Journal of Elementary Education (JELEDUC)
Volume 2 (2) 73 – 84, December 2025
E-ISSN: 3063-5330 (Online)
DOI: 10.38040/jeleduc.v2i2.xxxx
The article is published with Open Access at: https://jurnal.umla.ac.id/index.php/JELEDUC/index

Development of a Science Literacy-Based E-module to Improve Science Learning Outcomes for Fourth Grade Students

Ila Nur Maulida[1], Novialita Angga Wiratama[2]

[1]Universitas PGRI Ronggolawe, Tuban, Indonesia
[2] Universitas PGRI Ronggolawe, Tuban, Indonesia

✉ *Corresponding Author: ilamaulida487@gmail.com*

ABSTRACT

This research focuses on the low learning outcomes of students in the IPAS subject about different energy forms. The study aims to assess the validity, practicality, and effectiveness of a science literacy-based e-module for fourth-grade students. It follows the Research and Development (R&D) method using the ADDIE model, which has five stages: Analyze, Design, Development, Implement, and Evaluation. The participants were 29 fourth-grade students from SDN Plaosan and class teacher. Data were collected through interviews, observations, questionnaires, and tests. The e-module met eligibility criteria with high validation scores: 86% for material, 84% for media, and 93. 3% for language. Teacher and student practicality scores were 88% and 94. 75%, respectively. The effectiveness score was 78%. In conclusion, the e-module is valid, practical, and effective for enhancing learning outcomes in fourth-grade classrooms.

Keywords: E-module, Science Literacy, Learning Outcomes

Received: 20 September 2025	*Revised: 09 November 2025*	*Accepted: 11 November 2025*	*Published: 30 December 2025*

Citation:

Maulida, I. N. & Wiratama, N. A. (2025). Development of a Science Literacy-Based E-module to Improve Science Learning Outcomes for Fourth Grade Students. *JELEDUC: Journal of Elementary Education 2*(2), 73–84. DOI: 10.38040/jeleduc.v2i2.xxxx

INTRODUCTION

Education is a systematic and structured learning process to develop an individual's cognitive, affective, and psychomotor abilities through teaching, training, and experience (Aprilyanti, Asbari, Supriyanti, & Fadilah, 2024). Education is a deliberate effort to create an atmosphere and learning model that allows students to achieve their maximum potential (Mayasar & Adrian, 2024). Success in educating and building human resources (HR) that are integrated, have positive attitudes, and dignified behavior reflects the high quality of a country's education system (Sya'adah, Kharisma, & Huda, 2025). Education is a continuous process because it takes place in all situations, both at home and at school, as well as in the community (Dewi, Pristiwanti, Badriah, & Hidayat, 2022). Based on the above opinions, it can be concluded that education is a continuous and systematic learning process that can take place in various environments, such as home, school, and society, with the aim of developing the individual's abilities comprehensively. According to Abels, the improvement of quality education is an important foundation in preparing Indonesia to face a competitive and dynamic future (Alek, 2022). In facing global demands and ensuring quality education, teachers need to focus on several important aspects: 1) Scientific literacy. 2) Active learning. 3) Meaning construction. 4) Accountability. 5) Use of technology. By focusing on these aspects, teachers can prepare students to become critical, creative individuals who are ready to face an ever-changing world (Nurdin, 2020). This means that what teachers need to focus on to meet global demands and ensure quality education are science literacy, active learning, meaning construction, accountability, and the use of technology.

Scientific literacy consists of the word "literacy", which means "reading ability" and "scientia", which means "knowledge". Scientific literacy can also be defined as the knowledge and scientific skills necessary to identify problems, gather new information, explain scientific phenomena, understand the characteristics of science, and comprehend how science and technology influence the natural world, intellect, and culture (Kristyowati & Purwanto, 2019). According to PISA (Programme for International Student Assessment), scientific literacy is the ability to use scientific knowledge, identify questions, draw conclusions based on evidence to understand and help make decisions related to nature and the changes made to nature through human activities (Winata, Cacik, & Seftia R. W., 2018). According to the Organisation For Economic Cooperation and Development (OECD), the indicators of science literacy include three competencies, namely explaining scientific phenomena, assessing or evaluating and designing scientific research, analyzing data and scientific evidence (Tillah & Subekti, 2025). In PISA 2022, Indonesia scored an average of 359 in reading, 366 in mathematics, and 383 in science, ranking 70th out of 80 countries. The average results for the three subjects—mathematics, reading, and science—in 2022 showed a decline (learning loss) of 12-13 points compared to 2018. Nevertheless, Indonesia's ranking in PISA 2022 rose by 5-6 positions compared to 2018. This increase in Indonesia's ranking was due to a larger decrease in the global average score compared to the decrease in Indonesia's score. However, the average scores of Indonesian students are still far below the OECD average, which is 472 points for mathematics, 476 points for reading, and 485 points for science (OEDC, 2022). This indicates the urgency of improving students' science literacy skills. In the context of education, science literacy is very important for enhancing critical thinking and problem-solving abilities. Therefore, we need to further understand science literacy and how to improve it.

Scientific literacy, which is the ability to understand and apply scientific concepts in daily life, is an important component in science subjects, because science itself is the study of natural phenomena and the processes that occur within them. IPAS is a curriculum development that integrates science and social studies into a single theme for learning. This learning combines natural science, which studies living and non-living things in the universe and their interactions, with social science, which includes geography, economics, anthropology, political science, history, and aspects

of human life as individuals and social beings interacting with their environment (Suhelayanti, Z, & Rahmawati, 2023).

Based on the observation results in the fourth grade at SDN Plaosan, it is also evident that the teacher has not implemented the use of technology, only using lecture methods, simple discussions, and only utilizing objects in the classroom. As a result, this has led to low learning outcomes for the students based on the pre-test conducted by the researcher, where many students have not completed the material. This is also supported by interviews with the students, where students feel difficulty with the material, but the teacher only explains briefly and only uses worksheets as a learning source, which in terms of content has not integrated with science literacy, in terms of media has not taken an electronic form, and in terms of language there are still several sentences that use informal language when formal language should be used. This is also in line with the results of interviews with the fourth-grade teacher at SDN Plaosan, who stated that he only utilizes objects in the classroom to explain the material and for simple discussions, which affects the learning outcomes of the students. Learning outcomes are the level of success of students in mastering a learning material at school in the form of grades (Kumalasari, Fathurohman, & Fakhriyah, 2023). Therefore, mastery or understanding of material can be seen from students' learning outcomes in the form of grades.

Based on these results, an effective strategy needs to be implemented to improve learning outcomes. The development of learning materials for the independent curriculum is one of the strategies that need to be undertaken (Wagiswari Santika, Dewi, & Putu Suharta, 2023). In learning, there needs to be teaching materials to carry out the learning process, among which is a module. According to Berlianda, (2022), a module is a book designed to allow students to learn independently from the guidance of an educator or to enable them to learn on their own. With the existence of this module, whenever students want to learn, they can use the module to study independently without the need for a teacher to accompany them. One of the computer-based learning devices that can be used as a teaching aid is the e-module. An electronic module (e-module) is a collection of learning information that is systematically organized based on a specific curriculum to achieve designated competencies in electronic form (Hardianti & Alyani, 2023). With electronic presentation, it is hoped that learners will feel enthusiastic and it can improve their learning outcomes. In addition, with the e-module, learners can also study independently as it can be accessed anytime and anywhere. In line with this, according to Cecep et al., electronic media that can be accessed by learners has several advantages and different qualities (Prasetya, Wirawan, & Sindu, 2017). With better advantages and qualities that can be accessed by learners, this electronic media in the form of e-modules will further assist learners in their study.

The researchers plan to develop teaching materials in the form of electronic modules or e-modules based on scientific literacy to enhance students' learning outcomes, which will include material on various forms of energy around us. Until now, the modules commonly used by students are printed modules, which are considered less effective, especially in the face of rapidly advancing information technology. Therefore, an innovation in learning is necessary by utilizing technology, namely the development of electronic modules or e-modules. The development of e-modules has its own advantages, as it can serve as an alternative learning resource for students, providing ease to learn by utilizing laptops or computers, or even gadgets, without having to spend extra money to produce more modules, and learning can be done anytime and anywhere. The researcher developed a science literacy-based e-module formatted as a flipbook with the help of the heyzine flipbook application. This application can make the modules more interactive, as we can add images and videos within them.

This research is supported by Fahmi in his research entitled "Development of Science Literacy-Based Modules to Improve Learning Outcomes in Class IV Natural Sciences" which received valid, practical, and effective categories for use in the learning process at school, thereby enhancing student learning outcomes (Fahmi, Nurlina, & Sualfasyah, 2023). Another study conducted by Efendi

et al., (2024) with the title "Development of Science Literacy-Based E-modules on Harmony in Ecosystems for Class V at SDN 11 Sitiung" obtained media, material, and language validation scores with an average score of 89%, categorized as very valid. The effectiveness, as assessed from the final learning test results of the students, achieved 85.55% with a very effective category, thereby improving student learning outcomes at SDN 11 Sitiung. Besides that, there is also research conducted by (Oktaviani, ., Maria, Astuty, & Enawaty, 2023). Based on those studies, it can be concluded that science literacy-based e-modules can improve student learning outcomes. Furthermore, it can be concluded that science literacy-based e-modules can be used as teaching materials while also enhancing student learning outcomes.

Based on the description above, the researcher conducts development with the aim of determining the level of validity, practicality, and effectiveness of the e-module in improving learning outcomes for fourth-grade elementary school students. "Development of a Science Literacy-Based E-module to Improve Science Learning Outcomes for Fourth Grade Students." The researcher hopes that the development of the science literacy-based e-module to enhance learning outcomes for fourth-grade students can help students learn more easily in any period, while also making it easier for teachers to introduce science literacy in an enjoyable way that relates to their learning.

METHODS

The type of research used by the researcher is research and development. To develop an e-module, a model that is considered suitable for the education system is required. Therefore, in this research and development, the researcher uses the ADDIE model. This model was chosen because it is often used for instructional development. According to Mulyatiningsih (2012), the ADDIE model is considered a more logical and comprehensive model compared to others, therefore this model can be used for various forms of product development such as learning strategies, media, models, instructional materials, and teaching methods (Puspasari, 2019). To develop the e-module, a model that is considered appropriate for the education system is required. Therefore, in this research and development, the researcher uses the ADDIE model. The 5 steps of the ADDIE model consist of analysis, design, development, implementation, and evaluation.

Research procedure

The research procedure is in accordance with the ADDIE steps, namely:

1. The initial stage undertaken by the researcher is analysis. The researcher analyzes the needs, characteristics of the students, and the curriculum used. The activities carried out by the researcher involve observation and direct interviews with students and fourth-grade teachers at SDN Plaosan.
2. The second stage is design. After obtaining the results from the conducted analysis, the researcher can design the required e-module. Before designing the e-module, the first thing to do is to outline the creation of the e-module. The steps in creating the e-module include: selecting teaching materials, designing learning materials, organizing the e-module's appearance design according to the component format, and developing an assessment instrument for the science literacy-based e-module. The next step is to turn the completed e-module into a flipbook using the heyzine flipbook application.
3. The third stage is development. The product design that has been created is then developed according to the steps that have been designed. If the e-module meets expectations, it can be submitted to expert validators in content, media, and language. After conducting validation, the researchers will receive suggestions and feedback to identify the weaknesses of the

developed e-module, which will then be improved to be better. The revised product will then proceed to the next stage.

4. The fourth stage is implementation. After the product has been developed and declared valid by the validator, the product can be implemented. At this stage, the researcher conducts field trials with the fourth-grade students of SDN Plaosan, involving 29 students and the class teacher.
5. In the fifth stage of evaluation. After the researcher obtains data during the implementation of the product, the researcher provides feedback to the students as part of the feedback activities from the developed product, and then manages the resulting data.

The data collection instruments used by the researchers are observation sheets, interview sheets, validation sheets from experts (material, media, and language), test sheets, questionnaires for teachers and students, as well as documentation. Quantitative and qualitative data analysis methods are used in this research. Qualitative data is obtained from observations, interviews, critiques, and suggestions from validators in the form of descriptive sentences, while quantitative data is obtained from the results of product feasibility validation by the team, student tests, and questionnaires from teachers and students. The formula used to analyze the validity and practicality of the data is appropriate Lase, (2023), which is below:

$$P = \frac{n}{N} \times 100\%$$

Explanation:
P = percentage
n = number of scores obtained
N = maximum score

The formula used to analyze the effectiveness data is the N-Gain according to Archambault.

$$N\ Gain = \frac{posttest\ score - pretest\ score}{maxsimum\ score - pretest\ score}$$

RESULTS

This research is a development study conducted at SDN Plaosan. The product produced is a science literacy-based e-module. The model used is ADDIE and the results obtained in the field are as follows:

1. Results of the analysis stages
   Data collection was carried out through observations in the classroom and interviews with students and the fourth-grade teacher at SDN Plaosan. There are three stages in the analysis phase, namely needs analysis, analysis of student characteristics, and curriculum analysis. The data results are listed in the table below.

TABLE 1. Needs analysis results

No.	The results obtained	Needs analysis results
1.	The teaching materials used in IPAS learning only use LKS books and are not yet integrated with science literacy.	Thus, the researchers utilized technology as a reference source for teaching materials through the development of science literacy-based e-modules that will later take the form of a Heyzine flipbook.
2.	The method used by the teacher in the learning process only employs lecture and question-and-answer methods.	Thus, the researchers utilized technology through the use of quizzes and learning videos available in the e-module to create active engagement between the teacher and the students.
3.	The unavailability of teaching materials in electronic form	Therefore, the researchers developed a science literacy-based e-module learning material that includes several components including materials, quizzes, and evaluation questions.

TABLE 2. Results of the analysis of student characteristics

No.	The results obtained
1	The subjects of this research trial are fourth-grade students of SDN Plaosan with a total of 29 students consisting of 14 male students and 15 female students.
2	From the trial subjects, there are several students who still find it difficult to understand the lessons, are bored, and lack interest in participating in the learning process.

TABLE 3. Curriculum analysis results

No.	Curriculum analysis results	Description
1.	Learning Outcomes	Students understand the sources and forms of energy as well as the processes of energy transformation in everyday life.
2.	Learning Objectives	1. Through the e-module learning materials, students can identify forms of energy and the process of energy transformation. 2. Through the Student Work Sheet (LKPD), students can analyze the process of energy transformation in electronic devices. 3. Through the e-module learning materials, students can mention examples of forms of energy in daily life. 4. Through the e-module learning materials and LKPD, students can determine the changes in energy that occur in an object or phenomenon.
3.	Learning Objective Flow	1. Identifying forms of energy and the existence of energy transformation processes. 2. Analyzing the energy transformation processes in electronic devices. 3. Mentioning examples of forms of energy in everyday life. 4. Determining the energy changes that occur in an object or phenomenon.

2. Design stage results

In this design stage, the researchers begin to design a science literacy-based e-module that will be developed according to the design outlined in the table.

TABLE 4. Design stage result

No.	Design stage	The results obtained
1	Selection of teaching materials	The chosen teaching material is a science literacy-based e-module created using the Canva application.
2	Designing teaching materials	In the stage of designing learning materials, the researcher collects learning materials that are in line with the curriculum used by SDN Plaosan, which is the Merdeka curriculum. The design of the materials in the e-module is expected to make the content of the e-module more comprehensive than the teaching materials, and the e-module content is adjusted to the indicators of science literacy so that it can improve the learning outcomes of the students.
3	Arrange the design of the e-module interface according to the component format.	The design of the science literacy-based e-module includes (1) title page (2) preface (3) table of contents (4) learning materials (5) summary (6) evaluation sheet (7) glossary (8) bibliography.
4	Developing assessment instruments for science literacy-based e-modules	The development of assessment instruments for science literacy-based e-modules aims to determine the level of validity, teacher and student response questionnaires are used to assess the level of practicality, and student test results evaluations are conducted to determine the level of effectiveness.
5	Turning the e-module that has been created into a flipbook	After completing the product using Canva, the e-module is transformed into a flipbook with the help of Heyzine flipbook.

3. Results of the development stages

At this stage, the researchers develop the product according to the existing design. After that, before the initial science literacy-based e-module product is used, it must be validated first by expert validators in content, language, and media (Rahayu, 2022). Validation by experts is carried out to ensure that the e-module product has good quality and meets established standards. Experts can provide objective assessments and suggestions so that the product can be used as an effective learning tool. Material expert validation was carried out by a UNIROW lecturer who is an expert in the field of science. The validation results conducted by

the material expert obtained a score percentage of 86% with a very valid category. Language expert validation was conducted by a UNIROW lecturer who is an expert in the field of Indonesian language. The validation results by the language expert obtained a score percentage of 93.3% with a very valid category. In addition, media expert validation was carried out by a UNIROW lecturer who is an expert in the field of media. The validation results by the media expert obtained a score percentage of 84% with a very valid category. From the results of the validation by the three experts, when combined, the average score percentage is 87.76%, with a very valid category.

4. Implementation stage results

The presentation of data during the trial of the science literacy-based e-module. The data on the level of practicality and effectiveness of the e-modules created by the researchers can be seen in the table below:

TABLE 5. The practicality of the e-module

No.	Description	Percentage	Category
1	Teacher response questionnaire	88%	Very practical
2	Student response questionnaire	94,75%	Very practical

TABLE 6. The effectiveness of e-modules

No.	Name	Pre-test score	Post-test score
1	AFF	25	85
2	APA	35	85
3	AHA	65	90
4	AKM	85	100
5	AZYAAS	65	90
6	BAFB	80	95
7	CSN	70	85
8	DVD	35	85
9	DAI	70	85
10	DZKA	85	100
11	FCZA	65	90
12	HHR	65	90
13	LNH	50	90
14	MNSS	40	90
15	MHQ	60	90
16	MAAG	40	90
17	MIAA	75	95
18	MASW	80	95
19	MMGR	80	95
20	NANP	80	95
21	NM	80	95
22	NTM	65	100
23	NH	55	95
24	PR	80	95
25	RMR	80	95
26	VVNK	85	100
27	WAPS	60	90
28	YS	60	90
29	AN	85	100
	Total	**1.900**	**2.680**
	Average	**65,51**	**92,41**
	Criteria	**Effective**	

5. Results of the evaluation stage

After conducting a validation analysis from experts, practicality, and effectiveness, the final analysis is as follows:

1. Level of validity

Based on the results of the validation assessment of the e-module designed by the researcher, it received an average score of 87.76%, categorized as very valid. Therefore, the final result of the science literacy-based e-module can be implemented in the IPA learning in the fourth grade of elementary school.

2. Level of practicality
   Based on the results of the practitioner assessment questionnaire by the fourth-grade teacher and the fourth-grade students of SDN Plaosan, the science literacy-based e-module designed by the researcher received a score percentage of 88% for the teacher response questionnaire, and 94.75% from the student response questionnaire, thus categorized as very practical. Therefore, the learning outcomes for science have been stated to be correct, accurate, and in accordance with the material, language, and media.
3. Level of effectiveness
   Based on table 5, the pre-test and post-test score data will be analyzed with calculations obtained using the N-Gain formula, categorized into the N-Gain interpretation.

$$\text{N Gain} = \frac{posttest\ score - pretest\ score}{maximum\ score - pretest\ score}$$

$$\text{N Gain} = \frac{92{,}41724137931 - 65{,}517241379310}{100 - 65{,}517241379310} = 0{,}78$$

Table 7. Interpretation of N-Gain values

Value N-Gain	Interpretation
G > 0,7	High
0,3 ≤ g ≤ 0,7	Currently
G < 0,3	Low

Source : (Sukarelawan, Indratno, & Ayu, 2024)

Based on the N-Gain calculation that has been conducted, the result is 0.78, which means that the e-module based on science literacy is highly effective. Then, the percentage of product effectiveness is calculated using the following formula.

$$\text{N Gain} = \frac{posttest\ score - pretest\ score}{maximum\ score - pretest\ score}\ x\ 100$$

$$\text{N Gain} = \frac{92{,}41724137931 - 65{,}517241379310}{100 - 65{,}517241379310}\ x\ 100 = 78\%$$

TABLE 8. Criteria for determining the level of effectiveness

Persentage (%)	Interpretation
< 40	Not effective
40 – 55	Less effective
56 – 75	Quite effective
>76	Effective

Source : (Sukarelawan et al., 2024)

Based on the calculation results, a gain percentage of 78% was obtained, which falls under the effective criteria. From these results, it can be concluded that the science literacy-based e-module for improving the learning outcomes in fourth-grade elementary school science is classified as effective with a high criterion and is effectively used in learning.

DISCUSSION

Based on the results of the validity tests that have been conducted, the science literacy-based e-module shows a very valid qualification from the experts, making it suitable for use in the learning process. This is because the development of the science literacy-based e-module has been carried out in a systematic manner. The process of developing the science literacy-based e-module is based on the ADDIE model. According to Mulyatiningsih (2012), the ADDIE model is considered to be a more logical and comprehensive model compared to other models; therefore, this model can be used for various forms of product development such as learning strategies, media, models, teaching materials, and teaching methods (Puspasari, 2019).

In addition, because the developed e-module is based on science literacy, its development must be aligned with the dimensions and indicators of science literacy. Previously, the indicators of science literacy have been stated in the introduction, and PISA (Programme for International Student Assessment) establishes that science literacy consists of four interrelated dimensions (aspects) (Eralita & Setiawan, 2022) which are : (1) Competence (science process). This aspect includes activities identifying scientific questions, explaining phenomena scientifically, and using scientific evidence; (2) Knowledge or science content. The knowledge aspect refers to concepts, facts, scientific theories, and principles; (3) Science context. The context aspect describes the understanding of key facts, concepts, and explanatory theories that form the foundation of scientific knowledge; (4) Attitude. Attitude towards science or scientific attitude plays a crucial role in learners' decisions to further develop their scientific knowledge and use scientific concepts and methods in their lives.

According to Nurjannati et al., (2022) there are four aspects of scientific literacy contained in teaching materials or modules because the development of science literacy-based e-modules is the same as the development of science literacy-based teaching materials. Science literacy consists of 4 aspects, these aspects are; (1) Science as the core of knowledge; (2) Science as a way to investigate; (3) Science as a way of thinking; (4) The interaction between science, technology, and society (Ummah, Rusilowati, & Yulianti, 2018). In accordance with the science literacy dimensions according to PISA, this aspect is very closely related to the context of science. This is about how science interacts with the real world, its impact, as well as the ethical and social issues that arise. From the opinion above, the researcher will later include scientific aspects as the core of knowledge represented by the section 'Let's Learn', ways of thinking and investigating represented by the section 'Let's Try!', and the interaction of science, technology, and society represented by 'Energy Around You!'

After developing the science literacy-based e-module product according to the dimensions and indicators of science literacy, a validity test was conducted with material experts, language experts, and media experts. Based on the validation results from the material and language experts, several revisions were needed, so the researcher had to improve the product before implementing it in schools. The validity test results from the material expert received a percentage score of 86% with a very valid category, the language expert received a percentage score of 93.3% with a very valid category, and the media expert received a percentage score of 84% with a valid category.

At the time of implementation, the researcher was able to test the practicality and effectiveness of the developed product. Data to determine the level of practicality can be obtained from teacher response questionnaires and student response questionnaires, where these questionnaires consist of 10 indicators. During the implementation, the researchers were able to test the level of practicality and effectiveness of the developed product. Data to determine the level of practicality can be obtained from teacher response questionnaires and student response questionnaires, where these questionnaires consist of 10 indicators. The level of practicality of the science literacy-based e-module developed by the researchers received a score percentage of 88% with a very practical category from the teacher response questionnaire and 94.75% with a very practical category from the student response questionnaire. Thus, it can be concluded that the science literacy-based e-module is practical for use in primary school learning. Primary school

students in the high grades, especially those between the ages of 9 to 12, are in a very important stage of cognitive development (Khasanah, Kharisma, Huda, & Mudayan, 2025).

At the time of implementation, the researcher not only collected data to see the level of practicality, but also collected data to determine the level of effectiveness of the e-module by giving post-test questions to the students. The results of the post-test will later be analyzed by the researcher along with the pre-test data that was obtained before the implementation of the e-module so that it can be determined whether the students' learning outcomes have improved or not. Actually, the learning outcomes themselves consist of various types of learning outcomes. According to Benjamin S. Bloom's taxonomy, the categorization of educational objectives must always refer to three types of domains that are inherent in the learners, namely: (1) The cognitive domain or thinking processes, (2) The affective domain or attitudes, and (3) The psychomotor domain or skills (Putra, Yaqin, & Saputra, 2024). But in this study, the researchers focused on cognitive assessment using tests.

The results of the students' pre-test obtained an average score of 65,51 and the post-test received an average score of 92,41, thus indicating an improvement in learning outcomes. From these scores, the N-Gain calculated to be 0,78, which falls into the high category, and a score percentage of 78%, categorized as effective. The research conducted by Efendi et al., (2024) states that e-modules are very effective for use in teaching, thereby improving students' learning outcomes. The research results conducted by Atmaji & Maryani, (2019), (Hardianti & Alyani, 2023), (Rahayu, 2022), and (Lubis & Rambe, 2022) also show an improvement in learning outcomes after using e-modules for teaching.

CONCLUSION

Based on the validation results from material experts, a score of 86% was obtained and categorized as 'very valid.' The validation results from media experts showed a percentage of 84% and were categorized as 'very valid.' Meanwhile, the validation results from language experts yielded a percentage of 93.3% and were categorized as 'very valid.' Therefore, the conclusion is that the science literacy-based e-module is 'very valid' to be used as teaching material to assist in the learning process.

The results of the teacher response questionnaire obtained a percentage of 88% and were categorized as 'very practical'. Meanwhile, the results of the student response questionnaire obtained a percentage of 94.75% and were categorized as 'very practical'. Based on the results, it can be concluded that the science literacy-based e-module is 'very practical' to be used in the learning process.

The effectiveness results of the e-module product with the subject tested on fourth-grade students of SDN Plaosan, with a total of 29 students. The results from the pretest of the students obtained an average score of 65.51, and the post-test received an average score of 92.41, categorized as effective. After being analyzed with the N-Gain formula, a result of 0.78 was obtained with the interpretation of N-Gain as 'high', and a percentage of 78% with the interpretation of N-Gain as 'effective'. Based on the results, it can be concluded that the science literacy-based e-module is 'effective' in improving the learning outcomes of students.

REFERENCES

Alek. (2022). Peningkatan Kualitas Pendidikan Untuk Mencetak Sumber Daya Manusia Berkualitas Menuju Indonesia Unggul. *Universitas Islam Negeri Syarif Hidayatullah Jakarta*, 1.

Aprilyanti, S., Asbari, M., Supriyanti, A., & Fadilah, I. A. (2024). Catatan Pendidikan Indonesia: Evaluasi, Solusi, & Ekspektasi. *Journal of Information Systems and Management (JISMA)*, *3*(2),

31–34.
Atmaji, R. D., & Maryani, I. (2019). Pengembangan E-Modul Berbasis Literasi Sains Materi Organ Gerak Hewan Dan Manusia Kelas V Sd. *Jurnal Fundadikdas (Fundamental Pendidikan Dasar)*, *2*(1), 28. https://doi.org/10.12928/fundadikdas.v2i1.687
Berlianda, A. (2022). Pengembangan E-Modul Bahasa Indonesia Berbasis Pendekatan Komunikatif Kelas Iv Sd/Mi. *Respository Raden Intan*, 1–42.
Dewi, R., Pristiwanti, D., Badriah, B., & Hidayat, S. (2022). Pengertian Pendidikan. *Jurnal Pendidikan Dan Konseling (JPDK)*, *4*(6). https://doi.org/10.13140/RG.2.2.25251.78880
Efendi, R., Filahanasari, E., & Gunawan, M. (2024). *Pengembangan E-Modul Berbasis Literasi Sains Ipas Materi Harmoni Dalam Ekositem Di Kelas V Sdn 11 Sitiung*. *10*(September).
Eralita, N., & Setiawan, Y. A. (2022). Studi Literasi Kimia Siswa Sekolah Menengah Kejuruan Pada Materi Zat Dan Perubahan. *Jurnal Eduscience*, *9*(3), 792–801. https://doi.org/10.36987/jes.v9i3.3349
Fahmi, N., Nurlina, N., & Sualfasyah, S. (2023). Pengembangan Modul Berbasis Literasi Sains untuk Meningkatkan Hasil Belajar IPA Kelas IV. *Naturalistic: Jurnal Kajian Dan Penelitian Pendidikan Dan Pembelajaran*, *7*(2), 1508–1518. https://doi.org/10.35568/naturalistic.v7i2.2819
Hardianti, R., & Alyani, F. (2023). Pengembangan E-Modul Berbasis Google Sites Pada Materi Rangka Manusia Kelas V Sekolah Dasar. *Pendas : Jurnal Ilmiah Pendidikan Dasar*, *8*(1), 5596–5604. https://doi.org/10.23969/jp.v8i1.8707
Khasanah, M., Kharisma, A. I., Huda, M. M., & Mudayan, A. (2025). Analysis of students ' critical thinking skills in natural and social sciences class IV SD Muhammadiyah 1 Ngimbang Lamongan. *JELEDUC: Journal of Elementary Education*, *2*(1), 31–41. https://doi.org/10.38040/jeleduc.v2i1.1225
Kristyowati, R., & Purwanto, A. (2019). Pembelajaran Literasi Sains Melalui Pemanfaatan Lingkungan. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, *9*(2), 183–191. https://doi.org/10.24246/j.js.2019.v9.i2.p183-191
Kumalasari, N., Fathurohman, I., & Fakhriyah, F. (2023). Pengembangan E-Modul Berbasis Kearifan Lokal Daerah Grobogan untuk Meningkatkan Hasil Belajar Siswa Sekolah Dasar. *Jurnal Paedagogy*, *10*(2), 554. https://doi.org/10.33394/jp.v10i2.7190
Lase, agnes lestariani. (2023). Pengembangan Modul Data Kelompok Untuk Meningkatkan Kemampuan Pemecahan Masalah Matematika. *Jurnal Ilmiah Mahasiswa Keguruan*, *2*(1), 1–9.
Lubis, A. M., & Rambe, A. (2022). Pengembangan E-Modul Berbasis Literasi Sains Fisika Di Madrasah Aliyah Negeri (Man) 3 Mandailing Natal. *PASCAL (Journal of Physics and Science Learning)*, *6*(1), 62–75. https://doi.org/10.30743/pascal.v6i1.5833
Mayasar, U. R., & Adrian, Y. (2024). Improving Student Learning Outcomes Of Grade V By Using The Think Pair Share Cooperative Learning Model In Thematic Learning At SDN Sungai Salai Hilir. *JELEDUC: Journal of Elementary Education*, *1*(2), 55–65.
Nurdin, N. (2020). Urgensi Literasi Sains Dalam Meningkatkan Kompetensi Widyaiswara PAI BDK Aceh Di Era Millenial. *Jurnal Pendidikan Sains Indonesia*, *7*(1), 55–63. https://doi.org/10.24815/jpsi.v7i1.12476
Nurjannati, N., Rahmad, M., & Irianti, M. (2022). PENGEMBANGAN E-MODUL BERBASIS LITERASI SAINS PADA MATERI RADIASI ELEKTROMAGNETIK. *Physics Education*, *1*(1), 1–11.
OEDC. (2022). *PISA PISA 2022 Results*.
Oktaviani, S., . A., Maria, H. T., Astuty, I., & Enawaty, E. (2023). Pengembangan E-Modul Ajar Berbasis Literasi Sains Pada Materi Cahaya Dan Penglihatan Di Sekolah Dasar. *Jurnal Teknologi Pendidikan (JTP)*, *16*(2), 85. https://doi.org/10.24114/jtp.v16i2.50905
Prasetya, I. G. A. S., Wirawan, I. M. A., & Sindu, I. G. P. (2017). Pengembangan E-Modul Pada Mata Pelajaran Pemodelan Perangkat Lunak Kelas Xi Dengan Model Problem Based Learning Di Smk Negeri 2 Tabanan. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *14*(1), 96–105. https://doi.org/10.23887/jptk.v14i1.9885

Puspasari, R. (2019). Pengembangan Buku Ajar Kompilasi Teori Graf dengan Model Addie. *Journal of Medives : Journal of Mathematics Education IKIP Veteran Semarang*, *3*(1), 137. https://doi.org/10.31331/medivesveteran.v3i1.702

Putra, R. P., Yaqin, M. A., & Saputra, A. (2024). Objek Evaluasi Hasil Belajar Pendidikan Agama Islam: Analisis Taksonomi Bloom (Kognitif, Afektif, Psikomotorik). *Jurnal Of Islamic And Education Research*, *2*(1), 149–158.

Rahayu, S. (2022). *Pengembangan E-Modul Berbasis Flip PDF Profesional pada Tema 8 Subtema 2 Pembelajaran1*.

Suhelayanti, Z, S., & Rahmawati, I. (2023). Pembelajaran Ilmu Pengetahuan Alam Sosial (IPAS). In *Penerbit Yayasan Kita Menulis*.

Sukarelawan, M. I., Indratno, T. K., & Ayu, S. M. (2024). *N-Gain vs Stacking*.

Sya'adah, A. M. M., Kharisma, A. I., & Huda, M. M. (2025). Analysis of natural and social sciences concept understanding of fifth grade students of SDN Bedahan , Lamongan Regency. *JELEDUC: Journal of Elementary Education*, *2*(1), 21–30. https://doi.org/10.38040/jeleduc.v2i1.1224

Tillah, N. F., & Subekti, H. (2025). *ANALISIS KEMAMPUAN LITERASI SAINS SISWA SMP BERDASARKAN INDIKATOR DAN LEVEL LITERASI SAINS*. *12*(1), 137–154.

Ummah, M., Rusilowati, A., & Yulianti, I. (2018). Pengembangan Bahan Ajar Berbasis Literasi Sains Materi Gelombang Cahaya. *Unnes Physics Education Journal*, *7*(3).

Wagiswari Santika, M. A., Dewi, P. K., & Putu Suharta, I. G. (2023). Pengembangan Modul Ajar Kurikulum Merdeka Berbasis Project Based Learning Untuk Meningkatkan Kemampuan Kolaborasi Siswa Smp Kelas Vii. *JIPMat*, *8*(2), 182–190. https://doi.org/10.26877/jipmat.v8i2.15805

Winata, A., Cacik, S., & Seftia R. W., I. (2018). Kemampuan Awal Literasi Sains Peserta Didik Kelas V Sdn Sidorejo I Tuban Pada Materi Daur Air. *JTIEE (Journal of Teaching in Elementary Education)*, *2*(1), 58. https://doi.org/10.30587/jtiee.v2i1.356