Therefore, this study can make a significant contribution to the development of learning practices and educational theory.

Conclusion

Building upon the development research, we can draw the following conclusions: (1) Experts and practitioners have proven that learning devices using Wordwall applications are valid for improving fifth-grade students' scientific literacy skills in elementary school science subjects. (2) Teachers and students have proven that integrated learning devices using Wordwall applications are practical for improving fifth-grade students' scientific literacy skills in elementary school science subjects. (3) Integrated learning devices using Wordwall applications to improve students' scientific literacy skills in the fifth grade of elementary school science subjects have been proven effective. Teachers can use the study's results as a reference when implementing Wordwall technology media in the learning process. Additionally, further research suggests the integration of Wordwall media on a broader scale.

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