

MoDIp Development: Digital Science Module Based on Local Wisdom Containing Recitation Enhancing Students' Digital Literacy

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Abstract. The limitations of the available science modules, because they have not integrated local wisdom and recitation in the contextual learning process to support students' digital literacy. This study aims for the development of a digital science module because it is based on local wisdom containing recitation for improvements to student digital literacy within the junior high school level. This type of research researches as well as develops through adaptation of the four-D (4D) model with a qualitative approach regarding product trials. 4D has 4 stages that are definition, design, develop, also to disseminate. The design of the digital science module is on a local wisdom base. That program contains local wisdom of Sembalun Village, East Lombok, West Nusa Tenggara. The digital module's validity, practicality, and effectiveness were each put to a test. Experts on materials confirmed the test having 93.75% in a feasible category. Experts in media plus experts in recitation programs validated it, with 96.42% and 95% in a feasible category. The teachers' practical test showed 96% very practical as the students' small scale field trial showed 96% very feasible. The next test checks whether the digital science module effectively improves students' digital literacy since researchers measured it qualitatively, gaining an N-Gain of 0.54. Results from the t-test are at 0.008, meaning digital literacy increased differently before and after the learning. The novelty in this study is the local wisdom-based science digital module strengthens the digitalization of student learning and recitation contextually and holistically. This research includes local wisdom material and strengthening student recitation in learning.

Keywords: Science digital module, local wisdom, digital literacy

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Introduction

A defining feature of the fourth industrial revolution is the widespread utilization of the internet across multiple facets of daily life (Paraniti et al., 2021a). In this context, 21st-century skills a vital role in facilitate the transformation brought about by Industry 4.0, which is marked by convenient access to diverse information sources. 21st century skills are a crucial element in supporting the transformation of the industrial revolution 4.0, which is characterized by easy access to various information (Yeoh et al., 2024). However, the reality of education in Indonesia is still not fully aligned with the demands of the

applicable curriculum. Therefore, the integration of various essential skills in the learning process at every level of education is very necessary in order to optimize student competence.

PISA 2022 results show that the pandemic reduced learning outcomes worldwide, but Indonesia's ranking 5–6 positions compared to 2018. (Kemdikbudristek, 2023; OECD, 2023). Every individual in meeting the demands of today's developments needs to have adequate literacy (Arifah et al., 2022). In 2022, the digital literacy level of Indonesian people is still in the moderate category, with a score of 3.54. This assessment is based on four main indicators, namely the ability to use digital literacy, awareness of ethics in the digital world, understanding of digital security, and a culture of using digital media wisely. (Kemenkominfo, 2022; van Laar et al., 2017). Research on digital literacy in schools shows the level of digital literacy in the sufficient category with an average score of 40.9%, this indicates that digital literacy in schools needs to be improved (Firdaus, et al., 2025). Meanwhile, the results of the identification of students' digital literacy abilities in science learning show different results in each school, namely 59.38% at SMPN 17 Batanghari and 93.75% at SMPN 33 Batanghari (Qoidah et al., 2024).

Digital literacy habits can be started in the classroom. Indicator digital literacy in schools include how much digital literacy is used and utilized in the classroom, how many students know how to use digital media and the internet, and how much digital reading material and teaching aids are available (Kemdikbud, 2017). The success of literacy can be supported by learning resources in the form of appropriate and good teaching materials by paying attention to technology and current conditions (Aslik et al., 2022). Therefore, teacher activity and creativity are needed by utilizing digital media that is developed as teaching materials (Redecker, 2017).

Digital module based on local wisdom that are equipped with recitation program as feedback for students and allow students to learn on their own, are one of the teaching materials that can be constructed by the teachers. The development of a module based on a recitation program is an answer that can be done in remediating conceptual errors when students learn independently (Sundari et al., 2021). This recitation program is expected to help build students' knowledge (Hermawati et al., 2021). so that digitalization of learning is very important in motivating student learning (Lin et al., 2017; de La Hera et al., 2024).

The problem in making modules is usually less interesting for students. Especially in science subjects. Because science subjects are science teaching materials that are directly related to student activities, the findings of preliminary observations show that the learning resources available in schools have not made it easier for students to understand science learning in schools (Arifah & Hasruddin, 2022), as well as mastering science concepts and understanding natural phenomena that occur in the surrounding environment (Saputra et al., 2016).

Based on the previous description, there are still a number of obstacles in the implementation of the independent curriculum, particularly in relation to the integration of local wisdom into teaching materials and the reinforcement of digital literacy, is currently in a transitional stage. This conclusion is supported by interview data collected from teachers and students at the junior high and MTs levels on Lombok Island, which revealed ongoing adjustments and challenges in practice. so the availability of teaching materials that accommodate local wisdom while strengthening digital literacy is still relatively limited. The teaching materials used in general still use printed modules and have not been integrated with local wisdom. Local wisdom is still applied separately in the Pancasila student profile strengthening program outside of class hours. Efforts made to overcome the problem are by integrating science teaching materials with local wisdom. The integration of local wisdom with subject matter can also be found in strengthening the Pancasila student profile in the independent curriculum (Kusnadi, 2022). Integration of local wisdom in science learning has great potential to improve the relevance and

contextuality of education (Fakhrurradhi et al., 2025). However, various challenges such as limited teacher knowledge, resources, curriculum support, and access to technology need to be addressed through training, development of teaching materials, and adequate policy support.

There are many research results on the use of electronic modules based on Indonesian local wisdom in learning. Several studies include the science E-module based on Papuan local wisdom (Batigin et al., 2024), the Science module using digital comics based on Kaili local wisdom (Rahmah, 2024), and the digital module based on Pacitan local wisdom assisted by QR codes (Saputro et al., 2024). A local wisdom-based interactive digital module significantly enhanced high school students' critical thinking dispositions compared to both conventional e-modules and control group (Syahfitri & Muntahanah, 2024), developed an interactive e-book on local history, integrating local wisdom with digital delivery, which effectively improved both cultural awareness and digital literacy among senior high school students (Saripudin et al., 2022). Several previous studies have shown that there is no digital module based on local wisdom as a reinforcement of student recitation in improving digital literacy. The novelty in this study is the science module as a reinforcement of the context of local wisdom and cultural values in the digitalization of learning and strengthening student recitation.

Methods

The last stage is disseminate carried out to socialize the products that have been made. Implementation of the revised product at the development stage to phase D students. Measurement of the effectiveness and improvement of students' digital literacy is carried out at this stage.

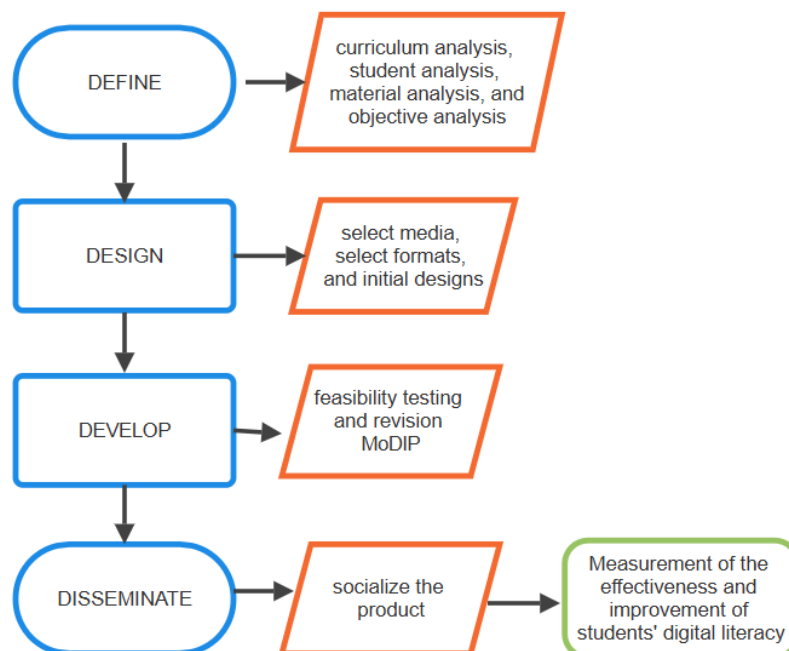


Figure 1. Procedure research and development adapting 4-D model

To find out the media and teaching materials used as well as identify elements of local wisdom in Sembalun Village, researchers conducted interviews with teachers, students, and local traditional leaders. To identify the needs, observations were conducted on science teachers, students and traditional leaders of Sembalun village in a preliminary study and interviews on the science teaching module of SMPN 1 Sembalun, East Lombok. Interviews were conducted about local wisdom in Sembalun, especially related to the *Bale Beleg* traditional house located in Sembalun village, East Lombok. In addition, curriculum analysis and direct observation were also carried out at the *Bale Beleg* traditional house as part of field data collection. The validation process was carried out to evaluate the practicality and feasibility aspects of the developed learning media. This activity involved six lecturers, namely two media experts, two science material experts, and two recitation program experts, accompanied by responses from science teachers and students to the MoDIp-based learning media developed.

In this study, the instruments used were a digital literacy questionnaire, interview sheets, and digital science module media validation sheets. The purpose of the interview sheet was to find out the problems and difficulties faced during the learning process, as well as to use the digital science module as a learning tool in addition to the available textbooks.

The questionnaire instrument was used to assess the level of digital literacy of students, while the validation sheet was used to evaluate the feasibility and practicality aspects of the digital science module designed as a learning medium. Details of the indicators used in the validation and measurement of digital literacy can be seen in Table 1 and Table 2.

Table 1. Validation indicators

No.	Media	Material	Recitation
1.	Visual Design Aspect	Alignment with Curriculum and Learning Objectives	Visual Design Aspect
2.	Navigation and Interactivity	Accuracy and Correctness of Content	Navigation and Interactivity
3.	Technical Quality	Suitability for Learner Characteristics	Design Consistency and Standards
4.	Design Consistency and Standards	Language Use in the Content	Suitability for Learner Characteristics
5.	Educational Functionality	Instructional Support Aspect	Instructional Support Aspect

Table 2. Digital literacy indicators

No.	Indicators
1.	The use of digital media
2.	Critical understanding of digital media usage
3.	Communication skills in the use of digital media
4.	Using Digital Science Modules (MoDIP)

Adapt and develop from (Paraniti et al., 2021b)

The data analysis technique in the developed module uses quantitative descriptive analysis techniques. This analysis is divided into 2 parts, namely MoDIp validity data analysis and digital literacy analysis.

- 1) Validity and practicality of science digital module the formula used for processing MoDIp feasibility percentage data (Rahmayani et al., 2022).

$$P = \frac{\sum x_i}{\sum x_j} \times 100\%$$

Description:

P: Percentage of eligibility score (%)

$\sum x_i$: total number of respondent answer scores obtained

$\sum x_j$: maximum number of scores

Table 3. Validity measurement

Interval (%)	Criteria	Description
85.01 – 100.00	Very valid/Very Practical	The digital module is used without revision
70.01 – 85.00	Enough	The digital module is quite valid or can be used but needs revision
50.01 – 70.00	Less valid	The digital module is less valid and is not recommended for use.
01.00 – 50.00	invalid	The digital module is invalid and should not be used

Adaptation (Akbar, 2015)

2) Effectiveness of digital modules

The N-Gain test to evaluate effectiveness. The interpretation of the results can provide a qualitative understanding of the effectiveness of the digital science module. The effectiveness of the digital science module was tested using the N-Gain formula which is calculated from the difference in students' pretest and posttest scores. The N-Gain formula is used to measure the level of improvement in students' abilities after using the module. The results of the N-Gain calculation are then interpreted qualitatively based on predetermined criteria, so that the effectiveness of the module in improving students' understanding can be known (Sesmiyanti et al., 2019).

The formula for calculating N-Gain is as follows.

$$\text{Normalized Gain} = \frac{\text{Score (Posttest)} - \text{Score (Pretest)}}{\text{Score (ideal)} - \text{Score (Pretest)}}$$

The results of the N-Gain calculation are categorized to assess the effectiveness of the digital science module:

High: N-Gain > 0,7

Moderate: $0,3 \leq \text{N-Gain} \leq 0,7$

Low: N-Gain < 0,3

The N-Gain value interprets that the developed digital science module is said to be effective

3) Analysis of digital literacy data

Student digital literacy data was analyzed using a percentage technique to describe the proportion of digital skill achievement. In addition, the assessment was carried out based on a rubric that had been systematically prepared to measure various aspects of digital literacy (Meliza et al., 2022). This approach allows for a comprehensive evaluation of students' digital literacy abilities quantitatively and qualitatively.

$$P = \frac{\sum x_i}{\sum x_j} \times 100\%$$

Description:
P : Percentage of digital literacy score
 Σx_i : total score obtained by respondents
 Σx_j : maximum score

Table 4. Category of student digital literacy

Score (%)	Category
81.00-100.00	Very good
61.00-80.00	Good
41.00-60.00	Not good
0<40.00	Very poor

Adaptation (Meliza et al., 2022)

Results and Discussion

In developing this MoDIP, researchers used the research and development method with 4-D stages. This model is directed, structured, and systematic in guiding development from the beginning to the final process of the resulting product (Rahmayani et al., 2022). The qualitative approach was chosen to describe in detail the improvement in digital literacy in phase D students. This study aims to develop a MoDIP product (digital science module) based on local wisdom containing a recitation program.

Define

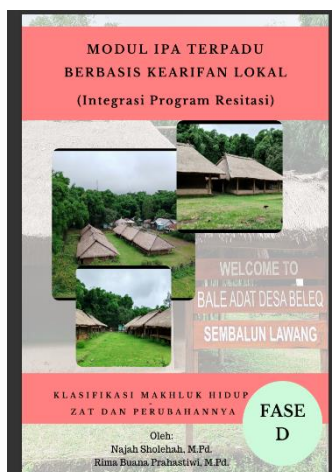
At this stage, a needs analysis was conducted, namely observation to identify the local wisdom of Sembalun Village, East Lombok, West Nusa Tenggara and school observation. Other needs analysis was conducted by interviewing teachers and local indigenous people. In addition, at this define stage, curriculum analysis and material analysis were conducted. The findings in this study are used as the basis for developing a digital science module based on local wisdom that is integrated with the pengajian program. To support this development, researchers conducted interviews with teachers and students at SMP Negeri 1 Sembalun to obtain information related to the use of learning media and the curriculum implemented at the school. From the results of the interviews, it was revealed that SMP Negeri 1 Sembalun still relies on printed books that have been distributed in the school environment. This is also supported by student statements that state that the school has not developed or accustomed to the use of digital teaching materials.

Based on the findings of observations and interviews with teachers, it can be concluded that local wisdom in Sembalun Village has not been integrated into the learning carried out. Therefore, researchers will use these findings as a basis for creating digital modules based on local wisdom as teaching materials. Based on the findings from interviews with teachers, students, and local residents, it can be concluded that there are four local wisdoms: namely the *Tandang Mendet Dance*, the *Ngayu-Ayu Custom*, the *Bale Beleq* traditional house, and the *Cupak Gerantang Dance*. Of the four local wisdoms, the researcher decided to develop a digital science module using the local wisdom of the *Bale Beleq* Traditional House. The *Bale Beleq* Traditional House was chosen based on the science material being developed, namely the classification of living things and substances and their changes. The consideration in question is that this material is the initial material in phase D and can be used to form the basis for students' habits in receiving materials based on local wisdom. As is known, SMP Negeri 1 Sembalun has not yet accustomed students

to using digital teaching materials. The students' lack of habituation in using digital teaching materials also affects students' digital literacy. Therefore, the researcher added a recitation program packaged in the form of practice questions in the form of a letter guessing game so that students, in addition to answering questions by playing games, can also gain knowledge from the recitation under the correct answer. Finding ways to apply games or game concepts in the classroom can be a promising and innovative tool for educators to engage their students in creative learning skills and attractive competition (Zainuddin et al., 2020). This is important to do so that students are accustomed to the use of digital assessments so that students' digital literacy increases. Integrating gamification into educational practices by aligning learning objectives can increase digital literacy and overall student engagement in learning and be more prepared to thrive in an increasingly digital world (Rzabayeva et al., 2024).

Design

After going through the Define stage, the researcher created a framework design containing the layout of the module display and the content to be filled in. The content to be filled in is in the form of material, both in the form of writing and images that are in accordance with everyday life, especially those related to the local wisdom of the *Bale Beleg* Traditional House. In addition to the material, the researcher also provides simple practicums on the module that can be done independently. Practice questions are also filled in the module which is packaged in the form of a game that is integrated with the recitation program. So that understanding of concepts and digital literacy can be honed independently. The following is the framework of the module content in Figure 2.



(a)



(b)



(c)

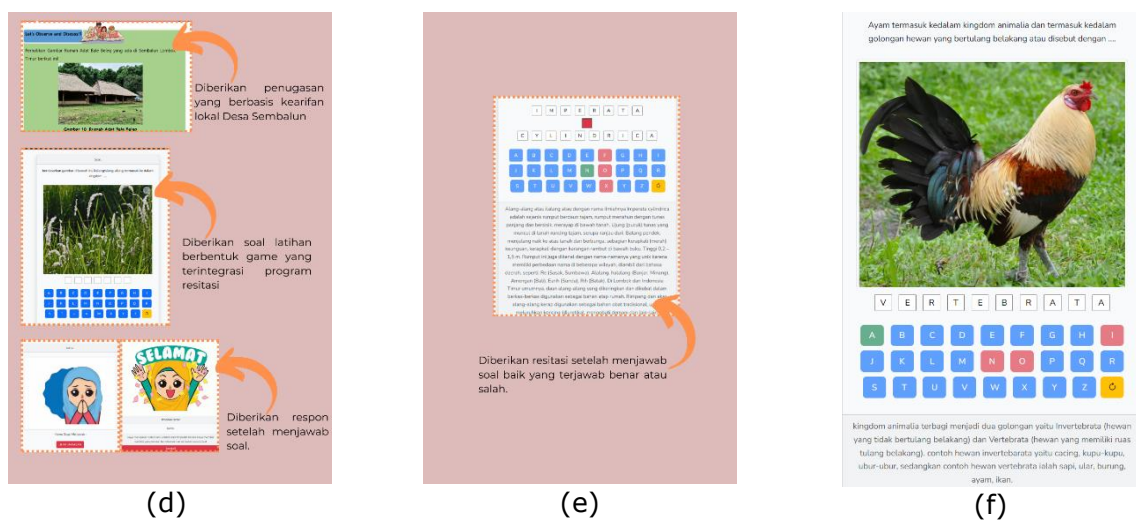


Figure 2. (a) cover, (b) outcomes learning, material, assignment, (c) module content view, (d) Local wisdom-based assignments and practice questions, (e) recitation program, (f) recitation program view on practice questions.

Develop

The purpose of this stage is to develop a digital science Module product that has been designed and then validated. After the development stage, a digital science module product based on local wisdom is obtained which is integrated with the Recitation program for SMP/MTs phase D students which is then carried out in a small group trial.

- Product development results according to design. The product that has been produced in this research and development is a digital science module based on a recitation program containing local wisdom for phase D students.
- Results of formative revision of the digital science module by material experts, media experts, recitation experts and field trials.

At this stage, before disseminate is carried out, the researcher validates the developed module. In this case, there are three criteria that are validated, namely validation of material suitability, media validation, validation of the recitation program with each criterion validated by two expert validators in their fields, and small group trial field practitioner by students and teachers. The following are the results of the validation and small-scale field trials by students that have been carried out.

The digital science modules that are developed also contain local wisdom, so that in integrated learning, local potential and local materials such as modules containing local wisdom materials can increase student activity (Marziah et al., 2015).

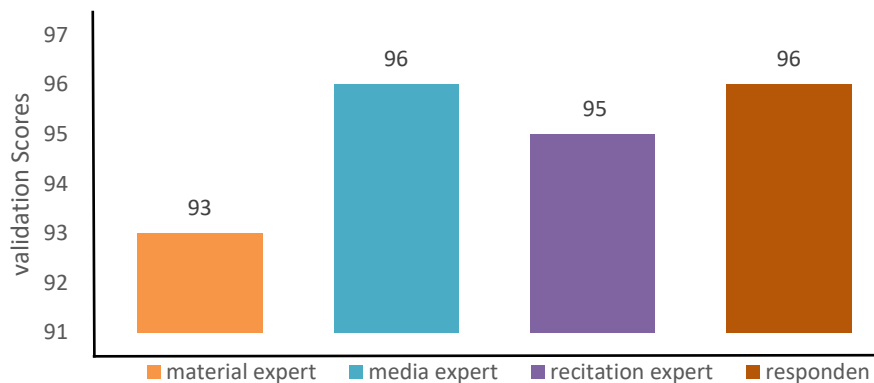


Figure 3. Validation and small group trial results of the science digital module

The validation of the three predetermined criteria and the outcomes of the small-scale field trials indicated that the module is highly feasible and practical. This suggests that the digital science module incorporating local wisdom and a recitation component is suitable for student implementation. Apart from digital science modules, there are several learning media or learning resources that are very feasible for implementation in learning, such as e-modules with local potential (Rachmawati et al., 2024), e-encyclopedia (Rosanti et al., 2024).

Disseminate

At this stage, the researcher conducted a trial and focus group discussion (FGD) of the developed module. This module was tested and used in classroom learning. FGD activities are carried out with the aim of equipping teachers in understanding how to use the developed digital science module. This activity also serves as an initial dissemination media to ensure the readiness of the module to be tested further in the context of classroom learning. After training through FGD, direct implementation of the module was carried out to grade VII students to test its effectiveness on students' digital literacy. At this stage, researchers collected data through initial tests (pretest) and final tests (posttest) related to digital literacy. The scores obtained before and after treatment with the digital module were analyzed to assess the extent to which the module influenced the improvement of students' digital literacy skills.

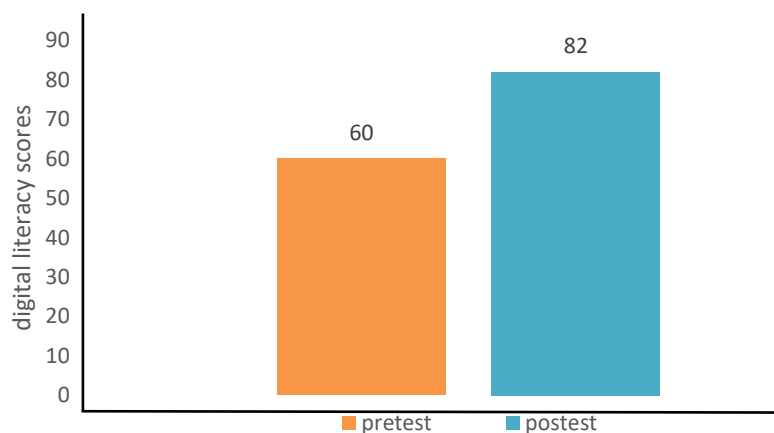


Figure 4. Comparison of pretest posttest score of digital literacy

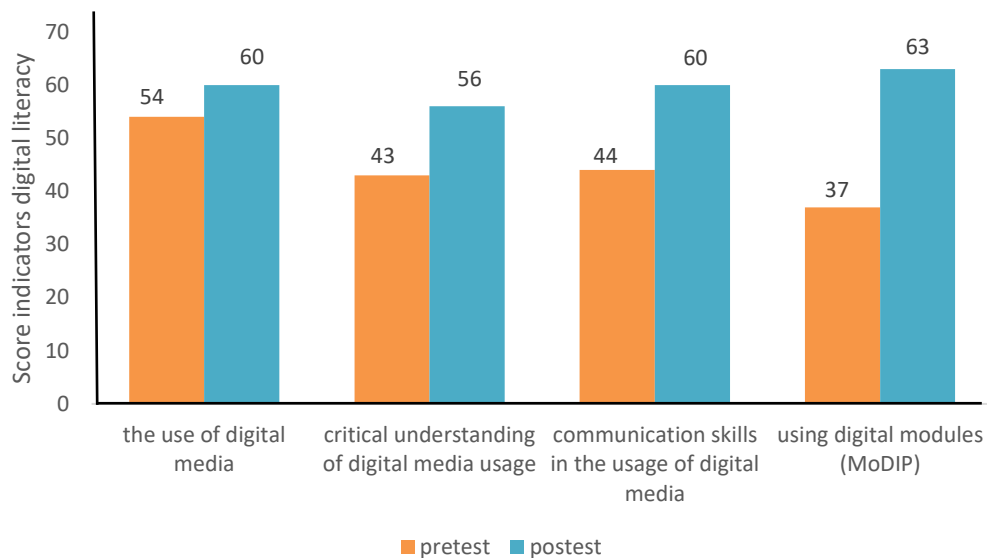


Figure 5. Comparison of pretest posttest score indicators of digital literacy

The digital literacy data of grade VII students in the image above shows an average pretest score of 60 and an increase after treatment with an average score of 82. After the use of the digital science module was implemented, students' digital literacy increased based on students' pretest and posttest scores. This is because students have studied the digital science module which contains features that facilitate students to practice digital literacy. This shows that students' digital literacy increased after using the science digital module. This is also in line with research conducted by (Muhammad & Ambarwati, 2021) that the use of e-books can improve digital literacy skills. This MoDIP is equipped with recitation in the form of a game, so that students are actively involved in the learning process, of course fun learning, skill development and concept mastery. Teachers can act as facilitators, guiding students in the learning process and teachers can monitor student progress in the learning process.

Based on Figure 4, all digital literacy indicators have shown improvement. Implementation of learning in the classroom, the teacher uses a digital module of local wisdom science that contains recitations, the teacher asks students to evaluate by scanning the barcode in the module, then questions will appear, when students answer the question, the students type the correct answer. if the answer is wrong, the typed letters will be red. if the answer is correct, the typed letters will be green. The correct answer will be accompanied by an explanation (recitation), with this learning activity students are motivated and interested in using the digital science module. The highest increase was in the indicator of MoDIP usage. This is reinforced by interview results, where students stated that using MoDIP in learning provides a new experience in the use of digital modules in the form of flipbooks, thereby equipping students with new skills in utilizing digital teaching materials. In addition, students working on practice questions in the form of games integrated with recitations below the correct answers is also a first-time experience for them (Sundari et al., 2021).

As the data shows, we can draw a conclusion that MoDIP has a positive effect on improving students' digital literacy. This improvement is reflected not only in numerical scores but also in students' engagement and positive perceptions of the learning process. Interactive features like MoDIP and gamification in the recitation program are not only visually appealing but also pedagogically (Kasmir, 2021; Luthfiah et al., 2021) effective in developing comprehensive digital literacy skills (Sundari et al., 2021).

Nowadays, literacy is not only used to enhance reading and writing skills, but it can also be combined with technological advancements into digital literacy. Digital literacy in its development includes skills in searching for information on digital platforms and being able to use devices that can change information and communicate digitally (Dewi et al., 2021). Based on the effectiveness test that has been carried out using quantitative descriptive tests, MoDIp has proven to be effective in improving students' digital literacy. In addition, qualitative and quantitative tests are used to test effectiveness. To test qualitative, the N-Gain Score is used while the quantitative test uses a simple paired t-test (Leedy & Ormrod, 2005). Table 5 shows the results of the N-Gain score test of students' digital literacy.

Table 5. Digital literacy N-Gain results

Spretest	Sposttest	N-Gain	Category
60	82	0.54	Medium effectiveness

Based on Table 5, N-Gain score for students' digital literacy of 0.54 with a medium category indicates that the digital science module is effectively used in learning to improve students' digital literacy. This is because the digital science module is the first time it has been used at SMPN 1 Sembalun East Lombok school so it is necessary to use electronic devices in learning to help in searching for information. In addition, the digital science module is also developed as learning media with local wisdom content. Learning activities using learning media can make students more enthusiastic about learning (Prameswati & Saifuddin, 2022). So that in learning to increase student activity, it needs to be integrated with local potential (Marziah et al., 2015) and using e-module with local potential is effective for learning (Rachmawati et al., 2024; Batigin et al., 2024; Saputro et al., 2024). This digital science module based on a local wisdom containing recitation program can help students understand science material, especially the classification of living things and make them aware that the potential for local wisdom in their area can be preserved. With this digital module, it is easier for students to access information. This is in accordance with the results of the paired t-test in Table 6.

Table 6. Paired sample t-test of digital literacy

Variable	Mean	Df	p-value	Decision
Digital literacy	71.91	16	0.008	There is a significant difference significant

Based on the results of the paired t-test in Table 6, the digital literacy data shows a p-value of 0.008 which is smaller than 0.05, so there is a significant difference. This finding indicates that learning using digital science modules can improve students' digital literacy compared to before using them. Thus, digital literacy has an important role in the learning process and significantly contributes to increasing students' self-efficacy (Getenet et al., 2024). The teaching and learning process is increasingly assisted by the development of internet technology. According to (Latip et al., 2022) digital literacy has a significant influence in improving student learning outcomes. The phenomenon of digital technology further strengthens the basic part of digital literacy (Restianty, n.d.). The integration of local wisdom containing a recitation program in the digital science module has proven to be effective in facilitating access to learning materials while improving students' digital

literacy. This module has proven effective not only in improving learning outcomes, but also in arousing students' interest in the material being studied. These findings indicate that digital modules that integrate local wisdom have the potential to be a choice of learning media that is in accordance with the demands of the digital era (Kurniasih et al., 2024). Students can expand their understanding of the material with interesting information about the classification of living things presented in the digital science module. Local wisdom about the material on the classification of living things found in this digital science module is easily associated with things that happen in everyday life. This helps students to understand science concepts applied in real life, making learning more relevant and meaningful (Hartini et al., 2018).

Conclusion

The digital science module based on local wisdom which contains a recitation program enhancing students' digital literacy is declared very feasible, practical, and effective for use in the learning process. Validity, practicality, and effectiveness tests have been conducted on the learning of the classification of living things material for grade VII students. Based on the results of the paired t-test, a p-value of 0.008 (<0.05) was obtained, which indicates a significant difference in the level of digital literacy of students before and after the implementation of the digital module. The implementation of the digital science module in schools showed a significant increase in students' digital literacy, both in technical and cognitive aspects as shown through effectiveness tests with N-gain analysis and t-tests. In addition, the active involvement of teachers in using the module also supports the implementation of contextual and meaningful learning.

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