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Development and Validation of an Educaplay-Integrated E-Module on Light for Elementary Science Learning

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Abstract: This study aims to develop an integrated light material e-module Educaplay as an innovative learning medium in elementary schools and to determine its feasibility and practicality. This study uses the Research and Development (R&D) method with the ADDIE model which includes the stages of analysis, design, development, implementation, and evaluation. The research subjects were 19 fifth-grade students of Bulu Elementary School. Data collection techniques were carried out through observation, interviews, documentation, expert validation questionnaires and teacher and student response questionnaires, then analyzed descriptively quantitatively using a Likert scale. The results of the study showed that the developed e-module received 93% validation from media experts, 95% from material experts, and 80% from language experts, thus being declared suitable for use. The results of the small-scale trial showed a teacher response of 96% and a student response of 93.5%, while in the large-scale trial, the teacher response was 96% and the student response was 96.5%, with a very good category. Thus, the integrated light material e-module Educaplay is declared very valid for use in science learning in elementary schools.

Keywords: E-Module; Educaplay; Elementary Science Education; Light; Digital Learning Media

Introduction

Education plays a crucial role in developing quality human resources, not only in terms of knowledge but also in skills and character. With the changing times, learning is required to be more adaptive and interactive, and capable of developing critical thinking, creativity, collaboration, and digital literacy skills as part of the demands of the 21st century (Julisa et al., 2023). In this context, teachers no longer act as the sole source of learning, but rather as facilitators who encourage students to actively construct knowledge independently and meaningfully.

Learning Natural and Social Sciences (IPAS) in elementary schools is an important tool for instilling conceptual understanding from an early age. IPAS integrates natural and social phenomena relevant to students' lives, so learning needs to be presented in a contextual and interactive manner (Asri et al., 2024). One of the topics in science is light, which includes concepts about the properties of light, such as rectilinear propagation, reflection, refraction, and dispersion. However, this topic is still considered difficult to understand due to its abstract nature. Research shows that approximately 68.75% of students have misconceptions about light sources (Nurfiyani et al., 2020), more than 70% of students do not understand the concept properly (Wulandari et al., 2024), and only about 38% of students achieved the Minimum Completion Criteria (Winarsih & Kuswara, 2025).

This situation demonstrates the need for teaching materials that can help students understand the concept of light through more engaging, visual, and interactive presentations. One possible alternative is the e-module. E-modules have the advantage of combining text, images, videos, animations, and learning activities into a single digital learning resource, enabling students to learn more independently and flexibly. However, e-modules that only present material and practice questions do not provide a fully interactive learning

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experience. Students can still act as recipients of information if the learning activities are limited to reading the material and working on questions in a conventional manner.

Therefore, e-modules need to be developed by integrating interactive learning platforms such as Educaplay. The integration of Educaplay provides added value compared to traditional e-modules because it allows the material to be supplemented with various interactive and gamified digital activities. Through activities such as quizzes, matching pairs, word searches, puzzles, and other educational games, students not only read and receive information but also directly engage in exploring, testing, and strengthening their understanding. Furthermore, interactive activities can provide feedback on student answers, helping students identify errors and improve their understanding directly. Therefore, the integration of Educaplay into e-modules is expected to increase engagement and motivation, as well as provide a more active and meaningful learning experience compared to using e-modules that only contain material and practice questions.

This problem was also found Based on observations at SDN Bulu, the learning process for light is still dominated by conventional, teacher-centered methods, resulting in relatively low student engagement. The use of learning media is also limited to textbooks, worksheets, and simple presentation media, resulting in limited opportunities for students to explore concepts independently and interactively. This situation impacts student learning outcomes, with approximately 40% of students achieving learning mastery, while approximately 60% have not achieved mastery, either in conceptual understanding or question-answering abilities. This indicates that learning for light still requires teaching materials that can increase student engagement and help visualize abstract concepts.

Various previous studies have developed e-modules as digital teaching materials to support more independent and flexible learning. E-modules are generally equipped with text, images, videos, and practice questions to help students understand the material. However, some e-modules still place interactive activities as supplementary, resulting in suboptimal student interaction with the material and more conventional evaluation activities. Therefore, there is a need to develop e-modules that not only function as sources of information but also provide learning activities that enable students to actively engage during the learning process.

On the other hand, Educaplay has been widely utilized as an interactive learning platform that can provide various game-based activities and digital exercises. The use of Educaplay in learning is known to provide a more engaging learning experience through interactive activities, quizzes, and educational games. However, research utilizing Educaplay generally positions it as a stand-alone learning medium or activity, while its systematic integration into e-modules, particularly on light material for elementary school students, remains understudied. Using Educaplay without integration with the main learning materials also has the potential to create a disconnect between learning materials and activities, resulting in the linkage between concept delivery, learning activities, and evaluation not being fully structured within a single learning unit.

Based on these conditions, there is still a research gap in the form of the need for digital teaching materials that integrate the advantages of e-modules with Educaplay interactive activities in a single learning unit. This integration is expected to not only make the presentation of the material more interesting, but also provide opportunities for students to interact directly with the material, practice, obtain feedback, and strengthen conceptual understanding through various activities. Therefore, this research focuses on the development of an e-module on light material integrated with Educaplay as an innovative learning medium for elementary school students. The developed product is expected to be an alternative teaching material that is more interactive, systematic, and in accordance with the characteristics of science learning in elementary schools.

Utilizing technology in learning can be one solution to address these issues. E-modules, as digital teaching materials, have the advantage of presenting material interactively through a combination of text, images, videos, and evaluations that can be accessed flexibly (Agung et al., 2022). Furthermore, the use of e-modules supports independent and student-centered learning, in accordance with the demands of the Independent Curriculum (Mangasak & Gasong, 2025). However, the use of e-modules in learning about light still needs to be developed so that they not only function as digital teaching materials but also provide interactive learning experiences and actively engage students.

One possible approach is to integrate e-modules with game-based learning platforms such as Educaplay. Educaplay provides a variety of interactive activities that can enhance student engagement, motivation, and learning outcomes (Ge'e & Dahlan, 2025; Dianingtyas et al., 2025), and has the potential to support the development of higher-order thinking skills through systematic digital learning activities (Nur'aeni et al., 2025). However, research on e-modules and Educaplay has largely been conducted separately or through integrated media, so combining the two cannot be directly viewed as a novel research initiative. Therefore, the novelty of this research lies in the development of an

e-module on light that integrates Educaplay's interactive activities in a structured manner into the learning flow. This integration is designed so that students not only read and understand the material through the e-module but also directly construct understanding through interactive game activities and evaluations related to the concept of light. With these characteristics, the developed product is expected to provide a more active and interactive learning experience that is in line with the learning characteristics of elementary school students.

Based on this description, the development of an e-module for light materials integrated with Educaplay is crucial to create more innovative, engaging, and meaningful learning for elementary school students. Therefore, this study aims to develop an e-module for light materials integrated with Educaplay as an innovative learning medium and to determine its feasibility based on assessments by material experts, media experts, and language experts.

Method

The type of research used is Research and Development (R&D) which aims to produce learning media in the form of an integrated light material e-module Educaplay as an innovative learning media for elementary school students. In this study, the researcher used the ADDIE development model which consists of five stages, namely: (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation (Sugiyono, 2019). The research scheme follows the ADDIE model flow.

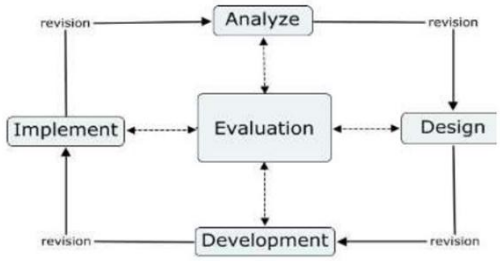


Figure 1. ADDIE diagram

The analysis stage was conducted to identify learning needs, student characteristics, learning conditions, and problems encountered in the lighting material. At this stage, data were collected through observations, interviews with fifth-grade teachers, and documentation of student learning outcomes at Bulu Elementary School. The design stage is the product design stage that begins with developing an e-module framework, determining learning outcomes and objectives, and designing the material content, display, and interactive activities based on Educaplay. At this stage, research instruments were also developed to assess the product's feasibility. The development stage was carried out by realizing the design into a complete e-module product. The e-module was developed by combining materials, images, videos, and interactive game activities through the Educaplay platform. After the product was completed, validation was carried out by experts, involving material experts, media experts, and language experts to assess the product's feasibility and provide suggestions for improvements. The implementation stage in this study was not carried out directly in the field due to time and cost constraints. Therefore, the research focused on the product development and validation stages by experts. The evaluation stage was carried out on a limited basis based on the validation results from the experts. This evaluation aimed to determine the feasibility level of the developed e-module and serve as a basis for revising and refining the product.

This research was conducted at SDN Bulu with the research subjects being all fifth-grade students totaling 19 studentsThe sampling technique used saturated sampling, so the entire population was used as the research sample. Data collection techniques included observation, interviews, and documentation, while data analysis used qualitative and quantitative descriptive techniques with the aid of a Likert scale to measure the level of product validity.

Results and Discussion

Analysis

Based on the results of preliminary research, several problems in the learning of science and science on light at SDN Bulu have been identified. The learning process is still dominated by conventional teacher-centered methods, resulting in students being less active in participating in learning activities. In addition, the use of learning media is still limited to textbooks and worksheets, and technology has not been optimally utilized as a learning support tool. The impact of these conditions is seen in the low student learning outcomes. Of the 20 fifth-grade students, only about 8 students (40%) achieved the Minimum Completion Criteria (KKM), while the other 12 students (60%) have not achieved completeness. This indicates that students' understanding of light material still needs to be improved.

Initial data collection was conducted through observation, interviews with fifth-grade teachers, and documentation. Interview results indicated that the learning process was still using the Independent Curriculum, but the utilization of digital learning media was not optimal. The needs analysis also revealed that the material in textbooks was insufficient to help

students understand the abstract concept of light. Teachers need additional learning media that can present material in a more engaging, interactive, and easily understood manner. These media are expected to include visual elements such as images, videos, and interactive activities to increase student motivation and engagement. Furthermore, students need learning media that not only present material but also provide enjoyable learning experiences through digital activities.

Based on these needs, the solution offered is the development of an integrated light e-module, Educaplay. This e-module is designed as a digital teaching material that combines text, images, videos, and interactive game activities such as quizzes, crosswords, and matching games. This medium is expected to help students understand the concept of light more concretely and improve their learning outcomes.

Product Design

The integrated light e-module by Educaplay is designed based on the learning outcomes and objectives of light for fifth grade elementary school. The e-module design is structured with student characteristics in mind, so the material is presented in simple, concise, and easy-to-understand language. This e-module is designed with an interactive concept that combines various elements, such as text, images, learning videos, and game-based activities through the Educaplay platform. The material presentation is systematic, starting from concept introduction to practice questions and evaluation. In addition, the e-module is also equipped with links that connect students directly to Educaplay game activities. The e-module creation process is carried out by designing the display using the Canva application, then converted into a digital flipbook format to provide a more engaging reading experience. The selection of colors, images, and layout is adjusted to the characteristics of elementary school students to increase learning interest. Learning videos are also included to help students understand abstract material.

Product Development

The Educaplay integrated light material e-module designed in this study was developed using the Canva app as the initial design stage. The e-module was then converted into a digital flipbook using the Heyzine Flipbooks platform to provide a more interactive display and facilitate navigation, similar to opening a real book.

During the development phase, further editing is carried out, including the addition of instructional videos, illustrations, and the insertion of links to interactive activities and Educaplay-based evaluation exercises. These links can be accessed directly by students by clicking on the links provided in each section of the material. The final product is then uploaded online and shared with students via a link, allowing them to access it using devices such as smartphones, laptops, or tablets with internet access.

The integrated light material e-module Educaplay consists of several main parts, namely: The initial part, including the cover, foreword, table of contents, and instructions for use. The core part, including learning outcomes, learning objectives, presentation of light material equipped with images, videos, and interactive activities based on Educaplay. The evaluation part, in the form of practice questions and interactive quizzes integrated with Educaplay. The closing part, including a summary of the material and learning reflections. With this development, the e-module not only functions as a digital teaching material, but also as an interactive learning medium that is able to increase student engagement through a combination of game-based materials and activities.

Validation of the Eligibility of Educaplay's Integrated E-Module

At this stage, researchers will validate the product with competent media expert validators, including lecturers from the Elementary School Teacher Education study program, material experts such as Natural Sciences lecturers from the Elementary School Teacher Education study program, and language experts from the Indonesian Language and Literature Education study program, to test the product's feasibility. After being evaluated by the validators, suggestions regarding the product developed by the researchers will be provided, so that researchers can revise the product that has been developed.

Table 1. Expert Validation Results for the Educaplay Integrated E-Module

Eligibility Aspect	Validation Index (%)	Information
Media	93%	Worthy
Material	95%	Worthy
Language	80%	Worthy

Table 1 shows that the validation results provided by the validators are valid and fall within the criteria of being feasible and very feasible. The Educaplay integrated e-module is declared valid in terms of overall media display, material, and language and is ready for testing. This is in line with other studies showing that the validation results for the e-module development from media experts obtained a score of 93%, from material experts obtained a score of 90.6%, and from language experts obtained a score of 83.3%. All three are categorized as feasible and very feasible (Rojikin et al., 2022). These results indicate that the developed e-

module is feasible and can be used as an alternative supplementary learning medium in the science and science learning process in elementary schools. Other research also states that the validation results of the e-module development from material experts obtained a score of 4.5 and from media experts obtained a score of 4.8 (Sintawati & Margunayasa, 2021).

Design Revision

The researchers revised the design based on suggestions from media experts, material experts, and language experts. Suggestions from the media expert validator included completing the subject and researcher identities, changing the background to a brighter one, and adding game instructions on the educaplay platform. Suggestions from the material expert validator included adding sources for each image in the E-Module. Suggestions from the language expert validator included consistent use of punctuation, especially exclamation marks, more systematic numbering of material points, and proper bibliography layout.



Figure 1. Before there was an identity

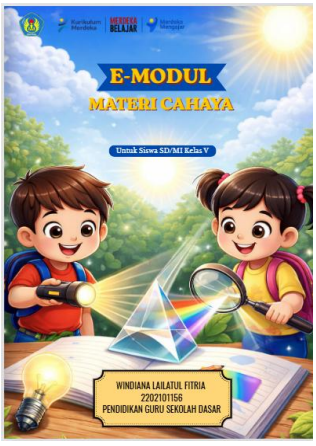


Figure 2. After there is an identity



Figure 3. Before the background is bright

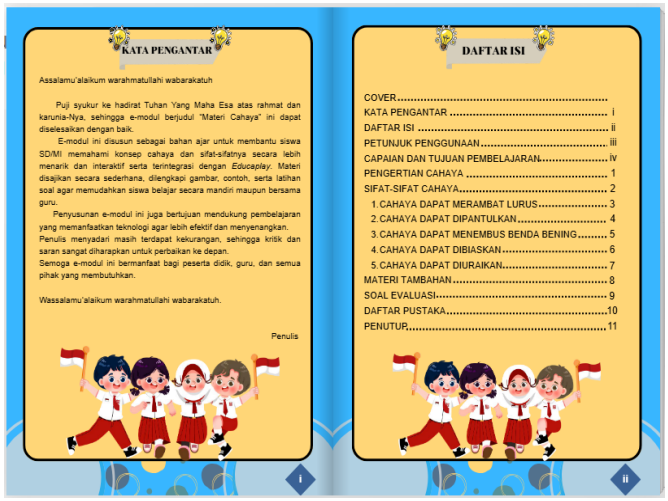


Figure 4. After the background is bright

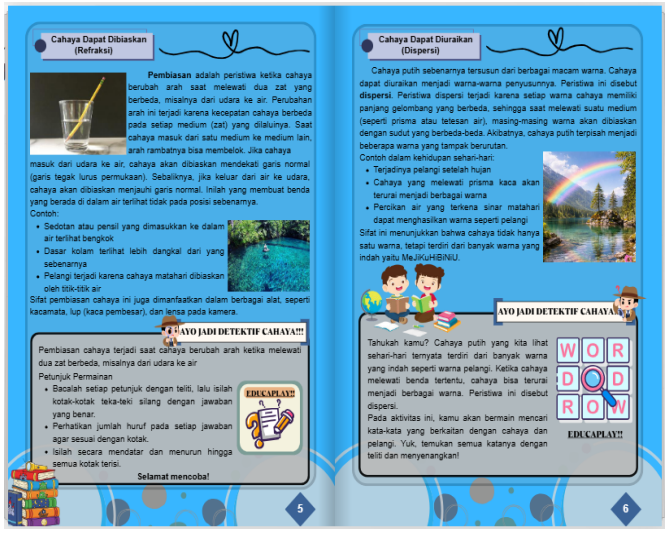


Figure 5. Before there is a source on the image

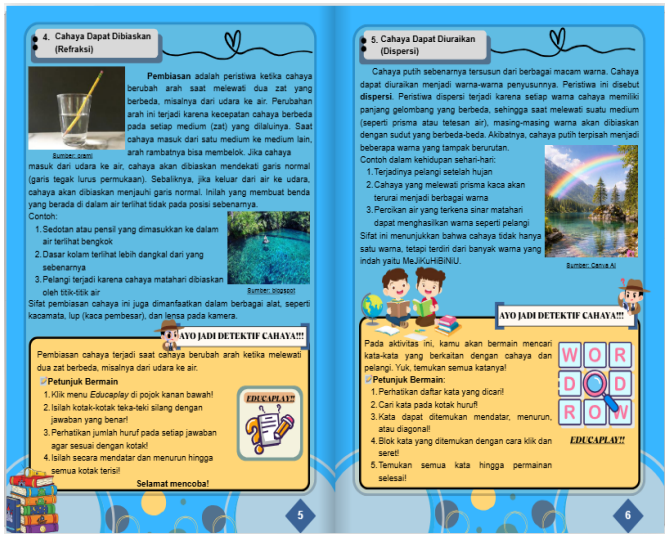


Figure 6. Once there is a source on the image

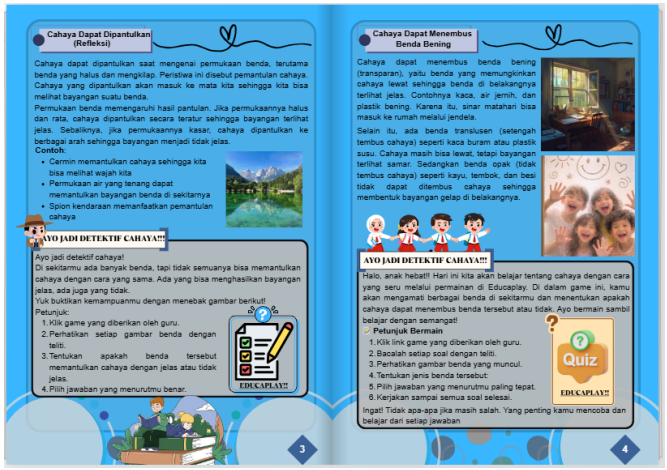


Figure 7. Before consistent use of exclamation marks

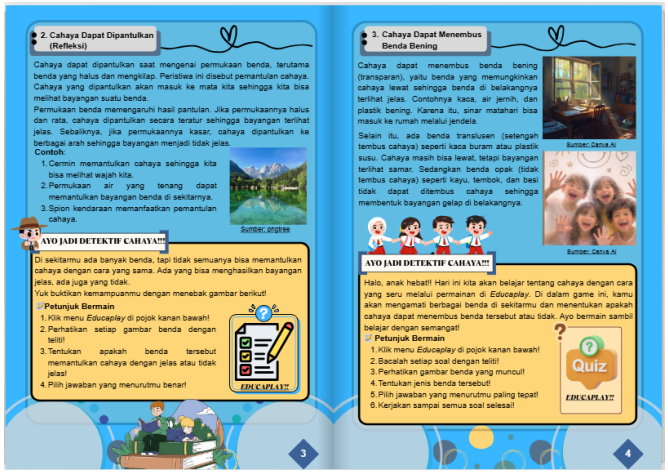


Figure 8. After consistent use of exclamation marks

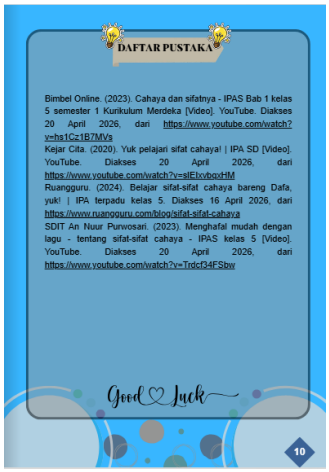


Figure 9. Before Revision of Writing Bibliography



Figure 10. After Revision of Writing Bibliography

Trial Results of the Educaplay Integrated E-Module Product

After going through expert validation and product revision, the Educaplay integrated e-module was then pilot tested to obtain teacher and student feedback on its practicality. The product trials were conducted in two stages: a small-scale trial and a large-scale trial. In a small-scale trial, 19 sixth-grade students were heterogeneously selected based on their ability levels. After the students participated in the learning process using the Educaplay integrated e-module, they and their teachers were given a response sheet containing 13 Likert-based questions to answer based on their experiences using the product developed by the researchers. The questionnaire had the following assessment criteria:(Mawardi, 2019): (5) strongly agree if you get a score of 81%–100%, (4) agree if you get a score of 61%–80%, (3) undecided if you get a score of 41%–60%, (2) disagree if you get a score of 21%–40%, and (1) strongly disagree if you get a score of 0%–20%.

$$V = \frac{tse}{tsh} \; x \; 100\% \qquad (1)$$

The percentage of teacher and student responses was calculated to determine the practicality of the Educaplay integrated e-module. A questionnaire was used to collect teacher and student responses covering two aspects: content quality and learning techniques, as well as media presentation. These two aspects were then divided into four indicators: material presentation, impact of media use on students, user instructions, and the appearance of the Educaplay integrated e-module.

Table 2. Teacher and Student Assessment of Educaplay Integrated E-Modules on a Small Scale

Teacher and Student Responses	Presentation	Information
Teacher	96%	Strongly agree
Student	93.2%	Strongly agree

Table 2 shows that teacher and student assessments of the Educaplay integrated e-module were categorized as very good, because they received a score above 81%. Thus, the Educaplay integrated e-module was assessed as very feasible based on 13 questions on a Likert scale, because almost all statements received a score of 5. However, there were a few suggestions from students, namely that the instructions for playing student activities in the sub-topic of light propagating in a straight line were still confusing and needed to be made more detailed so that students could easily understand. Thus, the researcher made improvements according to the student's suggestions. This is in line with other studies that show that teacher and student response questionnaires that received a score above 81% showed results that strongly agreed, meaning that the Educaplay Integrated E-Module is suitable for use in learning (Handika et al., 2025).

Table 3. Teacher and Student Assessment of Educaplay Integrated E-Modules on a Large Scale

Teacher and Student Responses	Presentation	Information
Teacher	96%	Strongly agree
Student	96.5%	Strongly agree

Table 3 shows that teacher and student assessments of the Educaplay integrated e-module were categorized as very good, with a score above 81%. Therefore, the Educaplay integrated e-module was deemed very feasible based on 13 questions on a Likert scale, with almost all statements receiving a score of 5. However, there were a few suggestions from students, namely that the instructions for playing on the Educaplay platform should be made clearer so that they are easier to understand, especially the word search puzzle feature where playing requires pressing the cursor to block and drag letters. Therefore, product revisions are needed during the large-scale trial phase in accordance with these student suggestions. This is in line with previous research that teacher and student response questionnaires that received a score above 81% showed strong agreement, meaning that the Educaplay Integrated E-Module is suitable for use in learning (Maharcika et al., 2021).

The results of the study indicate that the development of an integrated light e-module using Educaplay has a positive impact on the science learning process in fifth-grade elementary schools. This is evident in the increased student engagement during the learning process. Students become more active in participating in learning activities because the material is presented interactively through a combination of text, images, videos, and educational games based on Educaplay. Activities such as interactive quizzes, crosswords, and matching games can create a more enjoyable learning atmosphere so that students are more motivated to understand the light material. This is in line with research. Atika et al., (2024), that the use of gamification-based Educaplay has been proven to increase student learning engagement through more interactive and enjoyable learning activities. This is in line with other research that Educaplay can increase student learning engagement by making students more active, enthusiastic, and asking questions more often than before it was used (Lestari et al., 2025; Husada et al., 2026).

Furthermore, the use of e-modules also helps teachers deliver abstract material in a more concrete and understandable way. Visual presentations and instructional videos make it easier for students to grasp the concepts of light properties and their application in everyday life. This is in line with other research that teachers find it easier to explain science material using e-modules. E-modules have been shown to visualize abstract concepts, increase student engagement and understanding, and make material delivery more efficient (Anggraini et al., 2024; Kusumawati et al., 2024).

Based on teacher and student responses in both small-scale and large-scale trials, the e-module received a "very appropriate" rating, with a response rate above 90%. This indicates that the developed media is practical for use in learning and is capable of increasing student learning interest. These research findings align with research conducted by Isnaeni & Zulherman (2024) which states that the use of interactive e-modules based on FlipHTML5 can increase the learning motivation of elementary school students. The study showed that the developed e-modules obtained validation results of 96% from media experts with the category "very feasible", 70% from material experts with the category "feasible", and 85% from language experts with the category "very feasible". Other studies also showed that the developed e-modules obtained validation results of 88.71% from material experts and media experts with the category "very feasible" (Riyanto & Kawuryan, 2025). Other research also shows that the developed interactive e-module is valid and suitable for use, with assessment results from material experts of 81.17%, media experts of 90.00%, and language experts of 82.00%, indicating that the product is in the category of suitable to very suitable for use in learning (Fahrina et al., 2026).

Conclusion

Based on the results of research and development of the integrated light material e-module Educaplay for elementary school students, it can be concluded that it is valid based on validation by e-module experts and is declared suitable for use with a score of 93% from media experts, 95% from material experts, and 80% from language experts. In addition, the results of small-scale trials showed a teacher response of 96% and a student response of 93.5%, while in large-scale trials the teacher response was 96% and the student response was 96.5%, all of which were included in the strongly agree category.

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Author Contributions
Windiana Lailatul Fitria contributed to the research, product development, data analysis, and article writing. Ivayuni Listiani and Naniek Kusumawati served as advisors for the research and writing activities.

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Conflicts of Interest
The authors declare no conflict of interest.

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